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Pilot Study to Examine Training Eligibility Standards

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14. ABSTRACT *(Maximum 200 words)*:

The aim of this pilot study is to examine training enlistment standards utilizing Army Training Requirements and Resources System (ATRRS) training data which records individual-level training events for all MOS, but is limited to pass / fail outcomes. Specifically, we seek to investigate the tradeoffs between training eligibility and Advanced Individual Training (AIT) completion brought about through lowering / raising minimum enlistment training standards, and to develop methodologies which can be utilized to assist school proponents in assessing the appropriateness of their Aptitude Area (AA) cut scores. For the initial effort in this pilot, the 50 MOS investigated belonged to a handful of school proponents who expressed an interest in the objectives of this study, plus a few additional ones recommended by Army Accessions Command. Subsequently, an additional 30 MOS that promised sufficient numbers of (failure) observations were also included. The authors specify and estimate binary logistic regression models of pass / fail training outcomes over the 2001 – 2004 period. Training outcome is estimated as a function of AA governing composite, Soldier demographic, and component membership variables. The estimated models are then applied to the larger Army enlisted contract population to examine the policy tradeoffs. For select MOS, the policy analyses are examined more closely using risk analysis simulation methods.

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PILOT STUDY TO EXAMINE TRAINING ELIGIBILITY STANDARDS

EXECUTIVE SUMMARY

Research Requirement:

Training enlistment standards govern classification of new recruits into job training – i.e., Advanced Individual Training (AIT). The cognitive standards subset is largely the purview of school proponents in coordination with Army G-1. These standards establish qualifying cutoff score levels on Area Aptitude (AA) composites, derived from the Armed Services Vocational Aptitude Battery (ASVAB). The purpose of this study is to develop methodologies which can be utilized to assist school proponents in assessing the appropriateness of their AA cutoff score levels.

Procedure:

Regression models of pass / fail training outcomes over the 2001 – 2004 period utilizing Army Training Requirements and Resources System (ATRRS) data are specified and estimated for a total of 80 MOS with sufficient (failure) cases. Training outcome is specified as a function of AA governing composite, Soldier demographic, and component membership variables. The estimated models are then applied to the larger Army enlisted contract population to examine the policy tradeoffs between training eligibility and AIT completion. For select MOS, the policy analyses are examined more closely using risk analysis simulation methods.

Findings:

Predictive models were successfully developed and applied to elucidate the tradeoffs brought about through lowering / raising minimum enlistment training standards. Based on the relatively broad sample of MOS examined, the usefulness of the estimated models for conducting policy analysis suggests three major groupings of MOS. In the first group are MOS where cutoff score levels are relatively low and passing rates are uniformly high. The policy analyses for many of these MOS suggest that cutoff score levels could be lowered further without paying a noticeable price in reduced passing rates. In the second group are MOS where cutoff score levels are relatively high and passing rates are lower, estimated composite effects are relatively high, and predicted passing rates are more spread out in the vicinity of the current cutoff level. For these MOS the estimated models appear useful in revealing tradeoffs as cutoff score levels are changed. In a third group of MOS, the explanatory power of the model is low or non-existent. In most but not all of these the poor fit is presumed due to too few failure case observations, but a definitive conclusion is not possible.

Utilization and Dissemination of Findings:

Study findings establish the feasibility of examining the appropriateness of cutoff score levels with readily available Army data, and should encourage school proponents to examine this issue periodically. The findings were also used to inform a G-1 decision not to support a recent

proposal for across-the-board reductions in cutoff score levels. Finally, the findings constitute additional support in ongoing ASVAB validation efforts.

PILOT STUDY TO EXAMINE TRAINING ELIGIBILITY STANDARDS

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Pilot Study To Examine Training Eligibility Standards

Introduction

Army personnel managers frequently need to make tradeoffs between Soldiers' numbers, quality, training difficulty, and other factors when making personnel management and training decisions. Often, data pertaining to such tradeoffs exist but are not integrated into the decision process because they are not readily accessible.

Prospective Soldiers are recruited and classified using quality marks that are defined, in part, by minimum enlistment standards. When quality standards are set too high in an MOS it is more difficult to make its recruiting target, and when quality standards are set too low training performance suffers and attrition becomes a problem. The importance of appropriate quality marks is especially important when recruiting is difficult. This is evidenced by the number of recent calls to ARI from school proponents asking for analysis of the impact of lowering standards.

Two years ago ARI completed a small research effort that dealt with training eligibility standards in four MOS – see *Examining Training Eligibility Standards: Four Case Studies*, ARI Study Note 2005-01, October 2004. The research focused on the tradeoff between training eligibility and training performance, and grew out of a project sponsored by Human Resources Command. This research utilized detailed training data provided by the Army Training Support Center (ATSC) Automated Instructional Management System. From what we can tell, this kind of training performance data is not available for very many MOS.

The aim of this study is to examine training enlistment standards utilizing Army Training Requirements and Resources System (ATRRS) data which records individual-level training events for all MOS, but is limited to pass / fail outcomes. Specifically, we seek to investigate the tradeoffs between training eligibility and training completion that are brought about by lowering / raising minimum enlistment training standards on the "governing" composite, and to develop methodologies which can be used to assist school proponents in assessing the appropriateness of their AA cut scores. For the initial effort in this pilot, the 50 MOS investigated belonged to a handful of school proponents who expressed an interest in the objectives of this study, plus a few additional ones recommended by Army Accessions Command. Subsequently, we included an additional 30 MOS that promised sufficient numbers of observations and representation of most of the Career Management Fields (CMF).

While it is reasonable to consider the impact of cut scores on training eligibility, it should be understood that that is not the only purpose of cut scores. Cut scores are also designed to identify Soldiers who will be successful in their jobs after training. If training requirements are less demanding than job requirements, then cut scores which are based solely on training success may not succeed in discriminating between those who will be successful on the job from those who will not.

Approach

Perhaps the most important caveat to this study and the approach taken is that we restricted the analysis to so-called academic cases. We take at face value the information contained in the data base, and have no way to verify the categorization of outcomes into those due to academic versus non-academic reasons. In so doing, we assume that non-completion for non-academic reasons is not related to cognitive criteria.[1]

With the data readily available, we are able to examine the relationship between Advanced Individual Training (AIT) outcome and Soldier score on the governing Aptitude Area (AA) composite for the particular MOS, controlling for Soldier gender and education level, and Soldier component membership. As mentioned, the outcome measure was restricted to pass / fail, and we excluded non-academic failure cases. In addition, we focused on the first training attempt made by the Soldier.

We specified and estimated a logistic regression model to explain the Soldier's pass / fail training outcome as a function of Aptitude Area (AA) scores and other variables just mentioned. The relationship between training outcome probability P(Z), AA score, and other variables can be stated as

$$\text{Prob (outcome)} = P(Z) = e^{Z} / (1+e^{Z}),$$

where $Z = \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \ldots$; X are the independent explanatory variables; β are the estimated parameters; and "e" is base of the natural logarithms. The logistic regression curve is S-shaped. The relationship between the independent variables and the probability of passing is nonlinear. The probability estimates will always be between zero and one, regardless of the value of Z. Note that the increase in the odds of passing is given by the factor $e^{k\beta}$ for a k-point increase in the governing composite score.

For each MOS, we followed these steps: (a) estimate a binary logistic regression equation; (b) examine the explanatory and predictive power of the estimated model using goodness-of-fit statistics; (c) analyze the impact of changing the cutoff score upon eligibility and the probability of successfully completing the training. Policy recommendations per se are not made.

The policy analysis is conducted with respect to the larger Army enlisted contract population.[2] Using the contract population, for a given cutoff score we determine the corresponding size of the eligible pool, and express it as a percentage eligible. Next, we calculate the mean governing composite score for the eligible pool, and then use the

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[1] We conducted additional empirical analyses for 55D, 74B, 91W, and 96B, and found results that were consistent with the assumption. These analyses are offered as illustrative examples; more definitive support would entail analyses of a larger number of MOS.

[2] Army contract data are extracted from USAREC's Enlisted Accessions File. For most of the analyses, we employed extracts for the Apr 2002 through Aug 2003 period; for the remaining analyses we employed extracts for the Jan 1992 through Aug 2003 period. The differences in derived statistics over these two periods were negligible.

estimated regression model to calculate the predicted passing rate for the average Soldier in that pool, i.e. for Soldiers scoring at the average or mean of the eligible pool. The impact of a cutoff score change is provided by comparing the baseline percentage eligible and average passing rate with that under a policy case. The impact of the policy case can also be evaluated at other points besides the mean of the eligible group by identifying and calculating what those points of interest are and looking them up on a graph which shows how the probability of passing varies with the governing composite score. Graphs are provided in all of the analyses.

An example taken from the policy analysis of MOS 96B (Intelligence Analyst) will help to illustrate the steps involved (see Table 1). Skilled Technical (ST) is the governing composite for the MOS, and the current cutoff score (circa 2003) is 102. Given that cutoff level, 65% of Soldiers would be eligible for this training assignment, and the mean ST score of this pool is 114. At this score, the predicted passing rate is 72.2% for high school male graduates. Should the proponent consider a 5 point reduction in the cutoff level (from 102 to 97), the eligible pool would increase by 13 percentage points, the average ST score would fall to 112, and the corresponding predicted passing rate would fall to 67% for the average high school male Soldier in the newly enlarged pool. Thus, the tradeoff facing the proponent can be summarized as a 13 percentage point gain in the size of the eligible pool at a cost of 5 percentage points in the probability of passing for the average Soldier.

Table 1. Probability that a Regular Army Soldier (from the larger Army contract population) will pass the course based on the estimated regression model.

	ST Cutoff = 92	ST Cutoff = 97	ST Cutoff = 102	ST Cutoff = 107	ST Cutoff = 112
Percent Eligible (Regular Army)	*89.0%*	*78.2%*	*64.9%*	*49.6%*	*34.7%*
Mean	*109.45*	*111.59*	*114.16*	*117.18*	*120.51*
Passing Rates:					
High School Male	62.9%	67.3%	72.2%	77.4%	82.3%
College Male	71.6%	75.4%	79.5%	83.6%	87.4%
High School Female	71.1%	74.9%	79.1%	83.3%	87.1%
College Female	78.5%	81.7%	84.9%	88.1%	90.9%

For select MOS, we also examined the predictive power of the regression model and its application to policy analysis using risk analysis. [3] Risk analysis uses simulation methods to take into account all the sources of uncertainty found in the regression model and to consider the impact of policy changes not just at the mean composite score (i.e., for the average Soldier) but over the entire range of Soldier characteristics. The risk analysis results highlight the variability of training outcomes when the estimated nature of the model is explicitly considered. In cases where the standard errors of the estimated coefficients are relatively large, we find differences between the mean of the simulated

[3] Risk analysis was conducted for these MOS: 15Q, 27M, 33W, 35M, 46Q, 55D, 71D, 74B, 91D, 91W, 96B, 97E, and 98C. Description of the risk analysis results follows the main "discussion" of the MOS.

probabilities and the static prediction of the probability of passing evaluated at the mean governing composite score. The policy case impacts relative to the baseline, however, are the same in both simulation and static prediction modes.

Overview of Regression Model Results

We estimated models for 80 MOS that span 18 CMFs. These are shown in the Table of Contents, where the MOS titles and codes prevailing during the 2001 – 2004 period are shown under the current CMF structure.

For most of the MOS the estimated models were statistically significant.[4] In cases where they weren't, it was usually a problem of an insufficient number of failure cases. Not surprisingly, we achieved better model fits for the more "technical" MOS. The percentage of variation explained by the governing composite, demographics, and component membership ranged from three to twenty-one percent, and compares favorably to Armed Services Vocational Aptitude Battery (ASVAB) validation types of research, of which this is a variant.[5] The estimated effect of the governing composite upon the probability of passing was statistically significant and also of practical importance in most of the models. In these models, we typically found that the odds of passing increased by a factor of 1.04 to 1.10 for each one point increase in the composite score.

The regression results are summarized in Table 3 (which follows the Conclusions section).[6] In that table, for each MOS model we report the R-square (goodness-of-fit) statistic, the estimated odds factor for the governing composite, the total number of cases in the sample, and the number of failure cases. The regression model estimates and policy analyses are reported by MOS following these introductory and summary sections.

Based on the relatively broad sample of MOS examined, the usefulness of the estimated models for conducting policy analysis suggests three major groupings of MOS (see Table 2). In the <u>first group</u> are MOS where cutoff score levels are relatively low and passing rates are uniformly high. This gives way to estimated composite effects that are relatively low and predicted passing rates that are uniformly high in the vicinity of the current cutoff level. For these MOS there aren't any striking policy issues because the

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[4] The model Chi-square tests the null hypothesis that the coefficients for all of the terms in the model, except the constant, are zero. This is comparable to the overall F test for regression.

[5] In terms of R-values, the correlation measure favored by psychologists, the fits obtained range up to 0.45, and are quite respectable when considering use of a binary outcome variable and the implicit restriction in range when estimating from an Army input sample.

[6] The regression results have established the tendency of predicted passing probabilities to vary with composite scores. Despite the generally moderate explanatory power of the regression models as evidenced by goodness-of-fit statistics, the models are noticeably weak in predictive power. A combination of factors seems to be at work. In the first place, the observed variation in composite scores is limited inasmuch as Soldiers have been selected against the cutoff level. And second, there is a paucity of information available in the data base for use as explanatory variables. We really don't have a lot of insight into why a <u>particular</u> Soldier passes and another does not. Fortunately, for the kinds of policy analyses that we conduct, individual predictive accuracy is not a requirement.

training is apparently not demanding, and the estimated models reflect that reality.[7] The policy analyses for many of these MOS suggest that cutoff score levels could be lowered without paying a noticeable price in reduced passing rates. However, as noted above, if the training requirements are less demanding than the job requirements, then such lowered cutoff score levels could be reflected in diminished job performance. In the second group are MOS where cutoff score levels are relatively high and passing rates are lower, estimated composite effects are relatively high, and predicted passing rates are more spread out in the vicinity of the current cutoff level. For these MOS the estimated models appear useful in revealing tradeoffs as cutoff score levels are changed. In addition, there is a group of MOS that seems to fall in-between the first and second groupings. Finally, there is a third group of MOS for which the explanatory power of the estimated model is low or non-existent. In most but not all of these the poor fit is presumed due to too few failure case observations[8], but a definitive conclusion is not possible.

Table 2. Implied Groupings of MOS for Policy Analysis

First Group – limited policy analysis	13D, 13E, 13F, 14S, 15P, 21B, 44B, 45B, 25V, 31C, 31F, 31U, 52D, 55B, 63H, 63J, 63W, 67T, 67U, 73C, 71L, 75B, 75H, 88M, 91E, 91G, 92A, 92F, 92G, 92Y
In-Between Group	35E, 74B, 91B, 91J, 91R, 91S, 96D, 98K
Second Group – useful policy analysis	15B, 15F, 15G, 15Q, 27M, 33W, 35M, 46Q, 46R, 55D Phase I, 71D, 91A, 91C, 91D, 91K, 91P, 91Q, 91T, 91W, 91X, 96B, 96H, 96U, 97B, 97E, 98C, 98H, 98J
Third Group – poor model fit	13B, 13M, 14E, 14J, 25M, 25R, 31L, 31P, 31R, 31S, 35F, 74C, 91H, 91M, 98G

[7] There is one MOS (91E) with relatively high estimated composite effects but little variation in predicted passing rates across policy changes, and thus belongs with the first group.

[8] The apparent exceptions are 31S and 98G.

Conclusions

Have we identified a useful methodology that can be used to assist Army school proponents in examining the appropriateness of current composite cutoff score levels? We believe we can answer in the affirmative – at least for the more technical MOS with curricula that are relatively demanding. The ATRRS data base with its pass / fail information is readily available for all MOS, and will support the binary logistic regression method utilized here. Actual training performance scores would be better for analyses focused on ASVAB validity, and they would likely facilitate better predictive accuracy. However, for the limited objectives of this type of inquiry, pass / fail outcome measures may be sufficient.

Table 3. Summary of Regression Model Estimation Results

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Title	MOS	Estimated R-square Statistic	Estimated Governing Composite Odds Factor	No. Cases	No. Failures
CMF 13 - Field Artillery					
Cannon Crewmember	13B	0.008	1.009	10779	148
FA Automated Tactical Data Sys Specialist	13D	0.045	1.047	1505	75
Cannon Fire Direction Specialist	13E	0.155	1.117	1823	37
Fire Support Specialist	13F	0.074	1.079	3800	108
MLRS etc. Specialist	13M	0.003	1.019	2635	34
CMF 14 - Air Defense Artillery					
Patriot Fire Control Operator - Maintainer	14E	0.020	1.020	728	46
Air Defense Command C4I TOC Enhanced Opera	14J	0.076	1.013	1076	13
Avenger Crewmember	14S	0.028	1.035	1641	32
CMF 15 - Aviation					
Aircraft Power Plant Repairer	15B	0.099	1.081	465	39
Aircraft Electrician	15F	0.078	1.080	417	42
Aircraft Structural Repairer	15G	0.098	1.073	490	124
Aviation Operations Specialist	15P	0.051	1.027	1338	89
Air Traffic Control Operator	15Q	0.061	1.037	633	194
UH-60 Repairer	67T	0.045	1.041	1670	61
CH-47 Repairer	67U	0.041	1.027	972	83
CMF 21 - Engineer					
Combat Engineer	21B	0.056	1.041	1902	68
CMF 25 - Communications and Information Systems Operation					
Information Systems Operator - Analyst	74B	0.059	1.048	2360	173
Telecommunications Operator - Maintainer	74C	0.049	1.029	739	22
Multimedia Illustrator	25M	0.009	1.035	258	9
Visual Information Eq Operator / Maintainer	25R	0.027	1.001	105	14
Combat Documentation / Production Specialist	25V	0.098	1.025	215	15
Radio Operator - Maintainer	31C	0.047	1.057	1793	15
Network Switching Systems Operator	31F	0.038	1.045	3872	313
Cable Systems Installer - Maintainer	31L	0.014	1.039	2131	15
Microwave Systems Operator - Maintainer	31P	0.016	1.026	755	48
Multichannel Transmission Sys Opr - Mtr	31R	0.017	1.021	5849	45
Satellite Communications Specialist	31S	0.010	1.031	1236	94
Signal Support Systems Specialist	31U	0.030	1.036	3568	171
CMF 27 - Paralegal					
Legal Specialist	71D	0.162	1.152	423	47
CMF 33 - Electronic Warfare / Intercept Systems Maintenance					
Military Intelligence Systems Operator / Integrator	33W	0.151	1.127	572	136
CMF 42 - Adjutant General					
Personnel Administration Specialist	75B	0.034	1.029	2921	67
Personnal Services Specialist	75H	0.059	1.041	3024	67
Administrative Specialist	71L	0.038	1.045	7525	36
CMF 44 - Financial Management					
Finance Specialist	73C	0.121	1.099	1518	112

CMF 46 - Public Affairs					
Public Affairs Specialist	46Q	0.162	1.058	402	66
Public Affairs Broadcast Specialist	46R	0.164	1.097	259	66
CMF 63 - Mechanical Maintenance					
Metal Worker	44B	0.065	1.039	860	117
Small Arms Repairer	45B	0.169	1.129	540	45
Power Generation Equipment Repairer	52D	0.055	1.060	3275	83
Track Vehicle Repairer	63H	0.063	1.033	1205	41
QM & Chemical Equipment Repairer	63J	0.096	1.054	1643	106
Wheeled Vehicle Repairer	63W	0.070	1.036	4486	143
CMF 68 - Medical					
Medical Equipment Repairer	91A	0.062	1.034	241	135
Medical Specialist	91B	0.125	1.065	5054	381
Health Care - Practical Nurse	91C	0.135	1.100	475	80
Operating Room Specialist	91D	0.155	1.103	1063	158
Dental Specialist	91E	0.163	1.150	1143	84
Patient Administration Specialist	91G	0.048	1.037	652	22
Optical Laboratory Specialist	91H	0.115	1.147	86	10
Medical Logistics Specialist	91J	0.087	1.072	709	78
Medical Laboratory Specialist	91K	0.204	1.146	123	23
Hospital Food Service Specialist	91M	0.047	1.015	837	11
Radiology Specialist	91P	0.080	1.089	814	65
Pharmacy Specialist	91Q	0.162	1.087	572	129
Veterinary Food Inspection Specialist	91R	0.037	1.075	507	28
Preventative Medicine Specialist	91S	0.076	1.124	452	23
Animal Care Specialist	91T	0.214	1.143	376	52
Health Care Specialist	91W	0.137	1.102	10972	1565
Mental Health Specialist	91X	0.161	1.061	678	107
CMF 88 - Transportation					
Motor Transport Operator	88M	0.042	1.035	14310	200
CMF 89 - Ammunition					
Ammunition Specialist	55B	0.031	1.042	2680	33
Explosive Ordnance Disposal Specialist - Ph. I	55D	0.136	1.085	445	235
Explosive Ordnance Disposal Specialist - Ph. II	55D	0.043	1.046	178	119
CMF 92 - Supply and Services					
Automated Logistics Specialist	92A	0.070	1.050	11458	359
Unit Supply Specialist	92Y	0.061	1.042	9970	122
Petroleum Supply Specialist	92F	0.058	1.044	10491	174
Food Service Specialist	92G	0.026	1.050	10206	39
CMF 94 - Electronic Maintenance and Calibrations					
Radio / COMSEC Repairer	35E	0.055	1.041	1268	89
Special Electronic Device Repairer	35F	0.035	1.039	319	23
Radar Repairer	35M	0.181	1.202	245	9
Multiple Launch Rocket System Repairer	27M	0.164	1.093	244	42
CMF 96 - Military Intelligence					
Intelligence Analyst	96B	0.151	1.095	2863	617
Imagery Analyst	96D	0.089	1.084	529	73
Common Ground Station Operator	96H	0.060	1.072	521	36
Unmanned Aerial Vehicle Operator	96U	0.286	1.216	116	30
Counterintelligence Analyst	97B	0.210	1.148	1162	107
Human Intelligence Collector	97E	0.188	1.076	748	140

CMF 98 - Signals Intelligence / Electronic Warfare Operations					
Signals Intelligence Analyst	98C	0.187	1.120	1621	302
Voice Interceptor	98G	0.009	1.005	1461	113
Communications Interceptor / Locator	98H	0.050	1.041	474	277
Electronics Intelligence Analyst	98J	0.090	1.084	503	57
Signal Collector & Identifier	98K	0.104	1.123	374	36

Notes: Shaded entry in the R-square column indicates that the estimated regression model Chi-square test was not statistically significant at the P = .05 level; shaded entry in the number of failures column indicates less than 50 failure cases.

MOS Analyses

(see Table of Contents for order)

The analyses are presented as separate mini-reports for each MOS. For each report, we followed these steps: (a) describe the size and composition of the estimation sample; additional sampling statistics are also shown in an Appendix; (b) estimate a binary logistic regression equation and highlight the results; (c) examine the explanatory power of the estimated model using goodness-of-fit statistics; (d) analyze the impact of changing the cutoff score upon eligibility and the probability of successfully completing the training. For selected MOS (see footnote 3) we also supplement the policy analysis with risk analysis. Note that policy recommendations per se are not made.

13B: Cannon Crew Member

The final sample included 10,779 Soldiers who were coded as either graduates or academic failures during their first AIT attempt in this MOS during a period from 2001 to 2004. Only Soldiers who graduated (98.6%) or failed for academic reasons (1.4%) were included in the analysis sample because we assume that non-completion for non-academic reasons is not related to cognitive criteria.

In the sample, all of the Soldiers were male as this MOS is not open to women, most had a high school diploma but not more education (93%, 3% some college, 4% GED or less), and most were from Regular Army (57%, 43% National Guard). The governing AA composite, Field Artillery (FA), for this MOS has a cutoff score of 93; the sample mean is 106.45 (standard deviation = 11.243). See the Appendix for a description of Soldier characteristics for this MOS training sample.

A binary logistic regression model was estimated to explain pass/fail AIT outcomes and focused on the first training attempt. The estimation results are reported in

Table 1. 13B: Results of the binary logistic prediction model

Chi- Square		12.052**	
Log Likelihood		1551.197	
Nagelkerke R Square		.008	
Variable	Coefficient	Odds Ratio	Wald
Constant	3.099	22.167	15.059***
GUARD	.559	1.749	9.530**
FA	.009	1.009	1.486

* = p < .05   *** = p < .001
** = p < .005

Table 1 and indicate that a model, including the FA composite and Army component (GUARD = National Guard), accounts for less than one percent of the variation in the dependent variable. This model is statistically significant (χ^2 = 12.052, P = .002), and it has almost no explanatory power (Nagelkerke R^2 = .008).

There is no statistically significant effect for the FA composite, though there is one for National Guard membership. The model suggests that the FA composite score does not predict increased odds of passing, but there are relatively few failure observations for a definitive conclusion.

Policy Analysis. Given the model's lack of explanatory power, and notwithstanding the statistically significant effect for National Guard membership, this model is not appropriate for conducting policy analysis.

Appendix: Soldier Characteristics (13B)

Outcome	Gender	
	Male	Female
fail	1.4%	.0%
pass	98.6%	.0%

Outcome	Education Level		
	GED or less	High School Diploma	Some College or More
fail	.4%	1.4%	.9%
pass	99.6%	98.6%	99.1%

Outcome	Component		
	Regular Army	Army Reserve	National Guard
fail	1.7%	.0%	1.0%
pass	98.3%	100.0%	99.0%

13D: Field Artillery Tactical Data Systems Specialist

The final sample included 1505 Soldiers who were coded as either graduates or academic failures during their first AIT attempt in this MOS during a period from 2001 to 2004. Only Soldiers who graduated (95%) or failed for academic reasons (5%) were included in the analysis sample of 490 Soldiers because we assume that non-completion for non-academic reasons is not related to cognitive criteria.

In the sample, all of the Soldiers were male as this MOS is not open to women, most had a high school diploma but not more education (93%, 5% some college, 3% GED or less), and the greatest number were from Regular Army (86%, 14% National Guard). The governing AA composite, Field Artillery (FA), for this MOS has a cutoff score of 93; the sample mean is 106.58 (standard deviation = 11.429). See the Appendix for a description of Soldier characteristics for this MOS training sample.

A binary logistic regression model was estimated to explain pass/fail AIT outcomes and focused on the first training attempt. The estimation results are reported in

Table 1. 13D: Results of the binary logistic prediction model

Chi- Square		22.394***	
Log Likelihood		573.664	
Nagelkerke R Square		.045	
Variable	Coefficient	Odds Ratio	Wald
Constant	-1.912	.148	2.444
GUARD	.570	1.769	1.447
FA	.046	1.047	14.877***

* = p < .05 *** = p < .001
** = p < .005

Table 1 and indicate that a model including the FA composite, as well as Army component (GUARD = National Guard), accounts for almost five percent of the variation in the dependent variable. This model is statistically significant ($\chi^2 = 22.394$, $P < .001$), but its explanatory power is limited (Nagelkerke $R^2 = .045$).

There is a statistically significant effect for the FA composite. The model suggests that having a higher FA composite score increases the odds of passing. At the mean FA score, an increase of one point is associated with an increase of about 5% in the odds of passing the course, and a five-point increase in FA would increase the odds of passing by 29%.

Policy Analysis. Table 2 reports the probability that the average Soldier from the larger Army contract population would pass the course on the first attempt based upon the binary logistic model. These were calculated using the formula for finding probability in a binary logistic model, which is

$$e^{(\beta' x)} / (1 + e^{(\beta' x)}).$$

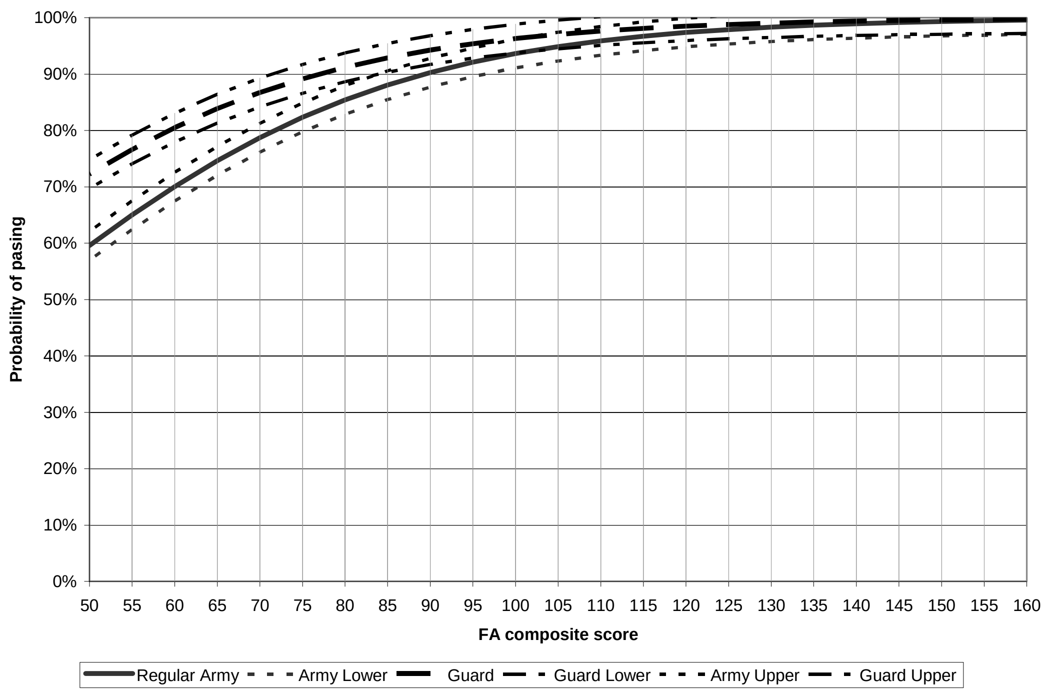
Because GUARD is not statistically significant, this analysis is confined to Soldiers from the Regular Army (though results would be similar for other demographic groups and National Guard members). Based on the model, when the cutoff score is at its current level (FA = 93), regular Army Soldiers with an average FA score (FA = 110.58) have approximately a 97% chance of passing. Currently, about 88% of Soldiers are eligible for MOS 13D assignment at the current cutoff (FA = 93). Lowering the cutoff by five points (FA = 88) would increase eligibility by seven percentage points (to 95%) and the average Soldier who would qualify for training would practically have the same chance of passing (96%). Raising the cutoff score by five points (FA = 98), the average Soldier would have the same chance of passing (97%) but eligibility would fall by about 11 percentage points.

Table 2. 13D: Probability that a Male Soldier with a High School Diploma (from the larger Army contract population) will pass the course based on the binary logistic model

	Cutoff = 83	Cutoff = 88	Cutoff = 93	Cutoff = 98	Cutoff = 113
Percent Eligible (Regular Army)	*98.6%*	*94.8%*	*87.7%*	*76.8%*	*61.9%*
Mean	*107.86*	*108.80*	*110.58*	*112.86*	*115.61*
Passing rate:					
High school male	96.1%	96.4%	96.8%	97.3%	97.8%

Figure 1 shows the relationship between FA and the probability of passing for Regular Army Soldiers and Guardsmen, including upper and lower bounds based upon the standard error of the estimated FA coefficient. For a particular FA score, trace a vertical line up to the curve, and then a horizontal line over to the axis to determine the corresponding probability of passing. For example, an FA score of 100 corresponds to a passing probability of about 95% for a high school educated, Regular Army male Soldier. One can see that Soldiers with a relatively low FA score have a reasonable chance of passing the course. As FA scores increase, the chance that a Soldier will pass the course increases.

Figure 1: Predicted Probability of Passing: Regular Army



Appendix: Soldier Characteristics (13D)

	Gender	
	Male	Female
fail	5.0%	.0%
pass	95.0%	.0%

	Education Level		
	GED or less	High School Diploma	Some College or More
fail	2.6%	5.2%	1.5%
pass	97.4%	94.8%	98.5%

	Component		
	Regular Army	Army Reserve	National Guard
fail	5.4%	.0%	2.4%
pass	94.6%	.0%	97.6%

13E: Cannon Fire Direction Specialist

The final sample included 1823 Soldiers who were coded as either graduates or academic failures during their first AIT attempt in this MOS during a period from 2001 to 2004. Only Soldiers who graduated (98.0%) or failed for academic reasons (2.0%) were included in the analysis sample because we assume that non-completion for non-academic reasons is not related to cognitive criteria.

In this sample, all of the students were male as this MOS is not open to women, most had a high school diploma but not more education (90%, 6% some college, 4% GED or less), and the greatest number were from the National Guard (59%, 41% Regular). The governing AA composite, Field Artillery (FA), for this MOS has a cutoff score of 93; the sample mean is 108.43 (standard deviation = 11.979). See the Appendix for a description of Soldier characteristics for this MOS training sample.

Table 1. 13E: Results of the binary logistic prediction model

Chi- Square		51.568***	
Log Likelihood		310.077	
Nagelkerke R Square		.155	
Variable	Coefficient	Odds Ratio	Wald
Constant	-7.924	.000	10.809***
GED	-1.454	.234	4.620*
COLLEGE	-.749	.473	.970
GUARD	1.476	4.374	12.629***
FA	.111	1.117	20.633***

* = p < .05 *** = p < .001
** = p < .005

A binary logistic regression model was estimated to explain pass/fail AIT outcomes and focused on the first training attempt. The estimation results are reported in Table 1 and indicate that a model, including the FA composite, education status (GED =

GED or less than a high school diploma, COLLEGE = some college or more education), and Army component (GUARD = National Guard), accounts for about 16 percent of the variation in the dependent variable. This model is statistically significant ($\chi^2 = 51.568$, P < .001), and has moderate explanatory power (Nagelkerke $R^2 = .155$).

There is a statistically significant effect for the FA composite, GED, and GUARD. The model suggests that having a higher FA composite score increases the odds of passing. At the mean FA score, an increase of one point is associated with an increase of about 11% in the odds of passing the course, and a five-point increase in FA would increase the odds of passing by 74%. Having less than a high school diploma decreases the odds of passing by 77%. National Guard membership increases the odds of passing by 337%.

Policy Analysis. Table 2 reports the probability that the average Regular Army Soldier from the larger Army contract population would pass the course based upon the binary logistic model. These were calculated using the formula for finding probability in a binary logistic model, which is

$$e^{(\beta' x)} / (1 + e^{(\beta' x)}).$$

Because the COLLEGE is not significant, the following analysis will be based upon Male Regular Army Soldiers factored by GED. Based on the model, when the cutoff score is at its current level (FA = 93), high school educated Soldiers with an average FA score (FA = 110.12) have approximately a 99% chance of passing, while those with less than a high school diploma have approximately a 95% chance of passing. Currently, about 88% of Soldiers are eligible for MOS 13E assignment at the current cutoff. Lowering the cutoff by five points (FA = 88) would increase eligibility by seven percentage points (to 95%)

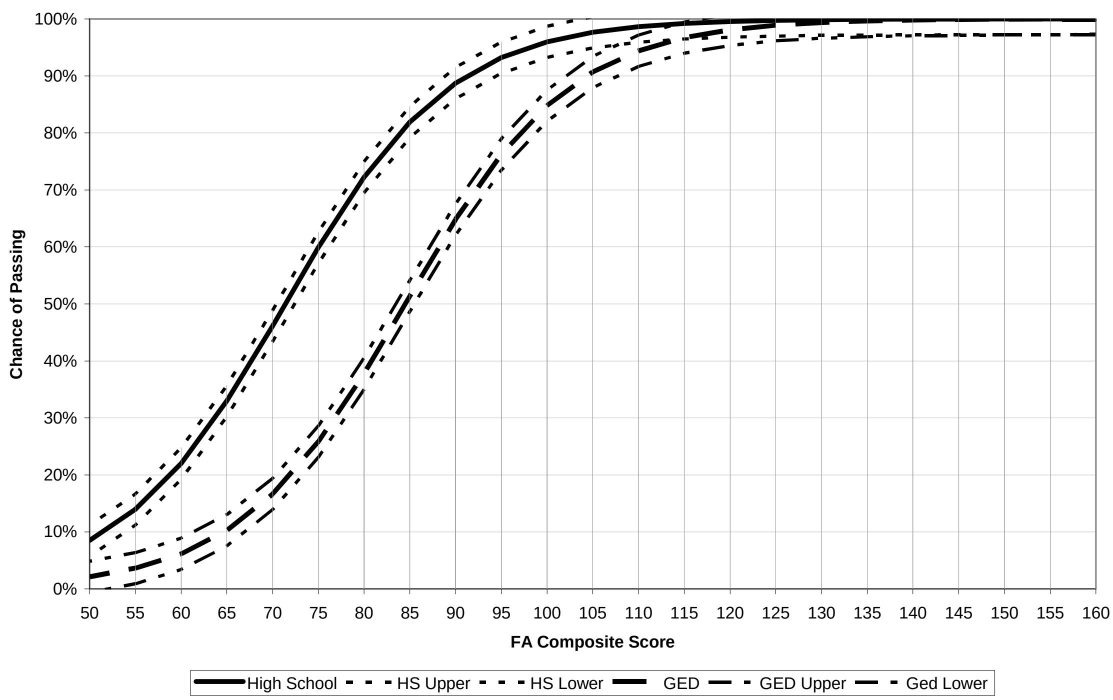
and the average high school educated Soldier who would qualify for training would practically have the same chance of passing (98%), as would the average soldier with less than a high school diploma (94%). Raising the cutoff score by five points (FA = 98), the average high school educated Soldier would have essentially the same chance of passing (99%), as would Soldiers with less than a highs school diploma (96%). However, eligibility would fall by about 11 percentage points.

Table 2. 13E: Probability that a Regular Army Soldier (from the larger Army contract population) will pass the course based on the binary logistic model

	Cutoff = 83	Cutoff = 88	Cutoff = 93	Cutoff = 98	Cutoff = 103
Percent Eligible (Regular Army)	*98.6*	*94.8*	*87.7*	*76.8*	*61.9*
Mean	*107.73*	*108.63*	*110.12*	*112.27*	*115.21*
Passing Rate:					
High School Male	98.3%	98.4%	98.7%	98.9%	99.2%
GED Male	93.0%	93.6%	94.5%	95.6%	96.8%

Figure 1 shows the relationship between FA and the probability of passing for high school and GED male Regular Army Soldiers, including upper and lower bounds based upon the standard error of the estimated FA coefficient. For a particular FA score, trace a vertical line up to the curve, and then a horizontal line over to the axis to determine the corresponding probability of passing. For example, an FA score of 100 corresponds to a passing probability of about 96% for a high school educated, Regular Army male Soldier. One can see that high school educated Soldiers with “low” FA scores have a poor chance of passing. However, this chance increases rather sharply as scores increase. The chance of passing for a Soldier with less than a high school diploma follows a similar pattern, but the improvement in the odds of passing takes place more slowly.

Figure 1: Predicted Probalility of Passing: Male Soldiers



Appendix: Soldier Characteristics (13E)

Outcome	Gender	
	Male	Female
fail	2.0%	.0%
pass	98.0%	.0%

Outcome	Education Level		
	GED or less	High School Diploma	Some College or More
fail	4.1%	2.0%	1.8%
pass	95.9%	98.0%	98.2%

Outcome	Branch of Army		
	Regular Army	Army Reserve	National Guard
fail	3.7%	.0%	.8%
pass	96.3%	.0%	99.2%

13F: Fire Support Specialist

The final sample included 3800 Soldiers who were coded as either graduates or academic failures <u>during their first AIT attempt</u> in this MOS during a period from 2001 to 2004. Only Soldiers who graduated (97.2%) or failed for academic reasons (2.8%) were included in the analysis sample because we assume that non-completion for non-academic reasons is not related to cognitive criteria.

In this sample, all of the students were male as this MOS is not open to women, most had a high school diploma but not more education (92%, 5% some college, 3% GED or less), and the greatest number were from Regular Army (69%, 31% National Guard). The governing AA composite, Field Artillery (FA), for this MOS has a cutoff score of 96; the sample mean is 111.67 (standard deviation = 10.287). See the Appendix for a description of Soldier characteristics for this MOS training sample.

Table 1. 13F: Results of the binary logistic prediction model

Chi- Square		64.804***	
Log Likelihood		917.192	
Nagelkerke R Square		.074	
Variable	Coefficient	Odds Ratio	Wald
Constant	-4.986	.007	14.248***
GUARD	1.227	3.411	17.673***
FA	.076	1.079	37.742***

* = p < .05 *** = p < .001
** = p < .005

A binary logistic regression model was estimated to explain pass/fail AIT outcomes and focused on the first training attempt. The estimation results are reported in Table 1 and indicate that a model, including the FA composite and Army component (GUARD = National Guard), accounts for about seven percent of the variation in the dependent variable. This model is statistically significant ($\chi^2 = 64.804$, $P < .001$), and has somewhat limited explanatory power (Nagelkerke $R^2 = .074$).

There is a statistically significant effect for the FA composite and GUARD. The model suggests that having a higher FA composite score increases the odds of passing. At the mean FA score, an increase of one point is associated with an increase of about 8% in the odds of passing the course, and a five-point increase in FA would increase the odds of passing by 46%. National Guard membership increases the odds of passing by 241%.

<u>Policy Analysis.</u> Table 2 reports the probability that the average Regular Army Soldier from the larger Army contract population would pass the course based upon the binary logistic model. These were calculated using the formula for finding probability in a binary logistic model, which is

$$e^{(\beta' x)} / (1 + e^{(\beta' x)}).$$

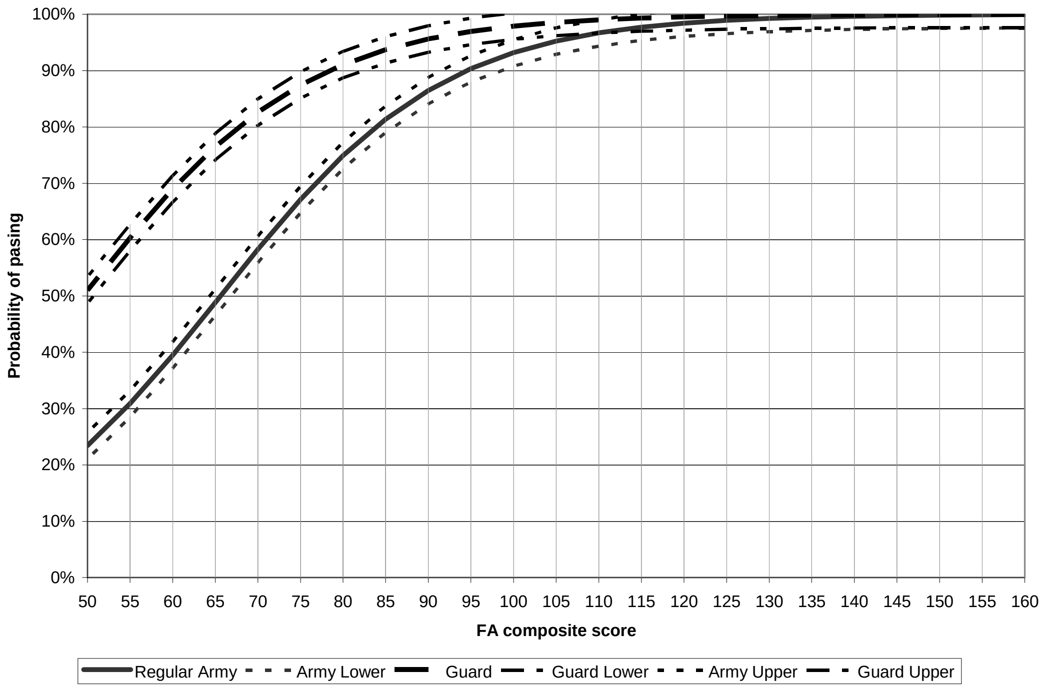
Based on the model, when the cutoff score is at its current level (FA = 96), Soldiers with an average FA score (FA = 111.41) have approximately a 97% chance of passing. Currently, about 81% of Soldiers are eligible for MOS 13F assignment at the current cutoff (FA = 96). Lowering the cutoff by five points (FA = 91) would increase eligibility by 10 percentage points (to 91%) and the average Soldier who would qualify for training would practically have the same chance of passing (96%). Raising the cutoff score by five points (FA = 101), the average Soldier would have almost the same chance of passing (98%) but eligibility would fall by about 12 percentage points.

Table 2. 13F: Probability that a Regular Army Soldier (from the larger Army contract population) will pass the course based on the binary logistic model

	Cutoff = 86	Cutoff = 91	Cutoff = 93	**Cutoff = 96**	Cutoff = 101	Cutoff = 106
Percent Eligible (Regular Army)	*96.9%*	*90.9%*	*87.7%*	***81.3%***	*68.6%*	*53.0%*
Mean	*108.37*	*109.70*	*110.12*	***111.94***	*114.53*	*117.49*
Passing Rate:						
High School Male	96.3%	96.6%	96.7%	**97.1%**	97.6%	98.1%

Figure 1 shows the relationship between FA and the probability of passing for Regular Army Soldiers and Guardsmen, including upper and lower bounds based upon the standard error of the estimated FA coefficient. For a particular FA score, trace a vertical line up to the curve, and then a horizontal line over to the axis to determine the corresponding probability of passing. For example, an FA score of 100 corresponds to a passing probability of about 95% for a high school educated, Regular Army male Soldier. One can see that Soldiers with “low” FA scores have a reasonable chance of passing the course. As FA scores increase, the chance that a Soldier will pass the course increases.

Figure 1: Predicted Probability of Passing: Regular Army



Appendix: Soldier Characteristics (13F)

Outcome	Gender	
	Male	Female
fail	2.8%	.0%
pass	97.2%	.0%

Outcome	Education Level		
	GED or less	High School Diploma	Some College or More
fail	1.9%	3.0%	1.1%
pass	98.1%	97.0%	98.9%

Outcome	Branch of Army		
	Regular Army	Army Reserve	National Guard
fail	3.6%	.0%	1.2%
pass	96.4%	.0%	98.8%

13M: Multiple Launch Rocket System Crew Member

The final sample included 2635 Soldiers who were coded as either graduates or academic failures during their first AIT attempt in this MOS during a period from 2001 to 2004. Only Soldiers who graduated (98.7%) or failed for academic reasons (1.3%) were included in the analysis sample because we assume that non-completion for non-academic reasons is random and not related to cognitive criteria.

In the sample, all of the Soldiers were male as this MOS is not open to women, most had a high school diploma but not more education (95%, 4% some college, 1% GED or less), and most were from Regular Army (79%, 21% National Guard). The governing AA composite, Operator / Food (OF), for this MOS has a cutoff score of 100; the sample mean is 110.54 (standard deviation = 8.865). See the Appendix for a description of Soldier characteristics for this MOS training sample.

A binary logistic regression model was estimated to explain pass/fail AIT outcomes and focused on the first training attempt. The estimation results are reported in Table 1 and indicate that a model, including the OF composite and Army component (GUARD = National Guard), accounts for about 0.3% of the variation in the dependent

Table 1. 13M: Results of the binary logistic prediction model

Chi- Square		1.170	
Log Likelihood		362.208	
Nagelkerke R Square		.003	
Variable	Coefficient	Odds Ratio	Wald
Constant	2.234	9.340	1.010
GUARD	.282	1.326	.385
OF	.019	1.019	.851

* = p < .05 *** = p < .001
** = p < .005

variable. This model is not statistically significant (χ^2 = 1.170, P = .557), and it has no explanatory power (Nagelkerke R^2 = .003).

There is no statistically significant effect for the OF composite or National Guard membership.

Policy Analysis. Because there are too few failure cases and the model for MOS 13M is not significant, policy analysis cannot be conducted.

Appendix: Soldier Characteristics (13M)

Outcome	Gender	
	Male	Female
fail	1.3%	.0%
pass	98.7%	.0%

Outcome	Education Level		
	GED or less	High School Diploma	Some College or More
fail	.0%	1.3%	1.0%
pass	100.0%	98.7%	99.0%

Outcome	Component		
	Regular Army	Army Reserve	National Guard
fail	1.4%	.0%	1.1%
pass	98.6%	.0%	98.9%

14E: Patriot Fire Control Enhanced Operator- Maintainer

The final sample included 728 Soldiers who were coded as either graduates or academic failures during their first AIT attempt for this MOS during a period from 2001 to 2004. Only Soldiers who graduated (93.7%) or failed for academic reasons (6.3%) were included in the analysis sample because we assume that non-completion for non-academic reasons is not related to cognitive criteria.

In the sample, most were male (88%, 12% female), most had a high school diploma but not more education (92%, 6% some college, 2% GED or less), and most were from were from the Regular Army (98%, 2% National Guard). The governing AA composite, Mechanical Maintenance (MM), for this MOS has a cutoff score of 102; the sample mean is 112.77 (standard deviation = 8.958). See the Appendix for a description of Soldier characteristics for this MOS training sample.

A binary logistic regression model was estimated to explain pass/fail AIT outcomes and focused on the first training attempt. The estimation results are reported in Table 1 and indicate that the binary logistic model, including the MM composite and gender (GENDER = female), accounts for two percent of the variation in the dependent

Table 1. 14E: Results of the forward stepwise binary logistic prediction model

Chi- Square		5.652	
Log Likelihood		337.451	
Nagelkerke R Square		.021	
Variable	Coefficient	Odds Ratio	Wald
Constant	.337	.802	1.401
GENDER	1.237	3.447	2.849
MM	.020	1.020	2.322

* = p < .05 *** = p < .001
** = p < .01

variable. This model is not statistically significant (χ^2 = 5.652, P = .059), and it has limited explanatory power (Nagelkerke R^2 = .021).

There are no statistically significant effects for the MM composite. The data are insufficient (too few failure observations) to determine if any of the variables, including MM, have a consistent effect upon passing.[9]

Policy Analysis. Given the model's lack of explanatory power, this model is not appropriate for conducting policy analysis.

[9] In previous research [Williams and Greenston, 2004] we reported a statistically significant model (with MM, GENDER, COLLEGE, and GED) for this MOS with data over the 1999 – 2000 period. Evidently there are too few failure cases and insufficient variation across the explanatory variables in the current data set (i.e., over the 2001 – 2004 period).

Appendix: Soldier Characteristics (14E)

Outcome	Gender	
	Male	Female
fail	6.9%	2.2%
pass	93.1%	97.8%

Outcome	Education Level		
	GED or less	High School Diploma	Some College or More
fail	.0%	6.9%	.0%
pass	100.0%	93.1%	100.0%

Outcome	Component		
	Regular Army	Army Reserve	National Guard
fail	6.5%	.0%	.0%
pass	93.5%	.0%	100.0%

14J: Air Defense Command C4I TOC Enhanced Operator/Maintainer

The final sample included 1076 Soldiers who were coded as either graduates or academic failures during their first AIT attempt in this MOS during a period from 2001 to 2004. Only Soldiers who graduated (98.8%) or failed for academic reasons (1.2%) were included in the analysis sample because we assume that non-completion for non-academic reasons is not related to cognitive criteria.

In the sample, most of the Soldiers were male (92%, 8% female), most had a high school diploma but not more education (87%, 10% some college, 3% GED or less), and most were from Regular Army (88%, 12% National Guard). The governing AA composites, General Technical (GT) and Mechanical Maintenance (MM), for this MOS have a cutoff scores of 100 and 97 respectively; the sample mean for GT is 112.63 (standard deviation = 9.353) and the sample mean for MM is 110.13 (standard deviation = 10.391). See the Appendix for a description of Soldier characteristics for this MOS training sample.

Table 1. 14J: Results of the binary logistic prediction model

Chi- Square		10.087	
Log Likelihood		130.572	
Nagelkerke R Square		.076	
Variable	Coefficient	Odds Ratio	Wald
Constant	4.780	9.055	1.534
GED	-2.401	.091	7.064**
COLLEGE	-.785	.456	.884
GUARD	-.040	.961	.002
GENDER	-.825	.438	1.061
GT	-.012	.988	1.52
MM	.013	1.013	.520

* = p < .05 *** = p < .001
** = p < .01

A binary logistic regression model was estimated to explain pass/fail AIT outcomes and focused on the first training attempt. The estimation results are reported in Table 1 and indicate that a model, including the GT and MM composites, education status (GED = GED or less education; COLLEGE = some college education), Army component (GUARD = National Guard), and gender (GENDER = female), accounts for about eight percent of the variation in the dependent variable. This model is not statistically significant (χ^2 = 10.087, P = .121).

There is no statistically significant effect for the GT or MM composites, though there is one for having a GED or less education. The model suggests that neither the GT nor the MM composite scores predict increased odds of passing, but there are relatively few failure observations for a definitive conclusion.

Policy Analysis. Given the model's overall lack of statistical significance, and notwithstanding the statistically significant effect for education status, this model is not appropriate for conducting policy analysis.

Appendix: Soldier Characteristics (14J)

Outcome	Gender	
	Male	Female
fail	1.1%	2.4%
pass	98.9%	97.6%

Outcome	Education Level		
	GED or less	High School Diploma	Some College or More
fail	8.8%	.9%	1.9%
pass	91.2%	99.1%	98.1%

Outcome	Component		
	Regular Army	Army Reserve	National Guard
fail	1.1%	.0%	2.3%
pass	98.9%	.0%	97.7%

14S: Avenger Crewmember

The final sample included 1641 Soldiers who were coded as either graduates or academic failures during their first AIT attempt in this MOS during a period from 2001 to 2004. Only Soldiers who graduated (98%) or failed for academic reasons (2%) were included in the analysis sample of 1641 Soldiers because we assume that non-completion for non-academic reasons is not related to cognitive criteria.

In the sample, all of the Soldiers were male as this MOS is not open to women, most had a high school diploma but not more education (90%, 3% some college, 7% GED or less), and the greatest number were from Regular Army (69%, 31% National Guard). The governing AA composite, Operator / Food (OF), for this MOS has a cutoff score of 85; the sample mean is 100.39 (standard deviation = 11.12.220). See the Appendix for a description of Soldier characteristics for this MOS training sample.

Table 1. 14S: Results of the binary logistic prediction model

Chi- Square		7.918*	
Log Likelihood		307.380	
Nagelkerke R Square		.028	
Variable	Coefficient	Odds Ratio	Wald
Constant	.497	1.644	.141
GUARD	.441	1.509	.763
OF	.034	1.035	5.895*

* = p < .05 *** = p < .001
** = p < .01

A binary logistic regression model was estimated to explain pass/fail AIT outcomes and focused on the first training attempt. The estimation results are reported in Table 1 and indicate that a model including the OF composite, as well as Army component (GUARD = National Guard), accounts for almost three percent of the variation in the dependent variable. This model is statistically significant (χ^2 = 7.981, P < .018), but its explanatory power is limited (Nagelkerke R^2 = .028).

There is a statistically significant effect for the OF composite. The model suggests that having a higher OF composite score increases the odds of passing. At the mean OF score, an increase of one point is associated with an increase of about 3% in the odds of passing the course, and a five-point increase in OF would increase the odds of passing by 19%.

Policy Analysis. Table 2 reports the probability that the average Soldier from the larger Army contract population would pass the course based upon the binary logistic model. These were calculated using the formula for finding probability in a binary logistic model, which is

$$e^{(\beta' x)} / (1 + e^{(\beta' x)}).$$

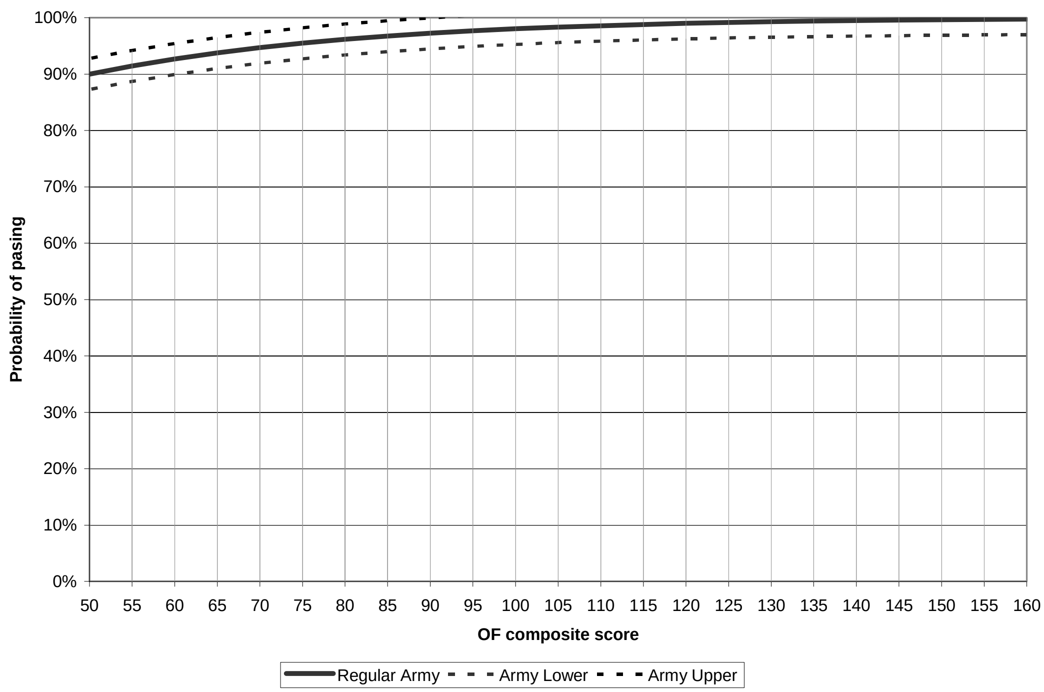
Because GUARD is not statistically significant, this analysis is confined to Soldiers from the Regular Army (though results would be similar for other demographic groups and National Guard members). Based on the model, when the cutoff score is at its current level (OF = 85), regular Army Soldiers with an average OF score (OF = 106.76) have approximately a 96% chance of passing. Currently, about 97% of Soldiers are eligible for MOS 14S assignment at the current cutoff (OF = 85). Lowering the cutoff by five points (OF = 80) would increase eligibility by two percentage points (to 99%) and the average Soldier who would qualify for training would practically have the same chance of passing (96%). Raising the cutoff score by five points (OF = 90), the average Soldier would have the same chance of passing (96%) but eligibility would fall by about five percentage points.

Table 2. 14S: Probability that a Regular Army Soldier (from the larger Army contract population) will pass the course based on the binary logistic model

	Cutoff = 75	Cutoff = 80	Cutoff = 85	Cutoff = 90	Cutoff = 95
Percent Eligible (Regular Army)	*99.9%*	*99.3%*	*97.2%*	*91.9%*	*80.9%*
Mean	*105.89*	*106.10*	*106.76*	*108.05*	*110.08*
Passing rate:					
High school male	95.5%	95.6%	95.8%	96.2%	96.7%

Figure 1 shows the relationship between OF and the probability of passing for male Regular Army Soldiers, including upper and lower bounds based upon the standard error of the estimated OF coefficient. For a particular OF score, trace a vertical line up to the curve, and then a horizontal line over to the axis to determine the corresponding probability of passing. For example, an OF score of 100 corresponds to a passing probability of about 98% for a high school educated, Regular Army male Soldier. One can see that Soldiers with a relatively low OF score have a very high chance of passing the course. As OF scores increase, the chance that a Soldier will pass the course increases.

Figure 1: Predicted Probability of Passing: Regular Army Male



Appendix: Soldier Characteristics (14S)

	Education Level		
	GED or less	High School Diploma	Some College or More
fail	1.8%	2.0%	.0%
pass	98.2%	98.0%	100.0%

	Component		
	Regular Army	Army Reserve	National Guard
fail	2.3%	.0%	1.2%
pass	97.7%	.0%	98.8%

15B (68B): Aircraft Power Plant Repairer

The final sample included 465 Soldiers who were coded as either graduates or academic failures during their first AIT attempt in this MOS during a period from 2001 to 2004. Only Soldiers who graduated (91.6%) or failed for academic reasons (8.4%) were included in the analysis sample because we assume that non-completion for non-academic reasons is not related to cognitive criteria.

In the sample, most were male (97%, 3% female), most had a high school diploma but not more education (87%, 6% some college, 7% GED or less), and most were from the Regular Army (63%, 34% Guard, 3% Reserve). The governing AA composite, Mechanical Maintenance (MM), for this MOS has a cutoff score of 102; the sample mean is 116.23 (standard deviation = 9.017). See the Appendix for a description of Soldier characteristics for this MOS training sample.

A binary logistic regression model was estimated to explain pass/fail AIT outcomes and focused on the first training attempt. The estimation results are reported in Table 1 and indicate that the model, including the MM composite, education status (GED = GED or less than a high school diploma), and Army component (GUARD = National Guard, RESERVE = Army Reserve) accounts for about ten percent of the variation in the dependent variable. This model is statistically significant ($\chi^2 = 20.689$, $P < .001$), and has moderate explanatory power (Nagelkerke $R^2 = .099$).

Table 1. 68B: Results of the binary logistic prediction model: MM only model			
	Chi- Square	20.689***	
	Log Likelihood	247.266	
	Nagelkerke R Square	.099	
Variable	Coefficient	Odds Ratio	Wald
Constant	-6.683	.001	7.035**
GED	-.812	.444	1.270
GUARD	1.216	3.372	6.148*
RESERVE	-.506	.603	.378
MM	.078	1.081	12.050***

* = p < .05 *** = p < .001
** = p < .01

There is a statistically significant effect for the MM composite. The model suggests that having a higher MM composite score increases the odds of passing. At the mean MM score, an increase of one point is associated with an increase of about eight percent in the odds of passing the course, and a five-point increase in MM would increase the odds of passing by 48%. There is also a significant effect for GUARD where guardsmen have 237% increased odds of passing.

Policy Analysis. Table 2 reports the probability that the average Soldier from the larger Army contract population would pass the course based upon the binary logistic model. These probabilities were calculated using the formula for finding probability in a binary logistic model, which is

$$e^{(\beta' x)} / (1 + e^{(\beta' x)}).$$

Because GED and RESERVE were not statistically significant, this analysis is confined to the modal demographic—Regular Army high school educated male Soldiers (though results would be similar for any demographic combination, except National Guardsmen). Based on the model, when the cutoff score is at its current levels (MM = 102), male

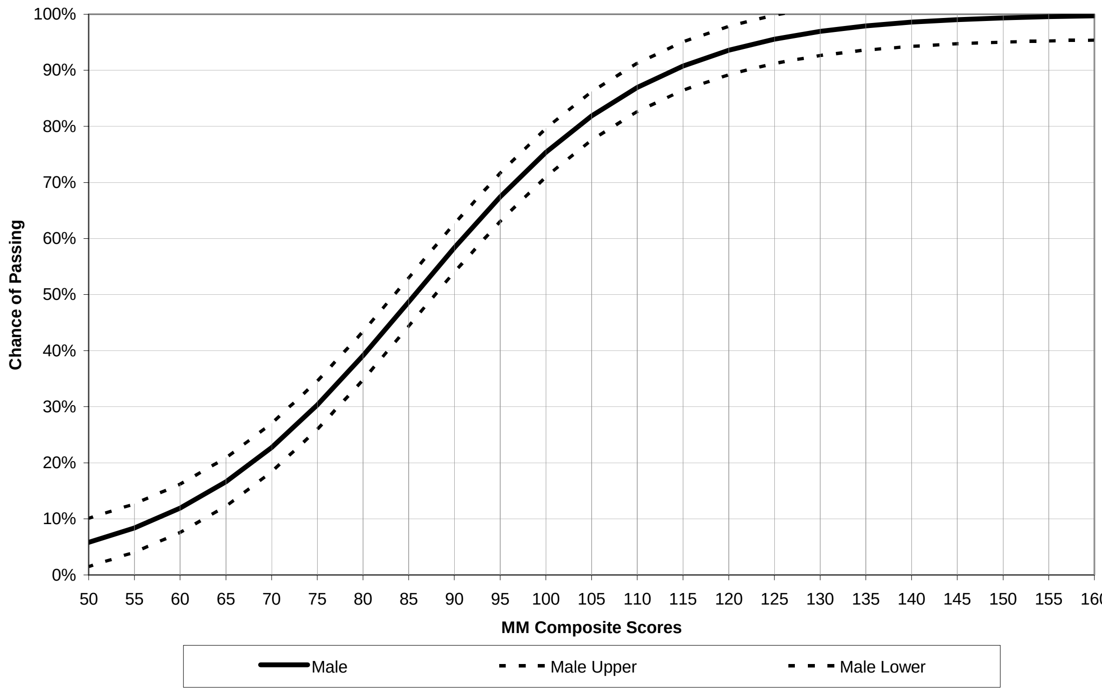
Soldiers with a high school diploma and an average MM score (MM = 113.76) have approximately a 90% chance of passing. Currently, about 55% of Soldiers are eligible for MOS 68B assignment at the current cutoff. Lowering the MM cutoff by five points (MM = 97) would increase eligibility by 13 percentage points, while the average male Soldier who would qualify for training would have a slightly lower chance of passing (88%). Raising the MM cutoff scores by five points (MM = 107), the average male Soldier who would still qualify for the MOS would have a slightly higher chance of passing (92%), but fewer Soldiers would be eligible (42%).

Table 2. 68B: Probability that a Soldier (from the larger Army contract population) will pass the course based on the binary logistic model

	Cutoff: MM = 92	Cutoff: MM = 97	Cutoff: MM = 102	Cutoff: MM = 107	Cutoff: MM = 112
Percent Eligible (Regular Army)	*78.8%*	*67.6%*	*55.0%*	*42.0%*	*29.3%*
Mean: MM	*108.60*	*111.03*	*113.76*	*116.80*	*120.09*
Passing rates:					
High School Male	85.7%	87.8%	89.9%	91.9%	93.6%

Figure 1 shows the relationship between MM and the probability of passing for high school educated male Soldiers, including upper and lower bounds based upon the standard error of the estimated MM coefficient. For a particular MM score, trace a vertical line up to the curve, and then a horizontal line over to the axis to determine the corresponding probability of passing. For example, a MM value of 100 corresponds to a passing probability of about 75% for a high school educated male Soldier.

Figure 1: Predicted Probability of Passing: High School Male Soldiers



Appendix A: Soldier Characteristics (68B)

Outcome	Gender: Male	Gender: Female
fail	8.4%	7.1%
pass	91.6%	92.9%

Outcome	Education Level: GED or less	Education Level: High School Diploma	Education Level: Some College or More
fail	9.4%	8.4%	7.1%
pass	90.6%	91.6%	92.9%

Outcome	Component: Regular Army	Component: Army Reserve	Component: National Guard
fail	10.2%	16.7%	4.4%
pass	89.8%	83.3%	95.6%

15F (68F): Aircraft Electrician

The final sample included 417 Soldiers who were coded as either graduates or academic failures during their first AIT attempt in this MOS during a period from 2001 to 2004. Only Soldiers who graduated (89.9%) or failed for academic reasons (10.1 %) were included in the analysis sample because we assume that non-completion for non-academic reasons is not related to cognitive criteria.

In the sample, most were male (95%, 5% female), most had a high school diploma but not more education (86%, 8% some college, 6% GED or less), and most were from the Regular Army (59%, 39% Guard, 2% Reserve). The governing AA composite, Mechanical Maintenance (MM), for this MOS has a cutoff score of 102; the sample mean is 114.11 (standard deviation = 8.833). See the Appendix for a description of Soldier characteristics for this MOS training sample.

A binary logistic regression model was estimated to explain pass/fail AIT outcomes and focused on the first training attempt. The estimation results are reported in Table 1 and indicate that the model, including the MM composite, education status (GED = GED or less than a high school diploma), Army component (GUARD = National Guard), and gender (GENDER = Female) accounts for about eight percent of the variation in the dependent variable. This model is statistically significant (χ^2 = 15.838, P = .003), and has somewhat limited explanatory power (Nagelkerke R^2 = .078).

Table 1. 68F: Results of the binary logistic prediction model: MM only model			
Chi- Square		15.838**	
Log Likelihood		256.597	
Nagelkerke R Square		.078	
Variable	Coefficient	Odds Ratio	Wald
Constant	-6.205	.002	5.833*
GED	-.092	.912	.018
GUARD	-.501	.606	2.093
GENDER	-.314	.730	.273
MM	.077	1.080	10.975***

* = p < .05 *** = p < .001
** = p < .01

There is a statistically significant effect for the MM composite. The model suggests that having a higher MM composite score increases the odds of passing. At the mean MM score, an increase of one point is associated with an increase of about eight percent in the odds of passing the course, and a five-point increase in MM would increase the odds of passing by 47%.

Policy Analysis. Table 2 reports the probability that the average soldier from the larger Army contract population would pass the course based upon the binary logistic model. These probabilities were calculated using the formula for finding probability in a binary logistic model, which is

$$e^{(\beta' x)} / (1 + e^{(\beta' x)}).$$

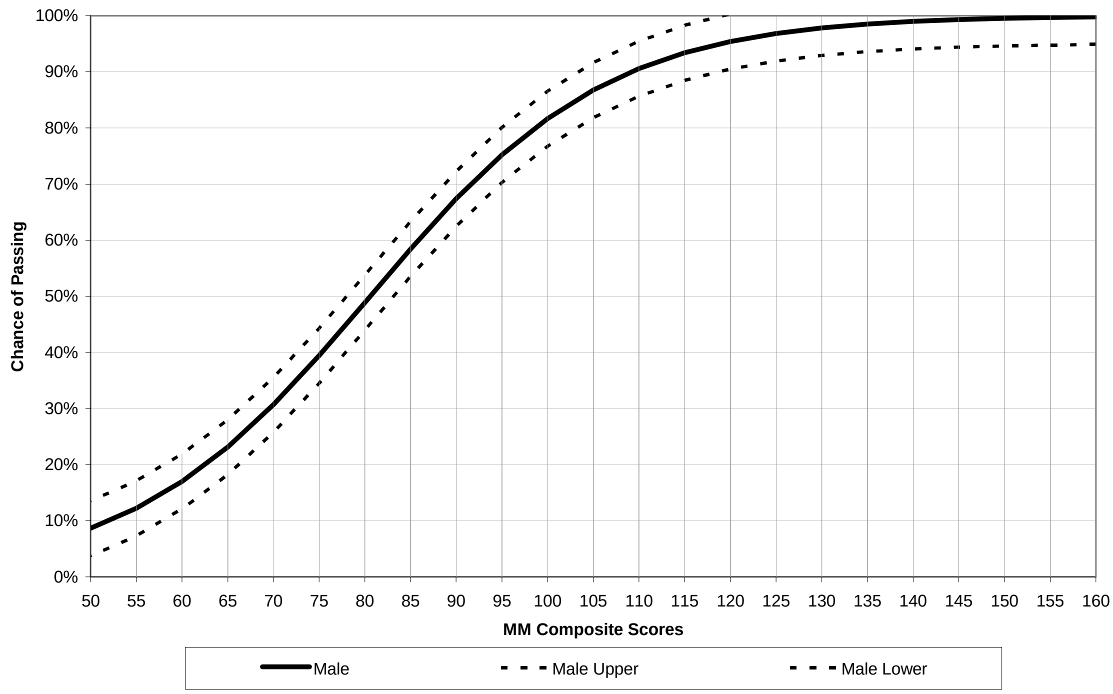
Because GED, GUARD, and GENDER were not statistically significant, this analysis is confined to the modal demographic—Regular Army high school educated male Soldiers (though results would be similar for any demographic combination). Based on the model, when the cutoff score is at its current level (MM = 102), male Soldiers with a high school diploma and an average MM score (MM = 113.76) have approximately a 93% chance of passing. Currently, about 55% of Soldiers are eligible for MOS 68F assignment at the current cutoff. Lowering the MM cutoff by five points (MM = 97) would increase eligibility by 13 percentage points, while the average male Soldier who would qualify for training would have a slightly lower chance of passing (91%). Raising the MM cutoff scores by five points (MM = 107), the average male Soldier who would still qualify for the MOS would have a slightly higher chance of passing (94%), but fewer Soldiers would be eligible (42%).

Table 2. 68F: Probability that a Soldier (from the larger Army contract population) will pass the course based on the binary logistic model

	Cutoff: MM = 92	Cutoff: MM = 97	Cutoff: MM = 102	Cutoff: MM = 107	Cutoff: MM = 112
Percent Eligible (Regular Army)	*78.8%*	*67.6%*	*55.0%*	*42.0%*	*29.3%*
Mean: MM	*108.60*	*111.03*	*113.76*	*116.80*	*120.09*
Passing rates:					
High School Male	89.6%	91.2%	92.8%	94.2%	95.4%

Figure 1 shows the relationship between MM and the probability of passing for high school educated male Soldiers, including upper and lower bounds based upon the standard error of the estimated MM coefficient. For a particular MM score, trace a vertical line up to the curve, and then a horizontal line over to the axis to determine the corresponding probability of passing. For example, a MM value of 100 corresponds to a passing probability of about 81% for a high school educated male Soldier.

Figure 1: Predicted Probability of Passing: High School Male Soldiers



Appendix A: Soldier Characteristics (68F)

Outcome	Gender: Male	Gender: Female
fail	9.6%	18.2%
pass	90.4%	81.8%

Outcome	Education Level: GED or less	High School Diploma	Some College or More
fail	12.0%	10.6%	12.4%
pass	88.0%	89.4%	87.6%

Outcome	Component: Regular Army	Army Reserve	National Guard
fail	8.5%	90.0%	12.4%
pass	91.5%	10.0%	87.6%

15G: Aircraft Structural Repairer

The final sample included 490 Soldiers who were coded as either graduates or academic failures during their first AIT attempt in this MOS during a period from 2001 to 2004. Only Soldiers who graduated (74.7%) or failed for academic reasons (25.3%) were included in the analysis sample because we assume that non-completion for non-academic reasons is not related to cognitive criteria.

In the sample, most were male (95%, 5% female), most had a high school diploma but not more education (89%, 8% some college, 3% GED or less), and the greatest number were from Regular Army (72%, 25% National Guard, 3% Reserve). The governing AA composite, Mechanical Maintenance (MM), for this MOS has a cutoff score of 102; the sample mean is 114.63 (standard deviation = 8.1). See the Appendix for a description of Soldier characteristics for this MOS training sample.

Table 1. 15G: Results of the binary logistic prediction model

Chi- Square		33.704***	
Log Likelihood		520.655	
Nagelkerke R Square		.098	
Variable	Coefficient	Odds Ratio	Wald
Constant	-7.052	.001	16.899
GED	-.613	.542	1.041
COLLEGE	.327	1.387	.526
RESERVE	-.019	.981	.001
GUARD	.682	1.977	5.356*
GENDER	.650	1.915	1.479
MM	.070	1.073	21.232***

* = p < .05 *** = p < .001
** = p < .005

A binary logistic regression model was estimated to explain pass/fail AIT outcomes and focused on the first training attempt. The estimation results are reported in

Table 1 and indicate that the model, including the MM composite, education level (GED = GED or less than high school diploma; COLLEGE = some college), Army component (GUARD = National Guard; RESERVE = Army Reserve) and gender (GENDER = female), accounts for about 10% of the variation in the dependent variable. This model is statistically significant ($\chi^2 = 33.704$, $P < .001$), and has moderate explanatory power (Nagelkerke $R^2 = .098$).

There are statistically significant effects for the MM composite and National Guard membership. The model suggests that having a higher MM composite score increases the odds of passing. At the mean MM score, an increase of one point is associated with an increase of about 7% in the odds of passing the course, and a five-point increase in MM would increase the odds of passing by 41%.

<u>Policy Analysis.</u> Table 2 reports the probability that the average Soldier from the larger Army contract population would pass the course based upon the binary logistic model. These were calculated using the formula for finding probability in a binary logistic model, which is

$$e^{(\beta' x)} / (1 + e^{(\beta' x)}).$$

Because GED, COLLEGE, RESERVE, and GENDER were not statistically significant, this analysis is confined to male Soldiers with a high school diploma from the Regular Army (though results would be similar for other demographic groups). Based on the model, when the cutoff score is at its current level (MM = 102), regular Army Soldiers with an average MM score (MM = 114.35) have approximately a 72% chance of passing. Currently, about 56% of Soldiers are eligible for MOS 15G assignment at the current cutoff (MM = 102). Lowering the cutoff by five points (MM = 97) would increase eligibility by 13 percentage points (to 69%), but the average Soldier who would qualify for training would have a somewhat lower chance of passing (68%). Raising the cutoff score by five points (MM = 107) would lead to a somewhat higher chance of passing for

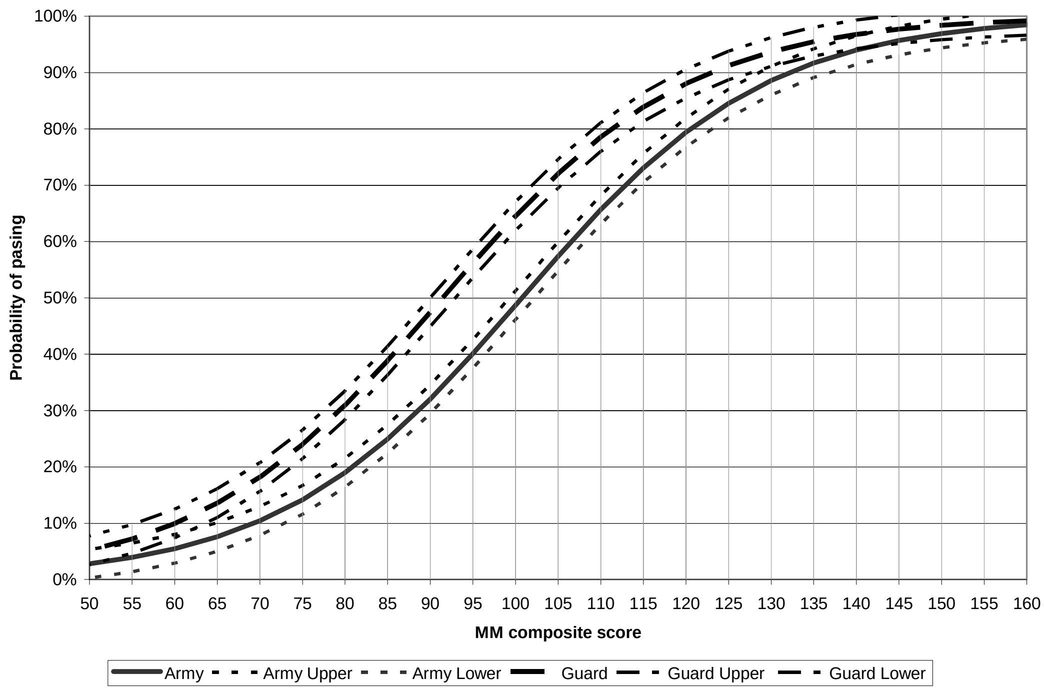
Table 2. 15G: Probability that a Soldier (from the larger Army contract population) will pass the course based on the binary logistic model

	Cutoff = 92	Cutoff = 97	Cutoff = 102	Cutoff = 107	Cutoff = 112
Percent Eligible (Regular Army)	*80.4%*	*68.6%*	*55.7%*	*42.7%*	*30.5%*
Mean	*109.05*	*111.56*	*114.35*	*117.44*	*120.78*
Passing rate:					
High school male	64.1%	68.1%	72.2%	76.3%	80.3%

the average Soldier (76%), but eligibility would fall by about 13 percentage points.

Figure 1 shows the relationship between MM score and the probability of passing for Regular Army Soldiers and Guardsmen, including upper and lower bounds based upon the standard error of the estimated MM coefficient. For a particular MM score, trace a vertical line up to the curve, and then a horizontal line over to the axis to determine the corresponding probability of passing. For example, an MM value of 100 corresponds to a passing probability of about 50% for a high school educated, Regular Army male Soldier.

Figure 1: Predicted Probability of Passing: Regular Army



Appendix: Soldier Characteristics (15G)

Outcome	Gender: Male	Gender: Female
fail	25.6%	20.0%
pass	74.4%	80.0%

Outcome	Education Level: GED or less	High School Diploma	Some College or More
fail	29.4%	25.7%	18.9%
pass	70.6%	74.3%	81.1%

Outcome	Component: Regular Army	Army Reserve	National Guard
fail	28.3%	26.7%	16.4%
pass	71.7%	73.3%	83.6%

15P: Aviation Operations Specialist

The final sample included 1338 Soldiers who were coded as either graduates or academic failures during their first AIT attempt in this MOS during a period from 2001 to 2004. Only Soldiers who graduated (93.3%) or failed for academic reasons (6.7%) were included in the analysis sample because we assume that non-completion for non-academic reasons is not related to cognitive criteria.

In the sample, most Soldiers were male (62%, 38% female), most had a high school diploma but not more education (86%, 10% some college, 4% GED or less), and the majority were from Regular Army (64%, 32% National Guard, 4% Reserve). The governing AA composite, Skilled Technical (ST), for this MOS has a cutoff score of 92; the sample mean is 105.29 (standard deviation = 10.2). See the Appendix for a description of Soldier characteristics for this MOS training sample.

Table 1. 15P: Results of the binary logistic prediction model

	Chi- Square	26.780***	
	Log Likelihood	627.597	
	Nagelkerke R Square	.051	
Variable	Coefficient	Odds Ratio	Wald
Constant	-.465	.628	.109
COLLEGE	.249	1.283	.317
GUARD	1.201	3.324	11.852***
GENDER	.238	1.269	1.014
ST	.027	1.027	3.794*

* = p < .05 *** = p < .001
** = p < .005

A binary logistic regression model was estimated to explain pass/fail AIT outcomes and focused on the first training attempt. The estimation results are reported in Table 1 and indicate that a model including the ST composite, education status (College

= some college education), Army component (GUARD = National Guard), and gender (GENDER = female) accounts for about five percent of the variation in the dependent variable. This model is statistically significant ($\chi^2 = 26.780$, $P < .001$), but has limited explanatory power (Nagelkerke $R^2 = .051$).

There is a statistically significant effect for the ST composite. The model suggests that having a higher ST composite score increases the odds of passing. At the mean ST score, an increase of one point is associated with an increase of about 3% in the odds of passing the course, and a five-point increase in ST would increase the odds of passing by 14%. There is also a significant effect for National Guard membership, where Guardsmen have 232% better odds of passing the course.

<u>Policy Analysis.</u> Table 2 reports the probability that the average Soldier from the larger Army contract population would pass the course based upon the binary logistic model. These were calculated using the formula for finding probability in a binary logistic model, which is

$$e^{(\beta' x)} / (1 + e^{(\beta' x)}).$$

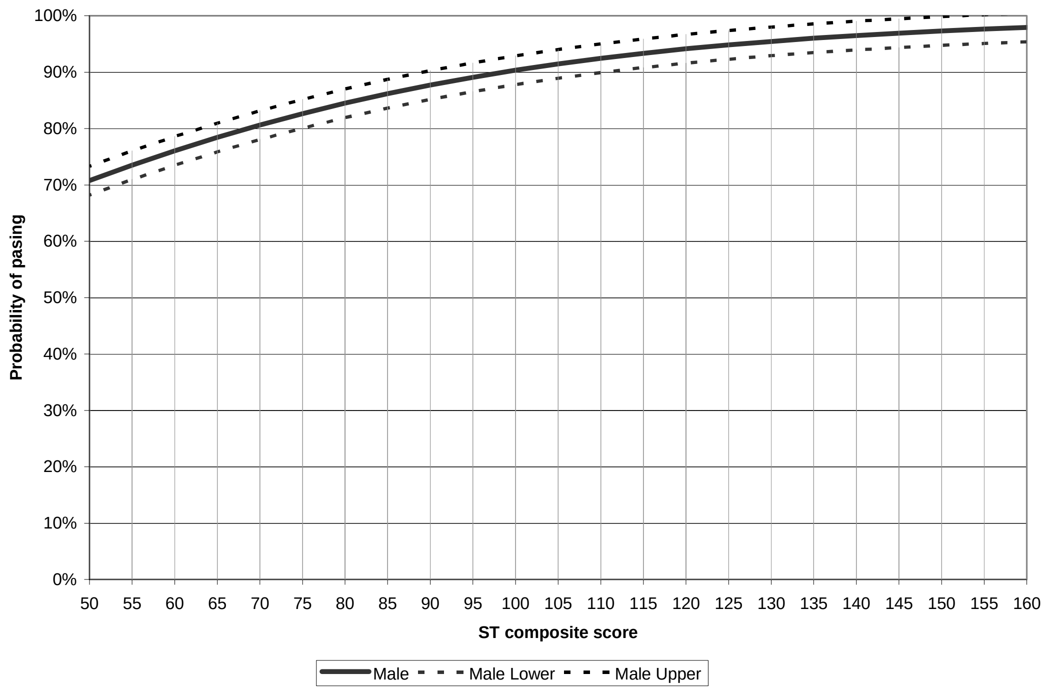
Because GENDER was not statistically significant, this analysis is confined to male Soldiers (though results would be similar for female soldiers). Based on the model, when the cutoff score is at its current level (ST = 92), male Soldiers with an average ST score (ST = 109.45) have approximately a 92% chance of passing. Currently, about 89% of Soldiers are eligible for MOS 15P assignment at the current cutoff (ST = 92). Lowering the cutoff by five points (ST = 87) would increase eligibility by 8 percentage points (to 97%) and the average Soldier who would qualify for training would have approximately the same probability of passing (92%). Raising the cutoff score by five points (ST = 97) would leave the average Soldier with about the same chance of passing (93%), but eligibility would fall by about 11 percentage points.

Table 2. 15P: Probability that a Soldier (from the larger Army contract population) will pass the course based on the binary logistic model

	Cutoff = 82	Cutoff = 87	Cutoff = 92	Cutoff = 97	Cutoff = 102
Percent Eligible (Regular Army)	*99.8%*	*97.1%*	*89.0%*	*78.2%*	*64.9%*
Mean	*106.82*	*107.67*	*109.45*	*111.59*	*114.16*
Passing rate:					
Male	91.8%	92.0%	92.3%	92.7%	93.2%

Figure 1 shows the relationship between ST and the probability of passing for Regular Army, male Soldiers, including upper and lower bounds based upon the standard error of the estimated ST coefficient. For a particular ST score, trace a vertical line up to the curve, and then a horizontal line over to the axis to determine the corresponding probability of passing. For example, an ST score of 100 corresponds to a passing probability of about 90% for a Regular Army male Soldier. One can see that Soldiers with a relatively low ST score have a reasonably high chance of passing the course. As ST scores increase, the chance that a soldier will pass the course increases.

Figure 1: Predicted Probability of Passing: Male



Appendix: Soldier Characteristics (15P)

Outcome	Gender: Male	Gender: Female
fail	6.9%	6.3%
pass	93.1%	93.7%

Outcome	Education Level: GED or less	Education Level: High School Diploma	Education Level: Some College or More
fail	.0%	7.2%	4.6%
pass	100.0%	92.8%	95.4%

Outcome	Branch of Army: Regular Army	Branch of Army: Army Reserve	Branch of Army: National Guard
fail	9.2%	.0%	2.4%
pass	90.8%	100.0%	97.6%

15Q: Air Traffic Controller

The final sample included 633 soldiers who were coded as either graduates or academic failures during their first training attempt in this MOS during a period from 2001 to 2004. Only soldiers who graduated (69.4%) or failed for academic reasons (30.6%) were included in the analysis sample because we assume that non-completion for non-academic reasons is not related to cognitive criteria.

In the sample, most were male (74%, 26% female), most had a high school diploma but not more education (82%, 16% some college, 2% GED or less), and most were Regular Army (87%, 13% National Guard).[10] The governing AA composite, Skilled Technical (ST), for this MOS has a cutoff score of 102; the sample mean is 112.75 (standard deviation = 10.532). See the Appendix for a description of Soldier characteristics for this MOS training sample.

A binary logistic regression model was estimated for this MOS and focused on the first training attempt. The estimation results are reported in Table 1 and indicate that the model, including the ST composite, education status (GED = GED or less than high school diploma; COLLEGE = some college), Army component (GUARD = National Guard) and gender (GENDER = female), accounts for about six percent of the variation in the dependent variable. This model is statistically significant ($\chi^2 = 27.954$, $P < .001$), but its explanatory power appears somewhat limited (Nagelkerke $R^2 = .061$).

[10] Four Soldiers were members of the Army Reserve; these Soldiers were included with the Regular Army for data analysis.

Table 1. 15Q: Results of the binary logistic prediction model			
Chi- Square		27.954***	
Log Likelihood		752.222	
Nagelkerke R Square		.061	
Variable	Coefficient	Odds Ratio	Wald
Constant	-3.422	.033	7.779
GED	-.604	.547	.970
COLLEGE	.459	1.583	2.824
GUARD	.869	2.383	6.927**
GENDER	-.081	.922	.156
ST	.036	1.037	11.382**

** = p < .005
*** = p < .001

There are statistically significant effects for both the ST composite and National Guard membership. The model suggests that having a higher ST composite score increases the odds of passing. At the mean ST score, an increase of one point is associated with an increase of about four percent in the odds of passing the course, and a five-point increase in ST would increase the odds of passing by 20%. There is also a noteworthy effect for GUARD, where the odds of a Guardsman passing this training exceed that of the average Soldier by 138%.

Policy Analysis. Table 2 reports the probability that the average soldier from the larger Army contract population would pass the course based upon the binary logistic model. These were calculated using the formula for finding probability in a binary logistic model, which is

$$e^{(\beta' x)} / (1 + e^{(\beta' x)}).$$

Because GENDER, GED, and COLLEGE were not statistically significant, this analysis is confined to the modal demographics—male Soldiers with a high school diploma (though results would be similar for any demographic combination). Based on the model, when the cutoff score is at its current level (ST = 102), regular Army soldiers with an average ST score (ST = 114.16) have approximately a 67% chance of passing. Currently, about 65% of Soldiers are eligible for MOS 15Q assignment at the current cutoff (ST = 102). Lowering the cutoff score by five points (ST = 97) would increase eligibility by about 13 percentage points, and the average Soldier who would qualify would have a slightly lower chance of passing (65%). Raising the cutoff by five points

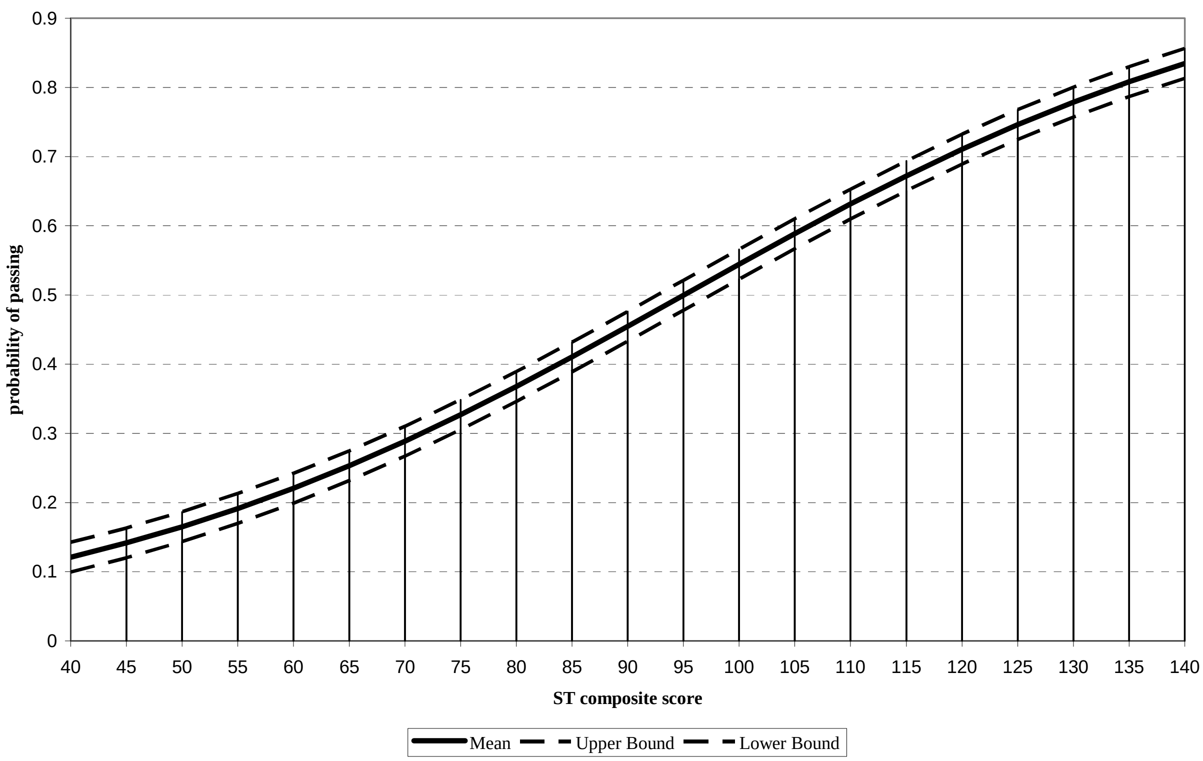
Table 2. 15Q: Probability that a Soldier (from the larger Army contract population) will pass the course based on the binary logistic model

	Cutoff = 92	Cutoff = 97	Cutoff = 102	Cutoff = 107	Cutoff = 112
Percent Eligible (Regular Army)	*89.0%*	*78.2%*	*64.9%*	*49.6%*	*34.7%*
Mean	*109.45*	*111.59*	*114.16*	*117.18*	*120.51*
Passing rate:					
Regular Army	62.7%	64.5%	66.5%	68.9%	71.4%
National Guard	80.0%	81.2%	82.6%	84.1%	85.6%

(ST = 107) would lead to only a slightly higher chance of passing (to 69%) for the average Soldier, while reducing eligibility by 15 percentage points (to 50%).

Figure 1 shows the relationship between ST and the probability of passing for Regular Army Soldiers, including upper and lower bounds based upon the standard error of the estimated ST coefficient. For a particular ST score, trace a vertical line up to the curve, and then a horizontal line over to the axis to determine the corresponding probability of passing. For example, an ST score of 100 corresponds to a passing probability of about 55% for a high school educated, Regular Army male Soldier. One can see that the probability of passing increases gradually, in a near linear fashion, within the range of possible ST scores.

Figure 1: Predicted Probability of Passing: Male High School Graduate, Regular Army



Appendix: Soldier Characteristics (15Q)

	Gender	
	Male	Female
fail	29.7%	33.5%
pass	70.3%	66.5%

	Education Level		
	GED or less	High School Diploma	Some College or More
fail	35.7%	32.2%	22.0%
pass	64.3%	67.8%	78.0%

	Component		
	Regular Army	Army Reserve	National Guard
fail	32.4%	.0%	19.2%
pass	67.6%	100.0%	80.8%

15Q Risk Analysis of Policy Alternatives

In this section we extend the policy analysis with a risk analysis of the policy alternatives considered using simulation methods. We employ the "@RISK" software package which is designed as an add-in for Microsoft Excel.[11] There are four steps in the risk analysis.

The first step is developing a model. A regression model for predicting the passing rate has been specified and estimated, and the results stored in Excel worksheet format. See Table 1.

The second step is identifying the uncertainty inherent in both the input variables (composite scores, Soldier characteristics) and the corresponding estimated parameters and specifying their possible values with probability distributions.

To approximate the governing composite distribution, we use the larger Army contract population (EAF file: those who contracted from Jan 1992 to Aug 2003). This distribution can be assumed to follow a normal distribution. The mean and standard deviation estimated from the contract population and used as input to the simulations are shown in Table R-1.

Table R-1. Input information for the simulations

	Mean	Std error / deviation
Constant	-3.422	1.227
ST var	107.02 (before truncation)	12.157
ST coeff	.036	.011
GENDER var	25.7% (female)	
GENDER coeff	.869	.205
GED var	2.8%	
GED coeff	-.604	.613
COLLEGE var	15.8%	
COLLEGE coeff	.459	.273
GUARD var	12.3%	
GUARD coeff	.869	.330

[11] Software is available from Palisade Corporation, Newfield, NY.

To approximate the distributions for the demographic variables (GENDER, GED, COLLEGE, RESERVE, and GUARD) we rely on the training data sample used to estimate the regression model. These distributions can be assumed to follow binomial distributions with means estimated from the training data sample as shown in Table R-1.

To approximate the distributions for the estimated parameters in the logit model, we note that, under very general conditions, the estimates will be asymptotically normally distributed.[12] The estimated coefficients (means and standard errors) are shown in Table R-1.

The third step is analyzing the model with simulation to determine the range and probabilities of all possible training outcome results. The results reported represent the simulation of the regression prediction equation for 1000 iterations using a fixed seed.[13] The comparisons are between the baseline case (ST = 102) and the policy cases (ST = 97 and ST = 107). These cases are delineated by the cutoff score level which serves as the lower truncation point in the composite score input distribution. The simulation results in Table R-2 describe the effect on the mean probability of passing as the ST cutoff score level is varied, and represent an improvement of the policy analysis presented in Table 2 because they reflect the simultaneous effects of all known sources of uncertainty.

Table R-2. 15Q simulation results

	ST = 97	ST = 102	ST = 107
Mean probability of passing	64.51%	65.37%	67.61%
Std deviation	25.93%	29.13%	27.82%

The frequency distributions of simulated effects are shown below in the histogram graphs. The histogram portrays the full range of outcomes that average to the mean effect as reported. Looking at the histogram for the baseline case (ST = 102), probability of passing is plotted on the horizontal axis and the height of each bar indicates the relative number of Soldiers at that passing probability. The information in the histograms is effectively summarized in Table R-3. In that table we see the percentage of Soldiers that meet or exceed a given chance of passing. For example, looking at the baseline case (ST = 102), just over 52% of Soldiers have a 70% or greater chance of passing.

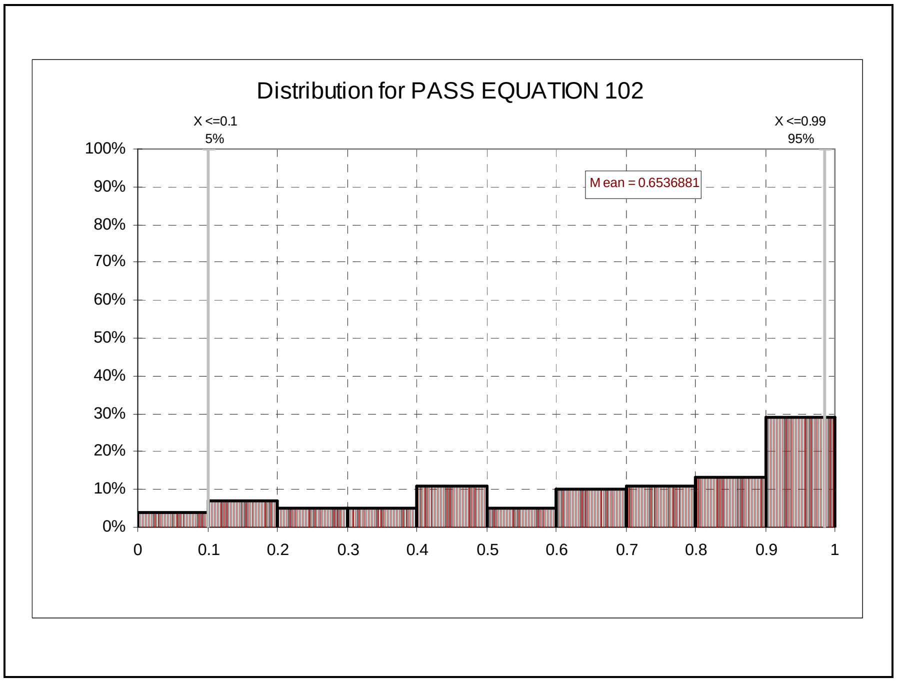
[12] The intuition is that logit estimates are derived from maximum likelihood (ML) estimation, and under fairly general conditions ML estimates are consistent and asymptotically normally distributed.
[13] Latin Hypercube (LH) sampling is utilized in drawing samples for the input distributions. It is designed to accurately recreate the input distribution through sampling in fewer iterations when compared with the Monte Carlo method. The key to LH sampling is stratification of the input probability distributions.

Table R-3.
Percent of simulated Soldiers that meet or exceed given chance of passing

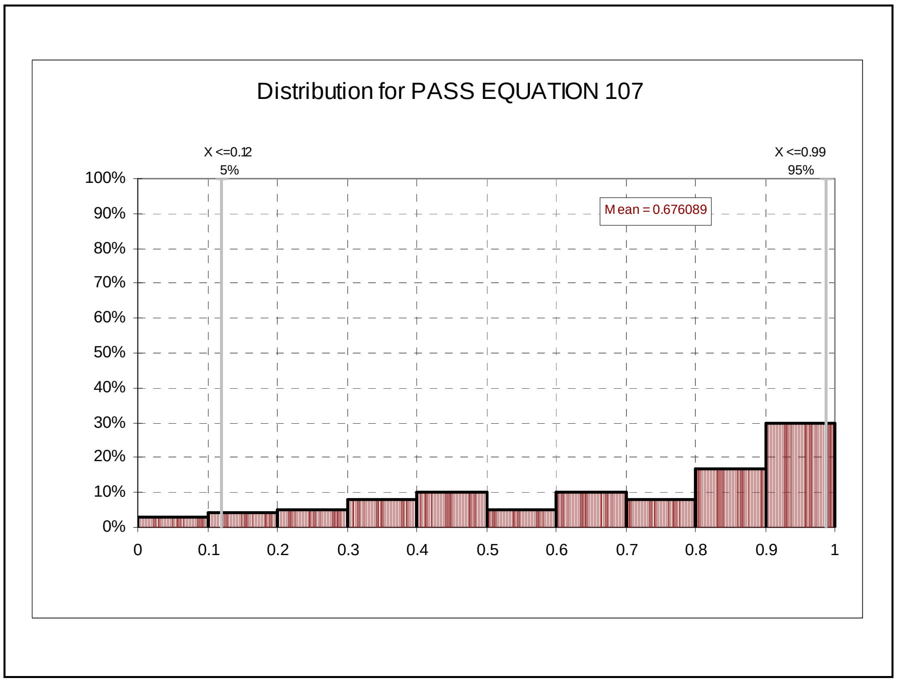
Chance of passing	ST = 97	ST = 102	ST = 107
95.0%	12.3%	17.8%	19.1%
90.0%	20.4%	28.3%	29.3%
85.0%	25.8%	36.2%	35.0%
80.0%	35.0%	41.5%	46.1%
75.0%	39.2%	45.6%	50.4%
70.0%	50.1%	52.4%	54.9%
65.0%	52.6%	56.3%	60.0%
60.0%	63.1%	62.2%	64.5%
55.0%	67.2%	65.1%	66.6%
50.0%	68.6%	67.3%	69.9%

We find that the mean probability of passing in the simulation is 65% (Table R-2, baseline). Looking at the histograms, we see the largest portion of Soldiers at the high end of passing probabilities, and the remainder distributed across the middle and lower range. We note that the mean simulated passing probability turns out to be about the same as the static prediction at the mean ST score (Table 2). In the simulated predictions we are calculating an average over all Soldiers and taking into account all sources of uncertainty, whereas in the static prediction we are calculating the probability of passing only at the mean ST score, ignoring the distribution of Soldier scores etc. as well as uncertainty. While recognizing this variability is important, we also note that the policy case impacts relative to the baseline are the same in both simulation and static prediction modes.

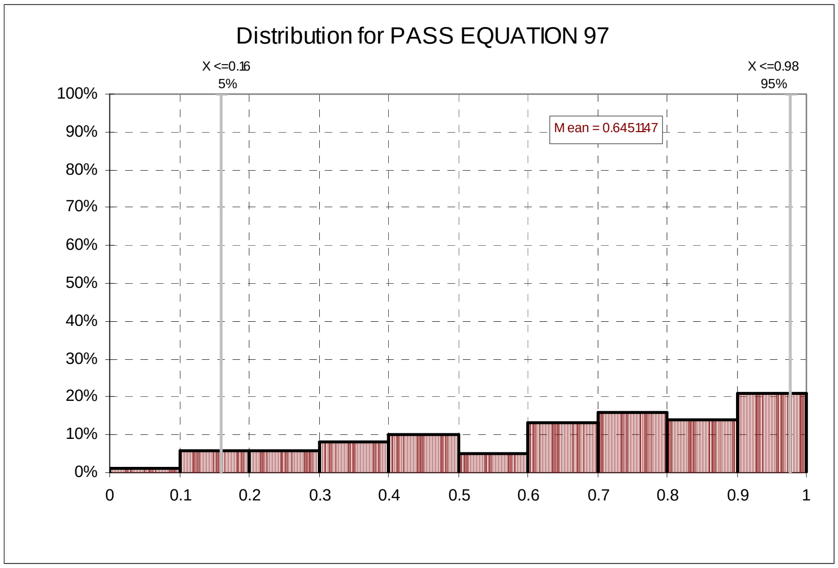
The fourth step is making a decision based on the results provided and the preferences of the school proponent. This involves the evaluation by the school proponent of the tradeoff between increased eligibility and reduced passing probabilities (and vice-versa).



Distribution for PASS EQUATION 102
X <=0.1
5%
X <=0.99
95%
Mean = 0.6536881
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1



Distribution for PASS EQUATION 107
X <=0.12
5%
X <=0.99
95%
Mean = 0.676089
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1


Distribution for PASS EQUATION 97
X <=0.16
5%
X <=0.98
95%
Mean = 0.645147
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1

15T (67T): UH-60 Repairer

The final sample included 1670 Soldiers who were coded as either graduates or academic failures during their first AIT attempt in this MOS during a period from 2001 to 2004. Only Soldiers who graduated (96.3%) or failed for academic reasons (3.7%) were included in the analysis sample because we assume that non-completion for non-academic reasons is not related to cognitive criteria.

In the sample, most were male (94%, 6% female), most had a high school diploma but not more education (88%, 4% some college, 8% GED or less), and most were from the Regular Army (73%, 25% Guard, 2% Reserve). The governing AA composite, Mechanical Maintenance (MM), for this MOS has a cutoff score of 102; the sample mean is 116.07 (standard deviation = 9.109). See the Appendix for a description of Soldier characteristics for this MOS training sample.

A binary logistic regression model was estimated to explain pass/fail AIT outcomes and focused on the first training attempt. The estimation results are reported in Table 1 and indicate that the model, including the MM composite, education status (COLLEGE = some college education), Army component (GUARD = National Guard, RESERVE = Army Reserve), and gender (GENDER = female), accounts for about five percent of the variation in the dependent variable. This model is statistically significant (χ^2 = 20.521, P = .001), and has limited explanatory power (Nagelkerke R^2 = .045).

Table 1. 67T: Results of the binary logistic prediction model

Chi- Square		20.521***	
Log Likelihood		503.008	
Nagelkerke R Square		.045	
Variable	Coefficient	Odds Ratio	Wald
Constant	-1.477	.228	.908
COLLEGE	.449	1.568	.543
GUARD	.897	2.453	4.809*
RESERVE	-.197	.822	.069
GENDER	-.461	.631	1.021
MM	.040	1.041	8.679**

* = $p < .05$ *** = $p < .001$
** = $p < .01$

There is a statistically significant effect for the MM composite. The model suggests that having a higher MM composite score increases the odds of passing. At the mean MM score, an increase of one point is associated with an increase of about four percent in the odds of passing the course, and a five-point increase in MM would increase the odds of passing by 22%. There is also a significant effect for GUARD where guardsmen have a 145% increased odds of passing.

<u>Policy Analysis.</u> Table 2 reports the probability that the average Soldier from the larger Army contract population would pass the course based upon the binary logistic model. These probabilities were calculated using the formula for finding probability in a binary logistic model, which is

$$e^{(\beta' x)} / (1 + e^{(\beta' x)}).$$

Because COLLEGE, RESERVE, and GENDER were not statistically significant, this analysis is confined to the modal demographic—Regular Army high school educated male Soldiers (though results would be similar for any demographic combination, except

National Guardsmen). Based on the model, when the cutoff score is at its current level (MM = 102), male Soldiers with a high school diploma and an average MM score (MM = 113.76) have approximately a 96% chance of passing. Currently, about 55% of Soldiers are eligible for MOS 67T assignment at the current cutoff. Lowering the MM cutoff by

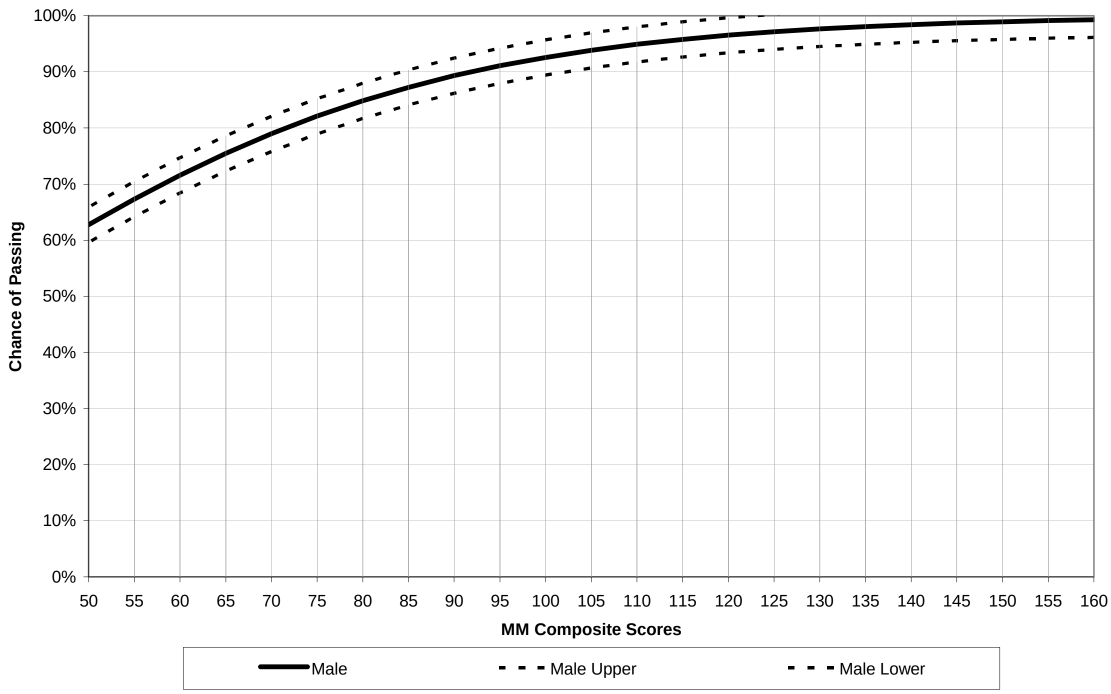
Table 2. 67T: Probability that a Soldier (from the larger Army contract population) will pass the course based on the binary logistic model

	Cutoff: MM = 92	Cutoff: MM = 97	Cutoff: MM = 102	Cutoff: MM = 107	Cutoff: MM = 112
Percent Eligible (Regular Army)	*78.8%*	*67.6%*	*55.0%*	*42.0%*	*29.3%*
Mean: MM	*108.60*	*111.03*	*113.76*	*116.80*	*120.09*
Passing rates:					
High School Male	94.6%	95.1%	95.6%	96.1%	96.5%

five points (MM = 97) would increase eligibility by 13 percentage points, while the average male Soldier who would qualify for training would have essentially the same chance of passing (95%). Raising the MM cutoff scores by five points (MM = 107), the average male Soldier who would still qualify for the MOS would have about the same chance of passing (96%), but fewer Soldiers would be eligible (42%).

Figure 1 shows the relationship between MM and the probability of passing for high school educated male Soldiers, including upper and lower bounds based upon the standard error of the estimated MM coefficient. For a particular MM score, trace a vertical line up to the curve, and then a horizontal line over to the axis to determine the corresponding probability of passing. For example, a MM value of 100 corresponds to a passing probability of about 93% for a high school educated male Soldier.

Figure 1: Predicted Probability of Passing: High School Male Soldiers



Appendix A: Soldier Characteristics (67T)

Outcome	Gender	
	Male	Female
fail	3.5%	6.1%
pass	96.5%	93.9%

Outcome	Education Level		
	GED or less	High School Diploma	Some College or More
fail	0.0%	4.0%	2.1%
pass	100.0%	96.0%	97.9%

Outcome	Component		
	Regular Army	Army Reserve	National Guard
fail	4.3%	5.4%	1.7%
pass	95.7%	94.6%	98.3%

15U (67U): CH-47 Helicopter Repairer

The final sample included 972 Soldiers who were coded as either graduates or academic failures during their first AIT attempt in this MOS during a period from 2001 to 2004. Only Soldiers who graduated (91.5%) or failed for academic reasons (8.5%) were included in the analysis sample because we assume that non-completion for non-academic reasons is not related to cognitive criteria.

In the sample, most were male (97%, 3% female), most had a high school diploma but not more education (88%, 7% some college, 5% GED or less), and most were from the Regular Army (69%, 21% Guard, 10% Reserve). The governing AA composite, Mechanical Maintenance (MM), for this MOS has a cutoff score of 102; the sample mean is 115.11 (standard deviation = 10.171). See the Appendix for a description of Soldier characteristics for this MOS training sample.

A binary logistic regression model was estimated to explain pass/fail AIT outcomes and focused on the first training attempt. The estimation results are reported in Table 1 and indicate that the model, including the MM composite, education status (GED = GED or less than a high school diploma, COLLEGE = some college education), Army component (GUARD = National Guard, RESERVE = Army Reserve), and gender (GENDER = female), accounts for about four percent of the variation in the dependent variable. This model is statistically significant (χ^2 = 17.649, P = .007), and has limited explanatory power (Nagelkerke R^2 = .041).

Table 1. 67U: Results of the binary logistic prediction model			
Chi- Square		17.649**	
Log Likelihood		549.498	
Nagelkerke R Square		.041	
Variable	Coefficient	Odds Ratio	Wald
Constant	-.850	.427	.581
GED	-4.53	.636	.633
COLLEGE	-.125	.883	.076
GUARD	.867	2.379	5.571*
RESERVE	.998	2.712	3.364
GENDER	-.362	.696	.420
MM	.027	1.027	7.467**

* = p < .05 *** = p < .001
** = p < .01

There is a statistically significant effect for the MM composite. The model suggests that having a higher MM composite score increases the odds of passing. At the mean MM score, an increase of one point is associated with an increase of about three percent in the odds of passing the course, and a five-point increase in MM would increase the odds of passing by 14%. There is also a significant effect for GUARD where guardsmen have 138% increased odds of passing.

<u>Policy Analysis.</u> Table 2 reports the probability that the average Soldier from the larger Army contract population would pass the course based upon the binary logistic model. These probabilities were calculated using the formula for finding probability in a binary logistic model, which is

$$e^{(\beta' x)} / (1 + e^{(\beta' x)}).$$

Because GED, COLLEGE, RESERVE, and GENDER were not statistically significant, this analysis is confined to the modal demographic—Regular Army high school educated male Soldiers (though results would be similar for any demographic combination, except

National Guardsmen). Based on the model, when the cutoff score is at its current levels (MM = 102), male Soldiers with a high school diploma and an average MM score (MM = 113.76) have approximately a 90% chance of passing. Currently, about 55% of Soldiers are eligible for MOS 67U assignment at the current cutoff. Lowering the MM cutoff by five points (MM = 97) would increase eligibility by 13 percentage points, while the

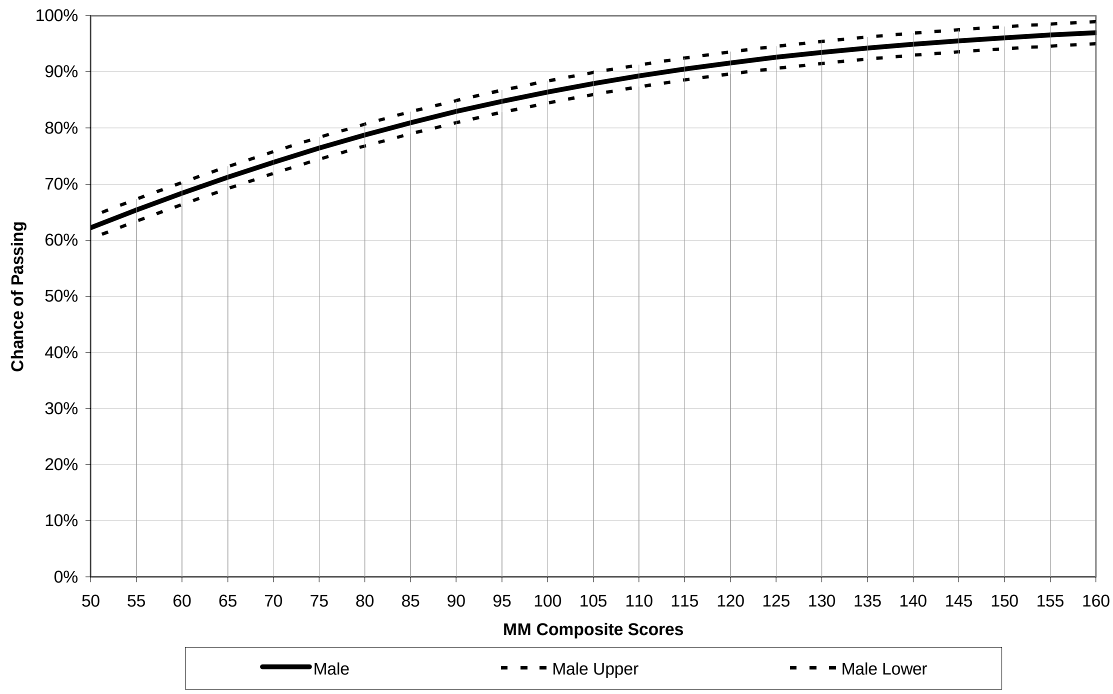
Table 2. 67U: Probability that a Soldier (from the larger Army contract population) will pass the course based on the binary logistic model

	Cutoff: MM = 92	Cutoff: MM = 97	Cutoff: MM = 102	Cutoff: MM = 107	Cutoff: MM = 112
Percent Eligible (Regular Army)	*78.8%*	*67.6%*	*55.0%*	*42.0%*	*29.3%*
Mean: MM	*108.60*	*111.03*	*113.76*	*116.80*	*120.09*
Passing rates:					
High School Male	88.9%	89.5%	90.2%	90.9%	91.6%

average male Soldier who would qualify for training would have essentially the same chance of passing (90%). Raising the MM cutoff scores by five points (MM = 107), the average male Soldier who would still qualify for the MOS would have about the same chance of passing (91%), but fewer Soldiers would be eligible (42%).

Figure 1 shows the relationship between MM and the probability of passing for high school educated male Soldiers, including upper and lower bounds based upon the standard error of the estimated MM coefficient. For a particular MM score, trace a vertical line up to the curve, and then a horizontal line over to the axis to determine the corresponding probability of passing. For example, a MM value of 100 corresponds to a passing probability of about 86% for a high school educated male Soldier.

Figure 1: Predicted Probability of Passing: High School Male Soldiers



Appendix A: Soldier Characteristics (67U)

Outcome	Gender: Male	Gender: Female
fail	8.4%	12.1%
pass	91.6%	87.9%

Outcome	Education Level: GED or less	High School Diploma	Some College or More
fail	9.1%	8.5%	8.3%
pass	90.9%	91.5%	91.7%

Outcome	Component: Regular Army	Army Reserve	National Guard
fail	10.2%	4.3%	4.9%
pass	89.8%	95.7%	95.1%

21B: Combat Engineer

The final sample included 1902 Soldiers who were coded as either graduates or academic failures <u>during their first AIT attempt</u> in this MOS during a period from 2001 to 2004. Only Soldiers who graduated (96.4%) or failed for academic reasons (3.6%) were included in the analysis sample of 1902 Soldiers because we assume that non-completion for non-academic reasons is not related to cognitive criteria.

In the sample, all of the Soldiers were male as this MOS is not open to women, most had a high school diploma but not more education (79%, 11% some college, 10% GED or less), and the greatest number were from Regular Army (54%, 41% National Guard, 5% Army Reserve). The governing AA composite, Combat (CO), for this MOS has a cutoff score of 87; the sample mean is 105.99 (standard deviation = 13.201). See the Appendix for a description of Soldier characteristics for this MOS training sample.

Table 1. 21B: Results of the binary logistic prediction model

Chi- Square		28.484***	
Log Likelihood		558.092	
Nagelkerke R Square		.056	
Variable	Coefficient	Odds Ratio	Wald
Constant	-1.057	.348	1.452
GUARD	.773	2.167	7.143**
CO	.040	1.041	21.394***

* = p < .05 *** = p < .001
** = p < .01

A binary logistic regression model was estimated to explain pass/fail AIT outcomes and focused on the first training attempt. The estimation results are reported in Table 1 and indicate that a model including the CO composite, as well as Army component (GUARD = National Guard), accounts for almost six percent of the variation in the dependent variable. This model is statistically significant ($\chi^2 = 28.484$, $P < .001$), but its explanatory power is limited (Nagelkerke $R^2 = .056$).

There is a statistically significant effect for the CO composite. The model suggests that having a higher CO composite score increases the odds of passing. At the mean CO score, an increase of one point is associated with an increase of about 4% in the odds of passing the course, and a five-point increase in CO would increase the odds of passing by 22%. There is also a significant effect for Guard where members of the National Guard have 117% greater odds of passing the course.

<u>Policy Analysis.</u> Table 2 reports the probability that the average Soldier from the larger Army contract population would pass the course based upon the binary logistic model. These were calculated using the formula for finding probability in a binary logistic model, which is

$$e^{(\beta' x)} / (1 + e^{(\beta' x)}).$$

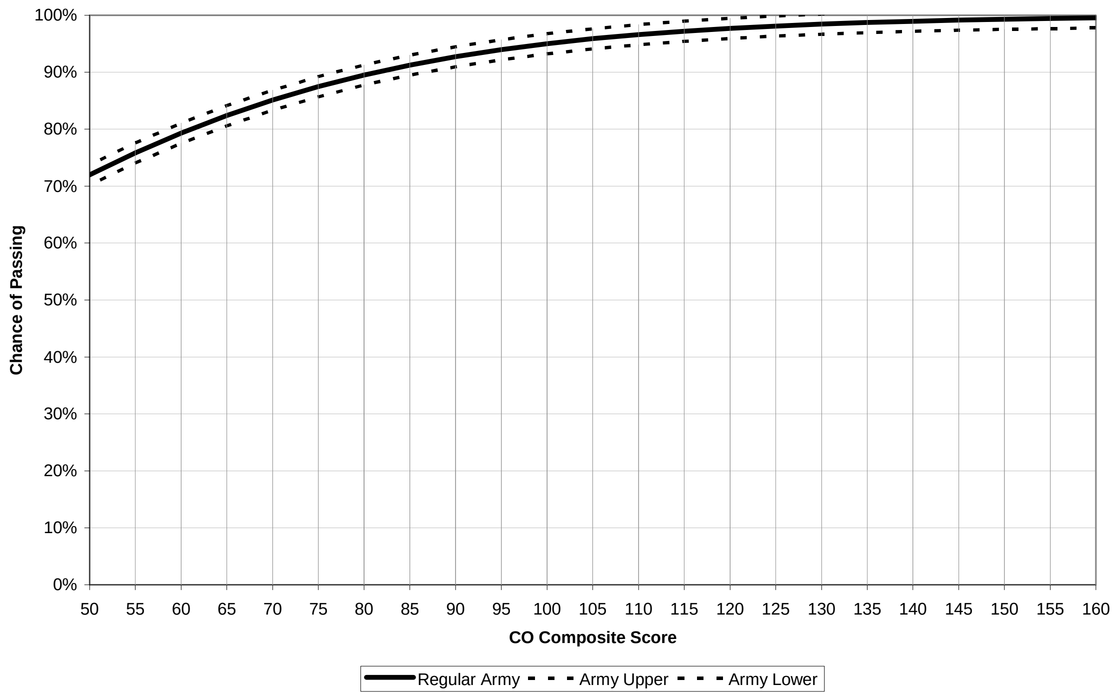
This analysis is confined to Soldiers from the Regular Army. Based on the model, when the cutoff score is at its current level (CO = 87), regular Army Soldiers with an average CO score (CO = 107.20) have approximately a 96% chance of passing. Currently, about 93% of Soldiers are eligible for MOS 21B assignment at the current cutoff. Lowering the cutoff by five points (CO = 82) would increase eligibility by two percentage points (to 98%) and the average Soldier who would qualify for training would practically have the same chance of passing (96%). Raising the cutoff score by five points (CO = 92), the average Soldier would have the same chance of passing (96%) but eligibility would fall by about nine percentage points.

Table 2. 21B: Probability that a male Regular Army Soldier (from the larger Army contract population) will pass the course based on the binary logistic model

	Cutoff = 83	Cutoff = 88	Cutoff = 93	Cutoff = 98	Cutoff = 113
Percent Eligible (Regular Army)	*99.4%*	*97.6%*	*92.8%*	*84.2%*	*72.7%*
Mean	*105.61*	*106.08*	*107.02*	*109.04*	*111.04*
Passing rate:					
High school male	96.0%	96.0%	96.2%	96.5%	96.7%

Figure 1 shows the relationship between CO and the probability of passing for Regular Army Soldiers, including upper and lower bounds based upon the standard error of the estimated CO coefficient. For a particular CO score, trace a vertical line up to the curve, and then a horizontal line over to the axis to determine the corresponding probability of passing. For example, a CO score of 100 corresponds to a passing probability of about 95% for a Regular Army male Soldier. One can see that Soldiers with a relatively low CO score have a reasonable chance of passing the course. As CO scores increase, the chance that a Soldier will pass the course increases.

Figure 1: Predicted Probalility of Passing: High School Male Soldiers



Appendix: Soldier Characteristics (21B)

	Gender	
	Male	Female
fail	3.6%	.0%
pass	96.4%	.0%

	Education Level		
	GED or less	High School Diploma	Some College or More
fail	.0%	4.4%	1.0%
pass	100.0%	95.6%	99.0%

	Component		
	Regular Army	Army Reserve	National Guard
fail	5.0%	.0%	2.2%
pass	95.0%	100.0%	97.8%

25B (74B): Information Systems Operator-Analyst

The final sample included 2360 soldiers who were coded as either graduates or academic failures during their first AIT attempt in this MOS during a period from 2001 to 2004. Only soldiers who graduated (92.7%) or failed for academic reasons (7.3%) were included in the analysis sample because we assume that non-completion for non-academic reasons is not related to cognitive criteria.

In the sample, most were male (74%, 26% female), most had a high school diploma but not more education (80%, 17% some college, 3% GED or less), and most were Regular Army (72%, 10% Army Reserve, 18% National Guard). The governing AA composite, Skilled Technical (ST), for this MOS has a cutoff score of 96; the sample mean is 110.55 (standard deviation = 10.905). See the Appendix for a description of Soldier characteristics for this MOS training sample.

A binary logistic regression model was estimated to explain pass/fail AIT outcomes and focused on the first training attempt. The estimation results are reported in

Table 1. 74B: Results of the binary logistic prediction model

Chi- Square		57.942***	
Log Likelihood		1179.196	
Nagelkerke R Square		.059	
Variable	Coefficient	Odds Ratio	Wald
Constant	-2.803	.061	8.241**
GED	.434	1.543	.501
COLLEGE	.575	1.777	4.180*
RESERVE	.744	2.104	4.371*
GUARD	.472	1.603	3.619
GENDER	.265	1.304	1.985
ST	.047	1.048	26.964***

* = p < .05 *** = p < .001
** = p < .005

Table 1 and indicate that a model including the ST composite, education status (GED = GED or less than high school diploma; COLLEGE = some college), Army component (GUARD = National Guard; RESERVE = Army Reserve), and gender (GENDER = female) accounts for only about six percent of the variation in the dependent variable. This model is statistically significant ($\chi^2 = 57.942$, $P < .001$), but its explanatory power is somewhat limited (Nagelkerke $R^2 = .059$).

There are statistically significant effects for the ST composite, having some college education, and Reserve membership. The model suggests that having a higher ST composite score increases the odds of passing. At the mean ST score, an increase of one point is associated with an increase of about five percent in the odds of passing the course, and a five-point increase in ST would increase the odds of passing by 26%. There is also a noteworthy effect for COLLGE: having a college education increases the odds of passing by 78%. Finally, there is a noteworthy effect for RESERVE, where the odds of a Reservist passing this training exceed that of the average Regular Army Soldier by 110%.

Policy Analysis. Table 2 reports the probability that the average soldier from the larger Army contract population would pass the course based upon the binary logistic model. These were calculated using the formula for finding probability in a binary logistic model, which is

$$e^{(\beta' x)} / (1 + e^{(\beta' x)}).$$

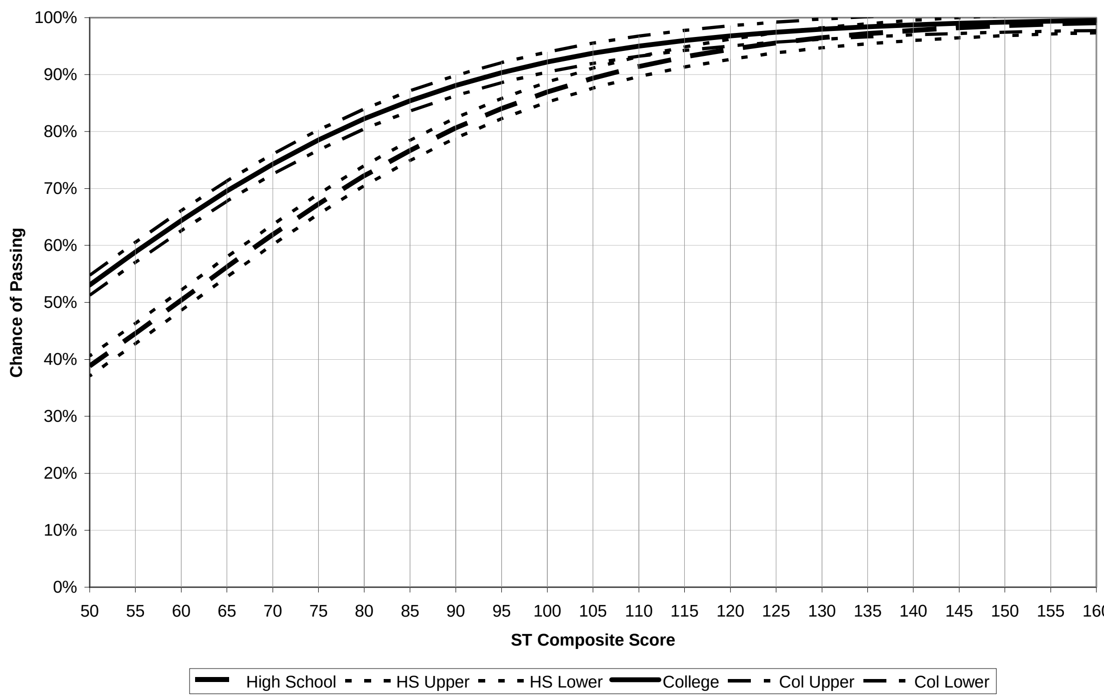
Because GED, GENDER, and GUARD were not statistically significant, this analysis is confined to the modal demographics factored by COLLEGE: Soldiers from the Regular Army with a high school or college education (though results would be similar for any demographic combination, except Reservists). Based on the model, when the cutoff score is at its current level (ST = 96), male soldiers with a high school diploma and an average ST score (ST = 113.07) have approximately a 92% chance of passing, while their counterparts with some college have approximately a 95% chance of passing. Currently, about 81% of Soldiers are eligible for MOS 74B assignment at the current cutoff (ST = 96). Lowering the cutoff by five points (ST = 91), eligibility would increase by 10 percentage points (to 91%) while the average Soldier who would qualify for training would have a about the same chance of passing (high school = 91%; college = 95%). Raising the cutoff score by five points (ST = 101), the average male Soldier with either a high school diploma or some college education would have a slightly higher chance of passing (high school = 93%; college = 96%) but eligibility would fall by about 13 percentage points (68%).

Table 2. 74B: Probability that a Soldier (from the larger Army contract population) will pass the course based on the binary logistic model

	Cutoff = 86	Cutoff = 91	Cutoff = 96	Cutoff = 101	Cutoff = 106
Percent Eligible (Regular Army)	*98.1%*	*91.0%*	*80.5%*	*67.8%*	*52.7%*
Mean	*107.41*	*109.06*	*111.14*	*113.60*	*116.55*
Passing rates:					
High School & GED male	90.4%	91.1%	91.8%	92.7%	93.6%
College male	94.4%	94.8%	95.2%	95.7%	96.2%

Figure 1 shows the relationship between ST and the probability of passing on the first attempt for Regular Army Soldiers factored by attending some college, including upper and lower bounds based upon the standard error of the estimated coefficient. For a particular ST score, trace a vertical line up to the curve, and then a horizontal line over to the axis to determine the corresponding probability of passing. For example, an ST score of 100 corresponds to a passing probability of about 87% for a high school educated, Regular Army male Soldier. One can see that while there is a steady increase in the probability of passing, both high school and college Soldiers reach a high probability of passing at relatively low ST scores.

Figure 1: Predicted Probalility of Passing: Male Soldiers



Testing a Central Assumption of the Approach

Central to our approach has been the estimation of model parameters using only academic passes and failure cases – we specifically exclude failure cases that have been identified with non-academic reasons for failure. In doing so we assume that non-completion for non-academic reasons is not related to cognitive criteria. In this section we report on our attempt examine the reasonableness of this assumption.

When we include non-academic failure cases in the data sample, we would expect the goodness-of-fit to deteriorate and to see smaller predicted composite effects, if higher scoring Soldiers predominate in these "additional" cases. Alternatively, if lower scoring Soldiers predominate in these cases, it is possible to see little or no deterioration in the fit of the model. In Table 4 we present the regression model results when an additional 460 non-academic failure cases are included in the analysis sample (for a total of 2820 cases). There is deterioration in the explanatory power of the model: the Nagelkerke R^2 declines from 0.059 in the original sample to 0.049 in the augmented sample. In addition, the ST composite effect falls from 1.048 to 1.023 in the augmented sample.

Table 4. 74B: Results of the binary logistic prediction model including academic failure and non-academic failure cases

Chi- Square		91.825***	
Log Likelihood		2911.504	
Nagelkerke R Square		.049	
Variable	Coefficient	Odds Ratio	Wald
Constant	-1.380	.251	7.296**
GED	-.219	.803	.603
COLLEGE	.249	1.282	3.337
GUARD	.747	2.110	24.922***
RESERVE	.785	2.192	16.847***
GENDER	-.127	.881	1.437
ST	.023	1.023	23.974***

* = p < .05 ** = p < .01
*** = p < .001

An even more extreme comparison might be between the original sample and a sample utilizing only the non-academic failure cases – i.e., replacing the academic failure cases in the original sample with non-academic failure cases. The hypothesis is that the latter bring increased randomness to the data set, and that the resulting regression model will not fit as well, and the estimated governing composite effects will be weaker. In Table 5 we present the regression model results when <u>only</u> non-academic failure cases are included (along with academic pass cases). This data sample has a total of 2647 observations. We find even greater deterioration in the explanatory power of the model: the Nagelkerke R^2 in the "non-academic failure" model is about 65% that of the original sample model (.039 versus .059). In addition, ST composite effect is considerably weaker: 1.013 for the sample including non-academic failures compared to 1.047 for the original sample.

Table 5. 74B: Results of the binary logistic prediction model including only non-academic failure cases

Chi- Square		63.518***	
Log Likelihood		2381.421	
Nagelkerke R Square		.039	
Variable	Coefficient	Odds Ratio	Wald
Constant	.063	1.065	.013
GED	-.409	.665	1.783
COLLEGE	.162	1.176	1.190
GUARD	.841	2.318	22.683***
RESERVE	.790	2.204	13.142***
GENDER	-.286	.752	5.875*
ST	.013	1.013	6.882**

* = p < .05 ** = p < .01
*** = p < .001

The results of these additional analyses support the approach taken to include only academic pass and failure cases in the data analysis sample. The non-academic failure cases were found to vary in a less predictable way with cognitive criteria and, we conclude, to represent the outcome of a different process.

Appendix: Soldier Characteristics (74B)

Outcome	Gender: Male	Gender: Female
fail	7.1%	8.1%
pass	92.9%	91.9%

	Education Level: GED or less	Education Level: High School Diploma	Education Level: Some College or More
fail	3.8%	8.2%	3.8%
pass	96.2%	91.8%	96.2%

	Component: Regular Army	Component: Army Reserve	Component: National Guard
fail	8.4%	3.7%	5.1%
pass	91.6%	96.3%	94.9%

74B Risk Analysis of Policy Alternatives

In this section we extend the policy analysis with a risk analysis of the policy alternatives considered using simulation methods. We employ the "@RISK" software package which is designed as an add-in for Microsoft Excel.[14] There are four steps in the risk analysis.

The first step is developing a model. A regression model for predicting the passing rate has been specified and estimated, and the results stored in Excel worksheet format. See Table 1.

The second step is identifying the uncertainty inherent in both the input variables (composite scores, Soldier characteristics) and the corresponding estimated parameters and specifying their possible values with probability distributions.

To approximate the governing composite distribution, we use the larger Army contract population (EAF file: those who contracted from Jan 1992 to Aug 2003). This distribution can be assumed to follow a normal distribution. The mean and standard deviation estimated from the contract population and used as input to the simulations are shown in Table R-1 (before truncation).

Table R-1. Input information for the simulations

	Mean	Std error / deviation
Constant	-2.803	.976
ST var	107.02 (before truncation)	12.157
ST coeff	.047	.009
GED var	3.3%	
GED coeff	.434	.613
COLLEGE var	16.9%	
COLLEGE coeff	.575	.281
GUARD var	17.5%	
GUARD coeff	.472	.248
RESERVE var	10.3%	
RESERVE coeff	.744	.356
GENDER var	25.6%	
GENDER coeff	.265	.188

[14] Software is available from Palisade Corporation, Newfield, NY.

To approximate the distributions for the demographic variables we rely on the training data sample used to estimate the regression model. These distributions can be assumed to follow binomial distributions with means estimated from the training data sample as shown in Table R-1.

To approximate the distributions for the estimated parameters in the logit model, we note that, under very general conditions, the estimates will be asymptotically normally distributed.[15] The estimated coefficients (means and standard errors) are shown in Table R-1.

The third step is analyzing the model with simulation to determine the range and probabilities of all possible training outcome results. The results reported represent the simulation of the regression prediction equation for 1000 iterations using a fixed seed.[16] The comparisons are between the baseline case (ST = 96) and the policy cases (ST = 91 and ST = 101). These cases are delineated by the cutoff score level which serves as the lower truncation point in the governing composite input distribution. The simulation results in Table R-2 describe the effect on the mean probability of passing as the ST cutoff score level is varied, and represent an improvement of the policy analysis presented in Table 2 because they reflect the simultaneous effects of all known sources of uncertainty.

Table R-2. 74B simulation results

	ST = 91	ST = 96	ST = 101
Mean governing composite	109.27	110.95	113.24
Mean probability of passing	87.52%	88.17%	89.16%
Std deviation	15.08%	14.14%	13.20%

The frequency distributions of simulated effects are shown below in the histogram graphs. The histogram portrays the full range of outcomes that average to the mean effect as reported. Looking at the histogram for the baseline case (ST = 96), probability of passing is plotted on the horizontal axis and the height of each bar indicates the relative number of Soldiers at that passing probability. The information in the histograms is effectively summarized in Table R-3. In that table we see the percentage of Soldiers

[15] The intuition is that logit estimates are derived from maximum likelihood (ML) estimation, and under fairly general conditions ML estimates are consistent and asymptotically normally distributed.
[16] Latin Hypercube (LH) sampling is utilized in drawing samples for the input distributions. It is designed to accurately recreate the input distribution through sampling in fewer iterations when compared with the Monte Carlo method. The key to LH sampling is stratification of the input probability distributions.

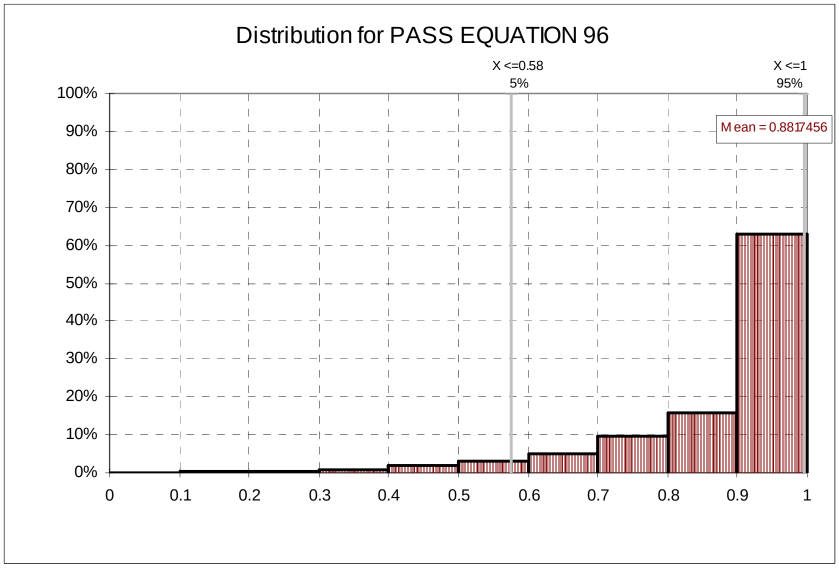
who meet or exceed a given chance of passing. For example, looking at the baseline case (ST = 96), about 89% of Soldiers have a 70% or greater chance of passing.

Table R-3.
Percent of simulated Soldiers that meet or exceed given chance of passing

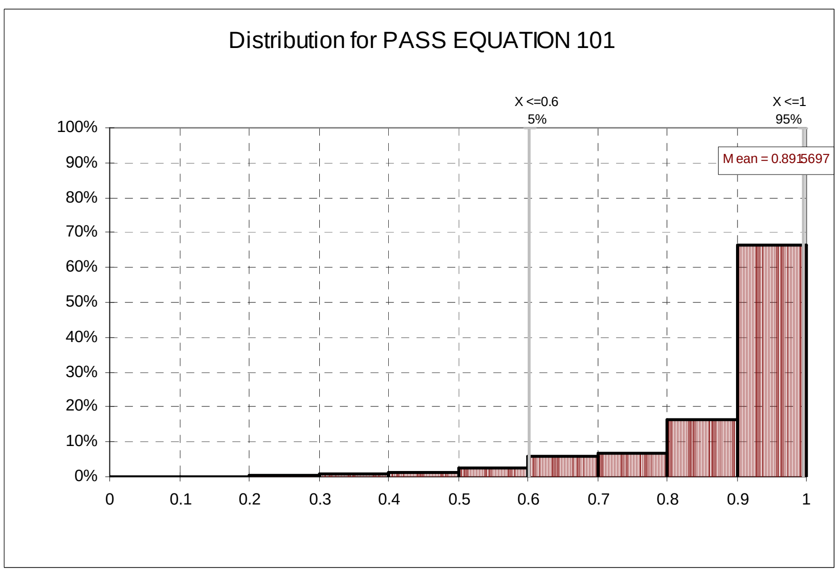
Chance of passing	ST = 91	ST = 96	ST = 101
95.0%	41.2%	43.7%	46.5%
90.0%	62.3%	63.1%	66.3%
85.0%	72.1%	73.6%	76.9%
80.0%	79.7%	79.1%	82.5%
75.0%	84.8%	85.8%	86.6%
70.0%	89.0%	88.7%	89.1%
65.0%	91.0%	91.6%	93.3%
60.0%	93.0%	94.0%	95.1%
55.0%	94.8%	95.6%	96.3%
50.0%	96.0%	96.9%	97.6%

We find that the mean probability of passing in the simulation is 88% (Table R-2, baseline). Looking at the histograms, we see the largest portion of Soldiers is in the highest range of passing scores, trending sharply downward as the probability of passing approaches zero. We note that the mean simulated passing probability is somewhat lower but comparable to the static prediction at the mean ST score (Table 2). In the simulated predictions we are calculating an average over all Soldiers and taking into account all sources of uncertainty, whereas in the static prediction we are calculating the probability of passing only at the mean ST score, ignoring the distribution of Soldier scores etc. as well as uncertainty. While recognizing this variability is important, we also note that the policy case impacts relative to the baseline are the same in both simulation and static prediction modes.

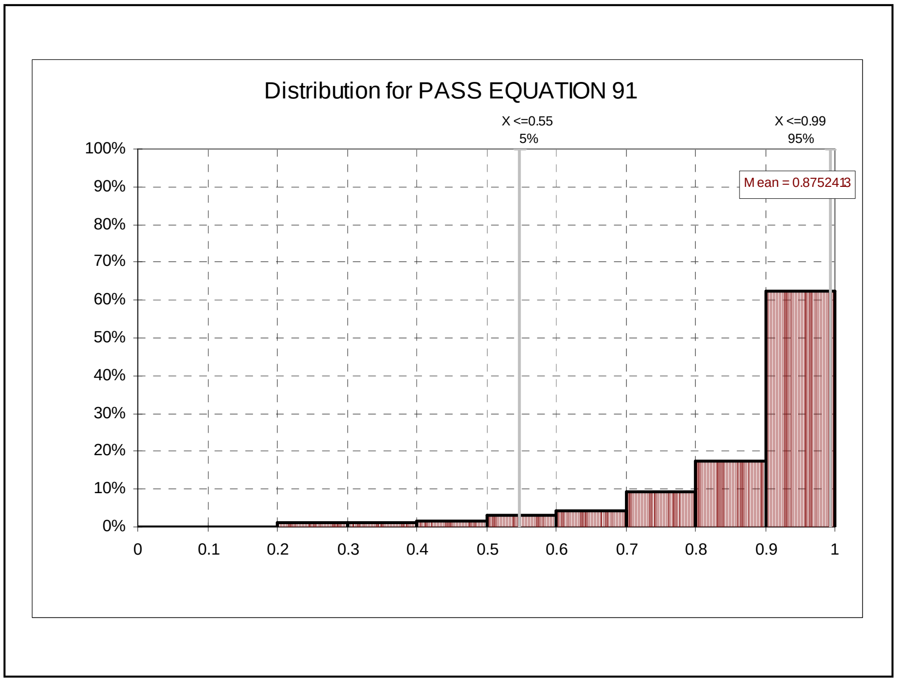
The fourth step is making a decision based on the results provided and the preferences of the school proponent. This involves the evaluation by the school proponent of the tradeoff between increased eligibility and reduced passing probabilities (and vice-versa).



Distribution for PASS EQUATION 96
X <=0.58
5%
X <=1
95%
Mean = 0.8817456
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1



Distribution for PASS EQUATION 101
X <=0.6
5%
X <=1
95%
Mean = 0.8915697
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1



Distribution for PASS EQUATION 91
X <=0.55
5%
X <=0.99
95%
Mean = 0.8752413
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1

25D (formerly 74C): Telecommunications Operator-Maintainer

The final sample included 739 soldiers who were coded as either graduates or academic failures during their first AIT attempt in this MOS during a period from 2001 to 2004. Only soldiers who graduated (97%) or failed for academic reasons (3%) were included in the analysis sample because we assume that non-completion for non-academic reasons is not related to cognitive criteria.

In the sample, most were male (66%, 34% female), most had a high school diploma but not more education (89%, 6% some college, 5% GED or less), and most were Regular Army (69%, 15% Army Reserve, 15% National Guard). The governing AA composites, Electrical Repair (EL) and Surveillance / Communication (SC), for this MOS have cutoff scores of 89 and 90, respectively; the sample mean of EL is 101.87 (standard deviation = 11.339), and the sample mean of SC is 100.63 (standard deviation = 10.670).

Table 1. 25D: Results of the binary logistic prediction model

Chi- Square		8.509	
Log Likelihood		189.457	
Nagelkerke R Square		.049	
Variable	Coefficient	Odds Ratio	Wald
Constant	.740	2.096	.207
GED	-.404	.668	.136
COLLEGE	-1.004	.366	2.340
RESERVE	-.235	.790	.184
GUARD	1.325	3.763	1.553
GENDER	.661	1.937	1.591
EL	-.003	.997	.004
SC	.029	1.029	.477

* = p < .05   *** = p < .001
** = p < .005

See the Appendix for a description of Soldier characteristics for this MOS training sample.

A binary logistic regression model was estimated to explain pass/fail AIT outcomes and focused on the first training attempt. The estimation results are reported in Table 1 and indicate that a model including the EL and SC composites, education status (GED = GED or less than high school diploma; COLLEGE = some college), Army component (GUARD = National Guard; RESERVE = Army Reserve), and gender (GENDER = female) accounts for only about five percent of the variation in the dependent variable. This model is not statistically significant (χ^2 = 8.509, P = .290), with limited explanatory power (Nagelkerke R^2 = .049).

There are no statistically significant effects for any of the variables in the equation. The model suggests that having a higher EL or SC composite score has no consistent effect upon the odds of passing, but there are probably too few failure cases for definitive conclusions.

Policy Analysis. Because the model estimated for 25D (74C) is not significant and has little explanatory power, no policy analysis can be developed from the existing data.

Appendix: Soldier Characteristics (25D)

Outcome	Gender	
	Male	Female
fail	3.5%	2.0%
pass	96.5%	98.0%

Outcome	Education Level		
	GED or less	High School Diploma	Some College or More
fail	3.0%	2.7%	6.5%
pass	97.0%	97.3%	93.5%

Outcome	Component		
	Regular Army	Army Reserve	National Guard
fail	3.1%	.9%	4.4%
pass	96.9%	99.1%	95.6%

25M: Media Illustrator

The final sample included 258 Soldiers who were coded as either graduates or academic failures during their first AIT attempt in this MOS during a period from 2001 to 2004. Only soldiers who graduated (96.5%) or failed for academic reasons (3.5%) were included in the analysis sample because we assume that non-completion for non-academic reasons is not related to cognitive criteria.

In the sample, most were male (67%, 33% female), most had a high school diploma or less education (78%, 17% some college, 5% GED or less), and the greatest number were Regular Army (48%, 28% Army Reserve, 24% National Guard). The governing AA composites, Electrical Repair (EL) and Skilled Technical (ST), for this MOS have cutoff scores of 93 and 92, respectively; the EL sample mean is 107.60 (standard deviation = 12.712) and the ST sample mean is 109.01 (standard deviation = 112.775). See the Appendix for a description of Soldier characteristics for this MOS training sample.

A binary logistic regression model was estimated to explain pass/fail AIT outcome and focused on the first training attempt. The estimation results are reported in Table 1 and indicate that a model, including the EL and ST composites, accounts for

Table 1. 25M: Results of the binary logistic prediction model

Chi- Square		0.614	
Log Likelihood		77.471	
Nagelkerke R Square		.009	
Variable	Coefficient	Odds Ratio	Wald
Constant	.1.575	4.832	.541
ST	-.018	.983	.030
EL	.034	1.035	.114

* = p < .05 *** = p < .001

about 0.9 percent of the variation in the dependent variable. This model is not statistically significant ($\chi^2 = 0.614$, $P = .736$), with little explanatory power (Nagelkerke $R^2 = .009$).

There are no statistically significant effects for any of the variables in the equation. The data are insufficient (too few failure observations) to determine if any of the variables, including EL or ST, have a consistent effect on passing.

Policy Analysis. Because the model estimated for 25M is not significant and has little explanatory power, no policy analysis can be developed from the existing data.

Appendix: Soldier Characteristics (25M)

Outcome	Gender	
	Male	Female
fail	4.1%	2.3%
pass	95.9%	97.7%

Outcome	Education Level		
	GED or less	High School Diploma	Some College or More
fail	.0%	4.0%	2.2%
pass	100.0%	96.0%	97.8%

Outcome	Component		
	Regular Army	Army Reserve	National Guard
fail	2.4%	6.9%	1.6%
pass	97.6%	93.1%	98.4%

25R: Visual Information Equipment Operator

The final sample included 105 Soldiers who were coded as either graduates or academic failures during their first AIT attempt in this MOS during a period from 2001 to 2004. Only soldiers who graduated (86.7%) or failed for academic reasons (13.3%) were included in the analysis sample because we assume that non-completion for non-academic reasons is not related to cognitive criteria.

In the sample, most were male (81%, 19% female), most had a high school diploma or less education (81%, 18% some college, 1% GED or less), and the greatest number were Regular Army (70%, 30% Army Reserve). The governing AA composite, Electrical Repair (EL), for this MOS has a cutoff score of 107; the sample mean is 117.30 (standard deviation = 7.186). See the Appendix for a description of Soldier characteristics for this MOS training sample.

A binary logistic regression model was estimated to explain pass/fail AIT outcome and focused on the first training attempt. The estimation results are reported in Table 1 and indicate that a model including the EL composite, Army component

Table 1. 25R: Results of the binary logistic prediction model

Chi- Square		1.565	
Log Likelihood		80.897	
Nagelkerke R Square		.027	
Variable	Coefficient	Odds Ratio	Wald
Constant	1.977	7.222	.153
RESERVE	-.688	.503	1.306
GENDER	.405	1.499	.222
EL	.001	1.001	.000

* = p < .05 *** = p < .001
** = p < .005

(RESERVE = Army Reserve), and gender (GENDER = female) accounts for about three percent of the variation in the dependent variable. This model is not statistically significant (χ^2 = 1.565, P = .667), and its explanatory power is limited (Nagelkerke R^2 = .027).

There are no statistically significant effects for any of the variables in the equation. The data are insufficient (too few failure observations) to determine if any of the variables, including EL, have a consistent effect upon passing.

Policy Analysis. Because the model estimated for 25R is not significant and has little explanatory power, no policy analysis can be developed from the existing data.

Appendix: Soldier Characteristics (25R)

Outcome	Gender	
	Male	Female
fail	14.1%	10.0%
pass	85.9%	90.0%

Outcome	Education Level		
	GED or less	High School Diploma	Some College or More
fail	.0%	16.5%	.0%
pass	100.0%	83.5%	100.0%

Outcome	Component		
	Regular Army	Army Reserve	National Guard
fail	10.8%	19.4%	.0%
pass	89.2%	80.6%	.0%

25V: Combat Documentation/Production

The final sample included 215 soldiers who were coded as either graduates or academic failures during their first AIT attempt in this MOS during a period from 2001 to 2004. Only Soldiers who graduated (93%) or failed for academic reasons (7%) were included in the analysis sample because we assume that non-completion for non-academic reasons is not related to cognitive criteria.

In this sample, most Soldiers were male (63%, 37% female), most had a high school diploma but not more education (82%, 17% some college, 1% GED or less), and most were Regular Army (70%, 24% Army Reserve, 6% National Guard). The governing AA composites, Skilled Technical (ST) and Electronics Repair (EL), for this MOS have cutoff scores of 92 and 93, respectively; the sample mean for ST is 109.00 (standard deviation = 15.03), and for EL it is 107.19 (standard deviation = 14.92). See the Appendix for a description of Soldier characteristics for this MOS training sample.

Table 1. 25V: Results of the binary logistic prediction model

Chi- Square		8.509*	
Log Likelihood		100.297	
Nagelkerke R Square		.098	
Variable	Coefficient	Odds Ratio	Wald
Constant	.666	1.947	.237
GENDER	-1.305	.271	5.061*
ST	.025	1.025	3.578[x]

[x] = $p < .06$
* = $p < .05$

A forward stepwise binary logistic regression model was estimated to explain pass/fail AIT outcomes and focused on the first training attempt. This type of model inserts (or removes) variables, one at a time, in order to maximize its predictive power.

The estimation results are reported in Table 1 and indicate that a model including the ST composite[17] and gender (GENDER = female) accounts for about ten percent of the variation in the dependent variable. This model is statistically significant ($\chi^2 = 8.059$, P = .014), with moderate explanatory power (Nagelkerke $R^2 = .098$).

The effect of ST is not statistically significant at the standard .05 level, though it approaches significance ($p = .059$). With this caveat, an increase of one point in ST is associated with an increase of almost three percentage points in the odds of passing the course, and a five-point increase in ST would increase the odds of passing by 33%. There are statistically significant effects for GENDER. The model suggests that females are less likely to pass – the odds of a female Soldier passing are 73% lower than for males.

Policy Analysis. Table 2 reports the probability that the average Soldier from the larger Army contract population would pass the course on the first attempt based upon the binary logistic model. These were calculated using the formula for finding probability in a binary logistic model, which is

$$e^{(\beta' x)} / (1 + e^{(\beta' x)}).$$

Based on the model, when the cutoff score is at its current level (ST = 92 and EL = 93), male Soldiers with average ST scores (ST = 110.09) have approximately a 97% chance of passing, while their female counterparts have approximately an 89% chance of passing. Currently, about 89% of soldiers qualify for MOS 25V assignment at the current cutoff (ST = 92 & EL = 93). Lowering the cutoff by five points (ST = 87 & EL = 88) increases eligibility by eight percentage points, and the average Soldier who would qualify for

[17] EL was excluded during the stepwise regression procedure as it was strongly correlated with ST, which was a better predictor of passing/failing.

training would have essentially the same chance of passing (male = 97%; female = 89%). Raising the cutoff score by five points (ST = 97 & EL = 98), the average Soldier who would still qualify for the MOS would have the essentially same chance of passing (male

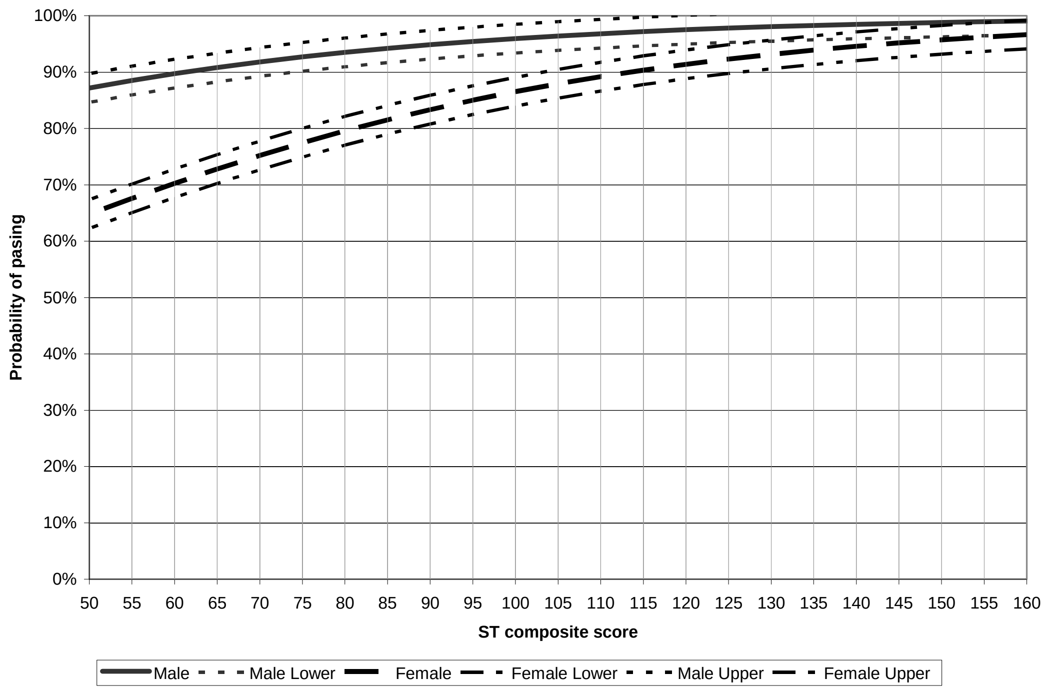
Table 2. 25V: Probability that a Soldier (from the larger Army contract population) will pass the course based on the binary logistic model

	Cutoff = 82/83	Cutoff = 87/88	Cutoff = 92/93	Cutoff = 97/98	Cutoff = 102/103
Percent Eligible (Regular Army)	*99.8%*	*97.1%*	*89.0%*	*78.2%*	*64.9%*
Mean: ST	*107.01*	*108.18*	*110.09*	*112.38*	*115.07*
Passing rates:					
Male	96.6%	96.7%	96.8%	97.0%	97.2%
Female	88.5%	88.8%	89.2%	89.8%	90.4%

= 97%; female = 90%), but fewer Soldiers would be eligible (78%).

Figure 1 shows the relationship between ST and the probability of passing for male and female Soldiers, including upper and lower bounds based upon the standard error of the estimated ST coefficient. For a particular ST score, trace a vertical line up to the curve, and then a horizontal line over to the axis to determine the corresponding probability of passing. For example, an ST score of 100 corresponds to a passing probability of about 95% for a high school educated, Regular Army male Soldier. One can see that the probability of passing increases slowly for male soldiers as ST increases, while it increases more rapidly for female soldiers.

Figure 1: Predicted Probability of Passing: Regular Army



Appendix: Soldier Characteristics (25V)

Outcome	Gender	
	Male	Female
fail	3.7%	12.5%
pass	96.3%	87.5%

Outcome	Education Level		
	GED or less	High School Diploma	Some College or More
fail	.0%	8.5%	.0%
pass	100.0%	91.5%	100.0%

Outcome	Component		
	Regular Army	Army Reserve	National Guard
fail	10.0%	.0%	.0%
pass	90.0%	100.0%	100.0%

25C (31C): Radio Operator - Maintainer

The final sample included 1793 Soldiers who were coded as either graduates or academic failures during their first AIT attempt for this MOS during a period from 2001 to 2004. Only Soldiers who graduated (99.2%) or failed for academic reasons (0.8%) were included in the analysis sample of 1793 Soldiers because we assume that non-completion for non-academic reasons is not related to cognitive criteria.

In this sample, most were male (92%, 8% female), most had a high school diploma but not more education (82%, 8% some college, 10% GED or less), and most were from were from the National Guard (57%, 42% Regular Army, 1% Reserve). The governing AA composites, Electrical Repair (EL) and Surveillance/Communications (SC), for this MOS both have cutoff scores of 98; the sample mean is 111.99 (standard deviation = 9.298) for EL and 11.84 (standard deviation = 9.081) for SC. EL and SC are correlated at .864 ($p < .001$). See the Appendix for a description of Soldier characteristics for this MOS training sample.

A binary logistic regression model was estimated to explain pass/fail AIT

Table 1. 31C: Results of the forward stepwise binary logistic prediction model

Chi- Square		7.773*	
Log Likelihood		165.609	
Nagelkerke R Square		.047	
Variable	Coefficient	Odds Ratio	Wald
Constant	6.548	697.563	3.669
GUARD	1.418	4.128	5.696*
EL	-.076	.927	2.052
SC	.055	1.057	1.026

* = p < .05 *** = p < .001
** = p < .01

outcomes and focused on the first training attempt. The estimation results are reported in Table 1 and indicate that the binary logistic model, including the EL and SC composites, and Army component (GUARD = National Guard), accounts for five percent of the variation in the dependent variable. This model is statistically significant ($\chi^2 = 7.773$, P = .051), and has limited explanatory power (Nagelkerke $R^2 = .047$).

There are no statistically significant effects for either the EL or SC composites, likely due to the small number of failure cases.[18] There is a statistically significant effect for GUARD, with increased odds of passing the course at 313%.

Policy Analysis. Given the model's lack of explanatory power, and notwithstanding the statistically significant effect for National Guard membership, this model is not appropriate for conducting policy analysis.

[18] It is noteworthy that the coefficient is negative for EL and positive for SC. Given the high correlation between the two, such a relationship usually suggests collinearity. The Appendix presents three additional models to test for this. When either EL (Table 1a) or SC (Table 1b) is included as the only composite, the EL or SC coefficient is negative. Finally, a forward stepwise method binary logistic regression model was estimated (Table 1c). This model excluded both EL and SC, leaving National Guard membership as the sole predictor of training success in MOS 31C. These results do not lend support to collinearity.

Appendix: Additional Regression Models

Table 1b. 31C: Results of the binary logistic prediction model excluding EL

Chi- Square		5.832	
Log Likelihood		167.550	
Nagelkerke R Square		.035	
Variable	Coefficient	Odds Ratio	Wald
Constant	5.436	229.586	2.775
GUARD	1.322	3.750	5.046*
SC	-.011	.989	.137

* = p < .05 *** = p < .001
** = p < .01

Table 1c. 31C: Results of the forward stepwise binary logistic prediction model

Chi- Square		5.693*	
Log Likelihood		167.689	
Nagelkerke R Square		.034	
Variable	Coefficient	Odds Ratio	Wald
Constant	4.237	69.182	194.636***
GUARD	1.302	3.675	4.936

* = p < .05 *** = p < .001
** = p < .01

Appendix: Soldier Characteristics (31C)

Outcome	Gender	
	Male	Female
fail	.8%	1.4%
pass	99.2%	98.6%

Outcome	Education Level		
	GED or less	High School Diploma	Some College or More
fail	1.1%	.9%	.0%
pass	98.9%	99.1%	100.0%

Outcome	Component		
	Regular Army	Army Reserve	National Guard
fail	1.5%	.0%	.4%
pass	98.5%	100.0%	99.6%

25F (31F): Network Switching Systems Operator

The final sample included 3872 Soldiers who were coded as either graduates or academic failures during their first AIT attempt for this MOS during a period from 2001 to 2004. Only Soldiers who graduated (91.9%) or failed for academic reasons (8.1%) were included in the analysis sample because we assume that non-completion for non-academic reasons is not related to cognitive criteria.

In this sample, most were male (88%, 12% female), most had a high school diploma but not more education (84%, 13% some college, 3% GED or less), and most were from were from the Regular Army (84%, 13% National Guard, 3% Reserve). The governing AA composites, Electrical Repair (EL) and Surveillance/Communications (SC), for this MOS have cutoff scores of 102 and 105 respectively; the sample mean is 114.87 (standard deviation = 8.570) for EL and 114.71 (standard deviation = 8.069) for SC. The EL and SC composites are correlated at the .842 level (p < .001). See the Appendix for a description of Soldier characteristics for this MOS training sample.

A binary logistic regression model was estimated to explain pass/fail AIT

Table 1. 31F: Results of the binary logistic prediction model

Chi- Square		64.574***	
Log Likelihood		2109.837	
Nagelkerke R Square		.038	
Variable	Coefficient	Odds Ratio	Wald
Constant	-3.047	.048	9.958**
COLLEGE	.345	1.411	2.774
GUARD	1.038	2.524	14.964***
GENDER	.321	1.378	2.660
EL	.003	1.003	.058
SC	.044	1.045	9.494***

* = p < .05 *** = p < .001
** = p < .01

outcomes and focused on the first training attempt. The estimation results are reported in Table 1 and indicate that the stepwise model, including the EL and SC composites, education status (COLLEGE = some college), Army component (GUARD = National Guard), and gender (GENDER = female), accounts for four percent of the variation in the dependent variable. This model is statistically significant ($\chi^2 = 64.574$, $P < .001$), and has limited explanatory power (Nagelkerke $R^2 = .038$).

There is a statistically significant effect for the SC composite.[19] The model suggests that having a higher SC composite score increases the odds of passing. At the mean SC score, an increase of one point is associated with an increase of about 5% in the odds of passing the course, and a five-point increase in SC would increase the odds of passing by 25%. There is also a statistically significant effect for GUARD, with increased odds of passing the course at 182%.

Policy Analysis. Table 2 reports the probability that the average Soldier from the larger Army contract population would pass the course based upon the binary logistic model. These were calculated using the formula for finding probability in a binary logistic model, which is

$$e^{(\beta' x)} / (1 + e^{(\beta' x)}).$$

The following analysis is focused upon male Soldiers with a high school diploma from the Regular Army (the modal categories). Based on the model, when the cutoff score is at its current level (EL = 102, SC = 105), male Soldiers with a high school diploma and average SC and EL scores (SC = 115.68, EL = 115.68) have approximately a 92% chance

[19] In the Appendix we also report estimated models excluding EL (Table 1a) and SC (Table 1b), because the aforementioned correlation between the two and the small coefficient for the EL composite suggested collinearity. While these models did confirm collinearity between EL and SC, neither model substantially improved upon the one including both composites. Thus, the full model was selected with the understanding that there is underlying collinearity.

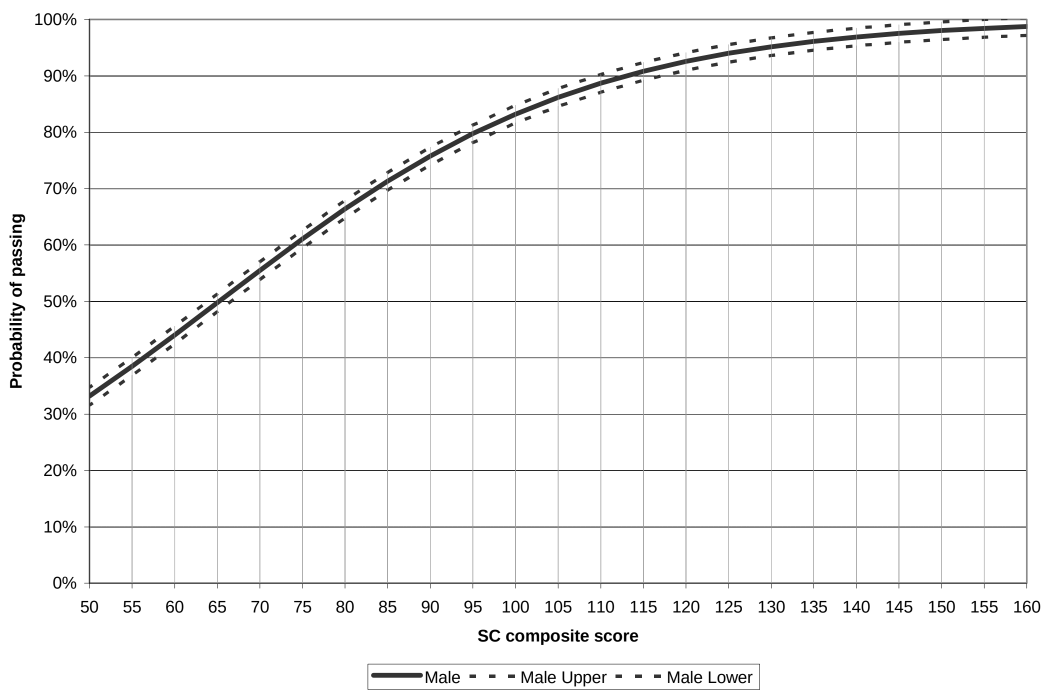
of passing. Currently, about 46% of Soldiers are eligible for MOS 31F assignment at the current cutoff (EL = 102, SC = 105). Lowering the cutoffs by five points (EL = 97, SC = 100) would increase eligibility by 15 percentage points (to 61%), and the average male Soldier who would qualify for training would have essentially the same chance of passing (91%). Raising the cutoff scores (EL = 107, SC = 110), the average male Soldier would have essentially the same chance of passing (93%) but eligibility would fall by about 14 percentage points.

Table 2. 31F: Probability that a Regular Army Soldier (from the larger Army contract population) will pass the course based on the binary logistic model

	Cutoff: EL = 92 SC = 95	Cutoff: EL = 97 SC = 100	Cutoff EL = 102 SC = 105	Cutoff EL = 107 SC = 110	Cutoff EL = 112 SC = 115
Percent Eligible (Regular Army)	*73.8%*	*60.6%*	*45.8%*	*32.3%*	*20.7%*
Mean: SC	*110.52*	*113.33*	*116.18*	*119.42*	*122.57*
Mean: EL	*110.18*	*112.82*	*115.68*	*118.93*	*112.23*
Passing Rates:					
High School Male	89.5%	90.7%	91.8%	92.9%	93.8%

Figure 1 shows the relationship between SC and the probability of passing for male Regular Army Soldiers based upon Table 1b (Appendix); it includes upper and lower bounds based upon the standard error of the estimated SC coefficient. For a particular SC score, trace a vertical line up to the curve, and then a horizontal line over to the axis to determine the corresponding probability of passing. For example, an SC score of 100 corresponds to a passing probability of about 85% for a high school educated, Regular Army male Soldier. One can see that Soldiers with low SC scores stand a fair chance of passing the course. As SC scores increase, the chance that a Soldier will pass the course increases. By the time the SC score reaches the current cutoff (SC = 105), male Soldiers already have approximately an 85% chance of passing the course.

Figure 1: Predicted Probability of Passing: Male Regular Army



Appendix: Additional Regression Models.

Table 1a. 31F: Results of the binary logistic prediction model excluding SC

Chi- Square		55.157***	
Log Likelihood		2119.254	
Nagelkerke R Square		.033	
Variable	Coefficient	Odds Ratio	Wald
Constant	-1.953	.142	25.669***
COLLEGE	.357	1.430	2.995
GUARD	1.021	2.777	14.731***
GENDER	.288	1.334	2.158
EL	.037	1.038	25.669***

* = p < .05 *** = p < .001
** = p < .01

Table 1b. 31F: Results of the binary logistic prediction model excluding EL

Chi- Square		64.516***	
Log Likelihood		2109.895	
Nagelkerke R Square		.038	
Variable	Coefficient	Odds Ratio	Wald
Constant	-3.000	.050	10.113
COLLEGE	.347	1.415	2.825
GUARD	1.039	2.828	15.014***
GENDER	.319	1.376	2.640
SC	.046	1.047	30.929***

* = p < .05 *** = p < .001
** = p < .01

Appendix: Soldier Characteristics (31F)

Outcome	Gender	
	Male	Female
fail	8.3%	6.9%
pass	91.7%	93.1%

Outcome	Education Level		
	GED or less	High School Diploma	Some College or More
fail	4.7%	8.6%	5.5%
pass	95.3%	91.4%	94.5%

Outcome	Branch of Army		
	Regular Army	Army Reserve	National Guard
fail	9.0%	2.3%	3.4%
pass	91.0%	97.7%	96.6%

25L (31L): Cable Systems Installer - Maintainer

The final sample included 2131 Soldiers who were coded as either graduates or academic failures during their first AIT attempt for this MOS during a period from 2001 to 2004. Only Soldiers who graduated (99.3%) or failed for academic reasons (0.7%) were included in the analysis sample of 2131 Soldiers because we assume that non-completion for non-academic reasons is not related to cognitive criteria.

In the sample, most were male (76%, 24% female), most had a high school diploma but not more education (87%, 7% some college, 6% GED or less), and most were from were from the Regular Army (56%, 28% National Guard, 16% Reserve). The governing AA composites, Electrical Repair (EL) and Surveillance/Communications (SC), for this MOS have cutoff scores of 89 and 90; the sample mean is 100.85 (standard deviation = 10.446) for EL and 100.74 (standard deviation = 10.184) for SC. EL and SC are correlated at .871 ($p < .001$). See the Appendix for a description of Soldier characteristics for this MOS training sample.

A binary logistic regression model was estimated to explain pass/fail AIT outcomes and focused on the first training attempt. The estimation results are reported in

Table 1. 31L: Results of the forward stepwise binary logistic prediction model

Chi- Square		2.333	
Log Likelihood		176.250	
Nagelkerke R Square		.014	
Variable	Coefficient	Odds Ratio	Wald
Constant	4.081	59.223	2.029
GENDER	-.656	.519	1.468
EL	-.027	.973	.338
SC	.038	1.039	.565

* = p < .05 *** = p < .001
** = p < .01

Table 1 and indicate that the binary logistic model, including the EL and SC composites, and gender (GENDER = female), accounts for one percent of the variation in the dependent variable. This model is not statistically significant ($\chi^2 = 2.333$, $P = .506$), and has little explanatory power (Nagelkerke $R^2 = .014$).

There are no statistically significant effects for the EL or SC composites. The data are insufficient (too few failure observations) to determine if any of the variables, including the composites, have a consistent effect upon passing.

Policy Analysis. Given the model's lack of explanatory power, this model is not appropriate for conducting policy analysis.

Appendix: Additional Regression Models

Table 1a. 31L: Results of the binary logistic prediction model excluding SC

Chi- Square	6.776*		
Log Likelihood	116.606		
Nagelkerke R Square	.041		
Variable	Coefficient	Odds Ratio	Wald
Constant	7.563	1926.569	5.486*
GUARD	1.384	3.989	5.470*
EL	-.030	.971	1.093

* = p < .05 *** = p < .001
** = p < .01

Table 1b. 31L: Results of the binary logistic prediction model excluding EL

Chi- Square	5.832		
Log Likelihood	167.550		
Nagelkerke R Square	.035		
Variable	Coefficient	Odds Ratio	Wald
Constant	5.436	229.586	2.775
GUARD	1.322	3.750	5.046*
SC	-.011	.989	.137

* = p < .05 *** = p < .001
** = p < .01

Table 1b. 31L: Results of the forward stepwise binary logistic prediction model

Chi- Square	5.693*		
Log Likelihood	167.689		
Nagelkerke R Square	.034		
Variable	Coefficient	Odds Ratio	Wald
Constant	4.237	69.182	194.636***
GUARD	1.302	3.675	4.936

* = p < .05 *** = p < .001
** = p < .01

Appendix: Soldier Characteristics (31L)

Outcome	Gender	
	Male	Female
fail	.6%	1.2%
pass	99.4%	98.8%

Outcome	Education Level		
	GED or less	High School Diploma	Some College or More
fail	.8%	.8%	.0%
pass	99.2%	99.2%	100.0%

Outcome	Component		
	Regular Army	Army Reserve	National Guard
fail	.8%	.3%	.7%
pass	99.2%	99.7%	99.3%

25P (31P): Microwave Systems Operator - Maintainer

The final sample included 755 Soldiers who were coded as either graduates or academic failures during their first AIT attempt for this MOS during a period from 2001 to 2004. Only Soldiers who graduated (93.6%) or failed for academic reasons (6.4%) were included in the analysis sample because we assume that non-completion for non-academic reasons is not related to cognitive criteria.

In the sample, most were male (92%, 8% female), most had a high school diploma but not more education (82%, 17% some college, 2% GED or less), and most were from were from the Regular Army (91%, 6% National Guard, 3% Reserve). The governing AA composites, Electrical Repair (EL), for this MOS has a cutoff score of 107; the sample mean is 116.73 (standard deviation = 7.007). See the Appendix for a description of Soldier characteristics for this MOS training sample.

A binary logistic regression model was estimated to explain pass/fail AIT outcomes and focused on the first training attempt. The estimation results are reported in Table 1 and indicate that the binary logistic model, including the EL composite,

Table 1. 31P: Results of the forward stepwise binary logistic prediction model

	Chi- Square	4.626	
	Log Likelihood	352.786	
	Nagelkerke R Square	.016	
Variable	Coefficient	Odds Ratio	Wald
Constant	-.236	.789	.008
COLLEGE	.242	1.274	.284
GENDER	-.702	.496	2.554
EL	.026	1.026	1.196

* = p < .05 *** = p < .001
** = p < .01

education status (COLLEGE = some college), and gender (GENDER = female), accounts for one percent of the variation in the dependent variable. This model is not statistically significant (χ^2 = 4.626, P = .201), and has little explanatory power (Nagelkerke R^2 = .016).

There are no statistically significant effects for the EL composite. The data are insufficient (too few failure observations) to determine if any of the variables, including EL, have a consistent effect upon passing.

Policy Analysis. Given the model's lack of explanatory power, this model is not appropriate for conducting policy analysis.

Appendix: Soldier Characteristics (31P)

Outcome	Gender	
	Male	Female
fail	5.9%	12.1%
pass	94.1%	87.9%

Outcome	Education Level		
	GED or less	High School Diploma	Some College or More
fail	7.7%	6.6%	4.8%
pass	92.3%	93.4%	95.2%

Outcome	Component		
	Regular Army	Army Reserve	National Guard
fail	6.8%	.0%	2.3%
pass	93.2%	100.0%	97.7%

25R (31R): Multi-channel Transmissions Systems Operator - Maintainer

The final sample included 5849 Soldiers who were coded as either graduates or academic failures <u>during their first AIT attempt</u> for this MOS during a period from 2001 to 2004. Only Soldiers who graduated (99.2%) or failed for academic reasons (0.8%) were included in the analysis sample of 5849 Soldiers because we assume that non-completion for non-academic reasons is not related to cognitive criteria.

In the sample, most were male (86%, 14% female), most had a high school diploma but not more education (88%, 10% some college, 2% GED or less), and most were from were from the Regular Army (84%, 13% National Guard, 3% Reserve). The governing AA composites, Electrical Repair (EL) and Surveillance/Communications (SC), for this MOS both have cutoff scores of 98; the sample mean is 110.01 (standard deviation = 8.968) for EL and 109.97 (standard deviation = 8.656) for SC. EL and SC are correlated at .861 ($p < .001$). See the Appendix for a description of Soldier characteristics for this MOS training sample.

A binary logistic regression model was estimated to explain pass/fail AIT

Table 1. 31R: Results of the forward stepwise binary logistic prediction model

Chi- Square		8.356	
Log Likelihood		519.359	
Nagelkerke R Square		.017	
Variable	Coefficient	Odds Ratio	Wald
Constant	1.113	3.043	.700
COLLEGE	.294	1.341	.236
RESERVE	-.921	.398	2.307
GENDER	-.202	.817	.264
EL	.021	1.021	.360
SC	.014	1.014	.165

* = p < .05 *** = p < .001
** = p < .01

outcomes and focused on the first training attempt. The estimation results are reported in Table 1 and indicate that the binary logistic model, including the EL and SC composites, education level (COLLEGE = some college) and Army component (RESERVE = Army Reserve), accounts for two percent of the variation in the dependent variable. This model is not statistically significant ($\chi^2 = 8.356$, P = .138), and has little explanatory power (Nagelkerke $R^2 = .017$).

There are no statistically significant effects for either the EL or the SC composite. The data are likely insufficient (too few failure observations) to determine if any of the variables, including the composites, have a consistent effect upon passing.

Policy Analysis. Given the model's lack of explanatory power, this model is not appropriate for conducting policy analysis.

Appendix: Soldier Characteristics (31R)

Outcome	Gender	
	Male	Female
fail	7.6%	6.7%
pass	92.4%	93.3%

Outcome	Education Level		
	GED or less	High School Diploma	Some College or More
fail	.0%	8.4%	5.5%
pass	100.0%	91.6%	94.5%

Outcome	Component		
	Regular Army	Army Reserve	National Guard
fail	7.7%	.0%	.0%
pass	92.3%	100.0%	100.0%

25S (31S): Satellite Communications

The final sample included 1236 Soldiers who were coded as either graduates or academic failures during their first AIT attempt for this MOS during a period from 2001 to 2004. Only Soldiers who graduated (92.4%) or failed for academic reasons (7.6%) were included in the analysis sample of 1236 Soldiers because we assume that non-completion for non-academic reasons is not related to cognitive criteria.

In the sample, most were male (96%, 4% female), most had a high school diploma but not more education (76%, 24% some college, 1% GED or less), and most were from were from the Regular Army (99%, < 1% National Guard, < 1% Reserve). The governing AA composite, Electrical Repair (EL), for this MOS has a cutoff scores of 116; the sample mean is 123.85 (standard deviation = 5.606). See the Appendix for a description of Soldier characteristics for this MOS training sample.

A binary logistic regression model was estimated to explain pass/fail AIT outcomes and focused on the first training attempt. The estimation results are reported in Table 1 and indicate that the binary logistic model, including the EL the composite,

Table 1. 31S: Results of the binary logistic prediction model

Chi- Square		5.277	
Log Likelihood		659.738	
Nagelkerke R Square		.010	
Variable	Coefficient	Odds Ratio	Wald
Constant	-1.383	.251	.349
COLLEGE	.394	1.483	1.910
GENDER	.176	1.192	.082
EL	.031	1.031	2.604

* = p < .05 *** = p < .001
** = p < .01

education level (COLLEGE = some college), and gender (GENDER = female), accounts for one percent of the variation in the dependent variable. This model is not statistically significant (χ^2 = 5.277, P = .153), and has little explanatory power (Nagelkerke R^2 = .010).

There are no statistically significant effects for the EL composite. Given the relatively high cutoff score level on the governing composite, we must presume there are other factors not captured in the model that would differentiate between passing and failure cases.

Policy Analysis. Given the model's lack of explanatory power, this model is not appropriate for conducting policy analysis.

Appendix: Soldier Characteristics (31S)

		Gender	
		Male	Female
		Column N %	Column N %
s1_pf1	fail	7.6%	6.7%
	pass	92.4%	93.3%

		Education Level		
		GED or less	High School Diploma	Some College or More
		Column N %	Column N %	Column N %
s1_pf1	fail	.0%	8.4%	5.5%
	pass	100.0%	91.6%	94.5%

		Component		
		Regular Army	Army Reserve	National Guard
		Column N %	Column N %	Column N %
s1_pf1	fail	7.7%	.0%	.0%
	pass	92.3%	100.0%	100.0%

25U (31U): Signal Support Systems Specialist

The final sample included 5568 Soldiers who were coded as either graduates or academic failures during their first AIT attempt for this MOS during a period from 2001 to 2004. Only Soldiers who graduated (96.9%) or failed for academic reasons (3.1%) were included in the analysis sample because we assume that non-completion for non-academic reasons is not related to cognitive criteria.

In this sample, most were male (83%, 17% female), most had a high school diploma but not more education (87%, 8% some college, 6% GED or less), and most were from were from the Regular Army (64%, 27% National Guard, 9% Reserve). The governing AA composites, Electrical Repair (EL) and Surveillance/Communications (SC), for this MOS both have cutoff scores of 93; the sample mean is 106.05 (standard deviation = 10.417) for EL and 105.61 (standard deviation = 10.041) for SC. EL and SC are correlated at 0.872 ($p < .001$). See the Appendix for a description of Soldier characteristics for this MOS training sample.

A binary logistic regression model was estimated to explain pass/fail AIT

Table 1. 31U: Results of the forward stepwise binary logistic prediction model excluding SC

Chi- Square		39.797***	
Log Likelihood		1488.189	
Nagelkerke R Square		.030	
Variable	Coefficient	Odds Ratio	Wald
Constant	-.397	.673	.312
RESERVE	.229	1.257	.595
GUARD	.621	1.860	8.509**
GENDER	-.055	.946	.082
EL	.036	1.036	27.171***

* = p < .05 *** = p < .001
** = p < .01

outcomes and focused on the first training attempt. The estimation results are reported in Table 1 and indicate that the stepwise model, including the EL composite, Army component (GUARD = National Guard; RESERVE = Army Reserve), and gender (GENDER = female), accounts for three percent of the variation in the dependent variable. This model is statistically significant ($\chi^2 = 39.797$, $P < .001$), and has limited explanatory power (Nagelkerke $R^2 = .030$).

There is a statistically significant effect for the EL composite.[20] The model suggests that having a higher EL composite score increases the odds of passing. At the mean EL score, an increase of one point is associated with an increase of about 4% in the odds of passing the course, and a five-point increase in EL would increase the odds of passing by 20%. There is also a statistically significant effect for GUARD, with increased odds of passing the course at 86%.

Policy Analysis. Table 2 reports the probability that the average Soldier from the larger Army contract population would pass the course based upon the binary logistic model. These were calculated using the formula for finding probability in a binary logistic model, which is

$$e^{(\beta' x)} / (1 + e^{(\beta' x)}).$$

The following analysis is focused upon male Soldiers with a high school diploma from the Regular Army (the modal categories). Based on the model, when the cutoff score is at its current level (EL = 93, SC = 93), male Soldiers with a high school diploma and an

[20] Initially we estimated a model including EL, SC, GUARD, RESERVE, and GENDER. This is reported in the Appendix (Table 1a). In that model neither of the coefficients for EL or SC was significant. Because the SC coefficient was close to being significant, it was theorized that the lack of significance was due to collinearity. The stepwise model retained EL while excluding SC, and thus confirmed this presumption. As further evidence, we found a statistically significant effect for the SC composite when inserted in place of the EL composite; see the Appendix (Table 1b).

average EL score (EL = 110.00) have approximately a 97% chance of passing. Currently, about 76% of Soldiers are eligible for MOS 31U assignment at the current cutoff (EL = 93, SC = 93). Lowering the cutoffs by five points (EL = 88, SC = 88) would increase eligibility by 12 percentage points (to 88%), and the average male Soldier who would qualify for training would have essentially the same chance of passing (97%). Raising the cutoff scores (EL = 98, SC = 98), the average male Soldier would have essentially the same chance of passing (98%) but eligibility would fall by about 13 percentage points.

Table 2. 31U: Probability that a Regular Army Soldier (from the larger Army contract population) will pass the course based on the binary logistic model

	Cutoff: EL = 83 SC = 83	Cutoff: EL = 88 SC = 88	Cutoff EL = 93 SC = 93	Cutoff EL = 98 SC = 98	Cutoff EL = 103 SC = 103
Percent Eligible (Regular Army)	*96.1%*	*88.2%*	*75.9%*	*62.5%*	*47.7%*
Mean	*106.23*	*107.73*	*110.00*	*112.56*	*115.55*
Passing Rates:					
High School Male	96.9%	97.1%	97.3%	97.5%	97.8%

Figure 1 shows the relationship between EL and the probability of passing for male Regular Army Soldiers by education, including upper and lower bounds based upon the standard error of the estimated EL coefficient. For a particular EL score, trace a vertical line up to the curve, and then a horizontal line over to the axis to determine the corresponding probability of passing. For example, an EL score of 100 corresponds to a passing probability of just above 95% for a high school educated, Regular Army male Soldier. One can see that Soldiers with a low EL score still stand a good chance of passing the course. As EL scores increase, the chance that a Soldier will pass the course increases somewhat. However, by the time EL scores reach the current cutoff (EL = 93) male Soldiers already have approximately a 95% chance of passing the course.

Figure 1: Predicted Probability of Passing: Male Regular Army

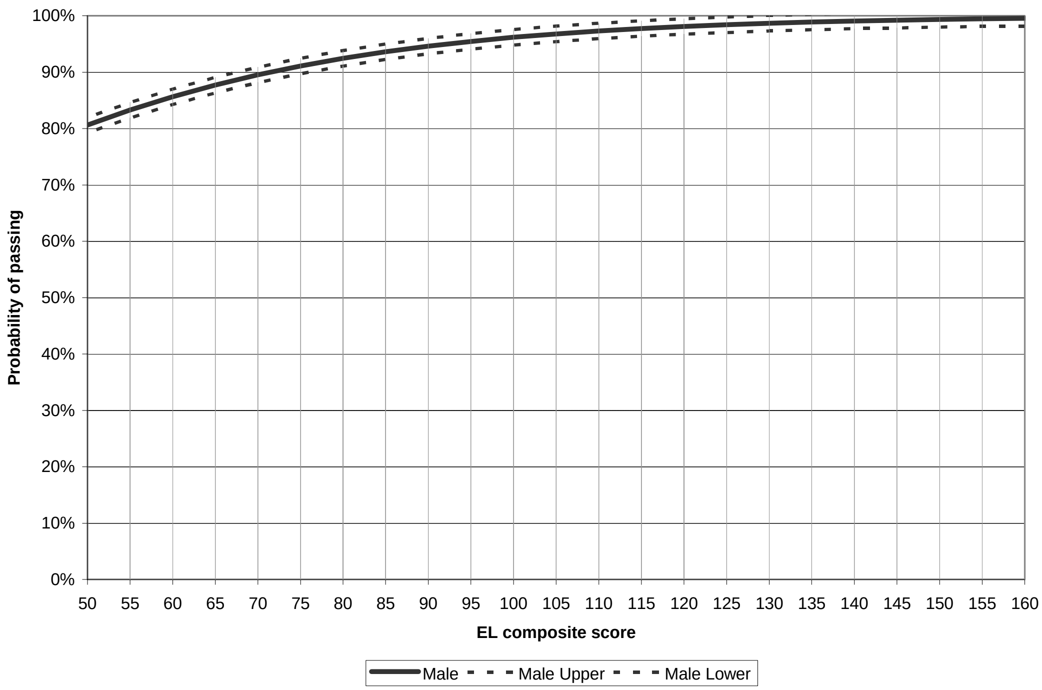


Table 1a. 31U: Results of the binary logistic prediction model including EL and SC

Chi- Square		40.059**	
Log Likelihood		1487.927	
Nagelkerke R Square		.030	
Variable	Coefficient	Odds Ratio	Wald
Constant	-.487	.614	.445
GUARD	.621	1.860	8.494**
RESERVE	.224	1.251	.568
GENDER	-.052	.949	.072
EL	.028	1.008	.271
SC	.028	1.029	3.379

* = p < .05 *** = p < .001
** = p < .01

Table 1b. 31U: Results of the binary logistic prediction model excluding EL

Chi- Square		36.287***	
Log Likelihood		1491.699	
Nagelkerke R Square		.027	
Variable	Coefficient	Odds Ratio	Wald
Constant	-.124	.883	.032
GUARD	.624	1.866	8.638**
RESERVE	.227	1.255	.586
GENDER	-.073	.929	.145
SC	.033	1.034	24.569***

* = p < .05 *** = p < .001
** = p < .01

Appendix: Soldiers Characteristics (31U)

Outcome	Gender	
	Male	Female
fail	2.9%	3.8%
pass	97.1%	96.2%

Outcome	Education Status		
	GED or less	High School Diploma	Some College or More
fail	1.9%	3.3%	.9%
pass	98.1%	96.7%	99.1%

Outcome	Component		
	Regular Army	Army Reserve	National Guard
fail	3.7%	2.5%	1.8%
pass	96.3%	97.5%	98.2%

27D (71D): Legal Specialist

The final sample included 423 Soldiers who were coded as either graduates or academic failures during their first AIT attempt for this MOS during a period from 2001 to 2004. Only Soldiers who graduated (88.9%) or failed for academic reasons (11.1%) were included in the analysis sample of 423 Soldiers because we assume that non-completion for non-academic reasons is not related to cognitive criteria.

In the sample, most were male (55%, 45% female), most had a high school diploma but not more education (78%, 21% some college, 1% GED or less), and most were from were from the Regular Army (63%, 21% National Guard, 16% Reserve). The governing AA composites, Clerical (CL), for this MOS has cutoff score of 110; the sample mean is 116.91 (standard deviation = 7.242). See the Appendix for a description of Soldier characteristics for this MOS training sample.

A binary logistic regression model was estimated to explain pass/fail AIT outcomes and focused on the first training attempt. The estimation results are reported in Table 1 and indicate that the model, including the CL composite, education status (COLLEGE = some college education), Army component (GUARD = National Guard, RESERVE = Army Reserve), and GENDER (GENDER = Female) accounts for about 16% of the variation in the dependent variable. This model is statistically significant (χ^2 = 35.844, $P < .001$), and has moderate explanatory power (Nagelkerke $R^2 = .162$).

Table 1. 71D: Results of the binary logistic prediction model

Chi- Square		35.844***	
Log Likelihood		259.268	
Nagelkerke R Square		.162	
Variable	Coefficient	Odds Ratio	Wald
Constant	-15.010	.000	15.790***
COLLEGE	1.124	3.368	4.872*
GUARD	1.426	4.163	7.892**
RESERVE	.558	1.747	1.358
GENDER	.676	1.967	4.022*
CL	.142	1.152	18.777***

* = p < .05 *** = p < .001
** = p < .01

There is a statistically significant effect for the CL composite. The model suggests that having a higher CL composite score increases the odds of passing. At the mean CL score, an increase of one point is associated with an increase of about 15% in the odds of passing the course, and a five-point increase in CL would increase the odds of passing by 103%. There are also statistically significant effects for COLLEGE, GUARD, and GENDER, with increased odds of passing the course at 237%, 316%, and 97% (for females), respectively.

Policy Analysis. Table 2 reports the probability that the average Soldier from the larger Army contract population would pass the course based upon the binary logistic model. These were calculated using the formula for finding probability in a binary logistic model, which is

$$e^{(\beta' x)} / (1 + e^{(\beta' x)}).$$

The following analysis is focused upon male and female Soldiers with a high school diploma or some college education from the Regular Army. Based on the model, when the cutoff score is at its current level (CL = 110), male (female) Soldiers with a high school diploma and an average CL score (CL = 118.71) have approximately an 86% (93%) chance of passing. Currently, about 36% of Soldiers are eligible for MOS 71D assignment at the current cutoff. Lowering the cutoff by five points (CL = 105) would

Table 2. 71D: Probability that a Regular Army Soldier (from the larger successful applicant population) will pass the course based on the binary logistic model

	Cutoff: CL = 100	Cutoff: CL = 105	Cutoff CL = 110	Cutoff CL = 115	Cutoff CL = 120
Percent Eligible (Regular Army)	*67.6%*	*51.2%*	*35.7%*	*23.2%*	*13.4%*
Mean	*112.63*	*115.40*	*118.71*	*122.06*	*125.38*
Passing Rates:					
High School Male	72.8%	79.8%	86.4%	91.1%	94.2%
High School Female	84.0%	88.6%	92.6%	95.3%	97.0%
College Male	90.0%	93.0%	95.5%	97.2%	98.2%
College Female	94.7%	96.3%	97.7%	98.5%	99.1%

increase eligibility by 15 percentage points (to 51%) and the average male (female) Soldier who would qualify for training would have a lower chance of passing (80%) (89%). Raising the CL cutoff score by five points (CL = 110) leads to an increase in passing rates for the average high school male (female) Soldier (91%) (95%), but few Soldiers would be eligible (23%).

Figure 1 shows the relationship between CL and the probability of passing for high school educated Regular Army Soldiers by gender. For a particular CL score, trace a vertical line up to the curve, and then a horizontal line over to the axis to determine the corresponding probability of passing. For example, a CL score of 100 corresponds to a passing probability of about 30% for a high school educated, Regular Army male Soldier.

Figure 1: Predicted Probability of Passing: High School Soldiers

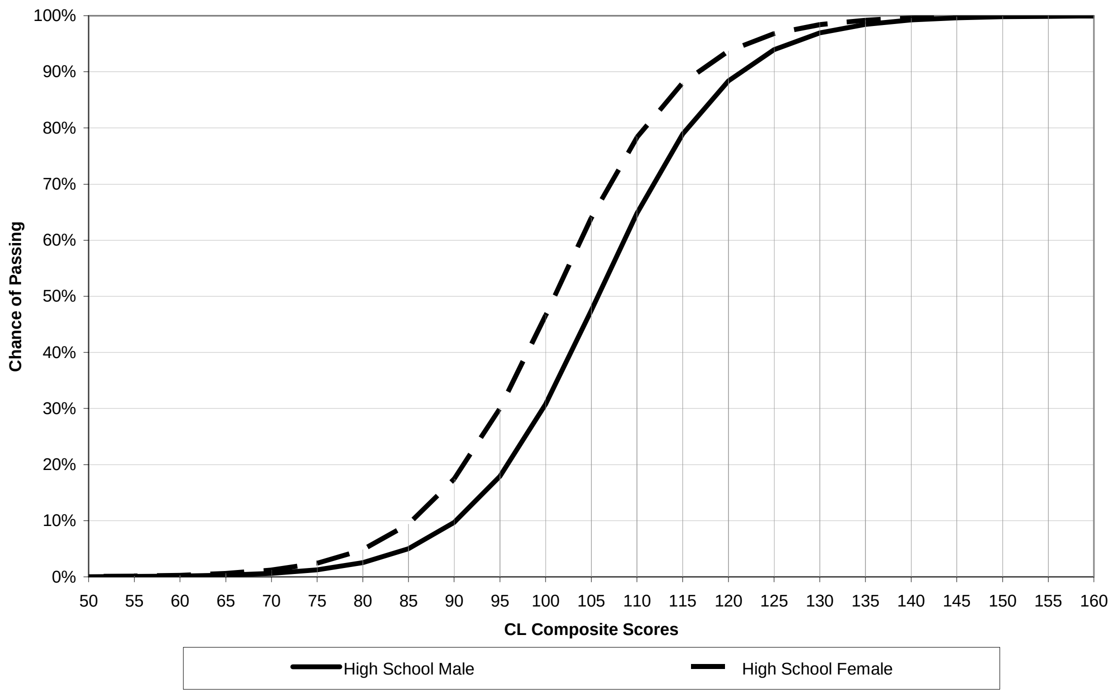


Figure 2 shows the relationship between CL and the probability of passing for male Soldiers by education level. The graph illustrates that college educated Soldiers have a noticeably better chance of passing this course.

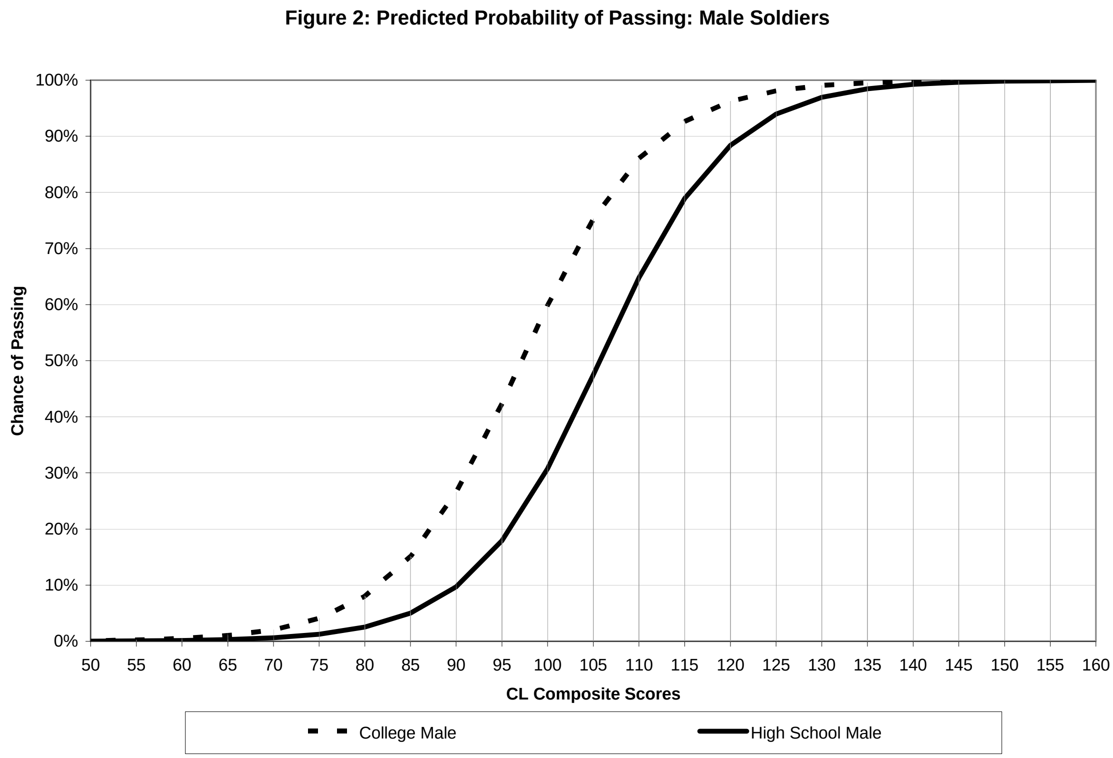
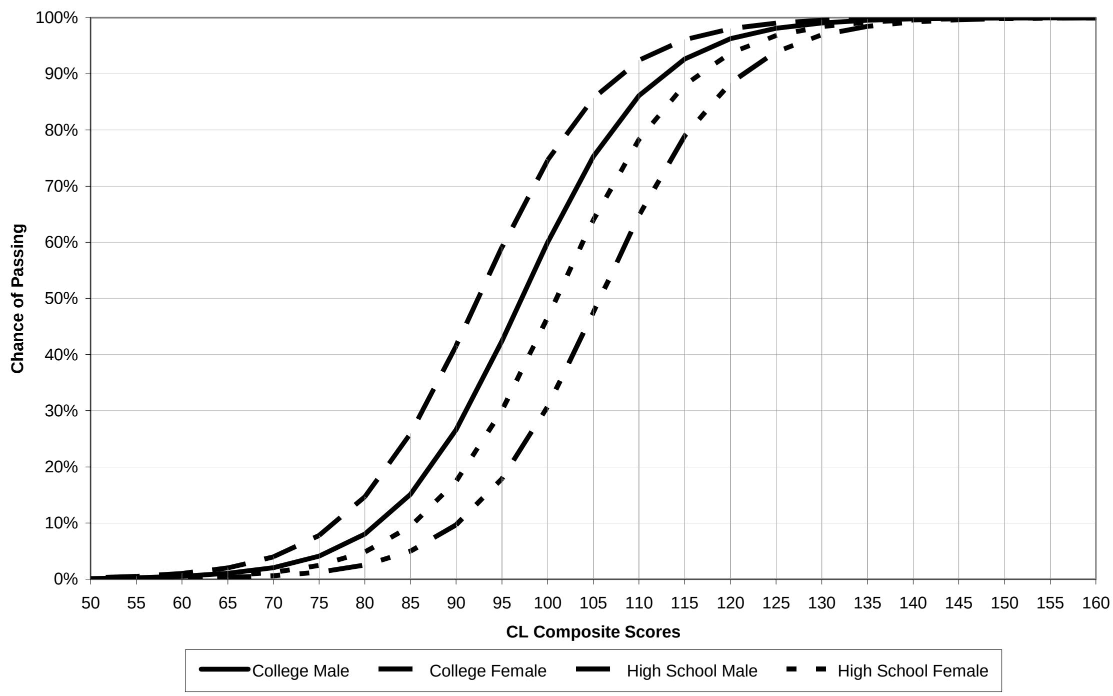


Figure 3 shows the relationship between CL and the probability of passing for Soldiers by education and gender. The graph illustrates that women with some college education have the best chance at passing the course, while high school educated males, the modal students, have the lowest chance of passing. Figure 3 also illustrates the magnitude of the effect brought about by gender and education. At the current cutoff score (CL = 110) college educated female Soldiers have about a 25 percentage point better chance of passing the course compared to high school educated males.

Figure 3: Predicted Probability of Passing: Education Level by Sex



Appendix: Soldier Characteristics (71D)

Outcome	Gender: Male	Gender: Female
fail	12.0%	10.0%
pass	88.0%	90.0%

Outcome	Education Level: GED or less	High School Diploma	Some College or More
fail	25.0%	12.8%	4.4%
pass	75.0%	87.2%	95.6%

Outcome	Component: Regular Army	Army Reserve	National Guard
fail	13.1%	8.8%	6.8%
pass	86.9%	91.2%	93.2%

71D Risk Analysis of Policy Alternatives

In this section we extend the policy analysis with a risk analysis of the policy alternatives considered using simulation methods. We employ the "@RISK" software package which is designed as an add-in for Microsoft Excel.[21] There are four steps in the risk analysis.

The first step is developing a model. A regression model for predicting the passing rate has been specified and estimated, and the results stored in Excel worksheet format. See Table 1.

The second step is identifying the uncertainty inherent in both the input variables (composite scores, Soldier characteristics) and the corresponding estimated parameters and specifying their possible values with probability distributions.

To approximate the governing composite distribution, we use the larger Army contract population (EAF file: those who contracted from Jan 1992 to Aug 2003). This distribution can be assumed to follow a normal distribution. The mean and standard deviation estimated from the contract population and used as input to the simulations are shown in Table R-1 (before truncation).

Table R-1. Input information for the simulations

	Mean	Std error / deviation
Constant	-15.010	3.778
CL var	107.16 (before truncation)	11.355
CL coeff	.142	.033
COLLEGE var	21.3%	
COLLEGE coeff	1.214	.550
GUARD var	20.8%	
GUARD coeff	1.426	.508
RESERVE var	16.1%	
RESERVE coeff	.558	.479
GENDER var	55.1%	
GENDER coeff	.676	.337

To approximate the distributions for the demographic variables we rely on the training data sample used to estimate the regression model. These distributions can be

[21] Software is available from Palisade Corporation, Newfield, NY.

assumed to follow binomial distributions with means estimated from the training data sample as shown in Table R-1.

To approximate the distributions for the estimated parameters in the logit model, we note that, under very general conditions, the estimates will be asymptotically normally distributed.[22] The estimated coefficients (means and standard errors) are shown in Table R-1.

The third step is analyzing the model with simulation to determine the range and probabilities of all possible training outcome results. The results reported represent the simulation of the regression prediction equation for 1000 iterations using a fixed seed.[23] The comparisons are between the baseline case (CL = 110) and the policy cases (CL = 105 and CL = 115). These cases are delineated by the cutoff score level which serves as the lower truncation point in the governing composite input distribution. The simulation results in Table R-2 describe the effect on the mean probability of passing as the CL cutoff score level is varied, and represent an improvement of the policy analysis presented in Table 2 because they reflect the simultaneous effects of all known sources of uncertainty.

Table R-2. 71D simulation results

	CL = 105	CL = 110	CL = 115
Mean governing composite	114.88	118.09	121.72
Mean probability of passing	65.3%	68.5%	70.5%
Std deviation	39.9%	39.5%	38.9%

The frequency distributions of simulated effects are shown below in the histogram graphs. The histogram portrays the full range of outcomes that average to the mean effect as reported. Looking at the histogram for the baseline case (CL = 110), probability of passing is plotted on the horizontal axis and the height of each bar indicates the relative number of Soldiers at that passing probability. The information in the histograms is effectively summarized in Table R-3. In that table we see the percentage of Soldiers who meet or exceed a given chance of passing. For example, looking at the baseline case (CL = 110), about 64% of Soldiers have a 70% or greater chance of passing.

[22] The intuition is that logit estimates are derived from maximum likelihood (ML) estimation, and under fairly general conditions ML estimates are consistent and asymptotically normally distributed.

[23] Latin Hypercube (LH) sampling is utilized in drawing samples for the input distributions. It is designed to accurately recreate the input distribution through sampling in fewer iterations when compared with the Monte Carlo method. The key to LH sampling is stratification of the input probability distributions.

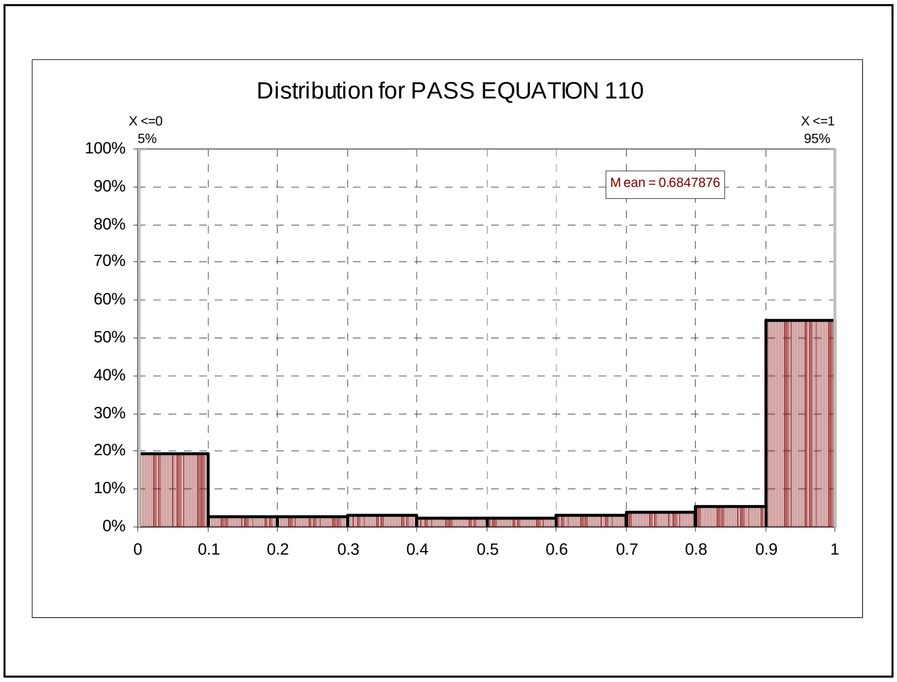
Table R-3.
Percent of simulated Soldiers that meet or exceed given chance of passing

Chance of passing	CL = 105	CL = 110	CL = 115
95.0%	43.6%	49.3%	52.2%
90.0%	49.8%	54.6%	56.3%
85.0%	52.9%	57.4%	60.7%
80.0%	55.1%	59.9%	63.0%
75.0%	57.7%	62.1%	65.1%
70.0%	59.4%	63.9%	66.4%
65.0%	61.4%	65.6%	67.5%
60.0%	63.2%	67.1%	69.1%
55.0%	64.9%	68.5%	70.5%
50.0%	66.7%	69.5%	72.2%

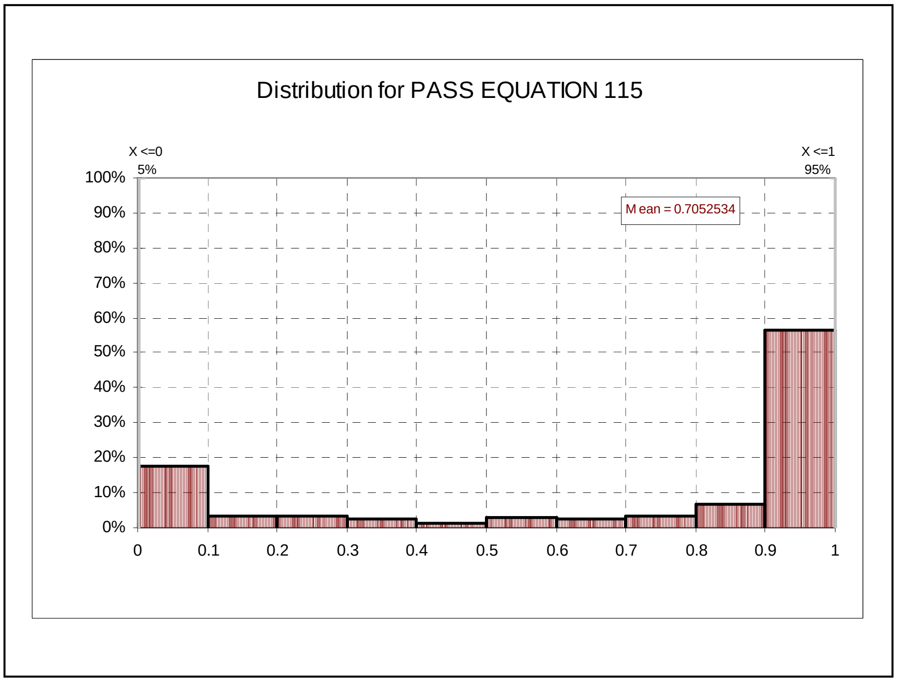
We find that the mean probability of passing in the simulation is 69% (Table R-2, baseline). Looking at the histograms, we see a large portion of Soldiers in the highest range of passing scores; however, it is also evident that a not insubstantial group of Soldiers has a very low chance of passing. Sensitivity analysis indicates that we can attribute this pattern to the relatively large standard errors on the constant and governing composite terms (specially the former) that come into play in the simulation. The relatively large standard errors introduce variability into the passing probabilities[24]. We note that the mean simulated passing probability turns out to be substantially lower (15 percentage points) than the static prediction at the mean CL score (Table 2). In the simulated predictions we are calculating an average over all Soldiers and taking into account all sources of uncertainty, whereas in the static prediction we are calculating the probability of passing only at the mean CL score, ignoring the distribution of Soldier scores etc. as well as uncertainty. While recognizing this variability is important, we also note that the policy case impacts relative to the baseline are the same in both simulation and static prediction modes.

The fourth step is making a decision based on the results provided and the preferences of the school proponent. This involves the evaluation by the school proponent of the tradeoff between increased eligibility and reduced passing probabilities (and vice-versa).

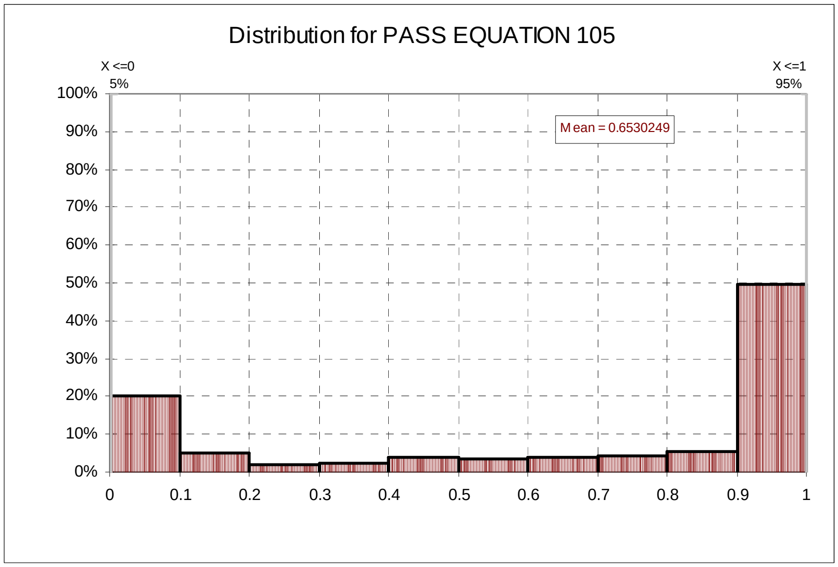
[24] The large standard error for the constant allows scores to be more spread out and allows for large groupings at the highest and lowest values. And since the probabilities of passing are calculated from the ratio: $e^{(\beta' x)} / (1 + e^{(\beta' x)})$, as the scores calculated from the equation become extreme, the ratios are more likely to approach zero and one.



Distribution for PASS EQUATION 110
X <=0
5%
X <=1
95%
Mean = 0.6847876
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1



Distribution for PASS EQUATION 115
X <=0
5%
X <=1
95%
Mean = 0.7052534
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1



Distribution for PASS EQUATION 105
X <=0
5%
X <=1
95%
Mean = 0.6530249
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1

33W: Military Intelligence Systems Operator/Integrator

The final sample included 572 soldiers who were coded as either graduates or academic failures during their first AIT attempt in this MOS during a period from 2001 to 2004. Only soldiers who graduated (76.2%) or failed for academic reasons (23.8%) were included in the analysis sample because we assume that non-completion for non-academic reasons is not related to cognitive criteria.

In the sample, most were male (92%, 8% female), most had a high school diploma but not more education (85%, 14% some college, < 1% GED or less), and most were Regular Army (97%, 1% Army Reserve, 2% National Guard). The governing AA composite, Skilled Technical (ST), for this MOS has a cutoff score of 113; the sample mean is 121.84 (standard deviation = 6.262). See the Appendix for a description of Soldier characteristics for this MOS training sample.

Table 1. 33W: Results of the binary logistic prediction model

Chi- Square		60.836***	
Log Likelihood		566.632	
Nagelkerke R Square		.151	
Variable	Coefficient	Odds Ratio	Wald
Constant	-13.436	.000	31.675***
COLLEGE	1.295	3.653	8.434**
GENDER	.156	1.168	.183
ST	.120	1.127	36.284***

* = p < .05 *** = p < .001
** = p < .01

A binary logistic regression model was estimated to explain pass/fail AIT outcomes and focused on the first training attempt. The estimation results are reported in Table 1 and indicate that the model, including the ST composite, education status

(COLLEGE = some college), and gender (GENDER = female), accounts for about 15% of the variation in the dependent variable. This model is statistically significant (χ^2 = 60.836, P < .001), with moderate explanatory power (Nagelkerke R^2 = .151).

There are statistically significant effects for the ST composite, having some college education, and National Guard membership. The model suggests that having a higher ST composite score increases the odds of passing. At the mean ST score, an increase of one point is associated with an increase of about 13% in the odds of passing the course, and a five-point increase in ST would increase the odds of passing by 82%. There is a noteworthy effect for COLLEGE, where the odds of a Soldier with some college education passing this training exceed that of the average male Soldier by over 265%.

Policy Analysis. Table 2 reports the probability that the average soldier from the larger Army contract population would pass the course based upon the binary logistic model. These were calculated using the formula for finding probability in a binary logistic model, which is

$$e^{(\beta' x)} / (1 + e^{(\beta' x)}).$$

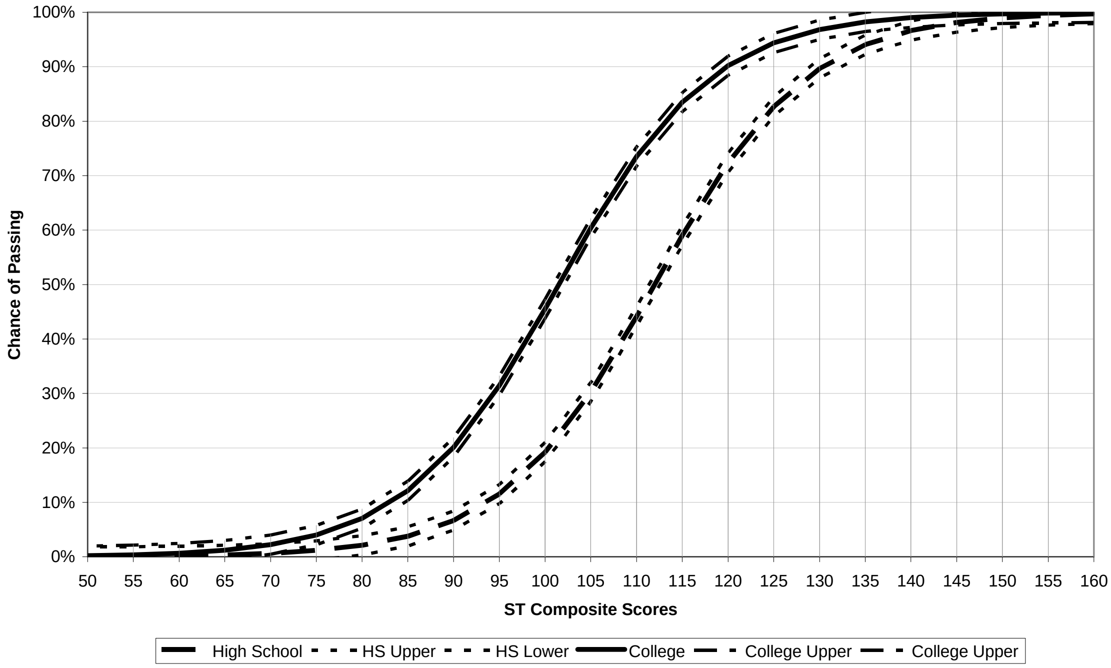
Because GENDER was not statistically significant, this analysis is confined to the modal demographics factored by COLLEGE—high school educated male Soldiers from the Regular Army (though results would be similar for any demographic combination). Based on the model, when the cutoff score is at its current level (ST = 113), soldiers with a high school diploma and an average ST score (ST = 120.51) have approximately a 74% chance of passing, while the college educated counterparts have approximately a 92% chance of passing. Currently, about only 32% of soldiers are eligible for MOS 33W assignment at the current cutoff (ST = 113). Lowering the cutoff by five points (ST = 108) would increase eligibility by 15 percentage points, while the average Soldier who would qualify for training would have a lower chance of passing (high school = 65%, college = 88%). Raising the cutoff score by five points (ST = 118), the average Soldier who would still qualify for the MOS would have a higher chance of passing (high school = 81%, college = 95%), but considerably fewer Soldiers would be eligible (20%).

Table 2. 33W: Probability that a Soldier (from the larger Army contract population) will pass the course based on the binary logistic model

	Cutoff = 103	Cutoff = 108	Cutoff = 113	Cutoff = 118	Cutoff = 123
Percent Eligible (Regular Army)	*61.9%*	*46.5%*	*31.9%*	*19.8%*	*10.7%*
Mean	*114.16*	*117.18*	*120.51*	*123.94*	*127.39*
Passing rates:					
High school male	55.6%	65.2%	73.6%	80.8%	86.4%
College male	84.2%	88.5%	92.0%	94.5%	96.3%

Figure 1 shows the relationship between ST and the probability of passing for Regular Army Soldiers with high school and (some) college education, including upper and lower bounds based upon the standard error of the estimated ST coefficient. For a particular ST score, trace a vertical line up to the curve, and then a horizontal line over to the axis to determine the corresponding probability of passing. For example, a ST value of 100 corresponds to a passing probability of about 20% for a high school educated male Soldier. One can see that the probability of passing increases steeply over the full range of the data.

Figure 1: Predicted Probalility of Passing: Male Soldiers With a High School Diploma or Some College Education



Appendix: Soldier Characteristics (33W)

Outcome	Gender	
	Male	Female
fail	23.5%	27.1%
pass	76.5%	72.9%

Outcome	Education Level		
	GED or less	High School Diploma	Some College or More
fail	.0%	26.6%	7.3%
pass	100.0%	73.4%	92.7%

Outcome	Component		
	Regular Army	Army Reserve	National Guard
fail	24.0%	16.7%	16.7%
pass	76.0%	83.3%	83.3%

33W Risk Analysis of Policy Alternatives

In this section we extend the policy analysis with a risk analysis of the policy alternatives considered using simulation methods. We employ the "@RISK" software package which is designed as an add-in for Microsoft Excel.[25] There are four steps in the risk analysis.

The first step is developing a model. A regression model for predicting the passing rate has been specified and estimated, and the results stored in Excel worksheet format. See Table 1.

The second step is identifying the uncertainty inherent in both the input variables (composite scores, Soldier characteristics) and the corresponding estimated parameters and specifying their possible values with probability distributions.

To approximate the governing composite distribution, we use the larger Army contract population (EAF file: those who contracted from Jan 1992 to Aug 2003). This distribution can be assumed to follow a normal distribution. The mean and standard deviation estimated from the contract population and used as input to the simulations are shown in Table R-1 (before truncation).

Table R-1. Input information for the simulations

	Mean	Std error / deviation
Constant	-13.435	2.387
ST var	107.02 (before truncation)	12.157
ST coeff	.120	.020
GENDER var	8.4%(female)	
GENDER coeff	.156	.363
COLLEGE var	14.3%	
COLEGE coeff	1.295	.446

To approximate the distributions for the demographic variables (GENDER, and COLLEGE) we rely on the training data sample used to estimate the regression model. These distributions can be assumed to follow binomial distributions with means estimated from the training data sample as shown in Table R-1.

To approximate the distributions for the estimated parameters in the logit model, we note that, under very general conditions, the estimates will be asymptotically normally

[25] Software is available from Palisade Corporation, Newfield, NY.

distributed.[26] The estimated coefficients (means and standard errors) are shown in Table R-1.

The third step is analyzing the model with simulation to determine the range and probabilities of all possible training outcome results. The results reported represent the simulation of the regression prediction equation for 1000 iterations using a fixed seed.[27] The comparisons are between the baseline case (ST = 113) and the policy cases (ST = 108 and ST = 118). These cases are delineated by the cutoff score level which serves as the lower truncation point in the governing composite input distribution. The simulation results in Table R-2 describe the effect on the mean probability of passing as the ST cutoff score level is varied, and represent an improvement of the policy analysis presented in Table 2 because they reflect the simultaneous effects of all known sources of uncertainty.

Table R-2. 33W simulation results

	ST = 108	ST = 113	ST = 118
Mean governing composite	117.34	120.81	124.61
Mean probability of passing	58.0%	61.9%	66.1%
Std deviation	37.6%	37.2%	36.2%

The frequency distributions of simulated effects are shown below in the histogram tables. The histogram portrays the full range of outcomes that average to the mean effect as reported. Looking at the histogram for the baseline case (ST = 113), probability of passing is plotted on the horizontal axis and the height of each bar indicates the relative number of Soldiers at that passing probability. The information in the histograms is effectively summarized in Table R-3. In that table we see the percentage of Soldiers that meet or exceed a given chance of passing. For example, looking at the baseline case (ST = 95), about 53% of Soldiers have a 70% or greater chance of passing.

We find that the mean probability of passing in the simulation is 62% (Table R-2, baseline). Looking at the histograms, we see a large portion of Soldiers in the highest range of passing scores; however, it is also evident that a not insubstantial group of Soldiers has a very low chance of passing. Sensitivity analysis indicates that we can attribute this pattern to the relatively large standard errors on the constant term and

[26] The intuition is that logit estimates are derived from maximum likelihood (ML) estimation, and under fairly general conditions ML estimates are consistent and asymptotically normally distributed.
[27] Latin Hypercube (LH) sampling is utilized in drawing samples for the input distributions. It is designed to accurately recreate the input distribution through sampling in fewer iterations when compared with the Monte Carlo method. The key to LH sampling is stratification of the input probability distributions.

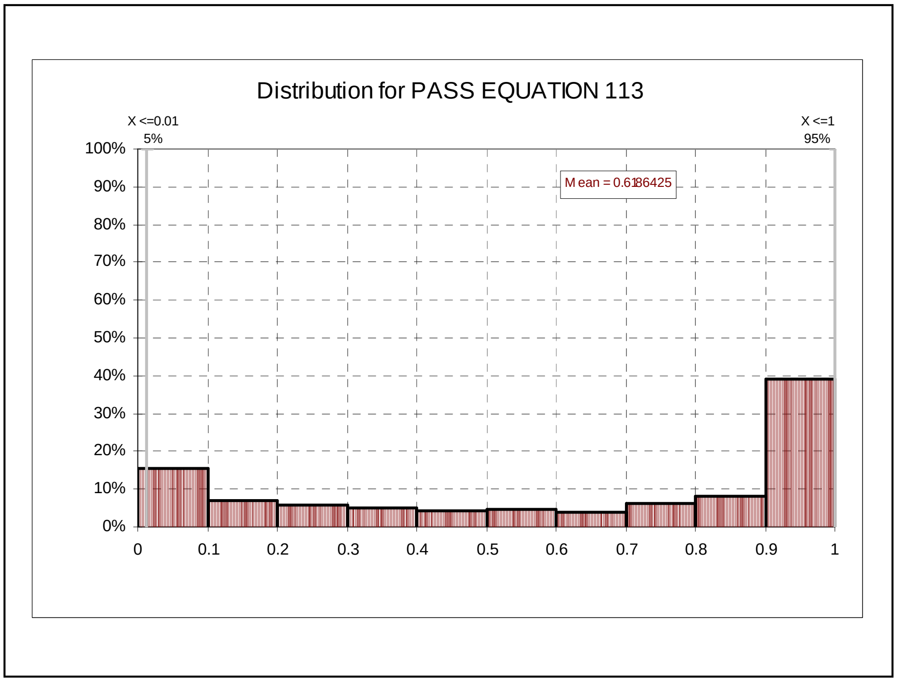
governing composite (to a lesser extent) that come into play in the simulation. The relatively large standard errors introduce variability into the passing probabilities[28]. We note that the mean simulated passing probability turns out to be about twelve percentage points lower than the static prediction at the mean ST score (Table 2). In the simulated predictions we are calculating an average over all Soldiers and taking into account all sources of uncertainty, whereas in the static prediction we are calculating the probability of passing only at the mean ST score, ignoring the distribution of Soldier scores etc. as well as uncertainty. While recognizing this variability is important, we also note that the policy case impacts relative to the baseline are the same in both simulation and static prediction modes.

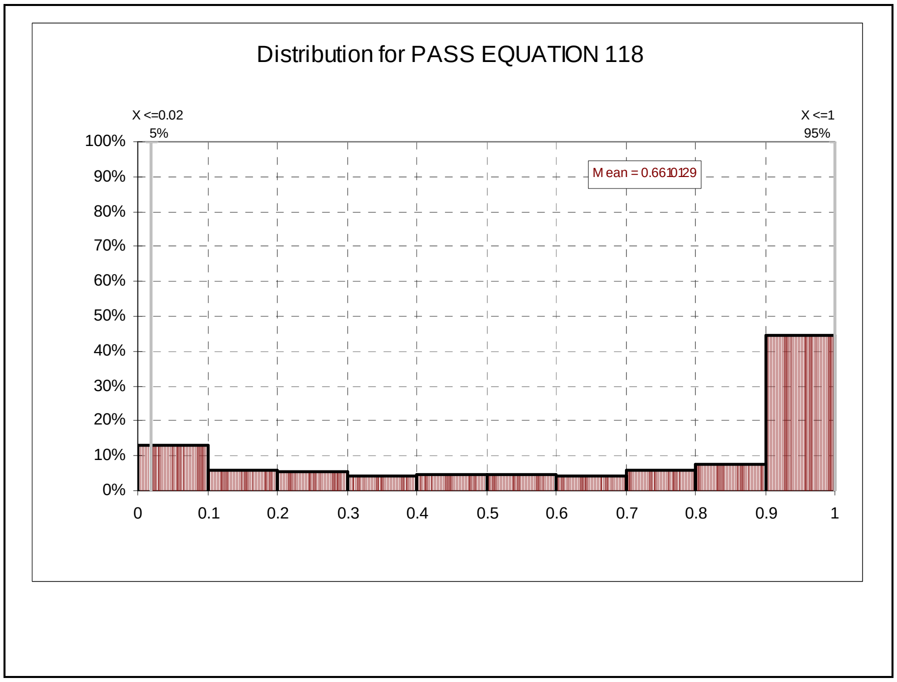
The fourth step is making a decision based on the results provided and the preferences of the school proponent. This involves the evaluation by the school proponent of the tradeoff between increased eligibility and reduced passing probabilities (and vice-versa).

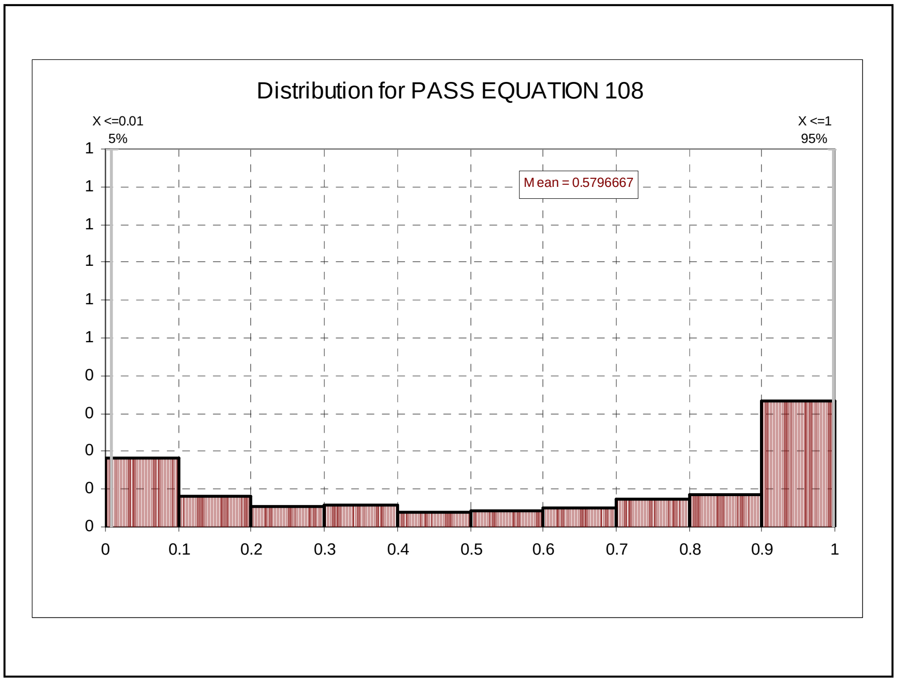
Table R-3.
Percent of simulated Soldiers that meet or exceed given chance of passing

Chance of passing	ST = 108	ST = 113	ST = 118
95.0%	25.5%	31.2%	38.1%
90.0%	33.4%	39.2%	44.7%
85.0%	39.0%	44.2%	48.6%
80.0%	42.1%	47.5%	52.1%
75.0%	45.4%	50.8%	55.1%
70.0%	49.6%	53.6%	58.0%
65.0%	52.4%	55.9%	60.3%
60.0%	54.5%	57.5%	62.3%
55.0%	57.2%	59.6%	64.8%
50.0%	58.6%	62.1%	67.0%

[28] The large standard error for the constant allows scores to be more spread out and allows for large groupings at the highest and lowest values. And since the probabilities of passing are calculated from the ratio: $e^{(\beta' x)} / (1 + e^{(\beta' x)})$, as the scores calculated from the equation become extreme, the ratios are more likely to approach zero and one.


Distribution for PASS EQUATION 113
X <=0.01
5%
X <=1
95%
Mean = 0.6186425
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1


Distribution for PASS EQUATION 118
X <=0.02
5%
X <=1
95%
Mean = 0.6610129
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1



Distribution for PASS EQUATION 108
X <=0.01
5%
X <=1
95%
Mean = 0.5796667
1
1
1
1
1
1
0
0
0
0
0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1

42A (75B): Personnel Administrative Specialist

The final sample included 2921 soldiers who were coded as either graduates or academic failures during their first AIT attempt in this MOS during a period from 2001 to 2004. Only soldiers who graduated (97.7%) or failed for academic reasons (2.3%) were included in the analysis sample because we assume that non-completion for non-academic reasons is not related to cognitive criteria.

In the sample, most were male (55%, 45% female), most had a high school diploma but not more education (89%, 8% some college, 3% GED or less), and the greatest number were from Regular Army (47%, 18% Army Reserve, 35% National Guard). The governing AA composite, Clerical (CL), for this MOS has a cutoff score of 92; the sample mean is 103.05 (standard deviation = 11.115). See the Appendix for a description of Soldier characteristics for this MOS training sample.

A binary logistic regression model was estimated to explain pass/fail AIT

Table 1. 75B: Results of the binary logistic prediction model

Chi- Square		19.526**	
Log Likelihood		618.774	
Nagelkerke R Square		.034	
Variable	Coefficient	Odds Ratio	Wald
Constant	.447	1.563	.242
GED	5.23	1.688	.260
COLLEGE	-.066	.936	.019
RESERVE	.215	1.240	.432
GUARD	.965	2.625	8.417**
GENDER	.169	1.184	.445
CL	.029	1.029	10.891**

* = p < .05 *** = p < .001
** = p < .005

outcomes and focused on the first training attempt. The estimation results are reported in Table 1 and indicate that a model including the CL composite, education status (GED = GED or less than high school diploma; COLLEGE = some college), Army component (GUARD = National Guard; RESERVE = Army Reserve), and gender (GENDER = female) accounts for only three percent of the variation in the dependent variable. This model is statistically significant ($\chi^2 = 19.526$, $P = .003$), but its explanatory power appears to be limited (Nagelkerke $R^2 = .034$).

There are statistically significant effects for the CL composite and Guard membership. The model suggests that having a higher CL composite score increases the odds of passing. At the mean CL score, an increase of one point is associated with an increase of about three percent in the odds of passing the course, and a five-point increase in CL would increase the odds of passing by 16%. There is also a noteworthy effect for GUARD: Guardsmen have 162% greater odds of passing than Regular Army Soldiers do.

Policy Analysis. Table 2 reports the probability that the average Soldier from the larger Army contract population would pass the course based upon the binary logistic model. These were calculated using the formula for finding probability in a binary logistic model, which is

$$e^{(\beta' x)} / (1 + e^{(\beta' x)}).$$

Because GED, COLLEGE, GENDER, and RESERVE were not statistically significant, this analysis is confined to the modal demographics: male Soldiers from the Regular Army with a high school education (though results would be similar for any demographic combination, except Guardsmen). Based on the model, when the cutoff score is at its current level (CL = 92), male Soldiers with a high school diploma and an average CL score (CL = 109.62) have approximately a 97% chance of passing. Currently, about 92% of Soldiers are eligible for MOS 75B assignment at the current cutoff (CL = 92). Lowering the cutoff by five points (CL = 87) would increase eligibility by 7 percentage points (to 99%) and the average Soldier who would qualify for training would have the same chance of passing (97%). Raising the cutoff score by five points (CL = 97), the average male Soldier with a high school diploma would have the same chance of passing

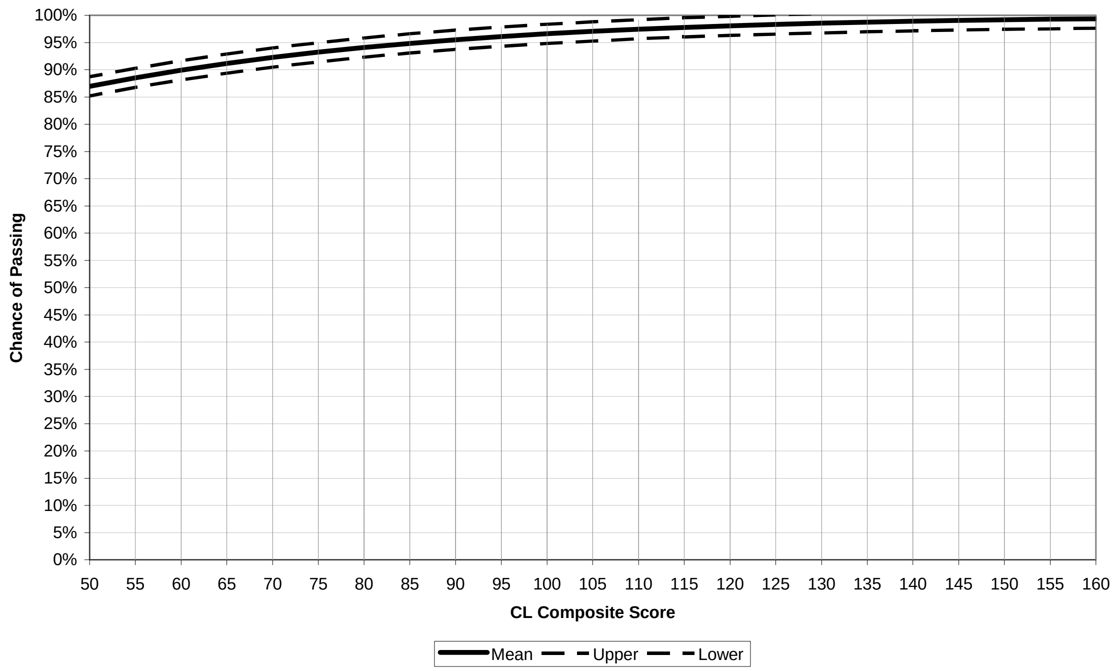
Table 2. 75B: Probability that a Soldier (from the larger Army contract population) will pass the course based on the binary logistic model

	Cutoff = 82	Cutoff = 87	Cutoff = 92	Cutoff = 97	Cutoff = 102
Percent Eligible (Regular Army)	*99.9%*	*99.0%*	*91.6%*	*80.0%*	*67.6%*
Mean	*107.50*	*107.85*	*109.62*	*111.79*	*114.18*
Passing rate:					
Male/High School	97.2%	97.3%	97.4%	97.6%	97.7%

but eligibility would fall by about 11 percentage points.

Figure 1 shows the relationship between CL and the probability of passing for Regular Army male Soldiers with a high school diploma, including upper and lower bounds based upon the standard error of the estimated CL coefficient. For a particular CL score, trace a vertical line up to the curve, and then a horizontal line over to the axis to determine the corresponding probability of passing. For example, a CL score of 100 corresponds to a passing probability of about 92% for a high school educated, Regular Army male Soldier. One can see that even at the lowest possible CL scores there is a very high chance of passing for a given Soldier. There is a gradual increase in the chance of passing as CL increases, and the chance is greater than 95% at the current cutoff score (CL = 95).

**Figure 1: Predicted Probalility of Passing:
Regular Army Male Soldiers with a High School Diploma**



Appendix: Soldier Characteristics (75B)

Outcome	Gender: Male	Gender: Female
fail	2.4%	2.2%
pass	97.6%	97.8%

	Education Level: GED or less	Education Level: High School Diploma	Education Level: Some College or More
fail	1.1%	2.3%	2.3%
pass	98.9%	97.7%	97.7%

	Component: Regular Army	Component: Army Reserve	Component: National Guard
fail	3.0%	2.5%	1.2%
pass	97.0%	97.5%	98.8%

42A (75H): Personnel Services Specialist

The final sample included 3024 Soldiers who were coded as either graduates or academic failures <u>during their first AIT attempt</u> in this MOS during a period from 2001 to 2004. Only Soldiers who graduated (98.7%) or failed for academic reasons (1.3%) were included in the analysis sample because we assume that non-completion for non-academic reasons is not related to cognitive criteria.

In this sample, Soldiers were split (50% male, 50% female), most had a high school diploma but not more education (89%, 9% some college, 2% GED or less), and the greatest number were from Regular Army (42%, 24% National Guard, 34% Army Reserve). The governing AA composite, Clerical (CL), for this MOS has a cutoff score of 92; the sample mean is 103.05 (standard deviation = 11.046). See the Appendix for a description of Soldier characteristics for this MOS training sample.

A binary logistic regression model was estimated to explain pass/fail AIT outcomes and focused on the first training attempt. The estimation results are reported in

Table 1. 75H: Results of the binary logistic prediction model

Chi- Square		22.660***	
Log Likelihood		385.494	
Nagelkerke R Square		.059	
Variable	Coefficient	Odds Ratio	Wald
Constant	.031	1.031	.001
GUARD	.086	1.090	.035
RESERVE	-.234	.791	.400
GENDER	.817	2.264	5.263*
CL	.040	1.041	20.349***

$* = p < .05$ $*** = p < .001$
$** = p < .005$

Table 1 and indicate that a model including the CL composite, component membership (GUARD, RESERVE) and gender (GENDER = female) accounts for about six percent of the variation in the dependent variable. This model is statistically significant ($\chi^2 = 22.660$, $P < .001$), but its explanatory power is limited (Nagelkerke $R^2 = .059$).

There is a statistically significant effect for the CL composite. The model suggests that having a higher CL composite score increases the odds of passing. At the mean CL score, an increase of one point is associated with an increase of about 4% in the odds of passing the course, and a five-point increase in CL would increase the odds of passing by 22%. There is also a significant effect for GENDER, where women have 126% higher odds of passing when compared to men.

Policy Analysis. Table 2 reports the probability that the average Soldier from the larger Army contract population would pass the course on the first attempt based upon the binary logistic model. These were calculated using the formula for finding probability in a binary logistic model, which is

$$e^{(\beta' x)} / (1 + e^{(\beta' x)}).$$

Based on the model, when the cutoff score is at its current level (CL = 92), male Soldiers with an average CL score (CL = 109.62) have approximately a 98.8% chance of passing, while female Soldiers have a 99.5% chance of passing. Currently, about 92% of Soldiers are eligible for MOS 75H assignment at the current cutoff (CL = 92). Lowering the cutoff by five points (CL = 87) would increase eligibility by seven percentage points (to 99%) and the average Soldier who would qualify for training would have the same chance of passing (male = 98.7%; female = 99.4%). Raising the cutoff score by five points (CL = 97), the average Soldier would have the about same chance of passing (male

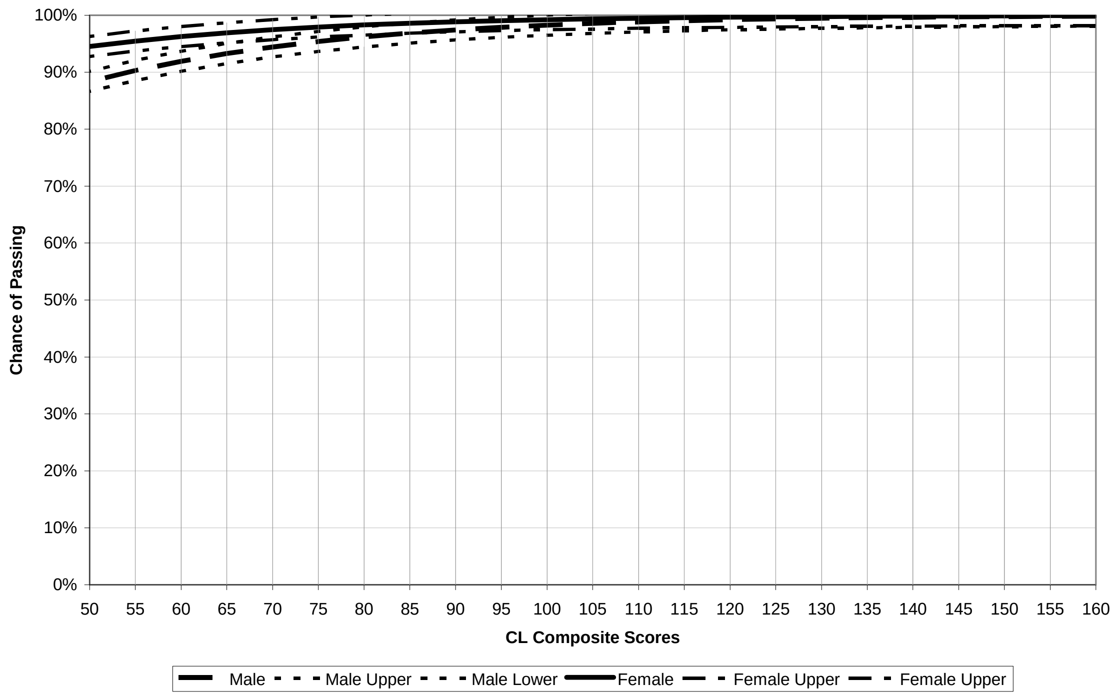
= 98.9%; female = 99.5%), but eligibility would fall by about 12 percentage points (80%).

Table 2. 75H: Probability that a Soldier (from the larger Army contract population) will pass the course based on the binary logistic model

	Cutoff = 82	Cutoff = 87	Cutoff = 92	Cutoff = 97	Cutoff = 102
Percent Eligible (Regular Army)	*99.9%*	*99.0%*	*91.6%*	*80.0%*	*67.6%*
Mean	*107.50*	*107.85*	*109.62*	*111.79*	*114.18*
Passing rates:					
High School Male	98.7%	98.7%	99.8%	98.9%	99.0%
High School Female	99.4%	99.4%	99.5%	99.5%	99.6%

Figure 1 shows the relationship between CL and the probability of passing for male and female Soldiers, including upper and lower bounds based upon the standard error of the estimated CL coefficient. For a particular CL score, trace a vertical line up to the curve, and then a horizontal line over to the axis to determine the corresponding probability of passing. For example, a CL score of 100 corresponds to a passing probability of about 99% for a high school educated, Regular Army male Soldier. One can see that Soldiers with a low CL score have a very high chance of passing the course. Thus, as CL scores increase, there is little room for an increase in the chance of passing.

Figure 1: Predicted Probalility of Passing: Male Soldiers



Appendix: Soldier Characteristics (75H)

Outcome	Gender	
	Male	Female
fail	1.7%	.8%
pass	98.3%	99.2%

Outcome	Education Level		
	GED or less	High School Diploma	Some College or More
fail	.0%	1.4%	.4%
pass	100.0%	98.6%	99.6%

Outcome	Component		
	Regular Army	Army Reserve	National Guard
fail	1.2%	1.6%	1.0%
pass	98.8%	98.4%	99.0%

42L (71L): Administrative Specialist

The final sample included 7525 Soldiers who were coded as either graduates or academic failures <u>during their first AIT attempt</u> in this MOS during a period from 2001 to 2004. Only Soldiers who graduated (99.5%) or failed for academic reasons (0.5%) were included in the analysis sample because we assume that non-completion for non-academic reasons is not related to cognitive criteria.

Soldiers were split (51% male, 49% female), most had a high school diploma but not more education (88%, 8% some college, 4% GED or less), and were approximately evenly divided among components (36% Regular Army, 29% National Guard, 35% Army Reserve). The governing AA composite, Clerical (CL), for this MOS has a cutoff score of 92; the sample mean is 103.49 (standard deviation = 11.020). See the Appendix for a description of Soldier characteristics for this MOS training sample.

A binary logistic regression model was estimated to explain pass/fail AIT outcomes and focused on the first training attempt. The estimation results are reported in

Table 1. 71L: Results of the binary logistic prediction model

Chi- Square		16.714**	
Log Likelihood		439.771	
Nagelkerke R Square		.038	
Variable	Coefficient	Odds Ratio	Wald
Constant	.319	1.376	.072
GUARD	.592	1.807	1.704
RESERVE	.218	1.244	.330
GENDER	.806	2.238	5.120*
CL	.044	1.045	14.020***

* = p < .05 *** = p < .001
** = p < .005

Table 1 and indicate that a model, including the CL composite, GUARD, RESERVE and GENDER, accounts for about four percent of the variation in the dependent variable. This model is statistically significant ($\chi^2 = 16.714$, P = .002), but its explanatory power is limited (Nagelkerke $R^2 = .038$).

There is a statistically significant effect for the CL composite. The model suggests that having a higher CL composite score increases the odds of passing. At the mean CL score, an increase of one point is associated with an increase of about 5% in the odds of passing the course, and a five-point increase in CL would increase the odds of passing by 25%. There is also a significant effect for GENDER where women have 124% higher odds of passing when compared to men.

Policy Analysis. Table 2 reports the probability that the average Soldier from the larger Army contract population would pass the course on the first attempt based upon the binary logistic model. These were calculated using the formula for finding probability in a binary logistic model, which is

$$e^{(\beta' x)} / (1 + e^{(\beta' x)}).$$

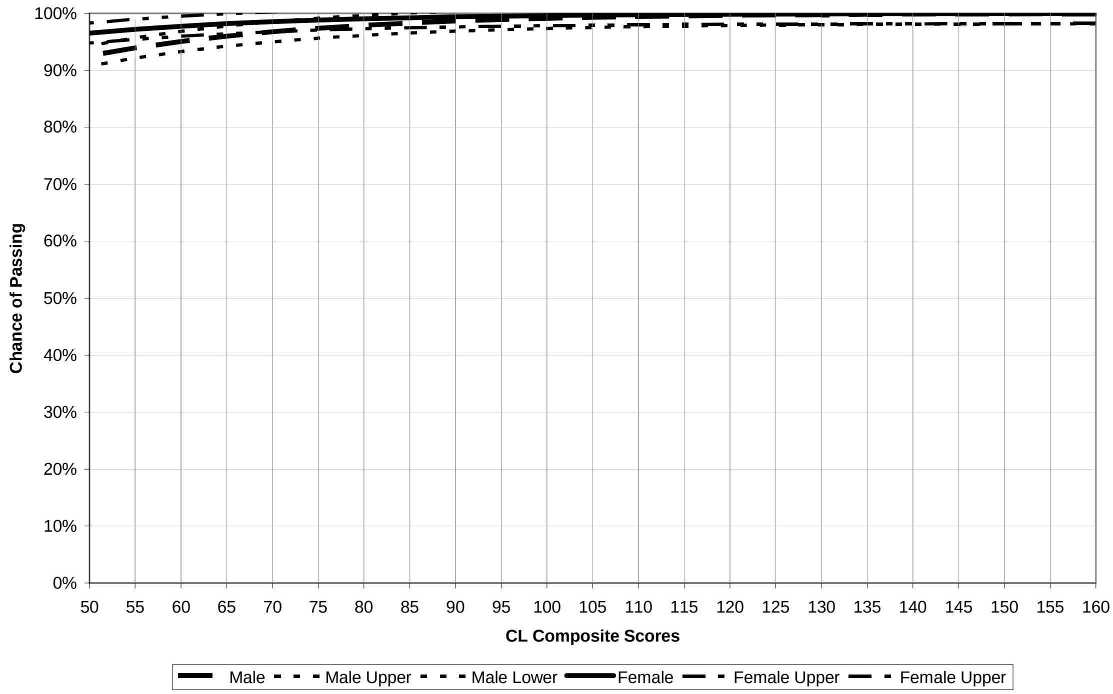
Table 2. 71L: Probability that a Soldier (from the larger Army contract population) will pass the course based on the binary logistic model

	Cutoff = 82	Cutoff = 87	Cutoff = 92	Cutoff = 97	Cutoff = 102
Percent Eligible (Regular Army)	*99.9%*	*99.0%*	*91.6%*	*80.0%*	*67.6%*
Mean	*107.50*	*107.85*	*109.62*	*111.79*	*114.18*
Passing rates:					
Male	99.4%	99.4%	99.4%	99.5%	99.5%
Female	99.7%	99.7%	99.7%	99.8%	99.8%

Based on the model, when the cutoff score is at its current level (CL = 92), male Soldiers with an average CL score (CL = 109.62) have approximately a 99.4% chance of passing, while female Soldiers have a 99.7% chance of passing. Currently, about 92% of Soldiers are eligible for MOS 71L assignment at the current cutoff (CL = 92). Lowering the cutoff by five points (CL = 87) would increase eligibility by seven percentage points (to 99%), and the average Soldier who would qualify for training would practically have the same chance of passing. Raising the cutoff score by five points (CL = 97) would leave the average Soldier with the same chance of passing, but eligibility would fall by about 12 percentage points (80%).

Figure 1 shows the relationship between CL and the probability of passing on the first attempt for male and female Soldiers, including upper and lower bounds based upon the standard error of the estimated CL coefficient. For a particular CL score, trace a vertical line up to the curve, and then a horizontal line over to the axis to determine the corresponding probability of passing. For example, a CL score of 100 corresponds to a passing probability of about 99% for a high school educated, Regular Army male Soldier. One can see that Soldiers with a relatively low CL score have a very high chance of passing the course. Thus, as CL scores increase, there is little room for an increase in the chance of passing.

Figure 1: Predicted Probalility of Passing: Male Soldiers



Appendix: Soldier Characteristics (71L)

Outcome	Gender	
	Male	Female
fail	.6%	.3%
pass	99.4%	99.7%

Outcome	Education Level		
	GED or less	High School Diploma	Some College or More
fail	.0%	.5%	.2%
pass	100.0%	99.5%	99.8%

Outcome	Component		
	Regular Army	Army Reserve	National Guard
fail	.6%	.5%	.3%
pass	99.4%	99.5%	99.7%

44C (73C): Finance Specialist

The final sample included 1518 soldiers who were coded as either graduates or academic failures during their first AIT attempt in this MOS during a period from 2001 to 2004. Only soldiers who graduated (92.6%) or failed for academic reasons (7.4%) were included in the analysis sample because we assume that non-completion for non-academic reasons is not related to cognitive criteria.

In the sample, most were male (56%, 44% female), most had a high school diploma but not more education (84%, 14% some college, 3% GED or less), and most were Regular Army (53%, 23% Army Reserve, 24% National Guard). The governing AA composite, Clerical (CL), for this MOS has a cutoff score of 92; the sample mean is 105.83 (standard deviation = 11.141). See the Appendix for a description of Soldier characteristics for this MOS training sample.

Table 1. 73C: Results of the binary logistic prediction model

Chi- Square		77.037***	
Log Likelihood		722.378	
Nagelkerke R Square		.121	
Variable	Coefficient	Odds Ratio	Wald
Constant	-7.451	.001	29.791***
GED	-8.38	.433	3.095
COLLEGE	.360	1.434	.769
RESERVE	.313	1.368	1.662
GUARD	.366	1.442	1.751
GENDER	.486	1.626	5.483*
CL	.094	1.099	48.865***

* = p < .05 *** = p < .001
** = p < .01

A binary logistic regression model was estimated to explain pass/fail AIT outcomes and focused on the first training attempt. The estimation results are reported in

Table 1 and indicate that the model, including the CL composite, education status (GED = GED or less than high school diploma; COLLEGE = some college), Army component (GUARD = National Guard; RESERVE = Army Reserve) and gender (GENDER = female), accounts for about 12% of the variation in the dependent variable. This model is statistically significant ($\chi^2 = 77.037$, $P < .001$), with moderate explanatory power (Nagelkerke $R^2 = .121$).

There are statistically significant effects for the CL composite and GENDER. The model suggests that having a higher CL composite score increases the odds of passing. At the mean CL score, an increase of one point is associated with an increase of about ten percent in the odds of passing the course, and a five-point increase in CL would increase the odds of passing by 60%. There is a noteworthy effect for GENDER, where the odds of a female Soldier passing this training exceed that of the average male Soldier by about 63%.

Policy Analysis. Table 2 reports the probability that the average Soldier from the larger Army contract population would pass the course based upon the binary logistic model. These were calculated using the formula for finding probability in a binary logistic model, which is

$$e^{(\beta' x)} / (1 + e^{(\beta' x)}).$$

Because GED and COLLEGE were not statistically significant, this analysis is confined to the modal demographics factored by GENDER—high school educated Soldiers from the Regular Army (though results would be similar for any demographic combination). Based on the model, when the cutoff score is at its current level (CL = 92), male soldiers with a high school diploma and an average CL score (CL = 108.87) have approximately a

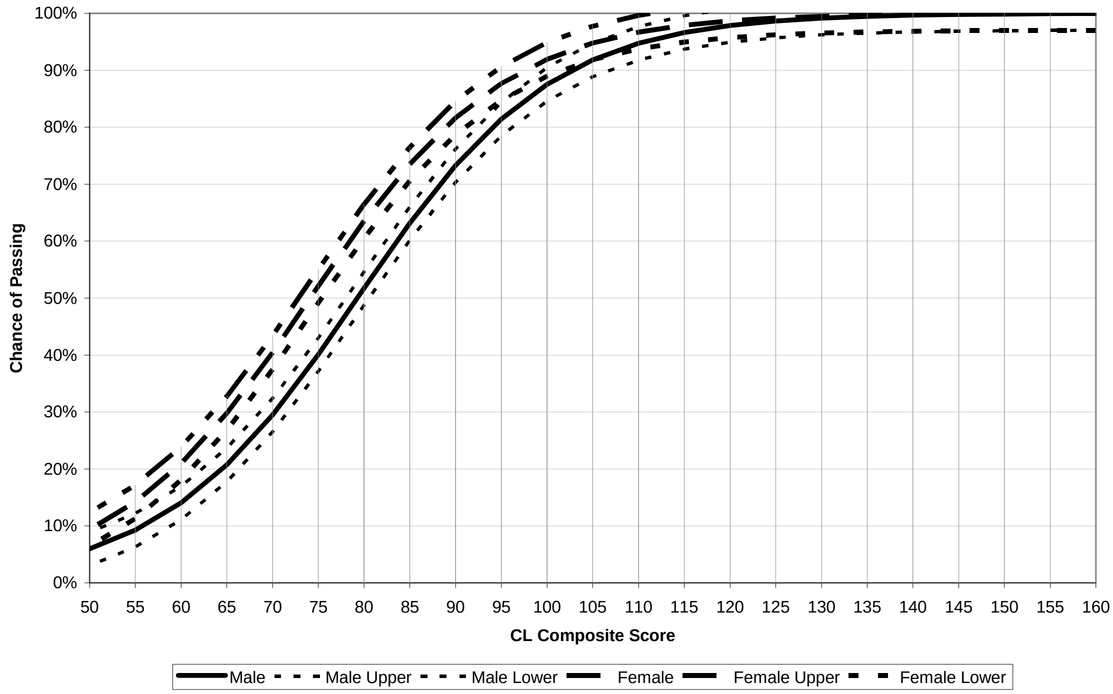
94% chance of passing, while the female counterparts have approximately a 96% chance of passing. Currently, about 92% of soldiers are eligible for MOS 73C assignment at the current cutoff (CL = 92). Lowering the cutoff by five points (CL = 87) would increase eligibility by seven percentage points, while the average Soldier who would qualify for training would have a about the same chance of passing (male = 93%, female = 96%). Raising the cutoff score by five points (CL = 97), the average Soldier who would still qualify for the MOS would have a about the same chance of passing (male = 95%, female = 97%), but considerably fewer Soldiers would be eligible (79%).

Table 2. 73C: Probability that a Soldier (from the larger Army contract population) will pass the course based on the binary logistic model

	Cutoff = 82	Cutoff = 87	Cutoff = 92	Cutoff = 97	Cutoff = 102
Percent Eligible (Regular Army)	*99.9%*	*99.0%*	*91.8%*	*79.2%*	*67.3%*
Mean	*107.26*	*107.48*	*108.87*	*111.22*	*113.36*
Passing rates:					
High school male	93.1%	93.4%	94.2%	95.3%	96.1%
High school female	95.7%	95.8%	96.3%	97.0%	97.6%

Figure 1 shows the relationship between CL and the probability of passing for Regular Army Soldiers, including upper and lower bounds based upon the standard error of the estimated CL coefficient. For a particular CL score, trace a vertical line up to the curve, and then a horizontal line over to the axis to determine the corresponding probability of passing. For example, a CL value of 100 corresponds to a passing probability of about 88% for a high school educated male Soldier. One can see that the probability of passing increases steeply over the full range of the data for Soldiers of both gender.

Figure 1: Predicted Probalility of Passing: High School Soldiers



Appendix: Soldier Characteristics (73C)

Outcome	Gender	
	Male	Female
fail	7.6%	7.1%
pass	92.45	96.7%

Outcome	Education Level		
	GED or less	High School Diploma	Some College or More
fail	15.8%	7.8%	3.3%
pass	84.2%	92.2%	96.7%

Outcome	Component		
	Regular Army	Army Reserve	National Guard
fail	7.8%	5.7%	8.2%
pass	92.3%	94.3%	91.8%

46Q: Journalist

The final sample included 402 soldiers who were coded as either graduates or academic failures during their first AIT attempt in this MOS during a period from 2001 to 2004. Only soldiers who graduated (83.6%) or failed for academic reasons (16.4%) were included in the analysis sample because we assume that non-completion for non-academic reasons is not related to cognitive criteria.

In the sample, most were male (61%, 39% female), most had a high school diploma but not more education (64%, 32% some college, 4% GED or less), and most were Regular Army (54%, 33% Army Reserve, 13% National Guard). The governing AA composite, General Technical (GT), for this MOS has a cutoff score of 110; the sample mean is 118.65 (standard deviation = 10.096). See the Appendix for a description of Soldier characteristics for this MOS training sample.

A binary logistic regression model was estimated to explain pass/fail AIT outcomes and focused on the first training attempt. The estimation results are reported in

Table 1. 46Q: Results of the binary logistic prediction model

Chi- Square		40.299***	
Log Likelihood		318.716	
Nagelkerke R Square		.162	
Variable	Coefficient	Odds Ratio	Wald
Constant	-5.653	.004	8.395**
GED	-.932	.384	1.868
COLLEGE	1.103	3.012	8.361**
RESERVE	.307	1.360	1.005
GUARD	2.591	13.338	7.510*
GENDER	.263	1.266	.629
GT	.057	1.058	11.911**

* = p < .05 *** = p < .001
** = p < .005

Table 1 and indicate that the model, including the GT composite, education status (GED = GED or less than high school diploma; COLLEGE = some college), Army component (GUARD = National Guard; RESERVE = Army Reserve) and gender (GENDER = female), accounts for about 16% of the variation in the dependent variable. This model is statistically significant ($\chi^2 = 40.299$, $P < .001$), with moderate explanatory power (Nagelkerke $R^2 = .162$).

There are statistically significant effects for the GT composite, having some college education, and National Guard membership. The model suggests that having a higher GT composite score increases the odds of passing. At the mean GT score, an increase of one point is associated with an increase of about six percent in the odds of passing the course, and a five-point increase in GT would increase the odds of passing by 33%. There is also a noteworthy effect for COLLGE, where having a college education increases the odds of passing by 200%. This finding is reasonable considering that those with a college education probably have had more practice writing. Finally, there is a noteworthy effect for GUARD, where the odds of a Guardsman passing this training exceed that of the average Soldier by over 1200%. This likely comes about because of the 53 Guard members who trained in this MOS, only three failed, producing a large effect.[29]

Policy Analysis. Table 2 reports the probability that the average soldier from the larger Army contract population would pass the course based upon the binary logistic model. These were calculated using the formula for finding probability in a binary logistic model, which is

[29] To investigate the reliability of this effect, we also estimated a model excluding the GUARD variable, and found a relatively small impact on the governing composite. The GT odds ratio (factor) was reduced from 1.058 to 1.050.

$$e^{(\beta' x)} / (1 + e^{(\beta' x)}).$$

Because GENDER and GED were not statistically significant, this analysis is confined to the modal demographics factored by COLLEGE—male Soldiers from the Regular Army (though results would be similar for any demographic combination, except Guardsmen). Based on the model, when the cutoff score is at its current level (GT = 110), soldiers with a high school diploma and an average GT score (GT = 118.25) have approximately a 75% chance of passing, while their compatriots with some college education have approximately a 90% chance of passing. Currently, about only 40% of soldiers are

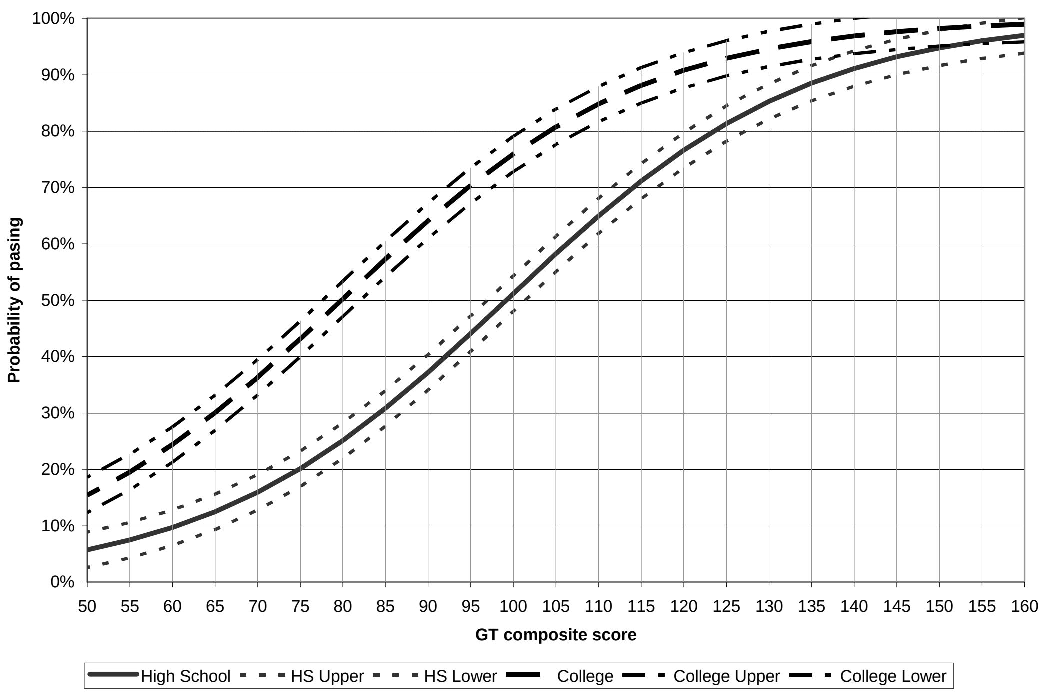
Table 2. 46Q: Probability that a Soldier (from the larger Army contract population) will pass the course based on the binary logistic model

	Cutoff = 100	Cutoff = 105	Cutoff = 110	Cutoff = 115	Cutoff = 120
Percent Eligible (Regular Army)	*69.9%*	*53.3%*	*39.7%*	*24.6%*	*15.1%*
Mean	*112.42*	*115.60*	*118.25*	*121.71*	*124.51*
Passing rates:					
High School & GED male	68.0%	71.8%	74.8%	78.3%	80.9%
College male	86.5%	88.4%	89.9%	91.6%	92.7%

eligible for MOS 46Q assignment at the current cutoff (GT = 110). Lowering the cutoff by five points (GT = 105) would increase eligibility by 13 percentage points, while the average male high school educated Soldier who would qualify for training would have a modestly lower chance of passing. Raising the cutoff score by five points (GT = 115), the average Soldier who would still qualify for the MOS would have a modestly higher chance of passing, but many fewer Soldiers would be eligible (25%).

Figure 1 shows the relationship between GT and the probability of passing for Regular Army Soldiers, including upper and lower bounds based upon the standard error of the estimated GT coefficient. For a particular GT score, trace a vertical line up to the curve, and then a horizontal line over to the axis to determine the corresponding probability of passing. For example, a GT value of 100 corresponds to a passing probability of about 52% for a high school educated male Soldier. One can see that the probability of passing increases steeply over the full range of the data for Soldiers in both education categories. However, the increase among those with some college rises much earlier than those who have a high school diploma or less.

Figure 1: Predicted Probability of Passing: Male, Regular Army



Appendix: Soldier Characteristics (46Q)

Outcome	Gender: Male	Gender: Female
fail	17.8%	14.2%
pass	82.2%	85.8%

	Education Level: GED or less	High School Diploma	Some College or More
fail	28.6%	20.0%	7.8%
pass	71.4%	80.0%	92.2%

	Component: Regular Army	Army Reserve	National Guard
fail	19.0%	16.5%	5.7%
pass	81.0%	83.5%	94.3%

46Q Risk Analysis of Policy Alternatives

In this section we extend the policy analysis with a risk analysis of the policy alternatives considered using simulation methods. We employ the "@RISK" software package which is designed as an add-in for Microsoft Excel.[30] There are four steps in the risk analysis.

The first step is developing a model. A regression model for predicting the passing rate has been specified and estimated, and the results stored in Excel worksheet format. See Table 1.

The second step is identifying the uncertainty inherent in both the input variables (composite scores, Soldier characteristics) and the corresponding estimated parameters and specifying their possible values with probability distributions.

To approximate the governing composite distribution, we use the larger Army contract population (EAF file: those who contracted from Jan 1992 to Aug 2003). This distribution can be assumed to follow a normal distribution. The mean and standard deviation estimated from the contract population and used as input to the simulations are shown in Table R-1 (before truncation).

Table R-1. Input information for the simulations

	Mean	Std error / deviation
Constant	-5.653	1.951
GT var	106.23 (before truncation)	11.149
GT coeff	.057	.016
GED var	3.5%	
GED coeff	-.932	.682
COLLEGE var	31.8%	
COLLEGE coeff	1.103	.381
GUARD var	13.2%	
GUARD coeff	2.591	.945
RESERVE var	33.1%	
RESERVE coeff	.307	.306
GENDER var	38.6%	
GENDER coeff	.236	.297

[30] Software is available from Palisade Corporation, Newfield, NY.

To approximate the distributions for the demographic variables we rely on the training data sample used to estimate the regression model. These distributions can be assumed to follow binomial distributions with means estimated from the training data sample as shown in Table R-1.

To approximate the distributions for the estimated parameters in the logit model, we note that, under very general conditions, the estimates will be asymptotically normally distributed.[31] The estimated coefficients (means and standard errors) are shown in Table R-1.

The third step is analyzing the model with simulation to determine the range and probabilities of all possible training outcome results. The results reported represent the simulation of the regression prediction equation for 1000 iterations using a fixed seed.[32] The comparisons are between the baseline case (GT = 110) and the policy cases (GT = 105 and GT = 115). These cases are delineated by the cutoff score level which serves as the lower truncation point in the governing composite input distribution. The simulation results in Table R-2 describe the effect on the mean probability of passing as the GT cutoff score level is varied, and represent an improvement of the policy analysis presented in Table 2 because they reflect the simultaneous effects of all known sources of uncertainty.

Table R-2. 46Q simulation results

	GT = 105	GT = 110	GT = 115
Mean governing composite	114.36	117.65	121.36
Mean probability of passing	68.9%	71.4%	72.6%
Std deviation	33.5%	32.1%	33.5%

The frequency distributions of simulated effects are shown below in the histogram graphs. The histogram portrays the full range of outcomes that average to the mean effect as reported. Looking at the histogram for the baseline case (GT = 110), probability of passing is plotted on the horizontal axis and the height of each bar indicates the relative number of Soldiers at that passing probability. The information in the histograms is effectively summarized in Table R-3. In that table we see the percentage of Soldiers

[31] The intuition is that logit estimates are derived from maximum likelihood (ML) estimation, and under fairly general conditions ML estimates are consistent and asymptotically normally distributed.
[32] Latin Hypercube (LH) sampling is utilized in drawing samples for the input distributions. It is designed to accurately recreate the input distribution through sampling in fewer iterations when compared with the Monte Carlo method. The key to LH sampling is stratification of the input probability distributions.

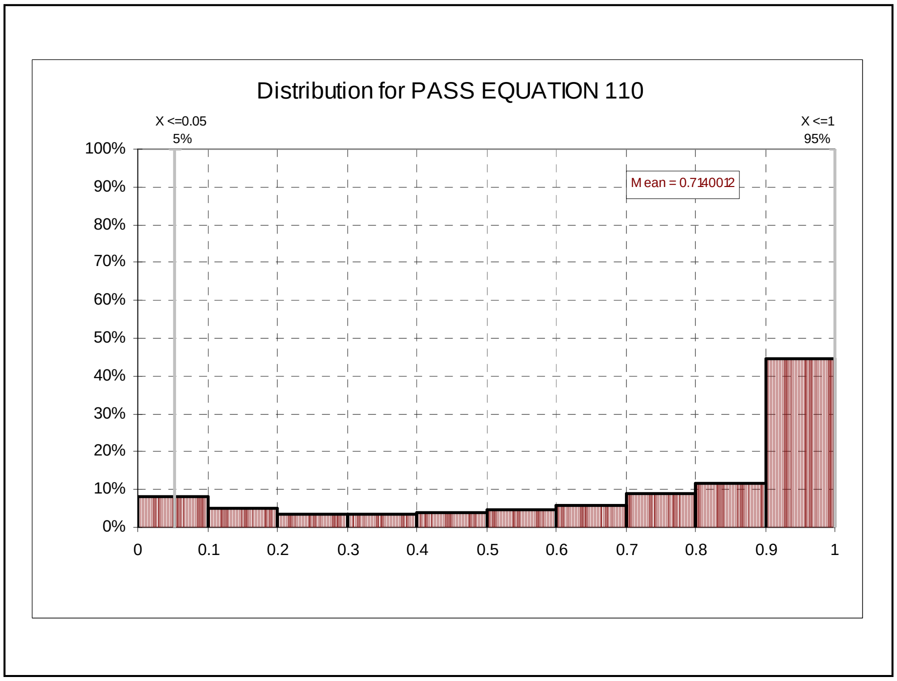
who meet or exceed a given chance of passing. For example, looking at the baseline case (GT = 110), about 65% of Soldiers have a 70% or greater chance of passing.

Table R-3.
Percent of simulated Soldiers that meet or exceed given chance of passing

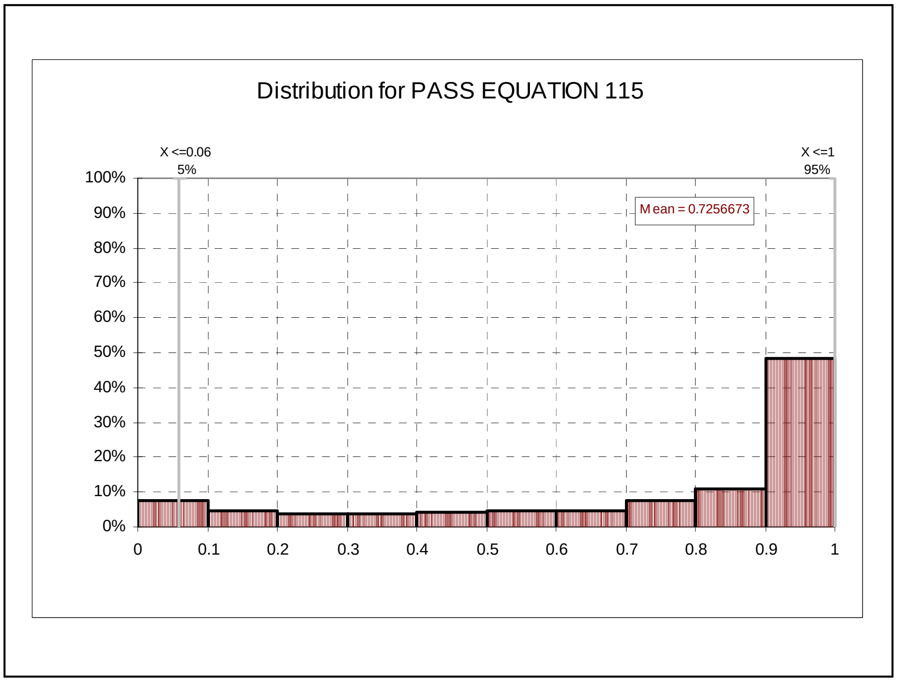
Chance of passing	GT = 105	GT = 110	GT = 115
95.0%	33.8%	35.0%	37.9%
90.0%	43.3%	44.5%	48.2%
85.0%	49.0%	50.3%	54.0%
80.0%	53.8%	56.0%	59.0%
75.0%	58.6%	61.2%	63.7%
70.0%	61.7%	65.1%	66.6%
65.0%	64.0%	68.4%	68.8%
60.0%	66.8%	71.1%	71.1%
55.0%	69.0%	73.4%	73.7%
50.0%	71.2%	75.6%	75.7%

We find that the mean probability of passing in the simulation is 71% (Table R-2, baseline). Looking at the histograms, we see a large portion of Soldiers in the highest range of passing scores, and the remainder distributed more or less uniformly across the entire range. We note that the mean simulated passing probability turns out to be slightly lower than the static prediction at the mean GT score (Table 2). In the simulated predictions we are calculating an average over all Soldiers and taking into account all sources of uncertainty, whereas in the static prediction we are calculating the probability of passing only at the mean GT score, ignoring the distribution of Soldier scores etc. as well as uncertainty. While recognizing this variability is important, we also note that the policy case impacts relative to the baseline are the same in both simulation and static prediction modes.

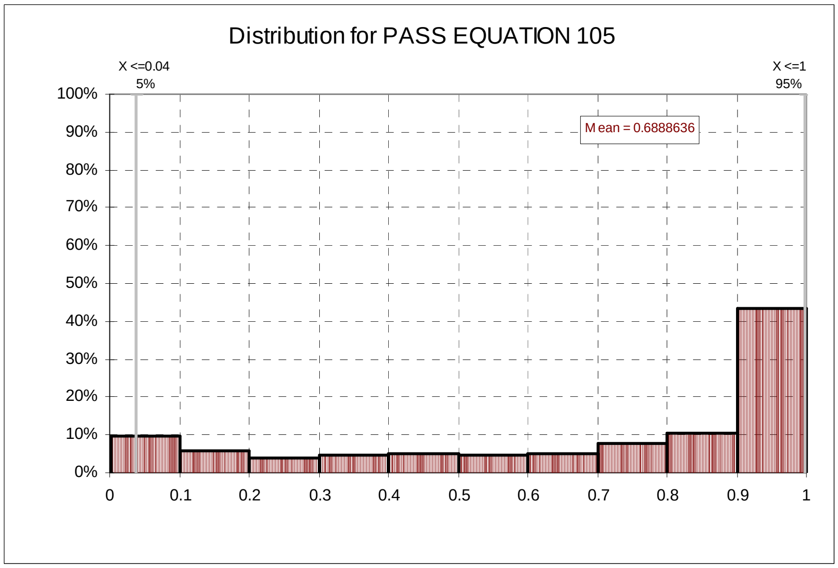
The fourth step is making a decision based on the results provided and the preferences of the school proponent. This involves the evaluation by the school proponent of the tradeoff between increased eligibility and reduced passing probabilities (and vice-versa).



Distribution for PASS EQUATION 110
X <=0.05
5%
X <=1
95%
Mean = 0.7140012
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1



Distribution for PASS EQUATION 115
X <=0.06
5%
X <=1
95%
Mean = 0.7256673
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1


Distribution for PASS EQUATION 105
X <=0.04
5%
X <=1
95%
Mean = 0.6888636
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1

46R: Broadcast Journalist

The final sample included 259 soldiers who were coded as either graduates or academic failures during their first AIT attempt in this MOS during a period from 2001 to 2004. Only soldiers who graduated (74.5%) or failed for academic reasons (25.5%) were included in the analysis sample because we assume that non-completion for non-academic reasons is not related to cognitive criteria.

In the sample, most were male (58%, 42% female), most had a high school diploma but not more education (68%, 29% some college, 3% GED or less), and most were Regular Army (69%, 26% Army Reserve, 15% National Guard). The governing AA composite, General Technical (GT), for this MOS has a cutoff score of 110; the sample mean is 117.56 (standard deviation = 6.446). See the Appendix for a description of Soldier characteristics for this MOS training sample.

A binary logistic regression model was estimated to explain pass/fail AIT outcomes and focused on the first training attempt. The estimation results are reported in

Table 1. 46R: Results of the binary logistic prediction model

Chi- Square		30.654***	
Log Likelihood		236.350	
Nagelkerke R Square		.164	
Variable	Coefficient	Odds Ratio	Wald
Constant	-10.399	.000	10.633**
GED	1.593	4.920	1.657
COLLEGE	1.013	2.753	6.241*
RESERVE	-.102	.903	.087
GUARD	.663	1.941	1.824
GENDER	.864	2.373	6.948**
GT	.093	1.097	11.712**

* = p < .05 *** = p < .001
** = p < .005

Table 1 and indicate that a model including the GT composite, education status (GED = GED or less than high school diploma; COLLEGE = some college), Army component (GUARD = National Guard; RESERVE = Army Reserve), and gender (GENDER = female) accounts for about 16% of the variation in the dependent variable. This model is statistically significant ($\chi^2 = 30.654$, $P < .001$), with moderate explanatory power (Nagelkerke $R^2 = .164$).

There are statistically significant effects for the GT composite, COLLEGE, and GENDER. The model suggests that having a higher GT composite score increases the odds of passing. At the mean GT score, an increase of one point is associated with an increase of about 10% in the odds of passing the course, and a five-point increase in GT would increase the odds of passing by 60%. There is also a noteworthy effect for COLLGE: having a college education increases the odds of passing by 175%. This finding is reasonable considering that those with a college education probably have had more practice with skills associated with writing and public speaking. Finally, there is a noteworthy effect for GENDER, where the odds of a female soldier passing this training exceed that of the average male soldier by a factor of 2.37 (or 137%). The reason for this remains unclear, but may be associated with better verbal ability among women.

Policy Analysis. Table 2 reports the probability that the average soldier from the larger Army contract population would pass the course on the first attempt based upon the binary logistic model. These were calculated using the formula for finding probability in a binary logistic model, which is

$$e^{(\beta' x)} / (1 + e^{(\beta' x)}).$$

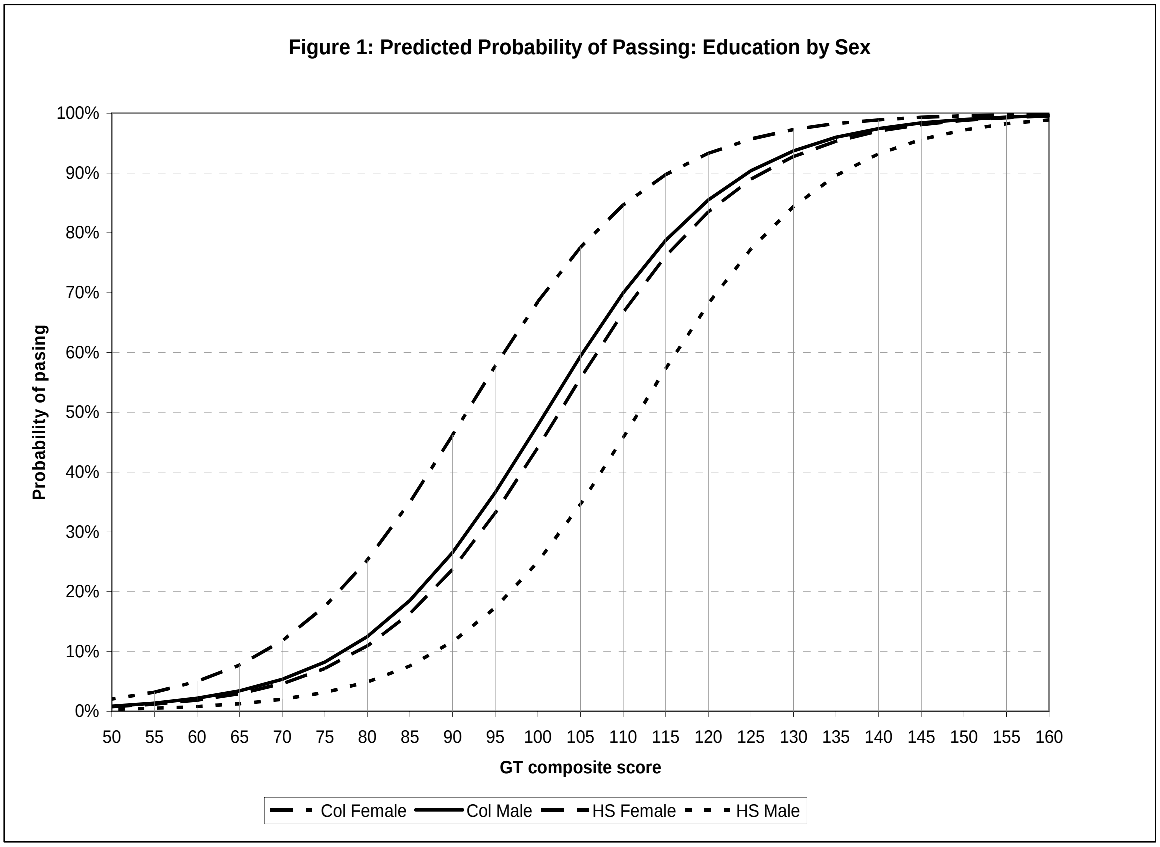
Because GED, RESERVE, and GUARD were not statistically significant, this analysis is confined to the modal demographics factored by COLLEGE and GENDER: Soldiers from the Regular Army with a high school or college education (though results would be similar for any demographic combination). Based on the model, when the cutoff score is at its current level (GT = 110), male Soldiers with a high school diploma and an average GT score (GT = 118.25) have approximately a 65% chance of passing, while their female counterparts with a high school diploma have approximately an 81% chance of passing. With some college education, male Soldiers have almost a 20 percentage point better chance of passing while female Solders have an 11 percentage point better chance. Currently, about only 40% of Soldiers are eligible for MOS 46R assignment at the current cutoff (GT = 110). Raising the cutoff score by five points (GT = 115), the

Table 2. 46R: Probability that a Soldier (from the larger Army contract population) will pass the course based on the binary logistic model

	Cutoff = 100	Cutoff = 105	Cutoff = 110	Cutoff = 115	Cutoff = 120
Percent Eligible (Regular Army)	*69.9%*	*53.3%*	*39.7%*	*24.6%*	*15.1%*
Mean	*112.42*	*115.60*	*118.25*	*121.71*	*124.51*
Passing rates:					
Male High School	51.4%	58.7%	64.5%	71.5%	76.5%
Male College	74.4%	79.7%	83.4%	87.4%	90.0%
Female High School	71.5%	77.1%	81.2%	85.6%	88.5%
Female College	87.3%	90.3%	92.2%	94.3%	95.5%

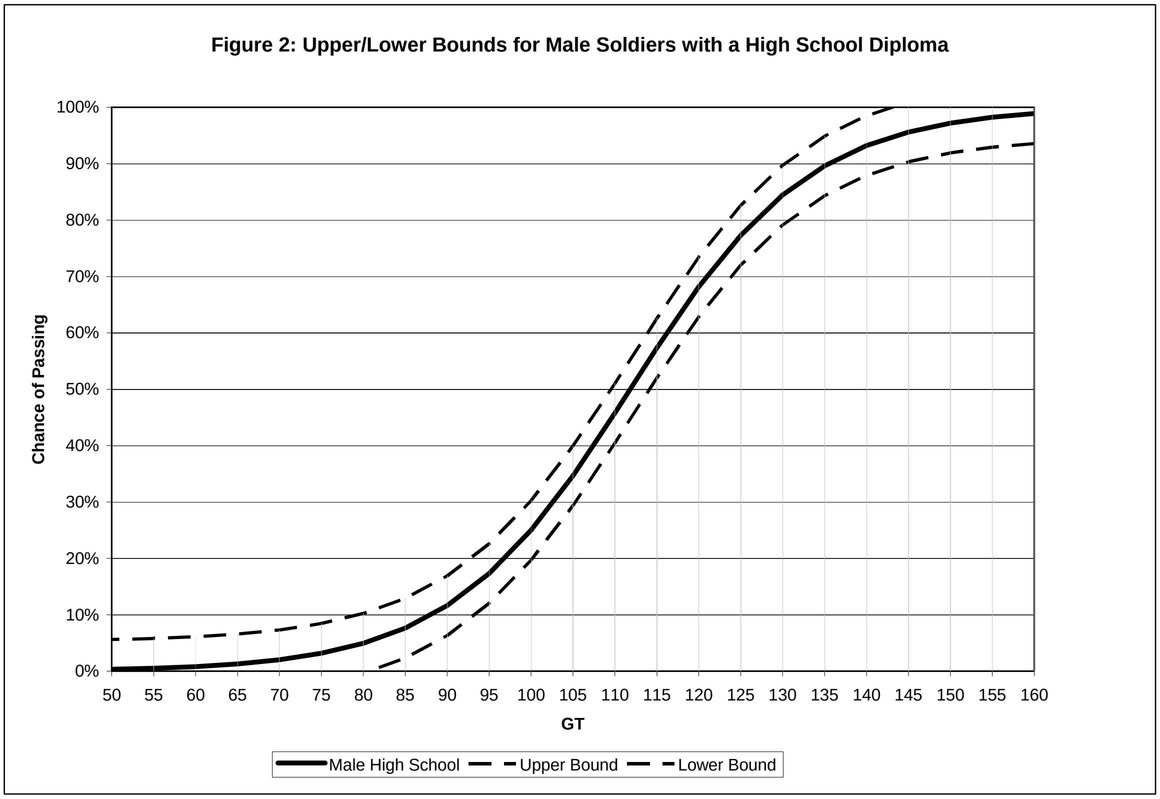
average qualifying male Soldier with a high school diploma would have a noticeably higher chance of passing, but many fewer Soldiers would be eligible for training. Lowering the cutoff by five points (GT = 105), a much larger number of Soldiers would be able to qualify for training with a modest adverse impact on passing rates for the average Soldier (except for the average high school educated, male Soldier).

Figure 1 shows the relationship between GT and the probability of passing for Regular Army Soldiers factored by COLLEGE and GENDER. For a particular GT score, trace a vertical line up to the curve, and then a horizontal line over to the axis to determine the corresponding probability of passing. For example, a GT value of 100



corresponds to a passing probability of about 48% for a male Soldier with some college. One can see that the probability of passing increases steeply over the full range of possible GT scores for Soldiers of both genders in both education categories. However, the increase among female Soldiers with some college rises much earlier than those who have a high school diploma or less. The increase among male Soldiers with a high school diploma or less education rises last, and at the current cutoff score (GT = 110) these Soldiers stand almost a 20 percentage point smaller chance of passing the course.

Figure 2 shows the curve for the modal category male Soldiers with a high school diploma with the upper and lower bounds of GT scores based upon the standard error of the estimated GT coefficient. The bounds are quite tight for these soldiers, except at the extremes. Bounds for the Soldiers from other demographic groups would look the same. This suggests that GT is a consistent predictor of success.



Appendix: Soldier Characteristics (46R)

Outcome	Gender: Male	Gender: Female
fail	30.0%	19.3%
pass	70.0%	80.7%

	Education Level: GED or less	Education Level: High School Diploma	Education Level: Some College or More
fail	12.5%	31.6%	12.2%
pass	87.5%	68.4%	87.8%

	Component: Regular Army	Component: Army Reserve	Component: National Guard
fail	25.7%	29.4%	17.9%
pass	74.3%	70.6%	82.1%

44B: Metal Worker

The final sample included 860 Soldiers who were coded as either graduates or academic failures during their first AIT attempt in this MOS during a period from 2001 to 2004. Only Soldiers who graduated (86.4%) or failed for academic reasons (13.6%) were included in the analysis sample because we assume that non-completion for non-academic reasons is not related to cognitive criteria.

In the sample, most were male (90%, 10% female), most had a high school diploma but not more education (89%, 2% some college, 9% GED or less), and most were from the Regular Army (43%, 37% Guard, 20% Reserve). The governing AA composite, General Maintenance (GM), for this MOS has a cutoff score of 93; the sample mean is 101.74 (standard deviation = 12.647). This MOS has an alternative governing AA composite cutoff, where soldiers with an GM score of 88 can also qualify if they have a General Technical (GT) score of 85; the sample mean for GT is 100.97 (standard deviation = 11.696); GT and GM are highly correlated (r = .787). See the Appendix for a description of Soldier characteristics for this MOS training sample.

A binary logistic regression model was estimated to explain pass/fail AIT outcomes and focused on the first training attempt. The estimation results for the first model are reported in Table 1 and indicate that the model, including the GM composite, education level (GED = GED or less education, COLLEGE = some college), Army component (GUARD = National Guard, RESERVE = Army Reserve), and gender (GENDER = female), accounts for about 7% of the variation in the dependent variable. This model is statistically significant ($\chi^2 = 31.089$, $P < .001$), and has limited explanatory power (Nagelkerke $R^2 = .065$).

Table 1. 44B: Results of the binary logistic prediction model: GM only model

Chi- Square		31.089***	
Log Likelihood		652.991	
Nagelkerke R Square		.065	
Variable	Coefficient	Odds Ratio	Wald
Constant	-1.894	.151	4.158*
GED	-.074	.929	.040
COLLEGE	.638	1.893	.374
GUARD	.201	1.222	.657
RESERVE	-6.27	.534	6.134*
GENDER	.269	1.309	.613
GM	.038	1.039	16.866***

* = p < .05 *** = p < .001
** = p < .01

There are statistically significant effects for the GM composite and Reserve membership. The model suggests that having a higher GM composite score increases the odds of passing. At the mean GM score, an increase of one point is associated with an increase of about four percent in the odds of passing the course, and a five-point increase in GM would increase the odds of passing by 21%. There is also a notable effect for Army Reserve membership where Reservists have 47% lower odds of passing.

A second model, which included the same variables from the first equation as well as the GT composite, accounted for the same amount of variation in the dependent variable. The GT composite did not have a significant effect. The results are shown in Appendix B.

<u>Policy Analysis.</u> Table 2 reports the probability that the average Soldier from the larger Army contract population would pass the course based upon the binary logistic model that includes only GM. These probabilities were calculated using the formula for finding probability in a binary logistic model, which is

$$e^{(\beta' x)} / (1 + e^{(\beta' x)}).$$

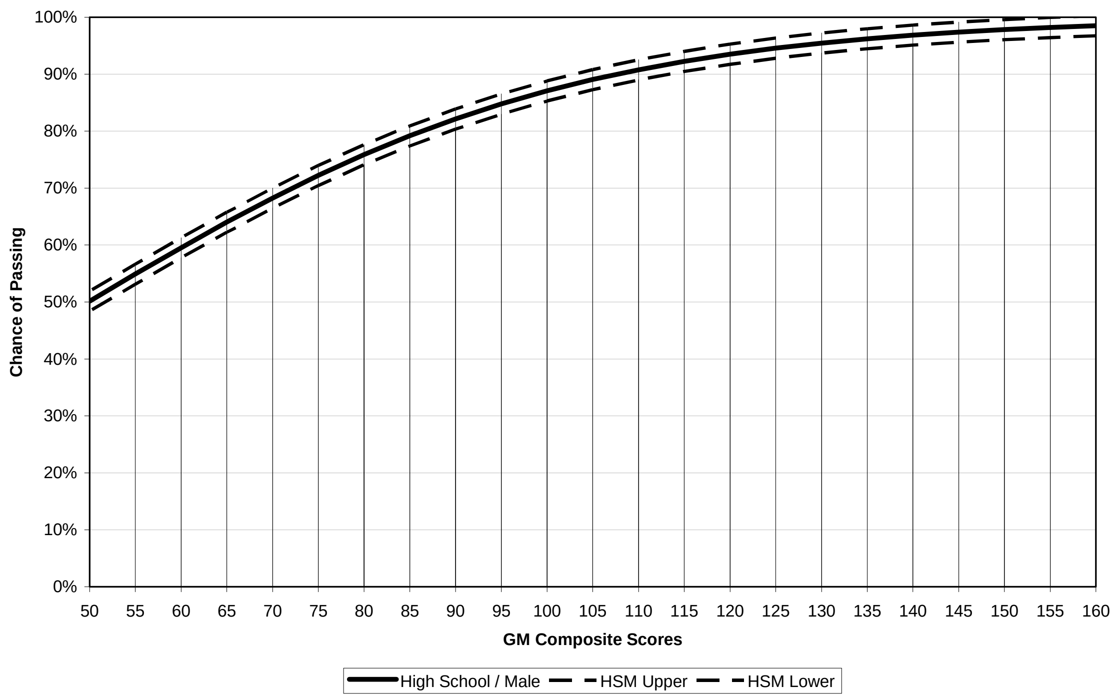
Because GED, COLLEGE, GUARD, and GENDER were not statistically significant, this analysis is confined to the modal demographic—Regular Army high school educated male Soldiers (though results would be similar for any demographic combination, except Reservists). Based on the model, when the cutoff score is at its current levels (GM = 93; or GM = 88 & GT = 85), male Soldiers with a high school diploma and average scores (GT = 106.47, GM = 107.55) have approximately a 90% chance of passing. Currently, about 86% of Soldiers are eligible for MOS 44B assignment at the current cutoff. Lowering the GM cutoff by five points (GM = 88; or GM = 83 & GT = 85) would increase eligibility by nine percentage points, while the average male Soldier who would qualify for training would have essentially the same chance of passing (89%). Raising the GT and GM cutoff scores by five points each (GM = 98; or GM = 93 & GT = 90), the average male Soldier who would still qualify for the MOS would have about the same chance of passing (90%), but fewer Soldiers would be eligible (71%)[33].

Table 2. 44B: Probability that a Soldier (from the larger Army contract population) will pass the course based on the binary logistic model

	Cutoff: GM = 83 **-or-** GM = 78 & GT = 85	Cutoff: GM = 88 **-or-** GM = 83 & GT = 85	Cutoff: GM = 93 **-or-** GM = 88 & GT = 85	Cutoff: GM = 98 **-or-** GM = 93 & GT = 90	Cutoff: GM = 103 **-or-** GM = 98 & GT = 95
Percent Eligible (Regular Army)	*98.6%*	*94.7%*	*85.7%*	*71.4%*	*56.6%*
Mean: GM	*104.31*	*104.99*	*106.47*	*108.89*	*111.51*
Mean: GT	*106.37*	*106.72*	*107.55*	*109.18*	*111.07*
Passing rates:					
High school male	88.8%	89.0%	89.6%	90.4%	91.2%

Figure 1 shows the relationship between GM and the probability of passing for high school educated male Soldiers, including upper and lower bounds based upon the standard error of the estimated GM coefficient. For a particular GM score, trace a vertical line up to the curve, and then a horizontal line over to the axis to determine the corresponding probability of passing. For example, a GM value of 100 corresponds to a passing probability of about 87% for a high school educated male Soldier.

Figure 1: Predicted Probability of Passing: Regular Army High School Male



[33] Appendix C shows the percent of Soldiers eligible under primary and alternative cutoff criteria.

Appendix A: Soldier Characteristics (44B)

Outcome	Gender	
	Male	Female
fail	13.6%	13.5%
pass	86.4%	86.5%

Outcome	Education Level		
	GED or less	High School Diploma	Some College or More
fail	14.7%	13.7%	5.9%
pass	85.3%	86.3%	94.1%

Outcome	Component		
	Regular Army	Army Reserve	National Guard
fail	12.6%	21.0%	10.9%
pass	87.4%	79.0%	89.1%

45B: Small Arms Repairer

The final sample included 540 Soldiers who were coded as either graduates or academic failures during their first AIT attempt in this MOS during a period from 2001 to 2004. Only Soldiers who graduated (91.7%) or failed for academic reasons (8.3%) were included in the analysis sample because we assume that non-completion for non-academic reasons is not related to cognitive criteria.

In the sample, most were male (77%, 23% female), most had a high school diploma but not more education (88%, 6% some college, 6% GED or less), and most were from the Regular Army (60%, 29% Guard, 11% Reserve). The governing AA composite, General Maintenance (GM), for this MOS has a cutoff score of 93; the sample mean is 101.34 (standard deviation = 12.051). This MOS has an alternative governing AA composite cutoff, where soldiers with a GM score of 88 can also qualify if they have a General Technical (GT) score of 85; the sample mean for GT is 101.74 (standard deviation = 12.051); GT and GM are highly correlated (r = .808). See the Appendix for a description of Soldier characteristics for this MOS training sample.

A binary logistic regression model was estimated to explain pass/fail AIT outcomes and focused on the first training attempt. The estimation results are reported in Table 1 and indicate that the model, including the GM composite, education level (GED = GED or less education, COLLGE = some college), Army component (GUARD = National Guard, RESERVE = Army Reserve), and gender (GENDER = female), accounts for about 17% of the variation in the dependent variable. This model is statistically significant ($\chi^2 = 41.351$, $P < .001$), and has moderate explanatory power (Nagelkerke $R^2 = .169$).

Table 1. 45B: Results of the binary logistic prediction model: GM only model

Chi- Square		41.351***	
Log Likelihood		268.432	
Nagelkerke R Square		.169	
Variable	Coefficient	Odds Ratio	Wald
Constant	-9.272	.000	16.918***
GED	.157	1.170	.040
COLLEGE	-.745	.475	1.182
GUARD	-.043	.957	.013
RESERVE	-.397	.673	.545
GENDER	.434	1.544	1.351
GM	.121	1.129	25.507***

* = p < .05 *** = p < .001
** = p < .01

There is a statistically significant effect for the GM composite. The model suggests that having a higher GM composite score increases the odds of passing. At the mean GM score, an increase of one point is associated with an increase of about 13% in the odds of passing the course, and a five-point increase in GM would increase the odds of passing by 83%.[34]

Policy Analysis. Table 2 reports the probability that the average soldier from the larger Army contract population would pass the course based upon the binary logistic model. These probabilities were calculated using the formula for finding probability in a binary logistic model, which is

$$e^{(\beta' x)} / (1 + e^{(\beta' x)}).$$

[34] A second model, which included the same variables from the first equation as well as the GT composite, accounted for approximately 18% of the variation in the dependent variable. This model is also statistically significant ($\chi^2 = 44.946$, P < .001). Regression model results are reported in Appendix B.

Because GED, COLLEGE, GUARD, RESERVE, and GENDER were not statistically significant, this analysis is confined to the modal demographic—Regular Army high school educated male Soldiers (though results would be similar for any demographic combination). Based on the model, when the cutoff score is at its current levels (GM = 93; or GM = 88 & GT = 85), male Soldiers with a high school diploma and an average GM score (GM = 107.55) have approximately a 97% chance of passing. Currently, about 86% of Soldiers are eligible for MOS 45B assignment at the current cutoff. Lowering the GM cutoff by five points (GM = 88; or GM = 83 & GT = 85) would increase eligibility by nine percentage points, while the average male Soldier who would qualify for training would have essentially the same chance of passing (97%). Raising the GT and GM cutoff scores by five points each (GM = 98; or GM = 93 & GT = 90), the average male Soldier who would still qualify for the MOS would have about the same chance of passing (98%), but fewer Soldiers would be eligible (71%).[35]

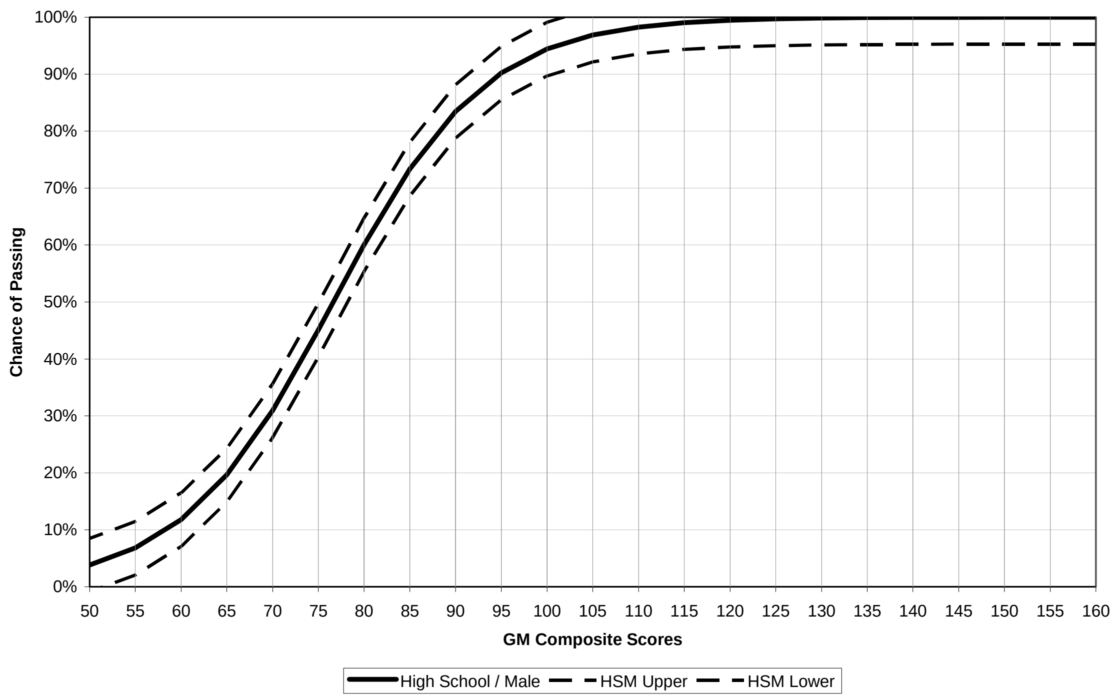
Table 2. 45B: Probability that a Soldier (from the larger Army contract population) will pass the course based on the binary logistic model

	Cutoff: GM = 83 **-or-** GM = 78 & GT = 85	Cutoff: GM = 88 **-or-** GM = 83 & GT = 85	Cutoff: GM = 93 **-or-** GM = 88 & GT = 85	Cutoff: GM = 98 **-or-** GM = 93 & GT = 90	Cutoff: GM = 103 **-or-** GM = 98 & GT = 95
Percent Eligible (Regular Army)	*98.6%*	*94.7%*	*85.7%*	*71.4%*	*56.6%*
Mean: GM	*104.31*	*104.99*	*106.47*	*108.89*	*111.51*
Mean: GT	*106.37*	*106.72*	*107.55*	*109.18*	*111.07*
Passing rates:					
High School Male	96.6%	96.9%	97.4%	98.0%	98.6%

[35] Appendix C shows the percent of Soldiers who are eligible according to primary and alternative cutoff criteria.

Figure 1 shows the relationship between GM and the probability of passing for high school educated male Soldiers, including upper and lower bounds based upon the standard error of the estimated GM coefficient. For a particular GM score, trace a vertical line up to the curve, and then a horizontal line over to the axis to determine the corresponding probability of passing. For example, a GM value of 100 corresponds to a passing probability of about 95% for a high school educated male Soldier.

Figure 1: Predicted Probability of Passing: Regular Army High School Male



Appendix A: Soldier Characteristics (45B)

Outcome	Gender	
	Male	Female
fail	7.7%	10.4%
pass	92.3%	89.6%

Outcome	Education Level		
	GED or less	High School Diploma	Some College or More
fail	5.7%	8.4%	9.0%
pass	94.3%	91.6%	91.0%

Outcome	Component		
	Regular Army	Army Reserve	National Guard
fail	8.0%	8.3%	9.0%
pass	92.0%	91.7%	91.0%

Appendix B

Table 1a. 45B: Results of the binary logistic prediction model: GM and GT model

Chi- Square		44.946***	
Log Likelihood		264.837	
Nagelkerke R Square		.183	
Variable	Coefficient	Odds Ratio	Wald
Constant	-10.792	.000	18.781***
GED	.217	1.243	.076
COLLEGE	-.819	.441	1.398
GUARD	-.035	.966	.008
RESERVE	-.526	.591	.939
GENDER	.372	1.451	.969
GM	.089	1.093	9.183**
GT	.048	1.049	3.488

$* = p < .05$ $*** = p < .001$
$** = p < .01$

Appendix C: Percent Eligible

Table 2a.
Percent eligible under primary and alternative cutoff criteria.

Cutoff	Qualify Both	Qualify GM Only	Qualify GM/GT Only	*Qualify Total*	*Do Not Qualify*
-10	95.2%	0.9%	2.5%	*98.6%*	*1.4%*
-5	87.6%	0.7%	6.4%	*94.7%*	*5.3%*
Current	75.1%	0.4%	10.2%	*85.7%*	*14.3%*
+5	59.9%	1.5%	10.0%	*71.4%*	*28.6%*
+10	44.0%	1.8%	10.8%	*56.6%*	*43.4%*

52D: Power Generation Equipment Repairer

The final sample included 3275 Soldiers who were coded as either graduates or academic failures during their first AIT attempt in this MOS during a period from 2001 to 2004. Only Soldiers who graduated (97.5%) or failed for academic reasons (2.5%) were included in the analysis sample because we assume that non-completion for non-academic reasons is not related to cognitive criteria.

In the sample, most were male (87%, 13% female), most had a high school diploma but not more education (88%, 5% some college, 7% GED or less), and most were from the Regular Army (60%, 20% Guard, 20% Reserve). The governing AA composite, General Maintenance (GM), for this MOS has a cutoff score of 97; the sample mean is 105.53 (standard deviation = 11.059). This MOS has an alternative governing AA composite cutoff, where soldiers with a GM score of 88 can also qualify if they have a General Technical (GT) score of 85; the sample mean for GT is 106.06 (standard deviation = 10.158); GT and GM are highly correlated (r = .708). See the Appendix for a description of Soldier characteristics for this MOS training sample.

A binary logistic regression model was estimated to explain pass/fail AIT outcomes and focused on the first training attempt. The estimation results are reported in Table 1 and indicate that the model, including the GM composite, education level (GED = GED or less education, COLLGE = some college), Army component (GUARD = National Guard, RESERVE = Army Reserve), and gender (GENDER = female), accounts for about six percent of the variation in the dependent variable. This model is statistically significant (χ^2 = 37.860, P < .001), and has somewhat limited explanatory power (Nagelkerke R^2 = .055).

Table 1. 52D: Results of the binary logistic prediction model			
Chi- Square		37.860***	
Log Likelihood		736.107	
Nagelkerke R Square		.055	
Variable	Coefficient	Odds Ratio	Wald
Constant	-2.470	.085	4.236*
GED	.494	1.638	.636
COLLEGE	.033	1.034	.003
GUARD	.120	1.128	.165
RESERVE	.630	1.877	2.911
GENDER	.166	1.180	.284
GM	.058	1.060	24.078***

* = p < .05 *** = p < .001
** = p < .01

There is a statistically significant effect for the GM composite. The model suggests that having a higher GM composite score increases the odds of passing. At the mean GM score, an increase of one point is associated with an increase of about six percent in the odds of passing the course, and a six-point increase in GM would increase the odds of passing by 33%.[36]

Policy Analysis. Table 2 reports the probability that the average Soldier from the larger Army contract population would pass the course based upon the binary logistic model. These probabilities were calculated using the formula for finding probability in a binary logistic model, which is

$$e^{(\beta' x)} / (1 + e^{(\beta' x)}).$$

[36] A second model, which included the same variables from the first equation as well as the GT composite, accounted for approximately 6% of the variation in the dependent variable. This model is also statistically significant ($\chi^2 = 38.048$, $P < .001$). Regression model results are reported in Appendix B.

Because GED, COLLEGE, GUARD, RESERVE, and GENDER were not statistically significant, this analysis is confined to the modal demographic—Regular Army high school educated male Soldiers (though results would be similar for any demographic combination). Based on the model, when the cutoff score is at its current levels (GM = 97; or GM = 88 & GT = 85), male Soldiers with a high school diploma and an average GM score (GM = 106.88) have approximately a 98% chance of passing. Currently, about 83% of Soldiers are eligible for MOS 52D assignment at the current cutoff. Lowering the GM cutoff by five points (GM = 92; or GM = 83 & GT = 85) would increase eligibility by 13 percentage points, while the average male Soldier who would qualify for training would have essentially the same chance of passing (97%). Raising the GM cutoff scores by five points (GM = 102; or GM = 93 & GT = 85), the average male Soldier who would still qualify for the MOS would have about the same chance of passing (99%), but fewer Soldiers would be eligible (71%).[37]

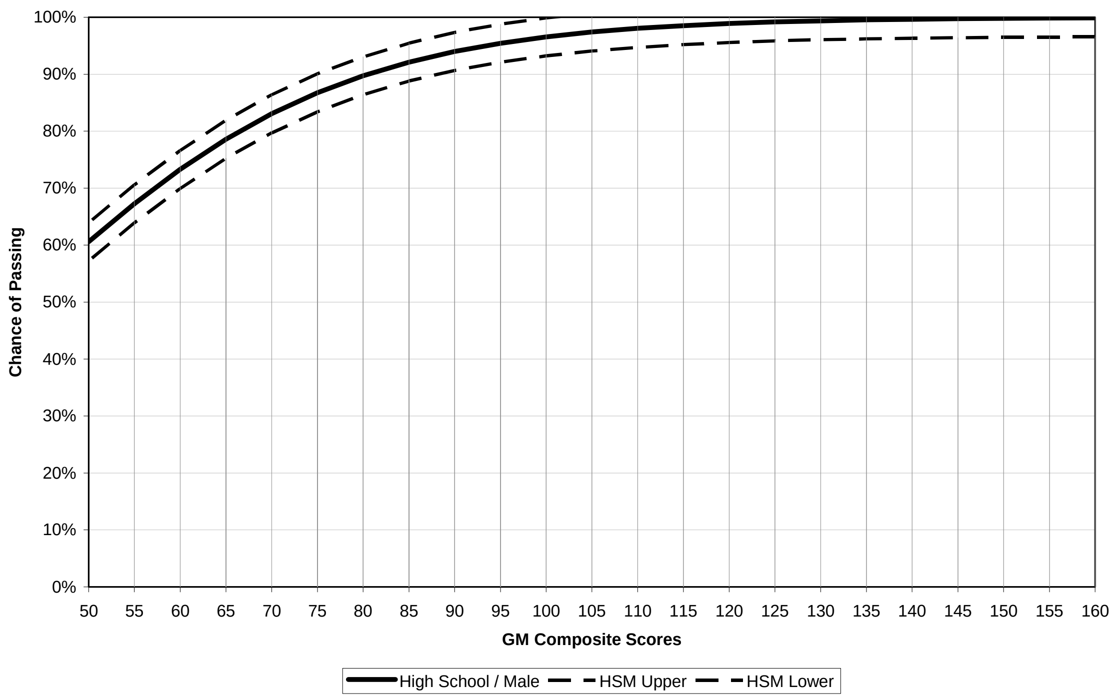
Table 2. 52D: Probability that a Soldier (from the larger Army contract population) will pass the course based on the binary logistic model

	Cutoff: GM = 87 **-or-** GM = 78 & GT = 85	Cutoff: GM = 92 **-or-** GM = 83 & GT = 85	Cutoff: GM = 97 **-or-** GM = 88 & GT = 85	Cutoff: GM = 102 **-or-** GM = 93 & GT = 85	Cutoff: GM = 107 **-or-** GM = 98 & GT = 85
Percent Eligible (Regular Army)	*97.1%*	*96.2%*	*83.4%*	*70.7%*	*57.6%*
Mean: GM	*104.65*	*105.46*	*106.88*	*108.98*	*111.30*
Mean: GT	*106.68*	*107.25*	*108.13*	*109.40*	*110.79*
Passing rates:					
High School Male	97.3%	97.5%	97.7%	97.9%	98.2%

[37] Appendix C shows the percent of Soldiers who are eligible according to primary and alternative cutoff criteria.

Figure 1 shows the relationship between GM and the probability of passing for high school educated male Soldiers, including upper and lower bounds based upon the standard error of the estimated GM coefficient. For a particular GM score, trace a vertical line up to the curve, and then a horizontal line over to the axis to determine the corresponding probability of passing. For example, a GM value of 100 corresponds to a passing probability of about 97% for a high school educated male Soldier.

Figure 1: Predicted Probability of Passing: Regular Army High School Male



Appendix A: Soldier Characteristics (52D)

Outcome	Gender	
	Male	Female
fail	2.4%	3.2%
pass	97.6%	96.8%

Outcome	Education Level		
	GED or less	High School Diploma	Some College or More
fail	1.3%	2.7%	1.9%
pass	98.7%	97.3%	97.5%

Outcome	Component		
	Regular Army	Army Reserve	National Guard
fail	3.0%	1.3%	2.5%
pass	97.0%	98.7%	97.5%

Appendix B

Table 1a. 52D: Results of the binary logistic prediction model: GM and GT model

Chi- Square		38.048***	
Log Likelihood		735.919	
Nagelkerke R Square		.055	
Variable	Coefficient	Odds Ratio	Wald
Constant	-2.219	.109	2.841
GED	.478	1.613	.595
COLLEGE	.027	1.027	.002
GUARD	.106	1.111	.125
RESERVE	.626	1.870	2.874
GENDER	.184	1.202	.345
GM	.063	1.065	15.658***
GT	-.007	.993	.118

* = p < .05 *** = p < .001
** = p < .01

Appendix C: Percent Eligible

Table 2a.
Percent eligible under primary and alternative cutoff criteria.

Cutoff	Qualify Both	Qualify GM Only	Qualify GM/GT Only	*Qualify Total*	*Do Not Qualify*
-10	86.3%	5.0%	5.8%	*97.1%*	*2.9%*
-5	77.0%	3.3%	12.0%	*96.2%*	*7.8%*
Current	65.1%	1.8%	16.4%	*83.4%*	*16.6%*
+5	50.2%	0.8%	19.7%	*70.7%*	*29.3%*
+10	37.0%	0.3%	20.2%	*57.6%*	*42.4%*

63H: Track Vehicle Repairer

The final sample included 1205 Soldiers who were coded as either graduates or academic failures during their first AIT attempt in this MOS during a period from 2001 to 2004. Only Soldiers who graduated (96.6%) or failed for academic reasons (3.4%) were included in the analysis sample of 1205 Soldiers because we assume that non-completion for non-academic reasons is not related to cognitive criteria.

In the sample, most of the Soldiers were male (91%, 9% female), most had a high school diploma but not more education (92%, 4% some college, 3% GED or less), and the greatest number were from Regular Army (82%, 17% National Guard, 1% Army Reserve). The governing AA composites, Mechanical Maintenance (MM) and General Technical (GT), for this MOS have a cutoff scores of 92 and 85 respectively; the sample mean for MM is 106.78 (standard deviation = 12.200) and for GT is104.69 (standard deviation = 10.784). The MM and GT composites are correlated at .609. See the Appendix for a description of Soldier characteristics for this MOS training sample.

Table 1. 63H: Results of the full binary logistic prediction model

Chi- Square		19.794***	
Log Likelihood		338.010	
Nagelkerke R Square		.063	
Variable	Coefficient	Odds Ratio	Wald
Constant	-3.042	.048	3.078
GUARD	1.339	4.050	3.650
GENDER	.374	1.453	.355
MM	.032	1.033	3.551
GT	.028	1.029	2.945

* = p < .05 *** = p < .001
** = p < .01

A binary logistic regression model was estimated to explain pass/fail AIT outcomes and focused on the first training attempt. The estimation results are reported in Table 1 and indicate that the model, including the GT and MM composites, Army component (GUARD = National Guard) and gender (1 = female), accounts for about six percent of the variation in the dependent variable. This model is statistically significant (χ^2 = 19.794, P = .001), with moderate explanatory power (Nagelkerke R^2 = .063).

While there are no statistically significant effects for any of the variables, both GT and MM approach significance. The model suggests that having a higher GT composite score increases the odds of passing. At the mean GT score, an increase of one point is associated with an increase of about three percent in the odds of passing the course, and a five-point increase in GT would increase the odds of passing by 15%. The model also suggests that having a higher MM composite score increases the odds of passing. At the mean MM score, an increase of one point is associated with an increase of about three percent in the odds of passing the course, and a five-point increase in GT would increase the odds of passing by 19%.

Policy Analysis. Table 2 reports the probability that the average Soldier from the larger Army contract population would pass the course on the first attempt based upon the binary logistic model. These were calculated using the formula for finding probability in a binary logistic model, which is

$$e^{(\beta' x)} / (1 + e^{(\beta' x)}).$$

The following analysis is confined to male Soldiers from the Regular Army (though results would be similar for other demographic groups). Based on the model, when the cutoff score is at its current level (GT = 85, MM = 92), Regular Army Soldiers with average GT and MM scores (GT = 108.38, MM = 108.64) have approximately a 98% chance of passing. Currently, about 82% of Soldiers are eligible for MOS 63H assignment at the current cutoff (GT = 85, MM = 92). Lowering the MM cutoff by five points (GT = 85, MM = 87) would increase eligibility by 8 percentage points (to 89%) and the average Soldier who would qualify for training would have essentially the same chance of passing (97%). Raising the cutoff scores by five points (GT = 90, MM = 97), the average Soldier would have essentially the same chance of passing (98%), but eligibility would fall by about 15 percentage points.

Table 2. 63H: Probability that a Male Soldier (from the larger Army contract population) will pass the course based on the binary logistic model

	Cutoff GT = 85 MM = 82	Cutoff GT = 85 MM = 87	Cutoff GT = 85 MM = 92	Cutoff GT = 90 MM = 97	Cutoff GT = 95 MM = 102
Percent Eligible (Regular Army)	*90.4%*	*88.6%*	*81.7%*	*66.7%*	*55.6%*
Mean: GT	*106.79*	*107.31*	*108.38*	*110.26*	*111.51*
Mean: MM	*105.29*	*106.47*	*108.64*	*111.31*	*113.94*
Passing rate:					
Male	*97.3%*	*97.1%*	*97.6%*	*97.9%*	*98.1%*

Figure 1 shows the relationship between MM and the probability of passing for Male Regular Army Soldiers, including upper and lower bounds based upon the standard error of the estimated MM coefficient[38]. For a particular MM score, trace a vertical line up to the curve, and then a horizontal line over to the axis to determine the corresponding probability of passing. For example, a MM score of 100 corresponds to a passing probability of about 95% for a high school educated, Regular Army male Soldier. One can see that Soldiers with a relatively low MM score still have a very good chance of

[38] Based upon parameter estimates of Appendix Table 1a.

passing the course. As MM scores increase, the chance that a Soldier will pass the course increases slightly.

Figure 1: Predicted Probalility of Passing: Male Soldiers

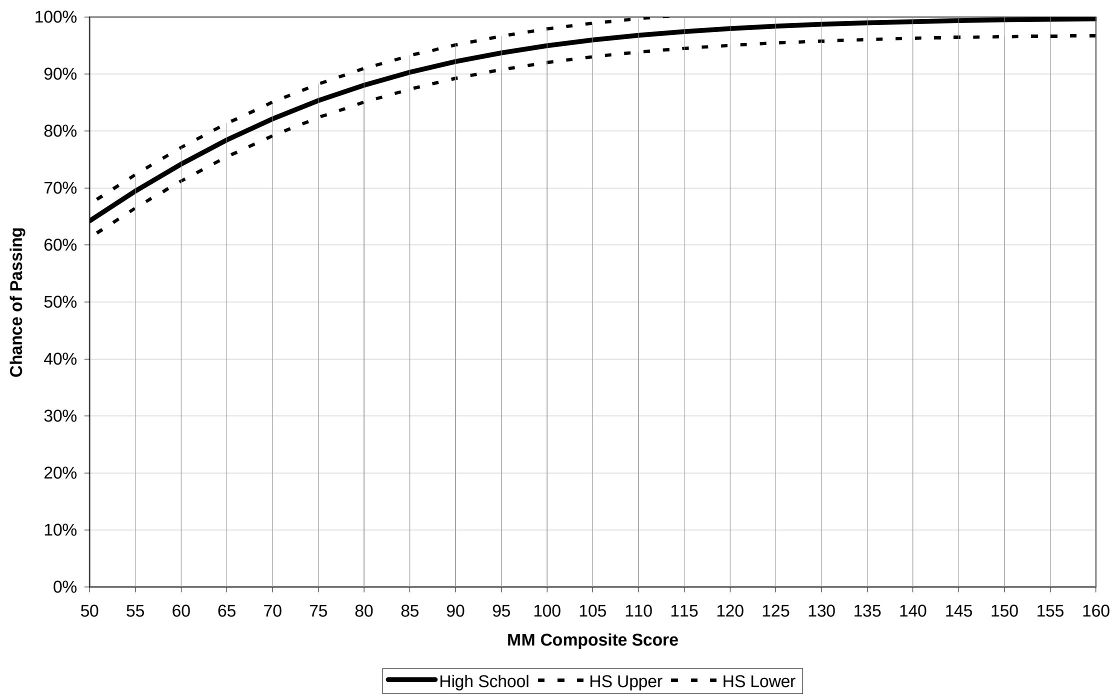


Table 1a. 63H: Results of the full binary logistic prediction model excluding GT

Chi- Square		17.315***	
Log Likelihood		17.315	
Nagelkerke R Square		.056	
Variable	Coefficient	Odds Ratio	Wald
Constant	-1.764	.171	1.334
GUARD	1.369	3.931	3.501
GENDER	.538	1.712	.757
MM	.047	1.049	10.061**

* = p < .05 *** = p < .001
** = p < .01

Table 1b. 63H: Results of the full binary logistic prediction model excluding MM

Chi- Square		16.018***	
Log Likelihood		341.785	
Nagelkerke R Square		.051	
Variable	Coefficient	Odds Ratio	Wald
Constant	-1.143	.319	.696
GUARD	1.438	4.214	3.870*
GENDER	.111	1.117	.033
GT	.042	1.043	9.706**

* = p < .05 *** = p < .001
** = p < .01

Appendix: Soldier Characteristics (63H)

	Gender	
	Male	Female
fail	3.5%	2.7%
pass	96.5%	97.3%

	Education Level		
	GED or less	High School Diploma	Some College or More
fail	.0%	3.6%	2.0%
pass	100.0%	96.4%	98.0%

	Component		
	Regular Army	Army Reserve	National Guard
fail	4.0%	.0%	1.0%
pass	96.0%	100.0%	99.0%

63J: Quartermaster and Chemical Equipment Repairer

The final sample included 1643 Soldiers who were coded as either graduates or academic failures during their first AIT attempt in this MOS during a period from 2001 to 2004. Only Soldiers who graduated (93.5%) or failed for academic reasons (6.5%) were included in the analysis sample because we assume that non-completion for non-academic reasons is not related to cognitive criteria.

In the sample, most were male (75%, 25% female), most had a high school diploma but not more education (87%, 4% some college, 9% GED or less), and most were from the Regular Army (45%, 29% Guard, 26% Reserve). The governing AA composite, Mechanical Maintenance (MM), for this MOS has a cutoff score of 92; the sample mean is 98.89 (standard deviation = 10.940). This MOS has an alternative governing AA composite cutoff, where soldiers with an MM score of 87 can also qualify if they have a General Technical (GT) score of 85; the sample mean for GT is 100.76 (standard deviation = 10.746) See the Appendix for a description of Soldier characteristics for this MOS training sample. GT and MM are correlated at r = .658.

A binary logistic regression model was estimated to explain pass/fail AIT outcomes. The model, including the MM and GT composites, education level (GED = GED or less education, COLLGE = some college), Army component (GUARD = National Guard, RESERVE = Army Reserve), and gender (GENDER = female), accounts for about 10% of the variation in the dependent variable. This model is statistically significant (χ^2 = 60.898, P < .001), and is a significant improvement upon the MM-only model reported in Appendix B (χ^2 = 9.186, P = .002). The model has moderate explanatory power (Nagelkerke R^2 = .096).

Table 2. 63J: Results of the binary logistic prediction model: MM and GT model

Chi- Square		60.898**	
Log Likelihood		725.170	
Nagelkerke R Square		.096	
Variable	Coefficient	Odds Ratio	Wald
Constant	-6.764	.001	21.325***
GED	.033	1.033	.006
COLLEGE	-0.71	.932	.020
GUARD	.751	2.118	7.864**
RESERVE	.450	1.568	2.739
GENDER	.256	1.292	1.135
MM	.052	1.054	10.188***
GT	.042	1.043	8.802**

* = p < .05 *** = p < .001
** = p < .01

There are statistically significant effects for the MM composite, the GT composite, and National Guard Membership. The model suggests that having a higher MM (GT) composite score increases the odds of passing. At the mean MM (GT) score, an increase of one (one) point is associated with an increase of about five (four) percent in the odds of passing the course, and a five-point increase in MM (GT) would increase the odds of passing by 29% (23%). There is also a notable effect for National Guard members where Guardsmen have 112% higher odds of passing.

<u>Policy Analysis.</u> Table 2 reports the probability that the average Soldier from the larger Army contract population would pass the course based upon the binary logistic model that includes both MM and GT. These were calculated using the formula for finding probability in a binary logistic model, which is

$$e^{(\beta' x)} / (1 + e^{(\beta' x)}).$$

Because GED, COLLEGE, and GENDER were not statistically significant, this analysis is confined to the modal demographic—high school educated male Soldiers (though results would be similar for any demographic combination). Based on the model, when the cutoff score is at its current levels (MM = 92, or GT = 85 & MM = 87), male Soldiers with a high school diploma and average composite scores (GT = 106.36, MM = 104.63) have approximately a 96% chance of passing. Currently, about 87% of Soldiers are eligible for MOS 63J assignment at the current cutoff. Lowering the MM cutoff by five points (MM = 87, or GT = 85 & MM = 82) would increase eligibility by 13 percentage points, while the average male Soldier who would qualify for training would have essentially the same chance of passing. Raising the cutoff scores by five points (MM = 97, or GT = 90 & MM = 92), the average male Soldier who would still qualify for the MOS would have about the same chance of passing, but fewer Soldiers would be eligible (66%)[39].

Table 2. 63J: Probability that a Soldier (from the larger Army contract population) will pass the course based on the binary logistic model

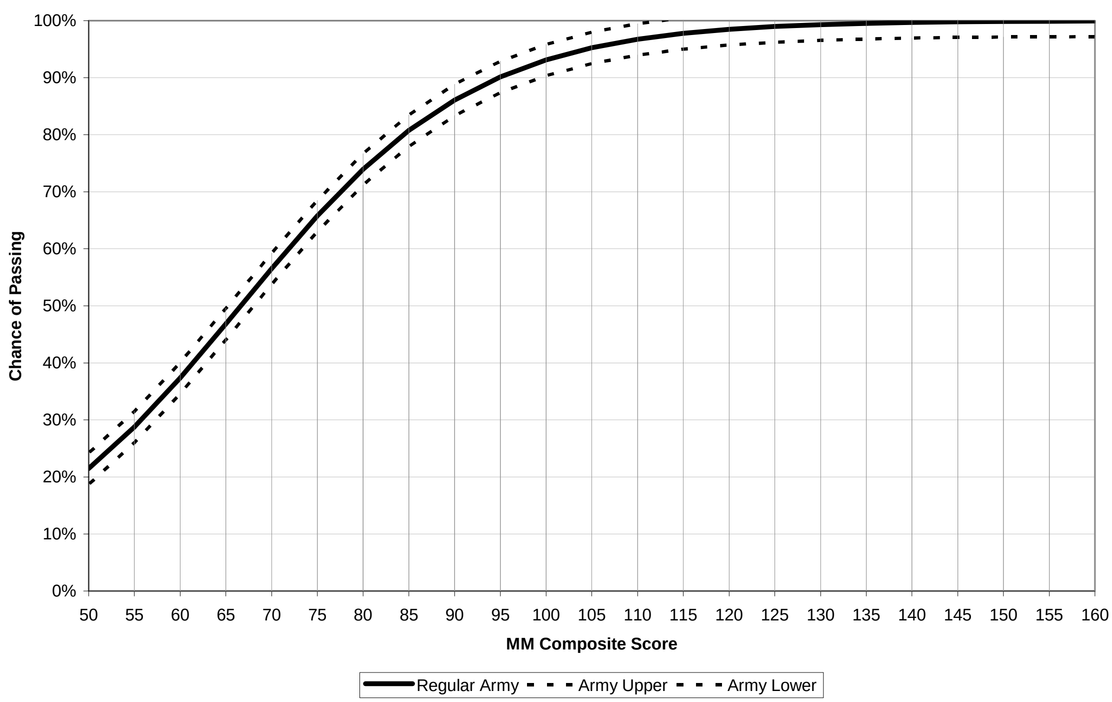
	Cutoff: MM = 82 **-or-** MM = 77 & GT = 85	Cutoff: MM = 87 **-or-** MM = 82 & GT = 85	Cutoff: MM = 92 **-or-** MM = 87 & GT = 85	Cutoff: MM = 97 **-or-** MM = 92 & GT = 85	Cutoff: MM = 102 **-or-** MM = 97 & GT = 85
Percent Eligible (Regular Army)	*98.2%*	*94.5%*	*86.9%*	*73.0%*	*58.4%*
Mean: MM	*104.63*	*105.22*	*106.43*	*108.83*	*111.51*
Mean: GT	*106.36*	*106.61*	*107.19*	*108.59*	*110.25*
Passing rates:					
High school male	95.9%	96.0%	96.3%	96.9%	97.5%

Figure 1 shows the relationship between MM and the probability of passing for high school educated male Soldiers, including upper and lower bounds based upon the

[39] Table 2 in Appendix C shows the percent of Soldiers who are eligible according to primary and alternative cutoff criteria.

standard error of the estimated MM coefficient (for the model in Appendix B). For a particular MM score, trace a vertical line up to the curve, and then a horizontal line over to the axis to determine the corresponding probability of passing. For example, a MM value of 100 corresponds to a passing probability of about 93% for a high school educated male Soldier.

Figure 1: Predicted Probalility of Passing: Male High School Soldiers



Appendix A: Soldier Characteristics (63J)

Outcome	Gender: Male	Gender: Female
fail	6.3%	7.0%
pass	93.7%	93.0%

Outcome	Education Level: GED or less	Education Level: High School Diploma	Education Level: Some College or More
fail	4.9%	6.6%	6.8%
pass	95.1%	93.4%	93.2%

Outcome	Component: Regular Army	Component: Army Reserve	Component: National Guard
fail	8.7%	4.8%	4.5%
pass	91.3%	95.2%	95.5%

Appendix B: Regression Model with MM Composite

Table 1a. 63J: Results of the binary logistic prediction model: MM-only model

Chi- Square		51.712***	
Log Likelihood		734.355	
Nagelkerke R Square		.081	
Variable	Coefficient	Odds Ratio	Wald
Constant	-5.197	.006	15.404***
GED	-.003	.997	.000
COLLEGE	-.038	.963	.006
GUARD	.756	2.129	7.948**
RESERVE	.463	1.588	2.911
GENDER	.348	1.416	2.153
MM	.078	1.081	31.520

* = p < .05 *** = p < .001
** = p < .01

The model, including the MM composite, education level (GED = GED or less education, COLLGE = some college), Army component (GUARD = National Guard, RESERVE = Army Reserve), and gender (GENDER = female), accounts for about 8% of the variation in the dependent variable. This model is statistically significant ($\chi^2 = 51.712$, $P < .001$), and has moderate explanatory power (Nagelkerke $R^2 = .081$).

There are statistically significant effects for the MM composite and National Guard Membership. The model suggests that having a higher MM composite score increases the odds of passing. At the mean MM score, an increase of one point is associated with an increase of about eight percent in the odds of passing the course, and a five-point increase in MM would increase the odds of passing by 48%. There is also a notable effect for National Guard members where Guardsmen have 113% higher odds of passing.

Appendix C: Percent Eligible

Table 2a.
Percent eligible: breakdown by primary and alternative criteria

Cutoff	Qualify Both	Qualify MM Only	Qualify MM/GT Only	Qualify Total	Do Not Qualify
-10	95.2%	0.9%	2.1%	98.2%	1.8%
-5	88.9%	0.7%	4.9%	94.5%	5.5%
Current	76.8%	0.5%	9.7%	86.9%	13.1%
+5	61.3%	2.0%	9.7%	73.0%	27.0%
+10	46.2%	3.0%	9.2%	58.4%	41.6%

63W: Wheeled Vehicle Repairer

The final sample included 4,486 Soldiers who were coded as either graduates or academic failures during their first AIT attempt in this MOS during a period from 2001 to 2004. Only Soldiers who graduated (96.8%) or failed for academic reasons (3.2%) were included in the analysis sample because we assume that non-completion for non-academic reasons is not related to cognitive criteria.

In this sample, most were male (88%, 12% female), most had a high school diploma but not more education (88%, 5% some college, 7% GED or less), and most were from Regular Army (52%, 30% National Guard, 18% Reserve). The governing AA composites, Mechanical Maintenance (MM) and General Technical (GT), for this MOS have cutoff scores of 92 and 85 respectively; the sample mean is 105.35 (standard deviation = 12.195) for MM, and 103.09 (standard deviation = 11.278) for GT. The governing AA composites are correlated at .954 ($p < .001$). See the Appendix for a description of Soldier characteristics for this MOS training sample.

A binary logistic regression model was estimated to explain pass/fail AIT

Table 1. 63W: Results of the binary logistic prediction model

Chi- Square		77.608***	
Log Likelihood		1189.304	
Nagelkerke R Square		.070	
Variable	Coefficient	Odds Ratio	Wald
Constant	-3.625	.027	12.871*
GED	.366	1.441	.591
COLLEGE	-.055	.947	.014
GUARD	.435	1.545	4.055*
RESERVE	1.076	2.933	10.089***
GENDER	-.061	.941	.059
MM	.032	1.032	8.959**
GT	.036	1.036	10.447***

* = p < .05 ** = p < .01 *** = p < .001

outcomes and focused on the first training attempt. The estimation results are reported in Table 1 and indicate that a model, including the MM and GT composites, education level (GED = GED or less education, COLLEGE = some college education), Army component (GUARD = National Guard; RESERVE = Army Reserve) and gender (GENDER = female), accounts for about six percent of the variation in the dependent variable. This model is statistically significant ($\chi^2 = 77.608$, $P < .001$), and has somewhat limited explanatory power (Nagelkerke $R^2 = .070$).

There are statistically significant effects for the MM composite, the GT composite, National Guard membership, and Reserve membership. The model suggests that having a higher MM composite score increases the odds of passing. At the mean MM score, an increase of one point is associated with an increase of about three percent in the odds of passing the course, and a five-point increase in MM would increase the odds of passing by 17%. The model also suggests that having a higher GT composite score increases the odds of passing. At the mean GT score, an increase of one point is associated with an increase of about four percent in the odds of passing the course, and a five-point increase in GT would increase the odds of passing by 20%. There is also a noteworthy effect for GUARD (RESERVE): the odds of passing the course for Guardsmen (Reservists) are 55% (193%) higher than that of the average Regular Army Soldier.

<u>Policy Analysis.</u> Table 2 reports the probability that the average Soldier from the larger Army contract population would pass the course based upon the binary logistic model. These were calculated using the formula for finding probability in a binary logistic model, which is

$$e^{(\beta' x)} / (1 + e^{(\beta' x)}).$$

This analysis is confined to the modal demographics: male Soldiers with a high school diploma from the Regular Army. Based on the model, when the cutoff score is at its current level (MM = 92, GT = 85), male soldiers with average scores (MM = 108.64, GT = 108.38) have approximately a 98% chance of passing. Currently, about 82% of Soldiers are eligible for MOS 63W assignment at the current cutoff (MM = 92, GT = 85). Raising the cutoff by five points (MM = 97, GT = 90), the average male Soldier who would qualify for training would have essentially the same chance of passing, while eligibility would decrease by 15 percentage points (to 67%). Lowering the cutoff score by five points (MM = 87, GT = 80) would increase eligibility by approximately 12 percentage points, and the average male Soldier would have essentially the same chance of passing as he would at the current cutoff score.

Table 3. 63W: Probability that a male Soldier (from the larger Army contract population) will pass the course based on the binary logistic model

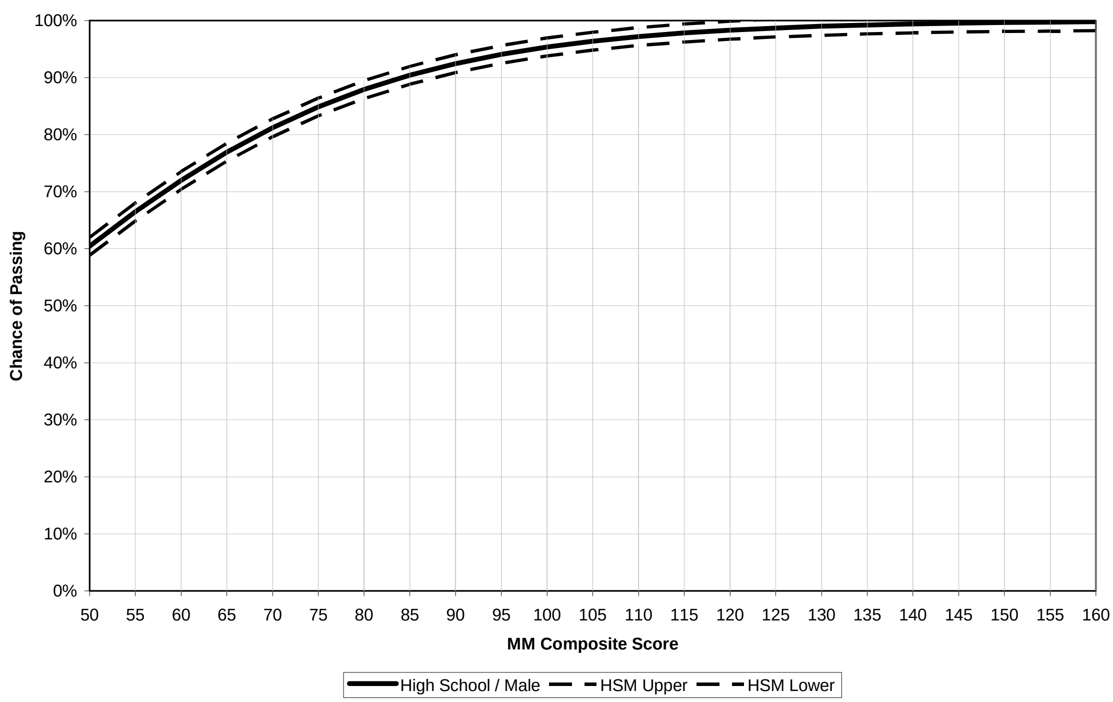
	Cutoff = 82/75	Cutoff = 87/80	Cutoff = 92/85	Cutoff = 97/90	Cutoff = 102/95
Percent Eligible (Regular Army)	*98.8%*	*94.2%*	*81.7%*	*66.7%*	*49.5%*
Mean: MM	*105.19*	*106.39*	*108.64*	*111.31*	*114.19*
Mean: GT	*106.58*	*106.58*	*108.38*	*110.26*	*112.34*
Passing rates:					
High School Male	97.3%	97.4%	97.7%	98.0%	98.3%

Figure 1 shows the relationship between MM and the probability of passing for male Regular Army Soldiers, based upon a regression model that excludes GT.[40] Figure 1 also includes upper and lower bounds based upon the standard error of the estimated

40 As shown in the Appendix. Models that include either MM or GT have nearly as good a fit as one containing both, and lend themselves more easily to graphing and interpretation.

MM coefficient. For a particular MM score, trace a vertical line up to the curve, and then a horizontal line over to the axis to determine the corresponding probability of passing. For example, an MM value of 100 corresponds to a passing probability of about 95% for a high school educated, Regular Army male Soldier. One can see that male Soldiers with a relatively low MM score stand a reasonably good chance of passing the course. As the MM (or GT) composite scores increase, the chance that a Soldier will pass the course increases, essentially reaching 100% just above the current cutoff.

Figure 1: Predicted Probability of Passing: Regular Army High School Male Soldiers



Appendix: Additional Regression Models

Table 1A. 63W: Results of the binary logistic prediction model excluding GT

Chi- Square		67.306***	
Log Likelihood		119.605	
Nagelkerke R Square		.061	
Variable	Coefficient	Odds Ratio	Wald
Constant	-2.176	.114	6.495**
GED	.369	1.446	.603
COLLEGE	.088	1.092	.035
GUARD	.440	1.553	4.679*
RESERVE	1.128	3.090	11.099***
GENDER	.087	1.091	.128
MM	.052	1.053	37.819***

* = p < .05 *** = p < .001
** = p < .01

Table 1B. 63W: Results of the binary logistic prediction model excluding MM

Chi- Square		68.135***	
Log Likelihood		1198.777	
Nagelkerke R Square		.061	
Variable	Coefficient	Odds Ratio	Wald
Constant	-2.205	.110	6.991**
GED	.381	1.464	.643
COLLEGE	-.015	.985	.001
GUARD	.418	1.519	4.223*
RESERVE	1.094	2.987	10.266***
GENDER	-.301	.740	1.584
GT	.054	1.055	40.427***

* = p < .05 *** = p < .001
** = p < .01

Appendix: Soldier Characteristics (63W)

Outcome	Gender: Male	Gender: Female
fail	3.1%	4.0%
pass	96.9%	96.0%

Outcome	Education Level: GED or less	Education Level: High School Diploma	Education Level: Some College or More
fail	1.6%	3.4%	2.3%
pass	98.4%	96.6%	97.7%

Outcome	Component: Regular Army	Component: Army Reserve	Component: National Guard
fail	4.1%	1.3%	2.7%
pass	95.9%	98.7%	97.3%

91A: Medical Equipment Repairer

The final sample included 241 Soldiers who were coded as either graduates or academic failures during their first AIT attempt in this MOS during a period from 2001 to 2004. Only Soldiers who graduated (44%) or failed for academic reasons (56%) were included in the analysis sample because we assume that non-completion for non-academic reasons is not related to cognitive criteria.

In the sample, most of the solders were male (84%, 16% female), most had a high school diploma but not more education (80%, 18% some college, 2% GED or less), and most were from Army Reserve (50%, 41% Regular Army, 10% National Guard). The governing AA composite, Electronics Repair (EL), for this MOS has a cutoff score of 107; the sample mean is 116.74 (standard deviation = 10.380). See the Appendix for a description of Soldier characteristics for this MOS training sample.

A binary logistic regression model was estimated to explain pass/fail AIT outcomes and focused on the first training attempt. The estimation results are reported in

Table 1. 91A: Results of the binary logistic prediction model

Chi- Square		11.351*	
Log Likelihood		319.248	
Nagelkerke R Square		.062	
Variable	Coefficient	Odds Ratio	Wald
Constant	-4.231	.015	3.774
COLLEGE	.083	1.086	.053
RESERVE	.413	1.512	2.063
GUARD	-.293	.746	.359
GENDER	-.683	.505	3.163
EL	.033	1.034	3.194^{x}

* = p < .05 *** = p < .001
** = p < .005 ^{x} p = .074

Table 1 and indicate that the model, including the EL composite, education level (COLLEGE), Army component (GUARD = National Guard, RESERVE = Army Reserve) and gender (GENDER = female), accounts for about six percent of the variation in the dependent variable. This model is statistically significant ($\chi^2 = 11.351$, P = .045), but it has somewhat limited explanatory power (Nagelkerke $R^2 = .062$).

The EL composite is not statistically significant at the usual p=.05 level, but is significant at the p = .074 level. The model suggests that having a higher EL composite score increases the odds of passing. At the mean EL score, an increase of one point is associated with an increase of about 4% in the odds of passing the course, and a five-point increase in EL would increase the odds of passing by 25%. There is also a near significant effect for GENDER where women have 49% lower odds of passing when compared to men.

Policy Analysis. Table 2 reports the probability that the average Soldier from the larger Army contract population would pass the course based upon the binary logistic model. These were calculated using the formula for finding probability in a binary logistic model, which is

$$e^{(\beta' x)} / (1 + e^{(\beta' x)}).$$

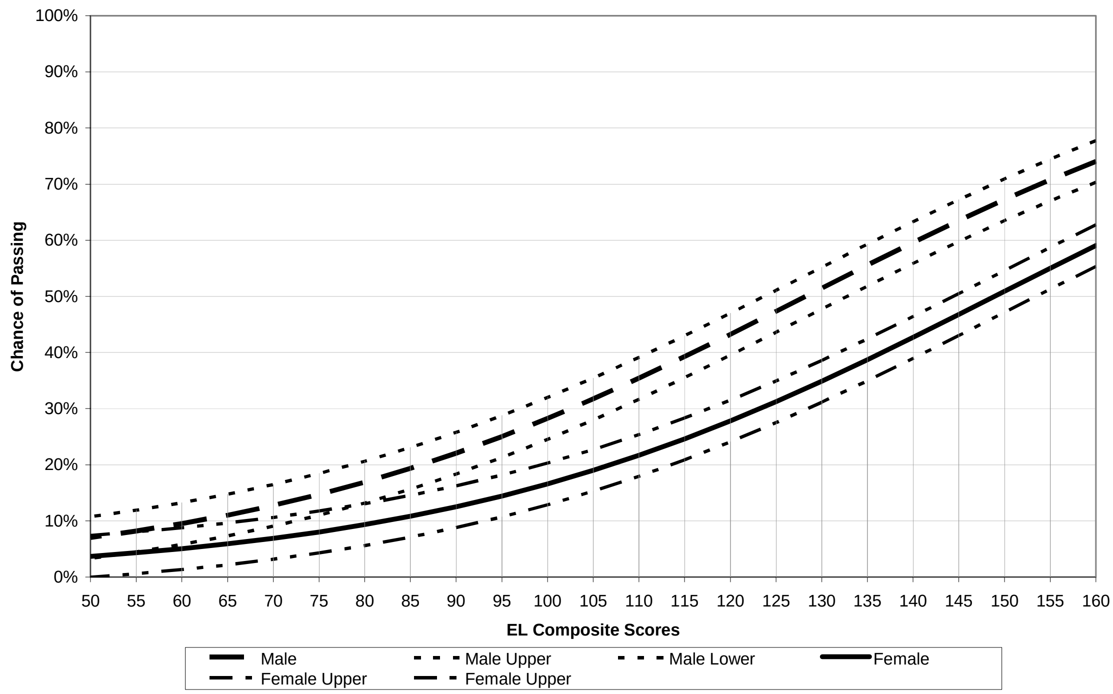
Based on the model, when the cutoff score is at its current level (EL = 107), male Soldiers with an average EL score (EL = 117.05) have approximately a 41% chance of passing on the first attempt, while female Soldiers have a 26% chance of passing. Currently, about 47% of Soldiers are eligible for MOS 91A assignment at the current cutoff (EL = 107). Lowering the cutoff by five points (EL = 102) increases eligibility by 15 percentage points (to 62%), while the average Soldier who would qualify for training would have practically the same chance of passing. Raising the cutoff score by five points (EL = 112), the average Soldier would have a somewhat higher chance of passing but eligibility would be reduced by 14 percentage points (to 33%).

Table 2. 91A: Probability that a Soldier (from the larger Army contract population) will pass the course based on the binary logistic model

	Cutoff = 97	Cutoff = 102	Cutoff = 107	Cutoff = 112	Cutoff = 117
Percent Eligible (Regular Army)	*76.09%*	*62.2%*	*47.4%*	*32.8%*	*22.9%*
Mean	*111.34*	*114.03*	*117.05*	*120.42*	*123.88*
Passing rates:					
Male High School	36.4%	38.5%	40.9%	43.6%	46.4%
Female High School	22.4%	24.0%	25.9%	28.1%	30.5%

Figure 1 shows the relationship between EL and the probability of passing for male and female Soldiers, including upper and lower bounds based upon the standard error of the estimated EL coefficient. For a particular EL score, trace a vertical line up to the curve, and then a horizontal line over to the axis to determine the corresponding probability of passing. For example, an EL value of 100 corresponds to a passing probability of about 28% for a high school educated, Regular Army male Soldier. One can see that Soldiers with scores in the vicinity of the cutoff level have a low chance of passing the course. Apparently, this is a relatively difficult course and the estimated model, based on limited information, does not provide much insight into the responsible factors.

Figure 1: Predicted Probalility of Passing: Regular Army Soldiers



Appendix: Soldier Characteristics (91A)

	Gender	
	Male	Female
fail	53.5%	69.2%
pass	46.5%	30.8%

	Education Level		
	GED or less	High School Diploma	Some College or More
fail	50.0%	56.5%	54.5%
pass	50.0%	43.5%	45.5%

	Component		
	Regular Army	Army Reserve	National Guard
fail	60.2%	50.8%	65.2%
pass	39.8%	49.2%	34.8%

91B: Medical Specialist[41]

The final sample included 5054 Soldiers who were coded as either graduates or academic failures during their first AIT attempt in this MOS during a period from 2001 to 2004. Only Soldiers who graduated (92.5%) or failed for academic reasons (7.5%) were included in the analysis sample because we assume that non-completion for non-academic reasons is not related to cognitive criteria.

In the sample, most were male (58%, 42% female), most had a high school diploma but not more education (85%, 11% some college, 4% GED or less), and most were from were from the Regular Army (57%, 22% National Guard, 26% Reserve). The governing AA composite, Skilled Technical (ST), for this MOS has a cutoff score of 95; the sample mean is 108.34 (standard deviation = 11.821). See the Appendix for a description of Soldier characteristics for this MOS training sample.

A binary logistic regression model was estimated to explain pass/fail AIT outcomes and focused on the first training attempt.

The estimation results are reported in Table 1 and indicate that a model, including the ST composite, education level (GED = GED or less than high school diploma; COLLEGE = some college),Army component (GUARD = National Guard; RESERVE = Army Reserve) and gender (GENDER = female), accounts for about 13% of the variation in the dependent variable. This model is statistically significant ($\chi^2 = 269.735$, $P < .001$), and has moderate explanatory power (Nagelkerke $R^2 = .125$).

[41] As of FY'02, MOS 91B was closed and merged with MOS 91W. Thus, this analysis applies only to Soldiers trained before the merger.

Table 1. 91B: Results of the binary logistic prediction model

Chi- Square		269.735***	
Log Likelihood		2432.666	
Nagelkerke R Square		.125	
Variable	Coefficient	Odds Ratio	Wald
Constant	-4.706	.009	54.022***
GED	-.030	.970	.008
COLLEGE	1.162	3.198	14.457***
RESERVE	.706	2.026	16.687***
GUARD	.847	2.332	24.812***
GENDER	.620	1.859	27.820***
ST	.063	1.065	105.984***

* = p < .05 *** = p < .001
** = p < .01

There is a statistically significant effect for the ST composite. The model suggests that having a higher ST composite score increases the odds of passing. At the mean ST score, an increase of one point is associated with an increase of about 6% in the odds of passing the course, and a five-point increase in ST would increase the odds of passing by 32%. There are also statistically significant effects for COLLEGE (220% increased odds of passing), Reserve membership (100% increased odds of passing), National Guard membership (133% increased odds of passing), and GENDER (86% increased odds of passing for women).

<u>Policy Analysis.</u> Table 2 reports the probability that the average Soldier from the larger Army contract population would pass the course based upon the binary logistic model. These were calculated using the formula for finding probability in a binary logistic model, which is

$$e^{(\beta' x)} / (1 + e^{(\beta' x)}).$$

Because GED was not statistically significant, this analysis is confined to male and female Soldiers with a high school diploma or some college education from the Regular Army. Based on the model, when the cutoff score is at its current level (ST = 95), male Regular Army Soldiers with a high school diploma (the modal categories) and an average ST score (ST = 110.70) have approximately a 93% chance of passing. Currently, about 83% of Soldiers are eligible for MOS 91B assignment at the current cutoff (ST = 95). Lowering the cutoff by five points (ST = 90) increases eligibility by 10 percentage points (to 93%), while the average male, high school educated Soldier who would qualify for training would have almost the same chance of passing (92%). Raising the cutoff score

Table 2. 91B: Probability that a Soldier (from the larger successful applicant population) will pass the course based on the binary logistic model

	Cutoff = 85	Cutoff = 90	Cutoff = 95	Cutoff = 100	Cutoff = 105
Percent Eligible (Regular Army)	*98.9%*	*92.8%*	*82.8%*	*70.6%*	*55.8%*
Mean	*107.18*	*108.67*	*110.70*	*113.07*	*115.93*
Passing rates:					
High School Male	91.5%	92.1%	92.9%	93.7%	94.6%
College Male	97.4%	97.6%	97.8%	98.1%	98.4%
High School Female	96.2%	96.5%	96.8%	97.2%	97.6%
College Female	98.9%	98.9%	99.1%	99.2%	99.3%

by five points (ST = 100), the average qualifying Soldier would have a marginally higher chance of passing (94%) but eligibility would fall by about 11 percentage points (to 71%).

Figure 1 shows the relationship between ST and the probability of passing for male Regular Army Soldiers by education, including upper and lower bounds based upon the standard error of the estimated ST coefficient. For a particular ST score, trace a vertical line up to the curve, and then a horizontal line over to the axis to determine the corresponding probability of passing. For example, an ST value of 100 corresponds to a passing probability of about 87% for a high school educated, Regular Army male Soldier. The graph illustrates the strength of the effect for some college over the lower range of aptitude scores.

Figure 1: Predicted Probalility of Passing: Male Soldiers

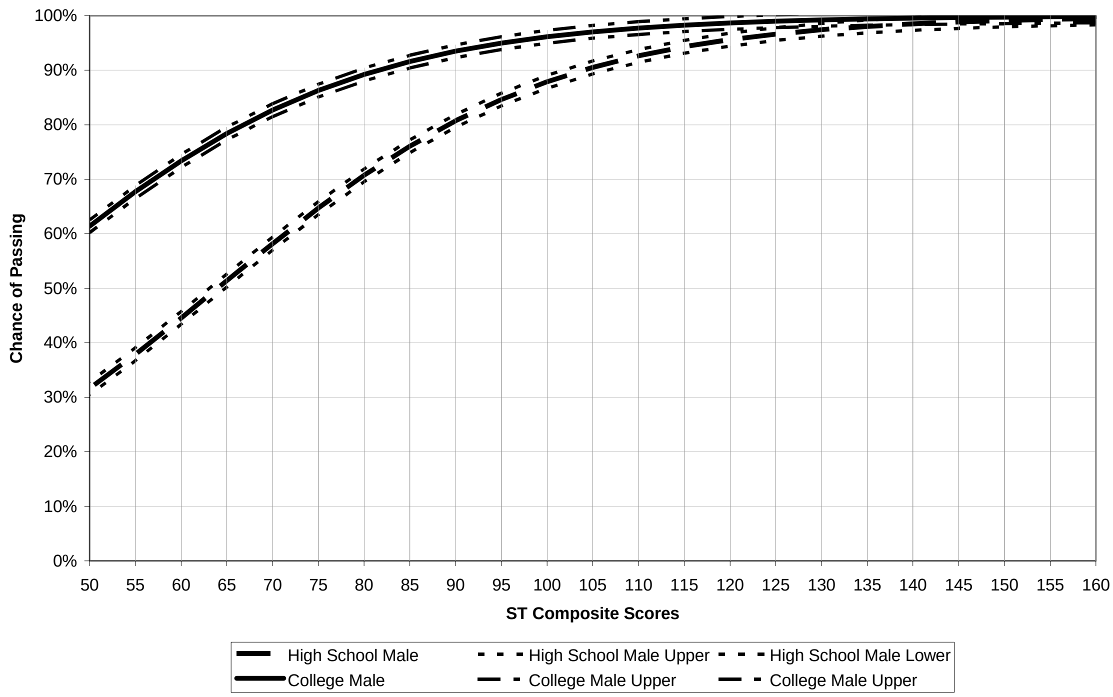


Figure 2 shows the relationship between ST and the probability of passing for female Regular Army Soldiers by education, including upper and lower bounds based upon the standard error of the estimated ST coefficient. The pattern is much the same as was apparent for male Soldiers.

Figure 3 shows the relationship between ST and the probability of passing for Regular Army Soldiers by education and gender.

Figure 2: Predicted Probalility of Passing: Female Soldiers

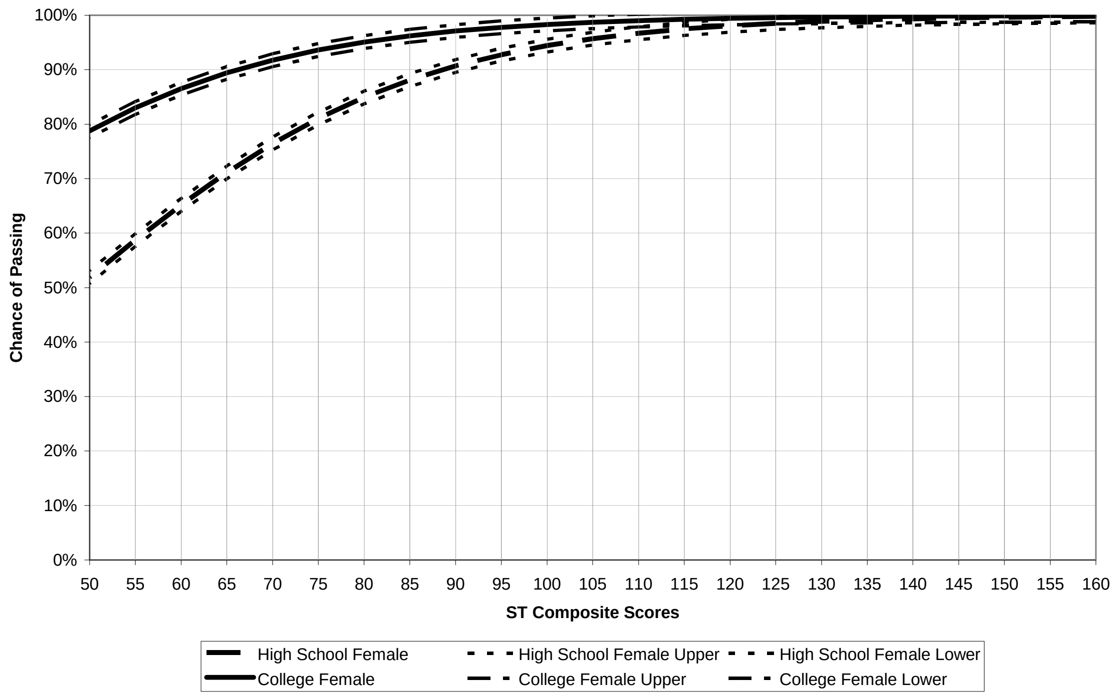
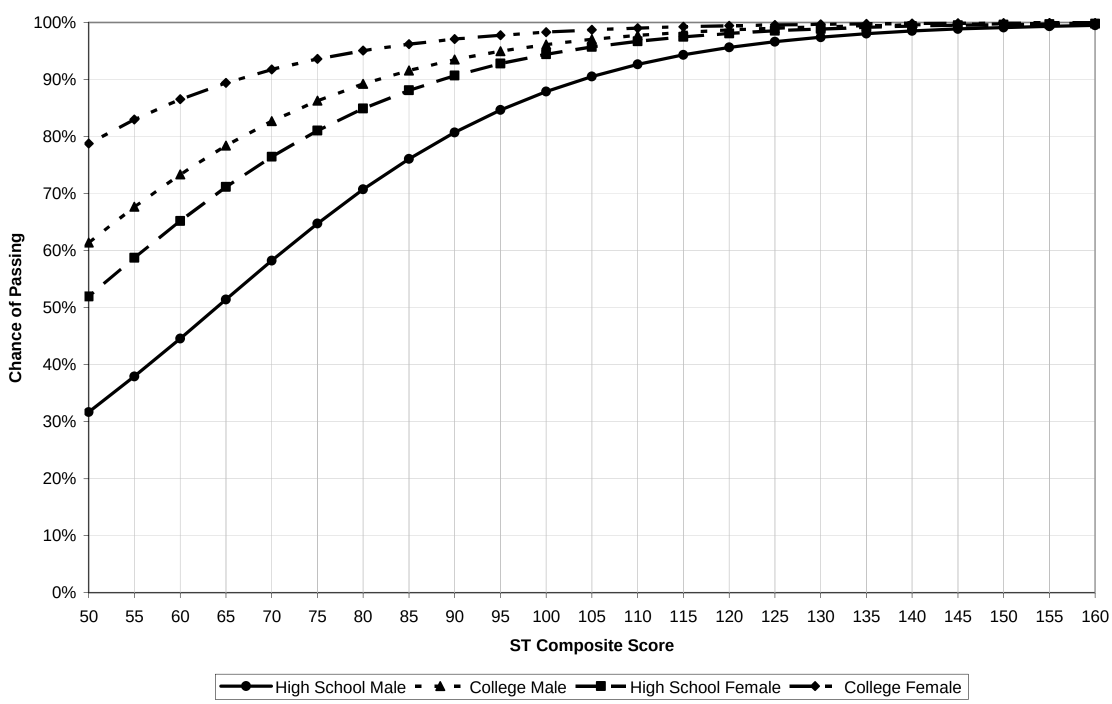


Figure 3: Probability of Passing: Education factored by Sex



Appendix: Soldier Characteristics (91B)

Outcome	Gender: Male	Gender: Female
fail	8.6%	6.1%
pass	91.4%	93.9%

	Education Level: GED or less	Education Level: High School Diploma	Education Level: Some College or More
fail	6.0%	8.3%	2.6%
pass	94.0%	91.7%	97.4%

	Component: Regular Army	Component: Army Reserve	Component: National Guard
fail	10.0%	4.1%	4.4%
pass	90.0%	95.9%	95.6%

91C: Health Care—Practical Nurse

The final sample included 475 Soldiers who were coded as either graduates or academic failures during their first AIT attempt in this MOS during a period from 2001 to 2004. Only Soldiers who graduated (83.2%) or failed for academic reasons (16.8%) were included in the analysis sample because we assume that non-completion for non-academic reasons is not related to cognitive criteria.

The sample was approximately split by gender (53% male, 47% female), most had a high school diploma but not more education (81%, 18% some college, 1% GED or less), and most were from Regular Army (59%, 1% National Guard, 40% Reserve). The governing AA composites, Skilled Technical (ST) and General Technical (GT), for this MOS have cutoff scores of 102 and 110, respectively; the sample mean is 117.19 (standard deviation = 7.907) for ST, and 117.57 (standard deviation = 5.815) for GT. There is a significant, strong correlation between ST and GT ($r = .678$, $P < .001$). See the Appendix for a description of Soldier characteristics for this MOS training sample.

A binary logistic regression model was estimated to explain pass/fail AIT

Table 1. 91C: Results of the binary logistic prediction model

Chi- Square		39.782***	
Log Likelihood		390.923	
Nagelkerke R Square		.135	
Variable	Coefficient	Odds Ratio	Wald
Constant	-11.521	.000	14.490***
COLLEGE	.308	1.360	.672
RESERVE	-.041	.960	.024
GENDER	.976	2.654	12.511***
ST	.095	1.100	15.590***
GT	.015	1.015	.217

* = p < .05 *** = p < .001
** = p < .005

outcomes and focused on the first training attempt. The estimation results are reported in Table 1 and indicate that a model, including the ST and GT composites, education level (COLLEGE = some college), Army component (RESERVE = Army Reserve), and gender (GENDER = female), accounts for about 14% of the variation in the dependent variable. This model is statistically significant ($\chi^2 = 39.782$, $P < .001$), and has moderate explanatory power (Nagelkerke $R^2 = .135$).[42]

There are statistically significant effects for the ST composite and GENDER. The model suggests that having a higher ST composite score increases the odds of passing. At the mean ST score, an increase of one point is associated with an increase of about 10% in the odds of passing the course, and a five-point increase in ST would increase the odds of passing by 61%.[43] There is also a noteworthy effect for GENDER: female Soldiers have increased odds of passing the course (165% higher).

Policy Analysis. Table 2 reports the probability that the average Soldier from the larger Army contract population would pass the course based upon the binary logistic model. These were calculated using the formula for finding probability in a binary logistic model, which is

$$e^{(\beta' x)} / (1 + e^{(\beta' x)}).$$

[42] Given the strong correlation between ST and GT, we also report regression results for GT and ST in separate regressions in the Appendix. The ST model has somewhat better explanatory power, though the GT model is also statistically significant. With both composites in the same equation, the ST composite dominates.

[43] As shown in the Appendix, the same effects would be seen with the GT composite.

Because GUARD and RESERVE were not statistically significant, this analysis is confined to the modal demographics factored by GENDER: male and female Soldiers from the Regular Army, but the results would apply to the average Guard and Reserve Soldier as well. Based on the model, when the cutoff score is at its current level (ST = 102, GT = 110), male soldiers with average ST and GT scores (ST = 117.40, GT = 117.85) have approximately an 82% chance of passing, while their female counterparts have approximately a 93% chance of passing. Currently, about 33% of Soldiers are eligible for MOS 92C assignment at the current cutoff level. Lowering the cutoff score by five points (ST = 97, GT = 105) would increase eligibility by 15 percentage points (to 47%), while average male and female Soldier passing rates would drop by 3 – 5

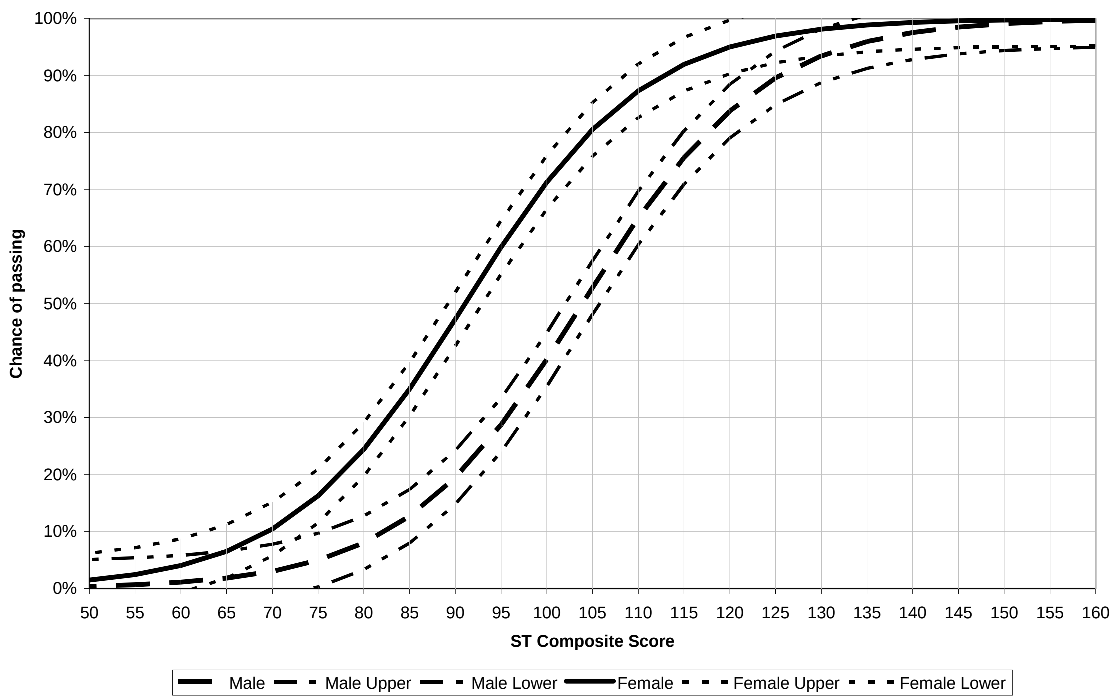
Table 2. 91C: Probability that a Soldier (from the larger Army contract population) will pass the course based on the binary logistic model

	Cutoff = 92/100	Cutoff = 97/105	Cutoff = 102/110	Cutoff = 107/110	Cutoff = 112/110
Percent Eligible (Regular Army)	*65.1%*	*47.2%*	*32.7%*	*28.2%*	*22.7%*
Mean: ST	*112.90*	*115.91*	*118.87*	*120.03*	*122.07*
Mean: GT	*117.62*	*117.65*	*118.51*	*118.88*	*119.68*
Passing rates:					
Male	72.5%	77.8%	82.5%	84.1%	86.7%
Female	87.2%	90.3%	92.6%	93.3%	94.5%

percentage points. Raising the ST cutoff by five points, but keeping GT constant at 110 (ST = 107, GT = 110), would increase average male and female passing rates slightly but eligibility would decrease by five percentage points (to 28%).

Figure 1 shows the relationship between ST and the probability of passing for male and female Regular Army Soldiers based on the regression in Table 1a (Appendix).

Figure 1: Predicted Probability of Passing: Male vs. Female Soldiers



It includes upper and lower bounds based upon the standard error of the estimated ST coefficient. For a particular ST score, trace a vertical line up to the curve, and then a horizontal line over to the axis to determine the corresponding probability of passing. For example, an ST score of 100 corresponds to a passing probability of about 72% for a high school educated, Regular Army female Soldier.

Appendix: Soldier Characteristics (91C)

Outcome	Gender: Male	Gender: Female
fail	20.6%	12.6%
pass	79.4%	87.4%

	Education Level: GED or less	High School Diploma	Some College or More
fail	.0%	18.2%	11.5%
pass	100.0%	81.8%	88.5%

	Component: Regular Army	Army Reserve	National Guard
fail	16.7%	16.8%	33.3%
pass	83.3%	83.2%	66.7%

Appendix: Additional Regression Models

Table 1a. 91C: Results of the binary logistic prediction model with only the ST composite.

Chi- Square		39.546***	
Log Likelihood		391.141	
Nagelkerke R Square		.134	
Variable	Coefficient	Odds Ratio	Wald
Constant	-10.597	.000	21.948***
COLLEGE	.317	1.373	.716
RESERVE	-.039	.961	.023
GENDER	.991	2.693	13.059***
ST	.102	1.107	27.020***

* = p < .05 *** = p < .001
** = p < .005

Table 1b. 91C: Results of the binary logistic prediction model with only the GT composite.

Chi- Square		23.197***	
Log Likelihood		407.509	
Nagelkerke R Square		.080	
Variable	Coefficient	Odds Ratio	Wald
Constant	-9.306	.000	10.870**
COLLEGE	.360	1.434	.948
RESERVE	-.026	.974	.010
GENDER	.680	1.974	6.794*
GT	.091	1.095	13.897***

* = p < .05 *** = p < .001
** = p < .005

91D: Operating Room Specialist

The final sample included 1063 Soldiers who were coded as either graduates or academic failures during their first AIT attempt in this MOS during a period from 2001 to 2004. Only Soldiers who graduated (85%) or failed for academic reasons (15%) were included in the analysis sample because we assume that non-completion for non-academic reasons is not related to cognitive criteria.

In the sample, most were female (53%, 47% male), most had a high school diploma but not more education (83%, 12% some college, 6% GED or less), and most were evenly divided between the Regular Army and the Reserves (48%, 48%, 3% National Guard). The governing AA composite, Skilled Technical (ST), for this MOS has a cutoff score of 92; the sample mean is 105.00 (standard deviation = 9.857). See the Appendix for a description of Soldier characteristics for this MOS training sample.

A binary logistic regression model was estimated to explain pass/fail AIT outcomes and focused on the first training attempt. The estimation results are reported in

Table 1. 91D: Results of the binary logistic prediction model

Chi- Square		98.320***	
Log Likelihood		795.314	
Nagelkerke R Square		.155	
Variable	Coefficient	Odds Ratio	Wald
Constant	-9.009	.000	39.299***
GED	.632	1.882	1.585
COLLEGE	1.255	3.509	8.227**
RESERVE	.169	1.184	.801
GUARD	.104	1.110	.039
GENDER	.903	2.467	23.073***
ST	.098	1.103	49.873***

* = p < .05 *** = p < .001
** = p < .01

Table 1 and indicate that a model, including the ST composite, education level (GED = GED or less than high school diploma; COLLEGE = some college), Army component and gender (GENDER = female), accounts for about 16% of the variation in the dependent variable. This model is statistically significant (χ^2 = 98.320, P < .001), and has moderate explanatory power (Nagelkerke R^2 = .155).

There is a statistically significant effect for the ST composite. The model suggests that having a higher ST composite score increase the odds of passing. At the mean ST score, an increase of one point is associated with an increase of about 10% in the odds of passing the course, and a five-point increase in ST would increase the odds of passing by 63%. There are also statistically significant effects for COLLEGE and GENDER, with increased odds of passing the course at 251% and 147% (for females), respectively.

Policy Analysis. Table 2 reports the probability that the average Soldier from the larger Army contract population would pass the course based upon the binary logistic model. These were calculated using the formula for finding probability in a binary logistic model, which is

$$e^{(\beta' x)} / (1 + e^{(\beta' x)}).$$

The following analysis is focused upon male and female Soldiers with a high school diploma or some college education from the Regular Army. Based on the model, when the cutoff score is at its current level (ST = 92), male Soldiers with a high school diploma and an average ST score (ST = 109.45) have approximately an 85% chance of passing; their female counterparts with a high school education would have approximately a 93% chance of passing. Currently, about 89% of Soldiers are eligible for MOS 91D assignment at the current cutoff (ST = 92). Lowering the cutoff by five points (ST = 87) would increase eligibility by eight percentage points (to 97%) while the average male Soldier who would qualify for training would have a slightly lower chance of passing (82%); the chance of the average female Soldier passing would remain unchanged (92%). Raising the cutoff score by five points (ST = 97) would lead to slightly higher chances of passing for average male and female Soldiers, but eligibility would be reduced by 11

Table 2. 91D: Probability that a Regular Army Soldier (from the larger Army contract population) will pass the course based on the binary logistic model

	Cutoff = 82	Cutoff = 87	Cutoff = 92	Cutoff = 97	Cutoff = 102
Percent Eligible (Regular Army)	*99.8%*	*97.1%*	*89.0%*	*78.2%*	*64.9%*
Mean	*106.82*	*107.67*	*109.45*	*111.59*	*114.16*
Passing Rates:					
High School Male	81.1%	82.4%	84.8%	87.3%	89.8%
College Male	93.8%	94.3%	95.1%	96.0%	96.9%
High School Female	91.4%	92.0%	93.2%	94.4%	95.6%
College Female	97.4%	97.6%	98.0%	98.3%	98.7%

percentage points,

Figure 1 shows the relationship between ST and the probability of passing for male Regular Army Soldiers by education, including upper and lower bounds based on the standard error of the estimated ST coefficient. For a particular ST score, trace a vertical line up to the curve, and then a horizontal line over to the axis to determine the corresponding probability of passing. For example, an ST score of 100 corresponds to a passing probability of about 70% for a high school educated, Regular Army male Soldier. One can see that Soldiers with a low ST score stand very little chance of passing the course. As ST scores increase, the chance that a Soldier will pass the course increases sharply. In addition, the graph illustrates that Soldiers with some college education have a noticeably better chance of passing this course.

Figure 1: Predicted Probalility of Passing: Male Soldiers

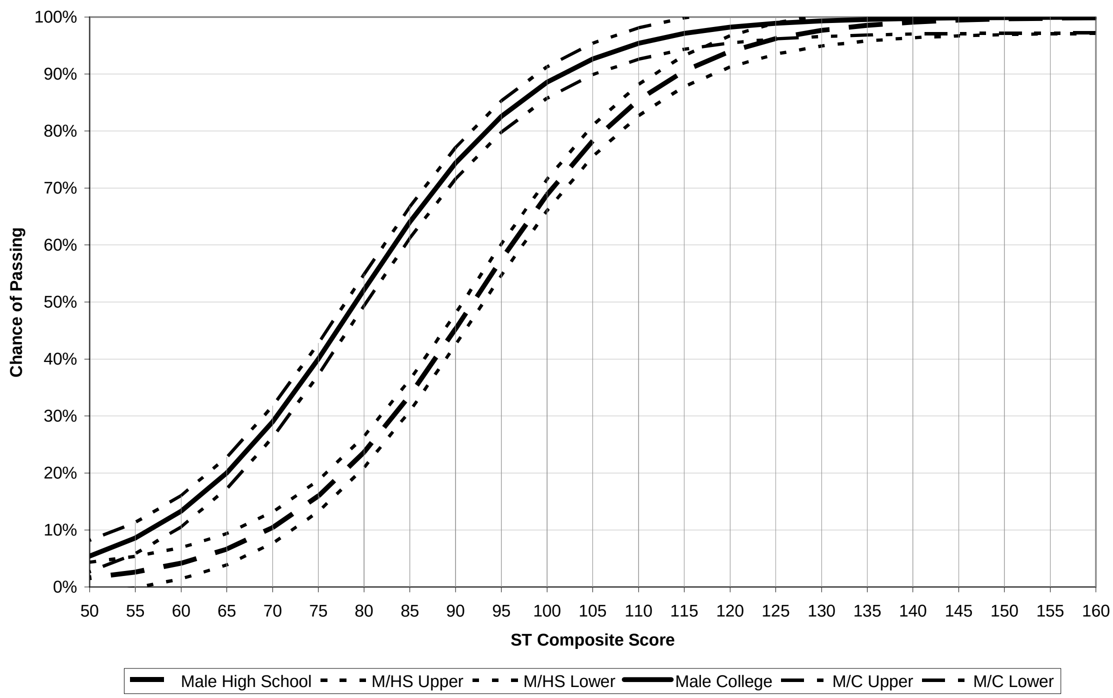


Figure 2 shows the relationship between ST and the probability of passing for high school educated Soldiers by gender, including upper and lower bounds based upon the standard error of the estimated ST coefficient. One can see that Soldiers with a low ST score stand very little chance of passing the course. As ST scores increase, the chance that a Soldier will pass the course increases sharply. In addition, the graph illustrates that female Soldiers have a noticeably better chance of passing this course.

Figure 2: Predicted Probability of Passing: High School Soldiers

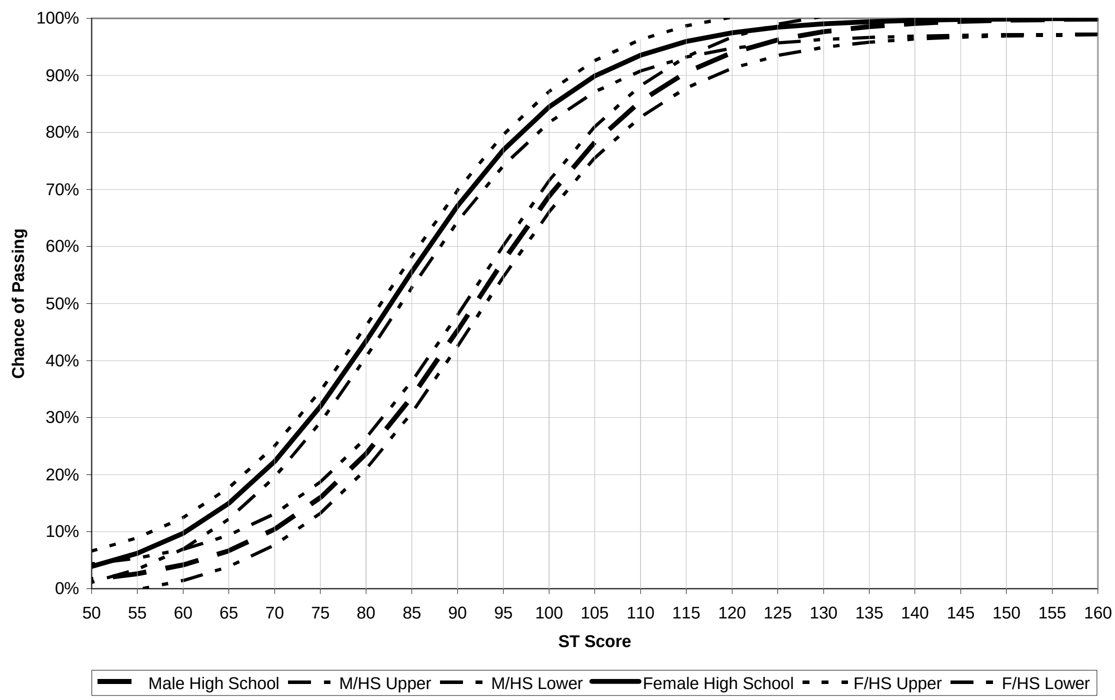
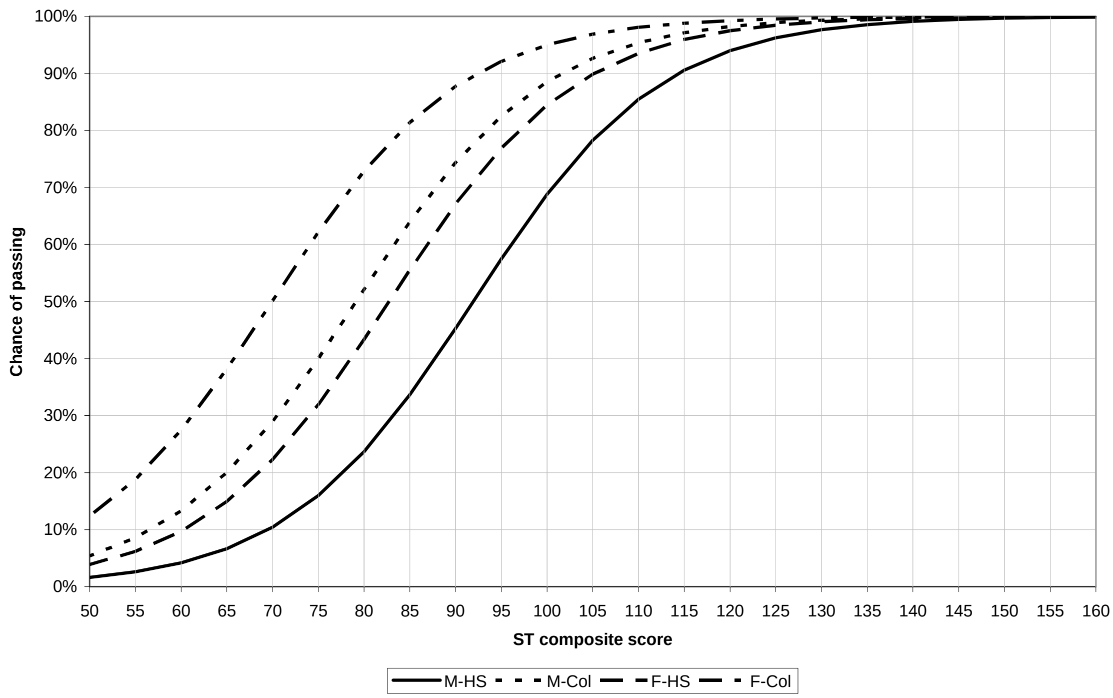


Figure 3 shows the relationship between ST and the probability of passing for Soldiers by education and gender. The graph illustrates that women with some college education have the best chance at passing the course, while high school educated males have the lowest chance of passing. Figure 3 also illustrates the magnitude of the effect brought about by gender and education. At the current cutoff score (ST = 92) college educated female Soldiers have more than a 40% better chance of passing the course compared to high school educated males. Even at a ST score as high as 112, college educated women still have approximately a 10% better chance of passing than high school educated males.

Figure 3: HS vs. College & Male vs. Female



Appendix: Soldier Characteristics (91D)

	Gender	
	Male	Female
fail	17.9%	12.1%
pass	82.1%	87.9%

	Education Level		
	GED or less	High School Diploma	Some College or More
fail	9.8%	16.6%	4.9%
pass	90.2%	83.4%	95.1%

	Component		
	Regular Army	Army Reserve	National Guard
fail	16.1%	13.6%	15.2%
pass	83.9%	86.4%	84.8%

91D Risk Analysis of Policy Alternatives

In this section we extend the policy analysis with a risk analysis of the policy alternatives considered using simulation methods. We employ the "@RISK" software package which is designed as an add-in for Microsoft Excel.[44] There are four steps in the risk analysis.

The first step is developing a model. A regression model for predicting the passing rate has been specified and estimated, and the results stored in Excel worksheet format. See Table 1.

The second step is identifying the uncertainty inherent in both the input variables (composite scores, Soldier characteristics) and the corresponding estimated parameters and specifying their possible values with probability distributions.

To approximate the governing composite distribution, we use the larger Army contract population (EAF file: those who contracted from Jan 1992 to Aug 2003). This distribution can be assumed to follow a normal distribution. The mean and standard deviation estimated from the contract population and used as input to the simulations are shown in Table R-1 (before truncation).

Table R-1. Input information for the simulations

	Mean	Std error / deviation
Constant	-9.009	1.437
ST var	107.12 (before truncation)	12.157
ST coeff	.098	.014
GENDER var	52.7% (female)	
GENDER coeff	.903	.188
GED var	5.7%	
GED coeff	.632	.502
COLLEGE var	11.5%	
COLLEGE coeff	1.255	.438
RESERVE var	48.4%	
RESERVE coeff	.169	.189
GUARD var	3.1%	
GUARD coeff	.104	.527

To approximate the distributions for the demographic variables (GENDER, GED, COLLEGE, RESERVE, and GUARD) we rely on the training data sample used to estimate the regression model. These distributions can be assumed to follow binomial distributions with means estimated from the training data sample as shown in Table R-1.

To approximate the distributions for the estimated parameters in the logit model, we note that, under very general conditions, the estimates will be asymptotically normally distributed.[45] The estimated coefficients (means and standard errors) are shown in Table R-1.

The third step is analyzing the model with simulation to determine the range and probabilities of all possible training outcome results. The results reported represent the simulation of the regression prediction equation for 1000 iterations using a fixed seed.[46] The comparisons are between the baseline case (ST = 92) and the policy cases (ST = 87 and ST = 97). These cases are delineated by the cutoff score level which serves as the lower truncation point in the governing composite input distribution. The simulation results in Table R-2 describe the effect on the mean probability of passing as the ST cutoff score level is varied, and represent an improvement of the policy analysis presented in Table 2 because they reflect the simultaneous effects of all known sources of uncertainty.

Table R-2. 91D simulation results

	ST =87	ST = 92	ST = 97
Mean governing composite	108.32	109.55	111.35
Mean probability of passing	73.6%	75.2%	77.8%
Std deviation	28.8%	27.9%	26.1%

The frequency distributions of simulated effects are shown below in the histogram graphs. The histogram portrays the full range of outcomes that average to the mean effect as reported. Looking at the histogram for the baseline case (ST = 92), probability of passing is plotted on the horizontal axis and the height of each bar indicates the relative number of Soldiers at that passing probability. The information in the histograms is effectively summarized in Table R-3. In that table we see the percentage of Soldiers that meet or exceed a given chance of passing. For example, looking at the baseline case (ST = 92), about 68% of Soldiers have a 70% or greater chance of passing.

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[44] Software is available from Palisade Corporation, Newfield, NY.

[45] The intuition is that logit estimates are derived from maximum likelihood (ML) estimation, and under fairly general conditions ML estimates are consistent and asymptotically normally distributed.

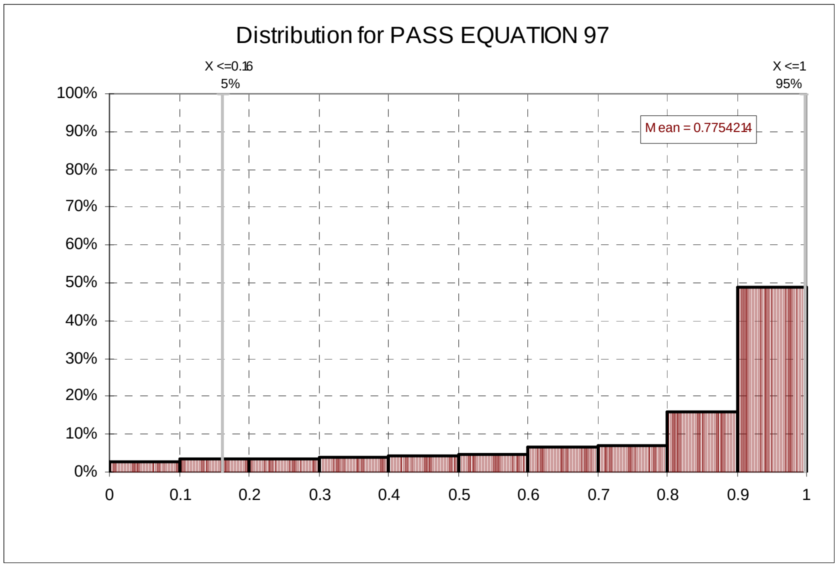
[46] Latin Hypercube (LH) sampling is utilized in drawing samples for the input distributions. It is designed to accurately recreate the input distribution through sampling in fewer iterations when compared with the Monte Carlo method. The key to LH sampling is stratification of the input probability distributions.

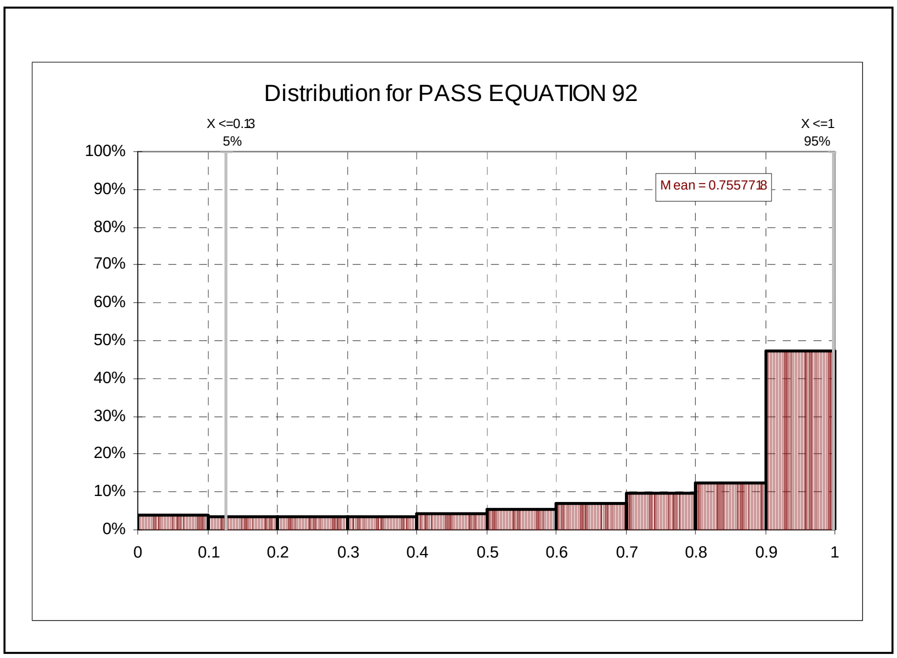
Table R-3.
Percent of simulated Soldiers that meet or exceed given chance of passing

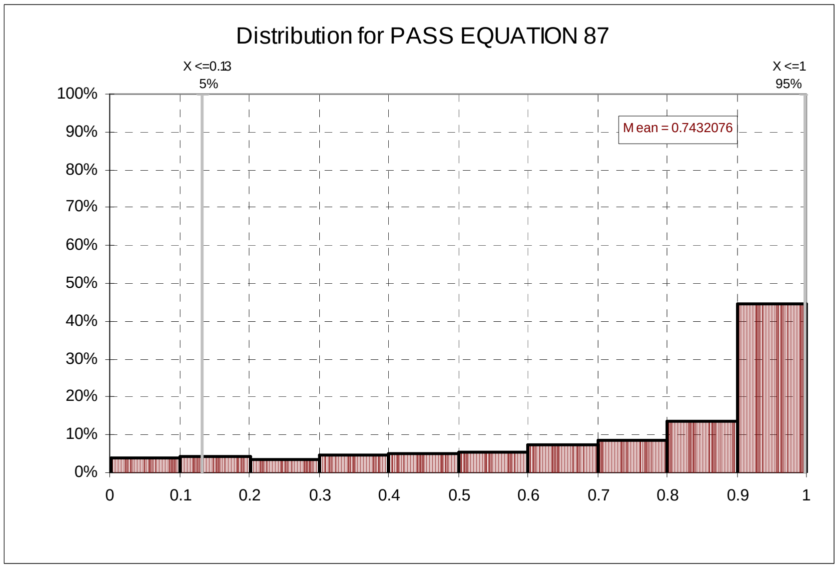
Chance of passing	ST = 87	ST = 92	ST = 97
95.0%	33.1%	34.6%	36.6%
90.0%	45.3%	46.1%	49.4%
85.0%	52.4%	53.3%	58.8%
80.0%	57.1%	60.1%	64.3%
75.0%	62.1%	63.8%	68.0%
70.0%	65.9%	67.9%	71.3%
65.0%	69.4%	71.7%	74.2%
60.0%	72.2%	74.7%	77.7%
55.0%	75.0%	77.5%	80.5%
50.0%	77.8%	80.2%	83.5%

We find that the mean probability of passing in the simulation is 75% (Table R-2, baseline). Looking at the histograms, we see the largest portion of Soldiers in the highest range of passing scores, and the remainder distributed in a stair step into the lower range. We note that the mean simulated passing probability is 10 – 20 percentage points lower than that for any of the means produced by the static prediction at the mean ST score (Table 2). Sensitivity analysis indicates that this is due to the standard error for the ST coefficient, which brings about a relatively large standard deviation in the predicted passing probability. Table R-2 shows that in any of the conditions, one standard deviation greater than the mean is over 100% passing probability, so in effect the average probability of passing is censored at that point, negatively skewing the data. This skew will produce a mean that is considerably lower than a mean that would be calculated if error were not taken into account. In the simulated predictions we are calculating an average over all Soldiers and taking into account all sources of uncertainty, whereas in the static prediction we are calculating the probability of passing only at the mean ST score, ignoring the distribution of Soldier scores etc. as well as uncertainty. While recognizing this variability is important, we also note that the policy case impacts relative to the baseline are the same in both simulation and static prediction modes.

The fourth step is making a decision based on the results provided and the preferences of the school proponent. This involves the evaluation by the school proponent of the tradeoff between increased eligibility and reduced passing probabilities (and vice-versa).


Distribution for PASS EQUATION 97
X <=0.16
5%
X <=1
95%
Mean = 0.7754214
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1


Distribution for PASS EQUATION 92
X <=0.13
5%
X <=1
95%
Mean = 0.7557718
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1



Distribution for PASS EQUATION 87
X <=0.13
5%
X <=1
95%
Mean = 0.7432076
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1

91E: Dental Specialist

The final sample included 1143 Soldiers who were coded as either graduates or academic failures <u>during their first AIT attempt</u> in this MOS during a period from 2001 to 2004. Only Soldiers who graduated (93%) or failed for academic reasons (7%) were included in the analysis sample because we assume that non-completion for non-academic reasons is not related to cognitive criteria.

In the sample, most were female (55%, 45% male), most had a high school diploma but not more education (86%, 10% some college, 4% GED or less), and most were from the Regular Army (56%, 33% Reserve, 11% National Guard). The governing AA composite, Skilled Technical (ST), for this MOS has a cutoff score of 92; the sample mean is 102.79 (standard deviation = 9.054). See the Appendix for a description of Soldier characteristics for this MOS training sample.

A binary logistic regression model was estimated to explain pass/fail AIT outcomes and focused on the first training attempt. The estimation results are reported in

Table 1. 91E: Results of the binary logistic prediction model

Chi- Square		78.587***	
Log Likelihood		521.662	
Nagelkerke R Square		.163	
Variable	Coefficient	Odds Ratio	Wald
Constant	-12.068	.000	30.364***
GED	-.877	.416	3.426
COLLEGE	-.183	.833	.200
RESERVE	.143	1.154	.303
GUARD	.679	1.971	1.785
GENDER	1.197	3.312	22.667***
ST	.140	1.150	40.138***

* = p < .05 *** = p < .001
** = p < .01

Table 1 and indicate that a model, including the ST composite and gender (GENDER = female), accounts for about 16% of the variation in the dependent variable. This model is statistically significant (χ^2 = 78.587, P < .001), and has moderate explanatory power (Nagelkerke R^2 = .163).

There is a statistically significant effect for the ST composite. The model suggests that having a higher ST composite score increases the odds of passing. At the mean ST score, an increase of one point is associated with an increase of about 15% in the odds of passing the course, and a five-point increase in ST would increase the odds of passing by 101%. There are also statistically significant effects for GENDER, with increased odds of passing the course at 231% (for females).

Policy Analysis. Table 2 reports the probability that the average Soldier from the larger Army contract population would pass the course based upon the binary logistic model. These were calculated using the formula for finding probability in a binary logistic model, which is

$$e^{(\beta' x)} / (1 + e^{(\beta' x)}).$$

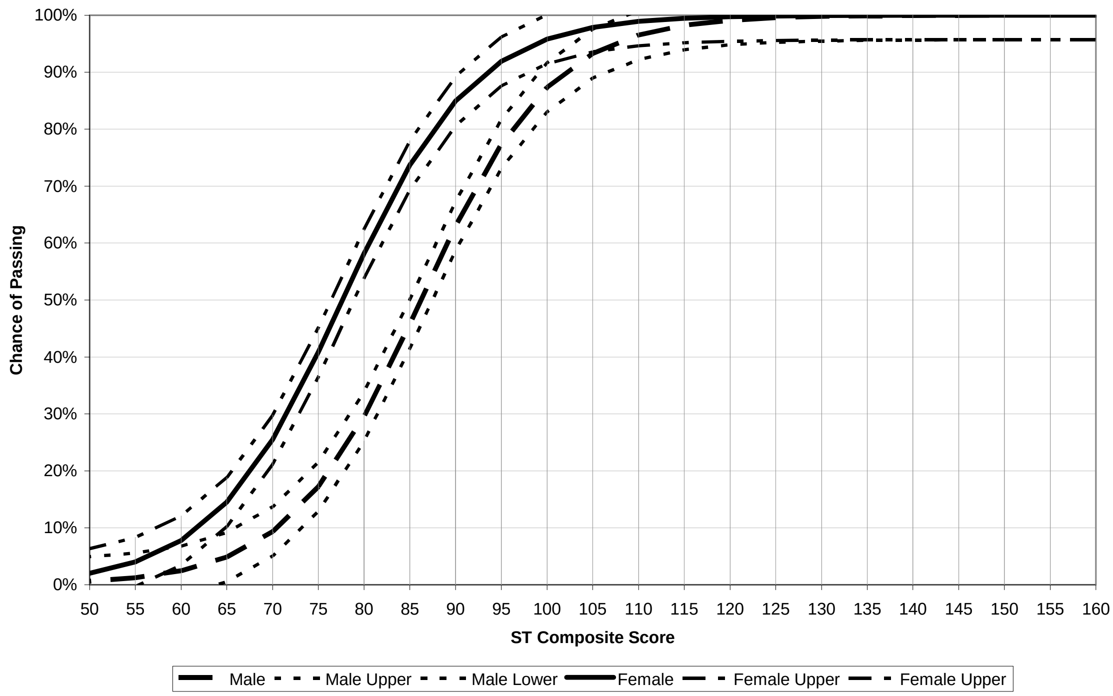
The following analysis is focused upon male and female Soldiers with a high school diploma or some college education from the Regular Army. Based on the model, when the cutoff score is at its current level (ST = 92), male Soldiers with a high school diploma and an average ST score (ST = 109.45) have approximately a 96% chance of passing; female Soldiers would have a slightly higher chance of passing (99%). Currently, about 89% of Soldiers are eligible for MOS 91E assignment at the current cutoff (ST = 92). Lowering the cutoff by five points (ST = 87) would increase eligibility by nine percentage points (to 97%) and the average male Soldier who would qualify for training would have about the same chance of passing (95%), as would the average female Soldier (99%). Raising the cutoff score by five points (ST = 97), the average male and female Soldier would have about the same chance of passing (97%, 99%) but eligibility would fall by about 11 percentage points.

Table 2. 91E: Probability that a Regular Army Soldier (from the larger Army contract population) will pass the course based on the binary logistic model

	Cutoff = 82	Cutoff = 87	Cutoff = 92	Cutoff = 97	Cutoff = 102
Percent Eligible (Regular Army)	*99.8%*	*97.1%*	*89.0%*	*78.2%*	*64.9%*
Mean	*106.82*	*107.67*	*109.45*	*111.59*	*114.16*
Passing Rates:					
High School Male	94.7%	95.3%	96.3%	97.2%	98.0%
High School Female	98.3%	98.5%	98.8%	99.1%	99.4%

Figure 1 shows the relationship between ST and the probability of passing for male and female Regular Army Soldiers with a high school education, including upper and lower bounds based upon the standard error of the estimated ST coefficient. For a particular ST score, trace a vertical line up to the curve, and then a horizontal line over to the axis to determine the corresponding probability of passing. For example, an ST score of 100 corresponds to a passing probability of about 87% for a high school educated, Regular Army male Soldier. One can see that Soldiers with a low ST score stand very little chance of passing the course. As ST scores increase, the chance that a Soldier will pass the course increases sharply. In addition, the graph illustrates that female Soldiers have a noticeably better chance of passing this course at lower scores.

Figure 1: Predicted Probability of Passing: High School Soldiers



91G: Patient Administration Specialist

The final sample included 652 Soldiers who were coded as either graduates or academic failures during their first AIT attempt in this MOS during a period from 2001 to 2004. Only Soldiers who graduated (97%) or failed for academic reasons (3%) were included in the analysis sample of 652 Soldiers because we assume that non-completion for non-academic reasons is not related to cognitive criteria.

In this sample, most were female (54%, 46% male), most had a high school diploma but not more education (82%, 13% some college, 5% GED or less), and most were from the Army Reserve (53%, 27% Regular Army, 20% National Guard). The governing AA composite, Clerical (CL), for this MOS has a cutoff score of 92; the sample mean is 104.06 (standard deviation = 10.509). See the Appendix for a description of Soldier characteristics for this MOS training sample.

A binary logistic regression model was estimated to explain pass/fail AIT outcomes and focused on the first training attempt. The estimation results are reported in

Table 1. 91G: Results of the binary logistic prediction model

Chi- Square		8.052*	
Log Likelihood		184.382	
Nagelkerke R Square		.048	
Variable	Coefficient	Odds Ratio	Wald
Constant	-.574	.564	.125
RESERVE	-.258	.773	.318
GENDER	.751	2.120	2.686
CL	.037	1.037	5.261*

* = p < .05 *** = p < .001
** = p < .01

Table 1 and indicate that a model, including the CL composite, component, and gender (GENDER = female), accounts for about five percent of the variation in the dependent variable. This model is statistically significant (χ^2 = 8.052, P = .048), and has limited explanatory power (Nagelkerke R^2 = .048).

There is a statistically significant effect for the CL composite. The model suggests that having a higher CL composite score increases the odds of passing. At the mean CL score, an increase of one point is associated with an increase of about 4% in the odds of passing the course, and a five-point increase in CL would increase the odds of passing by 20%.

Policy Analysis. Table 2 reports the probability that the average Soldier from the larger Army contract population would pass the course based upon the binary logistic model. These were calculated using the formula for finding probability in a binary logistic model, which is

$$e^{(\beta' x)} / (1 + e^{(\beta' x)}).$$

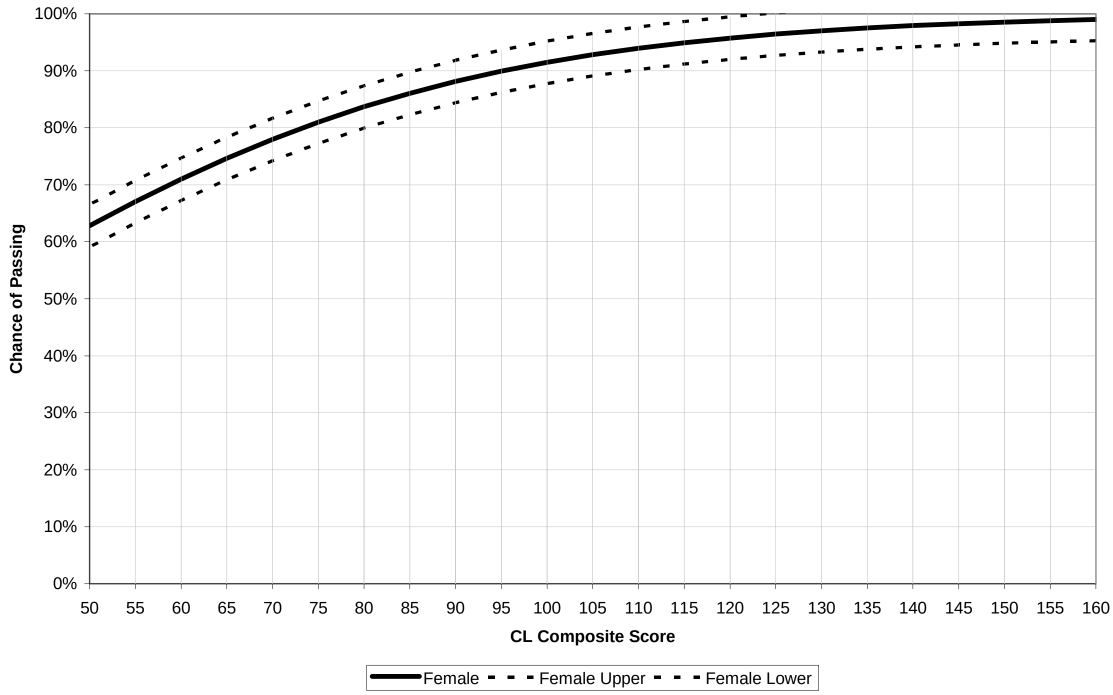
The following analysis is focused upon female Soldiers with a high school diploma (the modal categories) from the Regular Army. Based on the model, when the cutoff score is at its current level (CL = 92), female Soldiers with a high school diploma and an average CL score (CL = 109.17) have approximately a 94% chance of passing. Currently, about 92% of Soldiers are eligible for MOS 91G assignment at the current cutoff (CL = 92). Lowering the cutoff by five points (CL = 87) would increase eligibility by seven percentage points (to 99%) and the average female Soldier who would qualify for training would have about the same chance of passing (93%). Raising the cutoff score by five points (CL = 97), the average female Soldier would have about the same chance of passing (94%) but eligibility would fall by about 12 percentage points.

Table 2. 91G: Probability that a Regular Army Soldier (from the larger Army contract population) will pass the course based on the binary logistic model

	Cutoff = 82	Cutoff = 87	Cutoff = 92	Cutoff = 97	Cutoff = 102
Percent Eligible (Regular Army)	*99.9%*	*99.0%*	*91.6%*	*80.0%*	*67.6%*
Mean	*107.49*	*107.69*	*109.17*	*111.37*	*113.62*
Passing Rates:					
High School Female	93.4%	93.5%	93.8%	94.2%	94.7%

Figure 1 shows the relationship between CL and the probability of passing for female Regular Army Soldiers, including upper and lower bounds based upon the standard error of the estimated CL coefficient. For a particular CL score, trace a vertical line up to the curve, and then a horizontal line over to the axis to determine the corresponding probability of passing. For example, a CL score of 100 corresponds to a passing probability of about 90% for a high school educated, Regular Army female Soldier. One can see that female Soldiers with a low CL score still have a moderately good chance of passing the course. As CL scores increase, the chance that a Regular Army female Soldier will pass the course increases.

Figure 1: Probability of Passing: Female Regular Army Soldiers



Appendix: Soldier Characteristics (91G)

Outcome	Gender	
	Male	Female
fail	4.6%	2.3%
pass	95.4%	97.7%

Outcome	Education Level		
	GED or less	High School Diploma	Some College or More
fail	6.1%	3.8%	.0%
pass	93.9%	96.2%	100.0%

Outcome	Component		
	Regular Army	Army Reserve	National Guard
fail	3.9%	3.8%	1.5%
pass	96.1%	96.2%	98.5%

91H: Optical Laboratory Specialist

The final sample included 86 Soldiers who were coded as either graduates or academic failures <u>during their first AIT attempt</u> in this MOS during a period from 2001 to 2004. Only Soldiers who graduated (88.4%) or failed for academic reasons (11.6%) were included in the analysis sample because we assume that non-completion for non-academic reasons is not related to cognitive criteria.

In the sample, most of the Soldiers in MOS 91H were male (60%, 40% female), most had a high school diploma but not more education (84%, 13% some college, 4% GED or less), and most were from Regular Army (77%, 9% National Guard, 14% Army Reserve). The governing AA composite, General Maintenance (GM), for this MOS has a cutoff score of 97; the sample mean is 105.99 (standard deviation = 8.823). See the Appendix for a description of Soldier characteristics for this MOS training sample.

A binary logistic regression model was estimated to explain pass/fail AIT outcomes and focused on the first training attempt. The estimation results are reported in Table 1 and indicate that a model, including the GM composite and gender (GENDER = female), accounts for almost 12 percent of the variation in the dependent variable. This

Table 1. 91H: Results of the binary logistic prediction model

Chi- Square		5.235	
Log Likelihood		56.590	
Nagelkerke R Square		.115	
Variable	Coefficient	Odds Ratio	Wald
Constant	-12.128	.000	2.406
GENDER	.068	1.071	.010
GM	.137	1.147	3.202

* = p < .05   *** = p < .001
** = p < .005

model is borderline statistically significant (χ^2 = 5.235, P = .073), and has moderate explanatory power (Nagelkerke R^2 = .115).

There is no statistically significant effect for the GM composite. The model suggests that the GM composite score does not predict increased odds of passing, but there are too few failure observations for a definitive conclusion.

Policy Analysis. Given the model's lack of significance, this model is not appropriate for conducting policy analysis.

Excursion. In view of the fact that ST is the governing composite for many of the other technical MOS within CMF 91, we also estimated a regression model using ST in place of the GM composite. The results in Table 2 indicate a statistically significant model, and moderate explanatory power (Nagelkerke R^2 = .229). There is also a statistically significant effect for the ST composite. The model suggests that a higher ST composite score increases the odds of passing, but there are too few failure observations for a definitive conclusion.

Table 2. 91H: Results of the binary logistic prediction model utilizing ST composite

Chi- Square		10.718**	
Log Likelihood		51.107	
Nagelkerke R Square		.229	
Variable	Coefficient	Odds Ratio	Wald
Constant	-21.622	.000	5.780*
GENDER	-.104	.902	.020
ST	.227	1.255	6.673**

* = p < .05 *** = p < .001
** = p < .01

Appendix: Soldier Characteristics (91H)

Outcome	Gender	
	Male	Female
fail	9.8%	14.3%
pass	90.2%	85.7%

Outcome	Education Level		
	GED or less	High School Diploma	Some College or More
fail	.0%	12.5%	9.1%
pass	100.0%	87.5%	90.9%

Outcome	Component		
	Regular Army	Army Reserve	National Guard
fail	10.6%	8.3%	25.0%
pass	89.4%	91.7%	75.0%

91J: Medical Logistics Specialist

The final sample included 709 Soldiers who were coded as either graduates or academic failures during their first AIT attempt in this MOS during a period from 2001 to 2004. Only Soldiers who graduated (89%) or failed for academic reasons (11%) were included in the analysis sample because we assume that non-completion for non-academic reasons is not related to cognitive criteria.

In the sample, most of the Soldier in MOS 91J were male (56%, 44% female) most had a high school diploma but not more education (84%, 10% some college, 6% GED or less), and most were from Regular Army (49%, 40% National Guard, 11% Army Reserve). The governing AA composite, Clerical (CL), for this MOS has a cutoff score of 92; the sample mean is 102.92 (standard deviation = 11.858). See the Appendix for a description of Soldier characteristics for this MOS training sample.

A binary logistic regression model was estimated to explain pass/fail AIT outcomes and focused on the first training attempt. The estimation results are reported in

Table 1. 91J: Results of the binary logistic prediction model

Chi- Square		31.550***	
Log Likelihood		459.984	
Nagelkerke R Square		.087	
Variable	Coefficient	Odds Ratio	Wald
Constant	-5.856	.005	10.525***
GED	-.560	.571	1.114
GUARD	.661	1.938	1.700
RESERVE	.404	1.497	1.977
GENDER	.416	1.516	2.554
CL	.069	1.072	18.589***

* = p < .05 *** = p < .001
** = p < .01

Table 1 and indicate that a model, including the CL composite, GED (GED or less education), GUARD (National Guard Membership), RESERVE (Army Reserve Membership) and gender (GENDER = female), accounts for almost nine percent of the variation in the dependent variable. This model is statistically significant ($\chi^2 = 31.550$, $P < .001$), and has moderate explanatory power (Nagelkerke $R^2 = .087$).

There is a statistically significant effect for the CL composite. The model suggests that having a higher CL composite score increases the odds of passing. At the mean CL score, an increase of one point is associated with an increase of about 7% in the odds of passing the course, and a five-point increase in CL would increase the odds of passing by 41%.

Policy Analysis. Table 2 reports the probability that the average Soldier from the larger Army contract population would pass the course based upon the binary logistic model. These were calculated using the formula for finding probability in a binary logistic model, which is

$$e^{(\beta' x)} / (1 + e^{(\beta' x)}).$$

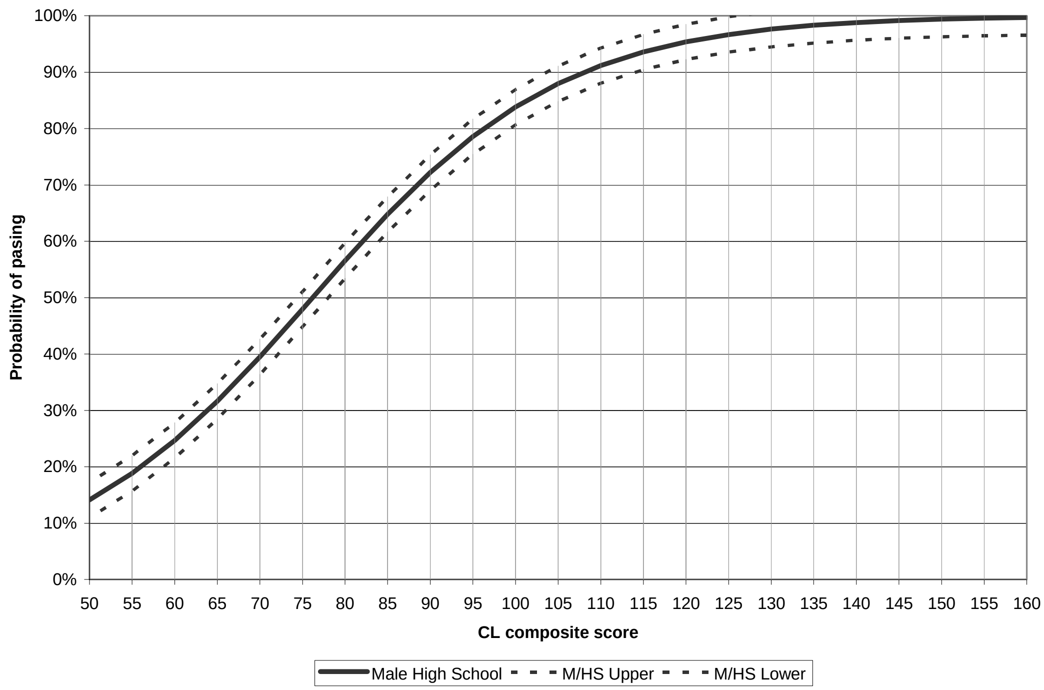
The following analysis is focused upon male Soldiers with a high school diploma (the modal categories) from the Regular Army. Based on the model, when the cutoff score is at its current level (CL = 92), male Soldiers with a high school diploma and an average CL score (CL = 109.17) have approximately a 91% chance of passing. Currently, about 92% of Soldiers are eligible for MOS 91J assignment at the current cutoff (CL = 92). Lowering the cutoff by five points (CL = 87) would increase eligibility by seven percentage points (to 99%) and the average male Soldier who would qualify for training would have about the same chance of passing (90%). Raising the cutoff score by five points (CL = 97), the average male Soldier would have about the same chance of passing (92%) while eligibility would fall by about 12 percentage points.

Table 2. 91J: Probability that a Soldier (from the larger Army contract population) will pass the course based on the binary logistic model

	Cutoff = 82	Cutoff = 87	Cutoff = 92	Cutoff = 97	Cutoff = 102
Percent Eligible (Regular Army)	*99.9%*	*99.0%*	*91.6%*	*80.0%*	*67.6%*
Mean	*107.49*	*107.69*	*109.17*	*111.37*	*113.62*
Passing Rates:					
Male	89.7%	89.8%	90.7%	91.9%	93.0%

Figure 1 shows the relationship between CL and the probability of passing for male Regular Army Soldiers, including upper and lower bounds based upon the standard error of the estimated CL coefficient. For a particular CL score, trace a vertical line up to the curve, and then a horizontal line over to the axis to determine the corresponding probability of passing. For example, a CL score of 100 corresponds to a passing probability of about 85% for a high school educated, Regular Army male Soldier. One can see that male Soldiers with a low CL score have a relatively low chance of passing the course. As CL scores increase, the chance that a Regular Army male Soldier will pass the course increases somewhat quickly.

Figure 1: Predicted Probability of Passing: Male, Regular Army



Appendix: Soldier Characteristics (91J)

Outcome	Gender: Male	Gender: Female
fail	11.2%	10.8%
pass	88.8%	89.2%

	Education Level: GED or less	High School Diploma	Some College or More
fail	12.5%	12.0%	2.7%
pass	87.5%	88.0%	97.3%

	Component: Regular Army	Army Reserve	National Guard
fail	13.6%	8.9%	6.7%
pass	86.4%	91.1%	93.3%

91K: Medical Laboratory Specialist

The final sample included 123 Soldiers who were coded as either graduates or academic failures during their first AIT attempt in this MOS during a period from 2001 to 2004. Only Soldiers who graduated (81%) or failed for academic reasons (19%) were included in the analysis sample because we assume that non-completion for non-academic reasons is not related to cognitive criteria.

In the sample, most of the Soldier in MOS 91K were male (55%, 45% female) most had a high school diploma but not more education (71%, 29% some college, 1% GED or less), and most were from Regular Army (76%, 4% National Guard, 20% Army Reserve). The governing AA composite, Skilled Technical (ST), for this MOS has a cutoff score of 107; the sample mean is 117.72 (standard deviation = 7.500). See the Appendix for a description of Soldier characteristics for this MOS training sample.

A binary logistic regression model was estimated to explain pass/fail AIT outcomes and focused on the first training attempt. The estimation results are reported in

Table 1. 91K: Results of the binary logistic prediction model

Chi- Square		16.614**	
Log Likelihood		101.614	
Nagelkerke R Square		.204	
Variable	Coefficient	Odds Ratio	Wald
Constant	-14.626	.000	8.183**
COLLEGE	-.244	.784	.196
RESERVE	-.900	.407	2.417
GENDER	1.406	4.082	6.024*
ST	.136	1.146	9.602**

* = p < .05 *** = p < .001
** = p < .01

Table 1 and indicate that a model, including the ST composite, COLLEGE (some college education), RESERVE (Army Reserve Membership) and gender (GENDER = female), accounts for 20% of the variation in the dependent variable. This model is statistically significant (χ^2 = 16.614, P = .002), and has moderate explanatory power (Nagelkerke R^2 = .204).

There is a statistically significant effect for the ST composite. The model suggests that having a higher ST composite score increases the odds of passing. At the mean ST score, an increase of one point is associated with an increase of about 15% in the odds of passing the course, and a five-point increase in ST would increase the odds of passing by 97%. There is also a statistically significant effect for GENDER where the odds of a female Soldier passing the course are 308% higher than the odds for a male Soldier.

Policy Analysis. Table 2 reports the probability that the average Soldier from the larger Army contract population would pass the course based upon the binary logistic model. These were calculated using the formula for finding probability in a binary logistic model, which is

$$e^{(\beta'x)} / (1 + e^{(\beta'x)}).$$

The following analysis is focused upon male Soldiers with a high school diploma (the modal categories) from the Regular Army. Based on the model, when the cutoff score is at its current level (ST = 107), male Soldiers with a high school diploma and an average ST score (ST = 116.55) have approximately a 77% chance of passing, while their female counterparts have approximately a 93% chance of passing. Currently, about 50% of Soldiers are eligible for MOS 91K assignment at the current cutoff (ST = 107). Lowering the cutoff by five points (ST = 102) would increase eligibility by 15 percentage points (to 65%) and the average male Soldier who would qualify for training would have a somewhat lower chance of passing (70%), while the average female soldier would have almost the same chance of passing (90%) as at the current cutoff. In raising the cutoff score by five points (ST = 112), the average qualifying male Soldiers would have a

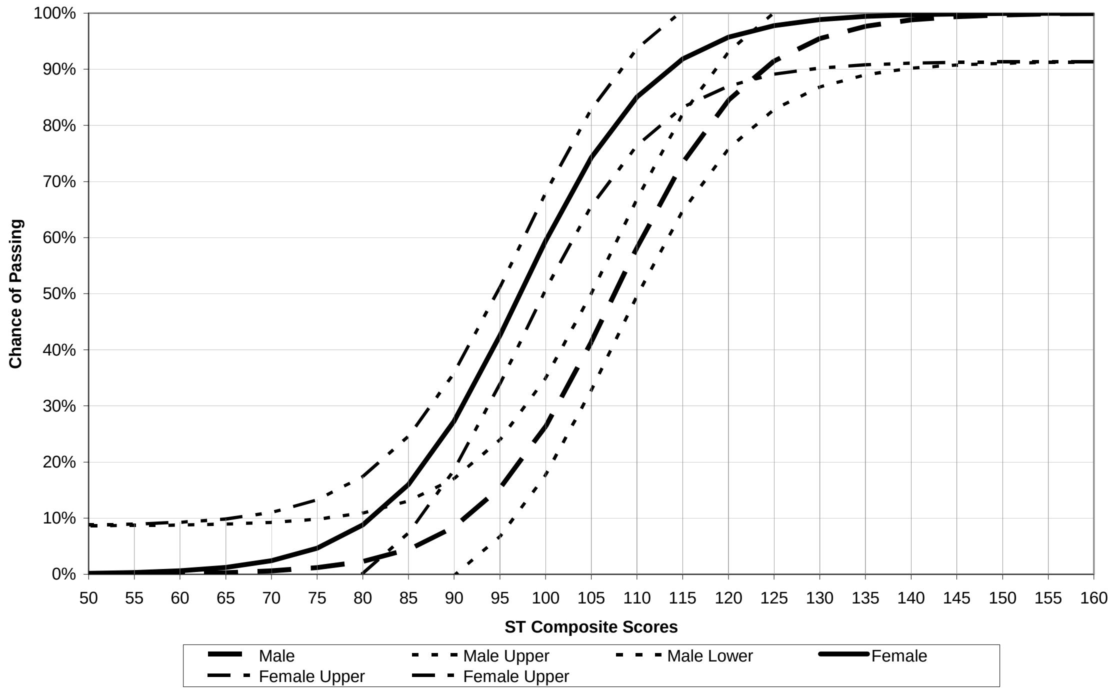
Table 2. 91K: Probability that a Regular Army Soldier (from the larger Army contract population) will pass the course based on the binary logistic model

	Cutoff = 97	Cutoff = 102	Cutoff = 107	Cutoff = 112	Cutoff = 117
Percent Eligible (Regular Army)	*78.2%*	*64.9%*	*49.6%*	*34.7%*	*22.0%*
Mean	*111.14*	*113.6%*	*116.55*	*119.83*	*123.23*
Passing Rates:					
Male	62.0%	69.5%	77.3%	84.2%	89.4%
Female	86.9%	90.3%	93.3%	95.6%	97.2%

higher chance of passing (84%) and the average female Soldier only a slightly higher chance of passing (96%), while eligibility would be reduced by 15 percentage points.

Figure 1 shows the relationship between ST and the probability of passing for male and female Regular Army Soldiers, including upper and lower bounds based upon the standard error of the estimated ST coefficient. For a particular ST score, trace a vertical line up to the curve, and then a horizontal line over to the axis to determine the corresponding probability of passing. For example, a ST score of 100 corresponds to a passing probability of about 70% for a high school educated, Regular Army female Soldier. One can see that male Soldiers with a low ST score have very little chance of passing, while female soldier with low ST scores have a somewhat higher chance of passing. As ST scores increase, the chance that a Regular Army male Soldier will pass the course increases more quickly for female Soldiers than for male Soldiers.

Figure 1: Predicted Probability of Passing: Regular Army Soldiers with a High School Diploma



Appendix: Soldier Characteristics (91K)

Outcome	Gender: Male	Gender: Female
fail	23.9%	12.5%
pass	76.1%	87.5%

	Education Level: GED or less	High School Diploma	Some College or More
fail	100.0%	17.2%	20.0%
pass	.0%	82.8%	80.0%

	Component: Regular Army	Army Reserve	National Guard
fail	17.0%	29.2%	.0%
pass	83.0%	70.8%	100.0%

91M: Hospital Food Service Specialist

The final sample included 837 Soldiers who were coded as either graduates or academic failures <u>during their first AIT attempt</u> in this MOS during a period from 2001 to 2004. Only Soldiers who graduated (98.7%) or failed for academic reasons (1.3%) were included in the analysis sample because we assume that non-completion for non-academic reasons is not related to cognitive criteria.

In the sample, most were male (64%, 36% female), most had a high school diploma but not more education (88%, 8% some college, 4% GED or less), and most were from Army Reserve (69%, 31% Regular Army, < 1% National Guard). The governing AA composite, Operator/Food (OF), for this MOS has a cutoff score of 95; the sample mean is 105.20 (standard deviation = 7.918). See the Appendix for a description of Soldier characteristics for this MOS training sample.

A binary logistic regression model was estimated to explain pass/fail AIT outcomes and focused on the first training attempt. The estimation results are reported in Table 1 and indicate that a model, including the OF composite, Army component

Table 1. 91M: Results of the binary logistic prediction model

Chi- Square		5.177	
Log Likelihood		111.980	
Nagelkerke R Square		.047	
Variable	Coefficient	Odds Ratio	Wald
Constant	1.989	7.311	.185
RESERVE	1.347	3.845	4.269*
GENDER	.213	1.237	.107
OF	.015	1.015	.109

* = p < .05 *** = p < .001

(RESERVE = Army Reserve) and gender (GENDER = female), accounts for five percent of the variation in the dependent variable. This model is not statistically significant (χ^2 = 5.177, P = .159), and has limited explanatory power (Nagelkerke R^2 = .047).

There is no statistically significant effect for the OF composite, though there is one for Army Reserve membership. The model suggests that the OF composite score does not predict increased odds of passing, but there are too few failure observations for a definitive conclusion.

Policy Analysis. Given the model's lack of explanatory power, and notwithstanding the statistically significant effect for Reserve membership, this model is not appropriate for conducting policy analysis.

Appendix: Soldier Characteristics (91M)

Outcome	Gender	
	Male	Female
fail	9.0%	6.2%
pass	91.0%	93.8%

Outcome	Education Level		
	GED or less	High School Diploma	Some College or More
fail	3.8%	9.5%	3.0%
pass	96.2%	90.5%	97.0%

Outcome	Component		
	Regular Army	Army Reserve	National Guard
fail	8.6%	6.3%	8.8%
pass	91.4%	93.7%	91.3%

91P: Radiology Specialist

The final sample included 814 Soldiers who were coded as either graduates or academic failures during their first AIT attempt in the first phase training for this MOS during a period from 2001 to 2004. Only Soldiers who graduated (92%) or failed for academic reasons (8%) were included in the analysis sample of 814 Soldiers because we assume that non-completion for non-academic reasons is not related to cognitive criteria.

In the sample, most were male (65%, 35% female), most had a high school diploma but not more education (76%, 21% some college, 3% GED or less), and most were from were from the Regular Army (63%, 10% National Guard, 27% Reserve). The governing AA composite, Skilled Technical (ST), for this MOS has a cutoff score of 107; the sample mean is 112.11 (standard deviation = 8.648). See the Appendix for a description of Soldier characteristics for this MOS training sample.

A binary logistic regression model was estimated to explain pass/fail AIT outcomes and focused on the first training attempt. The estimation results are reported in Table 1 and indicate that the model, including the ST composite, education level

Table 1. 91P: Results of the binary logistic prediction model

Chi- Square		28.356***	
Log Likelihood		424.894	
Nagelkerke R Square		.080	
Variable	Coefficient	Odds Ratio	Wald
Constant	-7.699	.000	9.082**
COLLEGE	1.022	2.778	4.529*
RESERVE	.278	1.321	.741
GUARD	.085	1.089	.038
GENDER	.586	1.797	4.008*
ST	.085	1.089	14.300***

* = p < .05 *** = p < .001
** = p < .01

(COLLEGE = some college), Army component (GUARD = National Guard; RESERVE = Army Reserve) and gender (GENDER = female), accounts for about eight percent of the variation in the dependent variable. This model is statistically significant ($\chi^2 = 28.356$, $P < .001$), and has moderate explanatory power (Nagelkerke $R^2 = .080$).

There is a statistically significant effect for the ST composite. The model suggests that having a higher ST composite score increases the odds of passing. At the mean ST score, an increase of one point is associated with an increase of about 9% in the odds of passing the course, and a five-point increase in ST would increase the odds of passing by 53%. There are also statistically significant effects for COLLEGE and GENDER, with increased odds of passing the course at 178% and 78% (for females), respectively.

Policy Analysis. Table 2 reports the probability that the average Soldier from the larger Army contract population would pass the course based upon the binary logistic model. These were calculated using the formula for finding probability in a binary logistic model, which is

$$e^{(\beta' x)} / (1 + e^{(\beta' x)}).$$

The following analysis is focused upon male and female Soldiers with a high school diploma or some college education from the Regular Army. Based on the model, when the cutoff score is at its current level (ST = 107), male Soldiers with a high school diploma (the modal categories) and an average ST score (ST = 116.55) have approximately a 90% chance of passing. Currently, about 50% of Soldiers are eligible for MOS 91P assignment at the current cutoff (ST = 107). Lowering the cutoff by five points (ST = 102) would increase eligibility by 15 percentage points (to 65%), and the average male Soldier who would qualify for training would have a somewhat lower chance of passing (88%). In raising the cutoff score by five points (ST = 112), the average male Soldier would have a slightly higher chance of passing (92%) while

Table 2. 91P: Probability that a Regular Army Soldier (from the larger Army contract population) will pass the course based on the binary logistic model

	Cutoff = 97	Cutoff = 102	Cutoff = 107	Cutoff = 112	Cutoff = 117
Percent Eligible (Regular Army)	*78.2%*	*64.9%*	*49.6%*	*34.7%*	*22.0%*
Mean	*111.14*	*113.6*	*116.55*	*119.83*	*123.23*
Passing Rates:					
High School Male	85.2%	87.6%	90.1%	92.3%	94.1%
College Male	94.1%	95.2%	96.2%	97.1%	97.8%
High School Female	91.2%	92.7%	94.2%	95.6%	96.6%
College Female	96.6%	97.2%	97.8%	98.4%	98.8%

eligibility would be reduced by 15 percentage points.

Figure 1 shows the relationship between ST and the probability of passing for Regular Army male Soldiers by education, including upper and lower bounds based on the standard error of the estimated ST coefficient. For a particular ST score, trace a vertical line up to the curve, and then a horizontal line over to the axis to determine the corresponding probability of passing. For example, an ST score of 100 corresponds to a passing probability of about 70% for a high school educated, Regular Army male Soldier. One can see that Soldiers with a low ST score stand very little chance of passing the course. As ST scores increase, the chance that a Soldier will pass the course increases sharply. In addition, the graph illustrates that Soldiers with some college education have a noticeably better chance of passing this course.

Figure 1: Predicted Probalility of Passing: Male Soldiers

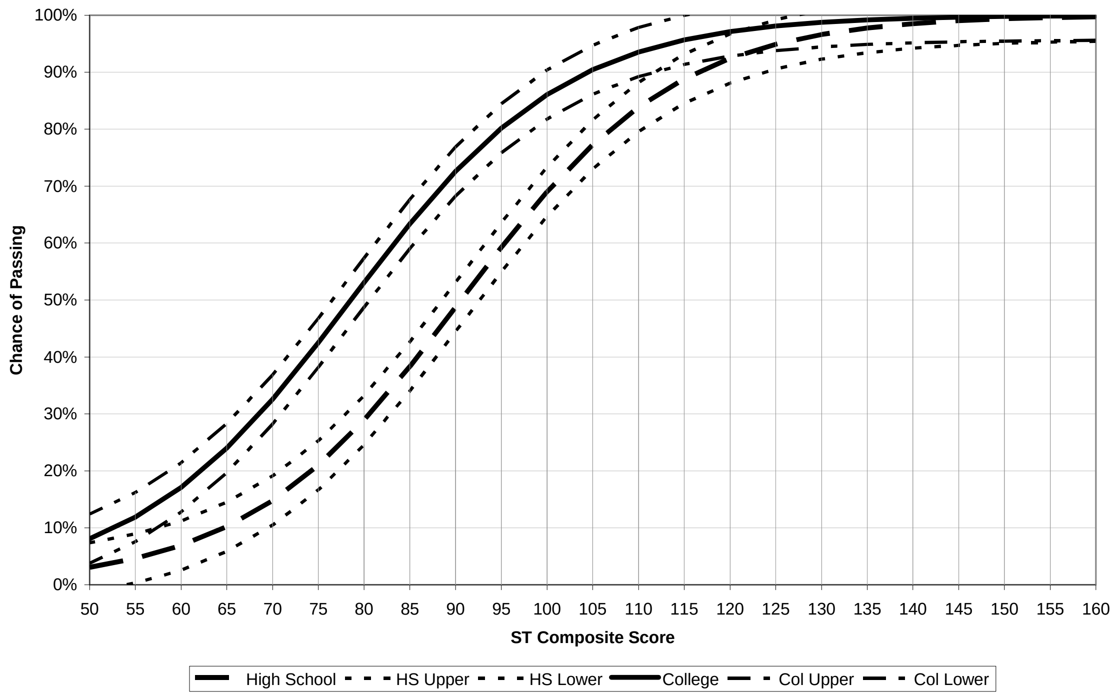


Figure 2 shows the relationship between ST and the probability of passing for high school educated Soldiers by gender, including upper and lower bounds based upon the standard error of the estimated ST coefficient. One can see that Soldiers with a low ST score stand very little chance of passing the course. As ST scores increase, the chance that a Soldier will pass the course increases sharply. In addition, the graph illustrates that female Soldiers have a noticeably better chance of passing this course.

Figure 2: Predicted Probalility of Passing: High School Soldiers

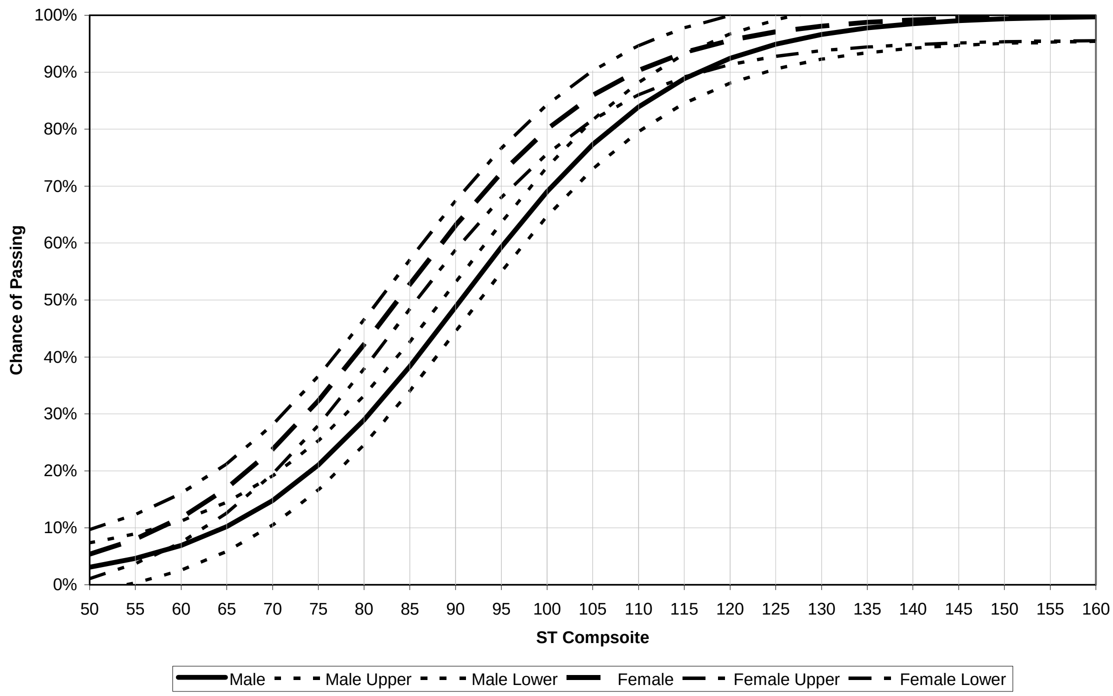
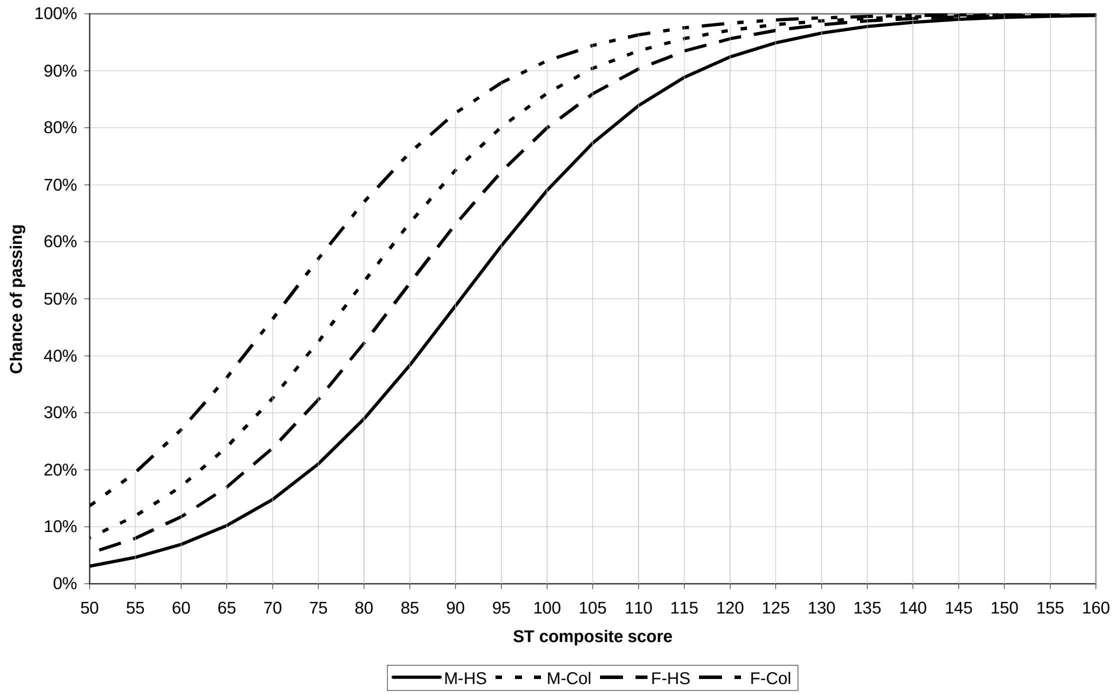


Figure 3 shows the relationship between ST and the probability of passing for Soldiers by education and gender. The graph illustrates that women with some college education have the best chance at passing the course, while high school educated males, the modal students, have the lowest chance of passing. Figure 3 also illustrates the magnitude of the effect brought about by gender and education. At the current cutoff score (ST = 102) college educated female Soldiers have more than a 20 percentage point better chance of passing the course compared to high school educated males. Even at a ST score as high as 120, college educated women still have approximately a 5 percentage point better chance of passing than high school educated males.

Figure 3: HS vs. College & Male vs. Female



Appendix: Soldier Characteristics (91P)

Outcome	Gender	
	Male	Female
fail	23.9%	12.5%
pass	76.1%	87.5%

	Education Level		
	GED or less	High School Diploma	Some College or More
fail	100.0%	17.2%	20.0%
pass	.0%	82.8%	80.0%

	Component		
	Regular Army	Army Reserve	National Guard
fail	17.0%	29.2%	.0%
pass	83.0%	70.8%	100.0%

91Q: Pharmacy Specialist

The final sample included 572 Soldiers who were coded as either graduates or academic failures during their first AIT attempt in this MOS during a period from 2001 to 2004. Only Soldiers who graduated (77%) or failed for academic reasons (23%) were included in the analysis sample of 572 Soldiers because we assume that non-completion for non-academic reasons is not related to cognitive criteria.

In the sample, most were male (55%, 45% female), most had a high school diploma but not more education (82%, 17% some college, 1% GED or less), and most were from were from the Regular Army (67%, 4% National Guard, 29% Reserve). The governing AA composite, Skilled Technical (ST), for this MOS has a cutoff score of 92; the sample mean is 107.66 (standard deviation = 10.338). See the Appendix for a description of Soldier characteristics for this MOS training sample.

A binary logistic regression model was estimated to explain pass/fail AIT outcomes and focused on the first training attempt. The estimation results are reported in

Table 1. 91Q: Results of the binary logistic prediction model

Chi- Square		64.255***	
Log Likelihood		546.426	
Nagelkerke R Square		.162	
Variable	Coefficient	Odds Ratio	Wald
Constant	-8.136	.000	33.200***
COLLEGE	.715	2.045	4.091*
RESERVE	.219	1.245	.804
GUARD	.093	1.097	.028
GENDER	.819	2.268	13.669***
ST	.084	1.087	39.512***

* = p < .05 *** = p < .001
** = p < .01

Table 1 and indicate that a model, including the ST composite, education level (COLLEGE = some college), Army component (GUARD = National Guard; RESERVE = Army Reserve) and gender (GENDER = female), accounts for about 16% of the variation in the dependent variable. This model is statistically significant ($\chi^2 = 64.255$, $P < .001$), and has moderate explanatory power (Nagelkerke $R^2 = .162$).

There is a statistically significant effect for the ST composite. The model suggests that having a higher ST composite score increases the odds of passing. At the mean ST score, an increase of one point is associated with an increase of about 9% in the odds of passing the course, and a five-point increase in ST would increase the odds of passing by 53%. There are also statistically significant effects for COLLEGE and GENDER, with increased odds of passing the course at 105% and 127% (for females), respectively.

Policy Analysis. Table 2 reports the probability that the average Soldier from the larger Army applicant population would pass the course based upon the binary logistic model. These were calculated using the formula for finding probability in a binary logistic model, which is

$$e^{(\beta' x)} / (1 + e^{(\beta' x)}).$$

The following analysis is focused upon male and female Soldiers with a high school diploma or some college education from the Regular Army. Based on the model, when the cutoff score is at its current level (ST = 92), male Soldiers with a high school diploma (the modal categories) and an average ST score (ST = 109.06) have approximately a 74% chance of passing. Currently, about 89% of Soldiers are eligible for MOS 91Q assignment at the current cutoff (ST = 92). Lowering the cutoff by five points (ST = 87) would increase eligibility by 8 percentage points (to 97%) and the average male Soldier who would qualify for training would have a somewhat lower chance of passing (71%). Raising the cutoff score by five points (ST = 97), the average male Soldier would have a somewhat higher chance of passing (77%), but eligibility would be reduced by about 11

Table 2. 91Q: Probability that a Regular Army Soldier (from the larger Army contract population) will pass the course based on the binary logistic model

	Cutoff = 82	Cutoff = 87	Cutoff = 92	Cutoff = 97	Cutoff = 102
Percent Eligible (Regular Army)	*99.8%*	*97.1%*	*89.0%*	*78.2%*	*64.9%*
Mean	*106.79*	*107.41*	*109.06*	*111.14*	*113.60*
Passing Rates:					
High School Male	69.7%	70.8%	73.6%	76.8%	80.3%
College Male	82.5%	83.2%	85.1%	87.2%	89.3%
High School Female	83.9%	84.6%	86.3%	88.3%	90.3%
College Female	91.4%	91.8%	92.8%	93.9%	95.0%

percentage points

Figure 1 shows the relationship between ST and the probability of passing for male Regular Army Soldiers by education, including upper and lower bounds based on the standard error of the estimated ST coefficient. For a particular ST score, trace a vertical line up to the curve, and then a horizontal line over to the axis to determine the corresponding probability of passing. For example, a ST score of 100 corresponds to a passing probability of about 55% for a high school educated, Regular Army male Soldier. One can see that Soldiers with a low ST score stand very little chance of passing the course. As ST scores increase, the chance that a Soldier will pass the course increases sharply. In addition, the graph illustrates that Soldiers with some college education have a noticeably better chance of passing this course.

Figure 1: Predicted Probalility of Passing: Male Soldiers

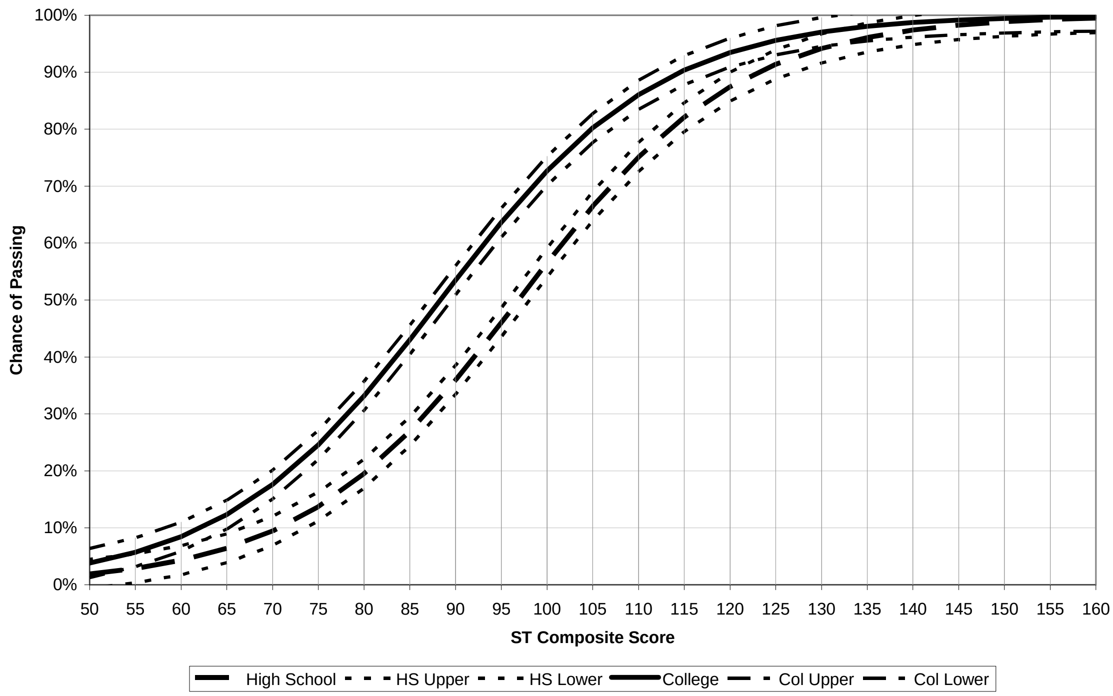


Figure 2 shows the relationship between ST and the probability of passing for high school educated Soldiers by gender, including upper and lower bounds based upon the standard error of the estimated ST coefficient. One can see that Soldiers with a low ST score stand very little chance of passing the course. As ST scores increase, the chance that a Soldier will pass the course increases sharply. In addition, the graph illustrates that female Soldiers have a noticeably better chance of passing this course.

Figure 2: Predicted Probalility of Passing: High School Soldiers

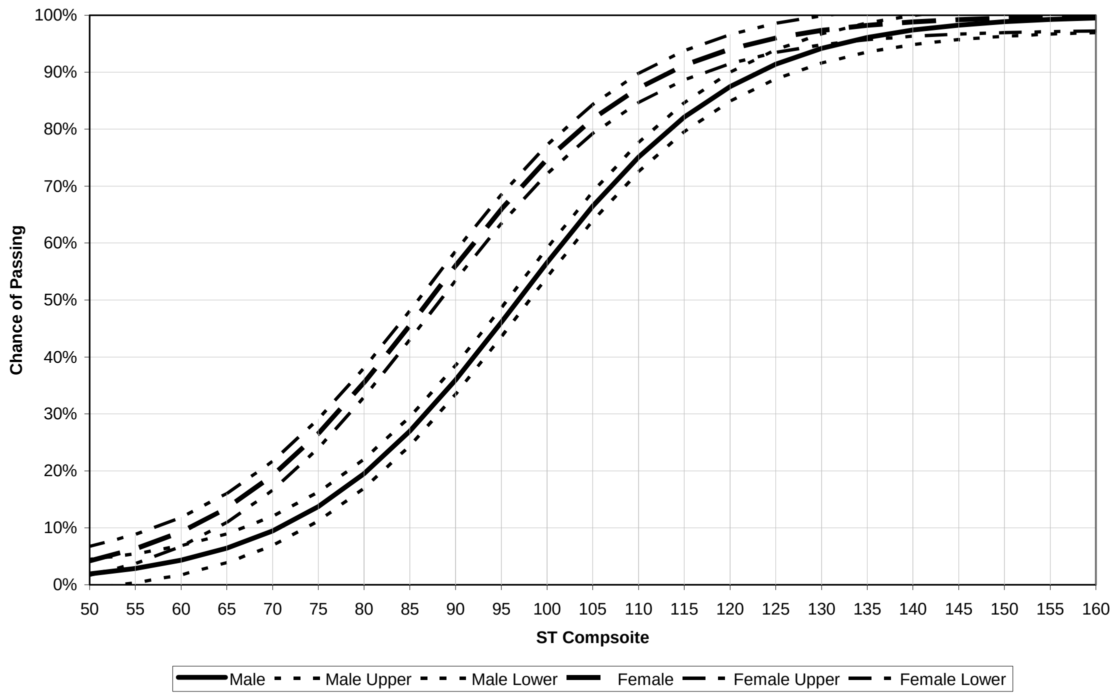
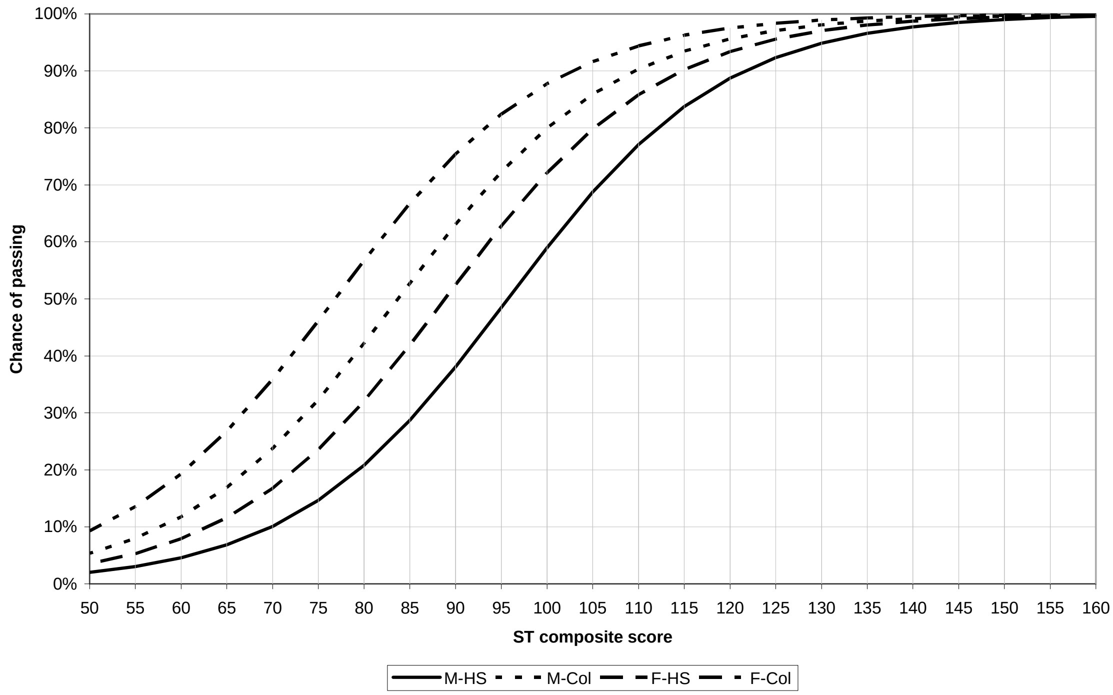


Figure 3 shows the relationship between ST and the probability of passing for Soldiers by education and gender. The graph illustrates that women with some college education have the best chance at passing the course, while high school educated males, the modal students, have the lowest chance of passing. Figure 3 also illustrates the magnitude of the effect brought about by gender and education. At the current cutoff score (ST = 92) college educated female Soldiers have more than a 30 percentage point better chance of passing the course compared to high school educated males. Even at a ST score as high as 120, college educated women still have approximately a 10 percentage point better chance of passing than high school educated males.

Figure 3: HS vs. College & Male vs. Female



Appendix: Soldier Characteristics (91Q)

Outcome	Gender: Male	Gender: Female
fail	25.3%	19.2%
pass	74.7%	80.8%

	Education Level: GED or less	Education Level: High School Diploma	Education Level: Some College or More
fail	40.0%	24.6%	11.5%
pass	60.0%	75.4%	88.5%

	Component: Regular Army	Component: Army Reserve	Component: National Guard
fail	24.0%	19.2%	23.8%
pass	76.0%	80.8%	76.2%

91R: Veterinary Food Inspection Specialist

The final sample included 507 Soldiers who were coded as either graduates or academic failures during their first AIT attempt in this MOS during a period from 2001 to 2004. Only Soldiers who graduated (94.5%) or failed for academic reasons (5.5%) were included in the analysis sample because we assume that non-completion for non-academic reasons is not related to cognitive criteria.

In the sample, most of the Soldier in MOS 91R were male (61%, 39% female), most had a high school diploma but not more education (82%, 15% some college, 2% GED or less), and most were from Regular Army (75%, 25% Army Reserve). The governing AA composite, Skilled Technical (ST), for this MOS has a cutoff score of 96; the sample mean is 105.43 (standard deviation = 8.234). See the Appendix for a description of Soldier characteristics for this MOS training sample.

Table 1. 91R: Results of the binary logistic prediction model

Chi- Square		6.524*	
Log Likelihood		210.094	
Nagelkerke R Square		.037	
Variable	Coefficient	Odds Ratio	Wald
Constant	-4.814	.008	2.162
GENDER	.338	1.402	.670
ST	.073	1.075	5.241*

* = p < .05   *** = p < .001
** = p < .01

A binary logistic regression model was estimated to explain pass/fail AIT outcomes and focused on the first training attempt. The estimation results are reported in Table 1 and indicate that a model, including the ST composite and gender (GENDER =

female), accounts for about four percent of the variation in the dependent variable[47]. This model is statistically significant ($\chi^2 = 6.524$, P = .037), with limited explanatory power (Nagelkerke $R^2 = .037$).

There is a statistically significant effect for the ST composite. The model suggests that having a higher ST composite score increases the odds of passing. At the mean ST score, an increase of one point is associated with an increase of about 8% in the odds of passing the course, and a five-point increase in ST would increase the odds of passing by 44%.

Policy Analysis. Table 2 reports the probability that the average Soldier from the larger Army contract population would pass the course based upon the binary logistic model. These were calculated using the formula for finding probability in a binary logistic model, which is

$$e^{(\beta' x)} / (1 + e^{(\beta' x)}).$$

The following analysis is focused upon male Soldiers with a high school diploma (the modal categories) from the Regular Army. Based on the model, when the cutoff score is at its current level (ST = 96), male Soldiers with a high school diploma and an average ST score (ST = 108.67) have approximately a 96% chance of passing. Currently, about 81% of Soldiers are eligible for MOS 91R assignment at the current cutoff (ST = 96). Lowering the cutoff by five points (ST = 91) would increase eligibility by ten percentage points (to 91%) and the average male Soldier who would qualify for training would have about the same chance of passing (96%). Raising the cutoff score by five points (ST =

[47] A full model was initially estimated including the ST composite, gender, level of education (i.e. some college) and Army Reserve membership. However, this model was not statistically significant ($\chi^2 = 8.079$, P = .089).

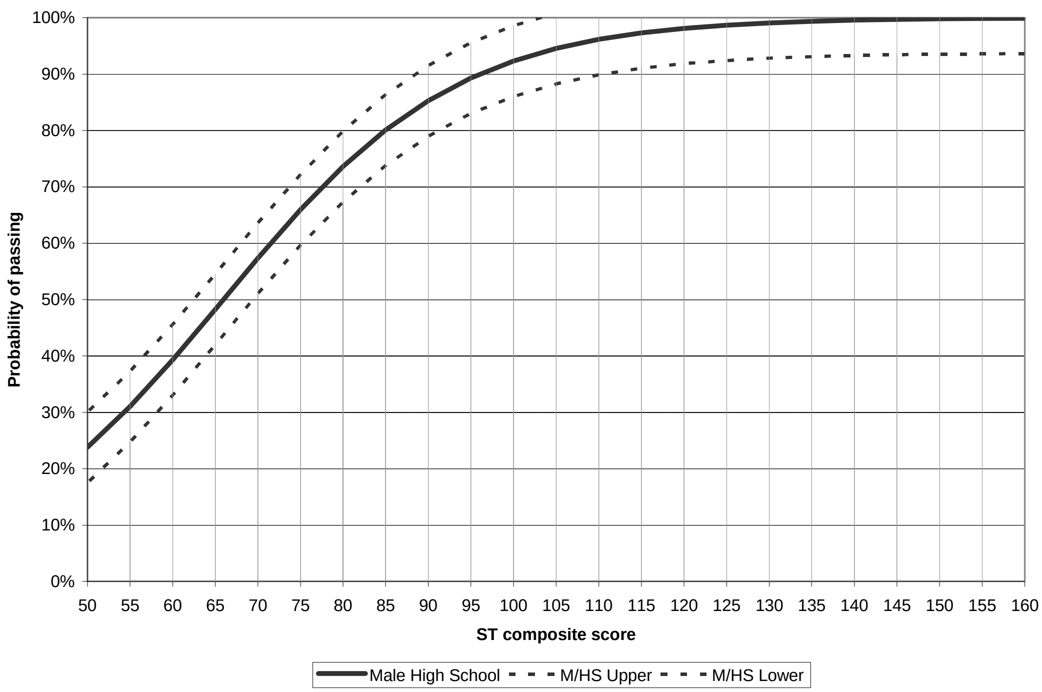
Table 2. 91R: Probability that a Regular Army Soldier (from the larger Army contract population) will pass the course based on the binary logistic model

	Cutoff = 86	Cutoff = 91	Cutoff = 96	Cutoff = 101	Cutoff = 106
Percent Eligible (Regular Army)	*98.1%*	*91.0%*	*80.5%*	*67.8%*	*52.7%*
Mean	*106.77*	*107.18*	*108.67*	*110.17*	*113.07*
Passing Rates:					
High school male	95.2%	95.3%	95.8%	*96.3%*	*96.9%*

101), the average male Soldier would have about the same chance of passing (96%) but eligibility would fall by about 13 percentage points.

Figure 1 shows the relationship between ST and the probability of passing for male Regular Army Soldiers, including upper and lower bounds based upon the standard error of the estimated ST coefficient. For a particular ST score, trace a vertical line up to the curve, and then a horizontal line over to the axis to determine the corresponding probability of passing. For example, an ST score of 100 corresponds to a passing probability of about 93% for a high school educated, Regular Army male Soldier. One can see that male Soldiers with a low ST score still have a moderate chance of passing the course. As ST scores increase, the chance that a Regular Army male Soldier will pass the course increases somewhat quickly. By the time the ST score reaches the current cutoff score (ST = 96), Soldiers already stand a good chance of passing the course.

Figure 1: Predicted Probability of Passing: Male, Regular Army



Appendix: Soldiers Characteristics (91R)

Outcome	Gender: Male	Gender: Female
fail	5.8%	5.1%
pass	94.2%	94.9%

	Education Level: GED or less	High School Diploma	Some College or More
fail	.0%	5.7%	5.1%
pass	100.0%	94.3%	94.9%

	Component: Regular Army	Army Reserve	National Guard
fail	6.5%	2.4%	.0%
pass	93.5%	97.6%	.0%

91S: Preventative Medicine Specialist

The final sample included 452 Soldiers who were coded as either graduates or academic failures during their first AIT attempt in this MOS during a period from 2001 to 2004. Only Soldiers who graduated (94.9%) or failed for academic reasons (5.1%) were included in the analysis sample because we assume that non-completion for non-academic reasons is not related to cognitive criteria.

In the sample, Soldiers in MOS 91S were almost evenly split (52% female, 48% male), most had a high school diploma but not more education (75%, 23% some college, 2% GED or less), and most were from Regular Army (64%, 15% National Guard, 21% Army Reserve). The governing AA composite, Skilled Technical (ST), for this MOS has a cutoff score of 102; the sample mean is 111.94 (standard deviation = 8.255). See the Appendix for a description of Soldier characteristics for this MOS training sample.

Table 1. 91S: Results of the binary logistic prediction model

Chi- Square		11.572**	
Log Likelihood		170.234	
Nagelkerke R Square		.076	
Variable	Coefficient	Odds Ratio	Wald
Constant	-9.763	.000	4.766**
GENDER	-0.79	.924	.032
ST	.117	1.124	7.970**

* = p < .05 *** = p < .001
** = p < .01

A binary logistic regression model was estimated to explain pass/fail AIT outcomes and focused on the first training attempt. The estimation results are reported in Table 1 and indicate that a model, including the ST composite and gender (GENDER =

female), accounts for almost eight percent of the variation in the dependent variable[48]. This model is statistically significant ($\chi^2 = 11.572$, P = .003), and has moderate explanatory power (Nagelkerke $R^2 = .076$).

There is a statistically significant effect for the ST composite. The model suggests that having a higher ST composite score increases the odds of passing. At the mean ST score, an increase of one point is associated with an increase of about 12% in the odds of passing the course, and a five-point increase in ST would increase the odds of passing by 79%.

Policy Analysis. Table 2 reports the probability that the average Soldier from the larger Army contract population would pass the course based upon the binary logistic model. These were calculated using the formula for finding probability in a binary logistic model, which is

$$e^{(\beta' x)} / (1 + e^{(\beta' x)}).$$

The following analysis is focused upon male Soldiers with a high school diploma from the Regular Army. Based on the model, when the cutoff score is at its current level (ST = 102), male Soldiers with a high school diploma and an average ST score (ST = 113.60) have approximately a 97% chance of passing. Currently, about 65% of Soldiers are eligible for MOS 91S assignment at the current cutoff (ST = 102). Lowering the cutoff by five points (ST = 97) would increase eligibility by 13 percentage points (to 78%) and the average male Soldier who would qualify for training would have about the same chance of passing (96%). Raising the cutoff score by five points (ST = 107), the average

[48] Variables for education status (GED or less, and some college) and Army component (National Guard or Army Reserve membership) were excluded because there were an insufficient number of failures in each variable category from which to make reliable estimates.

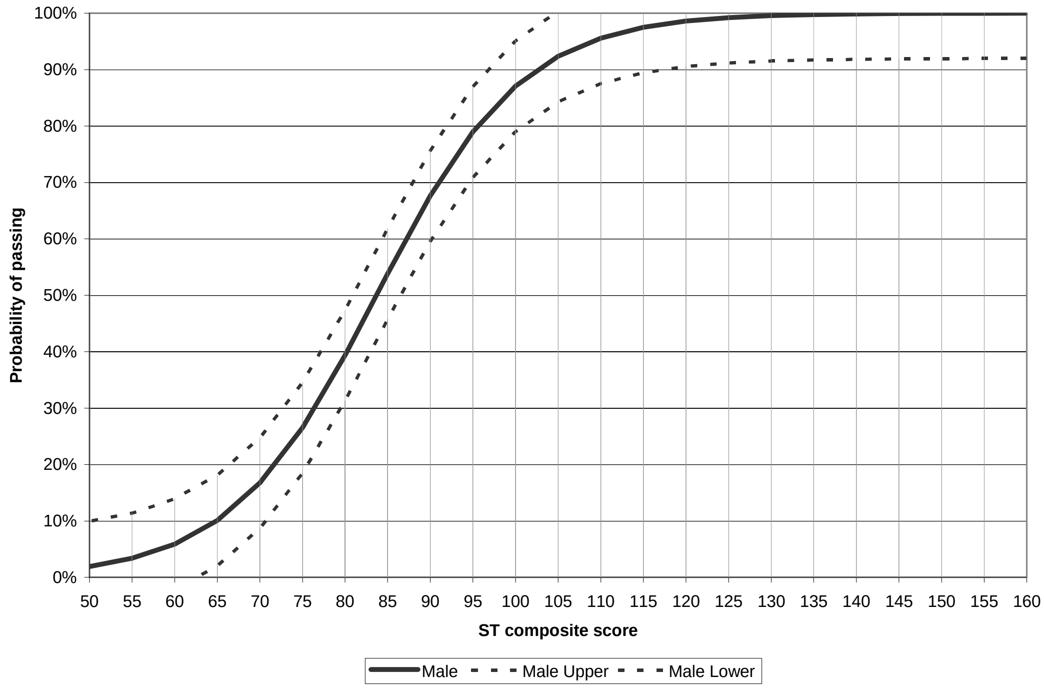
Table 2. 91S: Probability that a Regular Army Soldier (from the larger Army contract population) will pass the course based on the binary logistic model

	Cutoff = 92	Cutoff = 97	Cutoff = 102	Cutoff = 107	Cutoff = 112
Percent Eligible (Regular Army)	*89.0%*	*78.2%*	*64.9%*	*49.6%*	*34.7%*
Mean	109.06	111.14	113.60	116.55	119.83
Passing Rates:					
High School Male	95.1%	96.1%	97.1%	97.9%	98.6%

male Soldier would have about the same chance of passing (98%) but eligibility would fall by about 15 percentage points.

Figure 1 shows the relationship between ST and the probability of passing for male Regular Army Soldiers, including upper and lower bounds based upon the standard error of the estimated ST coefficient. For a particular ST score, trace a vertical line up to the curve, and then a horizontal line over to the axis to determine the corresponding probability of passing. For example, an ST score of 100 corresponds to a passing probability of about 87% for a high school educated, Regular Army male Soldier. One can see that male Soldiers with a low ST score have a low chance of passing the course. As ST scores increase, the chance that a Regular Army male Soldier will pass the course increases somewhat quickly. By the time the ST score reaches the current cutoff score (ST = 96), male Soldiers already stand a good chance of passing the course.

Figure 1: Predicted Probability of Passing: Male Regular Army



Appendix: Soldier Characteristics (91S)

Outcome	Gender: Male	Gender: Female
fail	4.2%	5.9%
pass	95.8%	94.1%

	Education Level: GED or less	Education Level: High School Diploma	Education Level: Some College or More
fail	9.1%	6.2%	1.0%
pass	90.9%	93.8%	99.0%

	Component: Regular Army	Component: Army Reserve	Component: National Guard
fail	6.2%	2.1%	4.5%
pass	93.8%	97.9%	95.5%

91T: Animal Care Specialist

The final sample included 376 Soldiers who were coded as either graduates or academic failures during their first AIT attempt in this MOS during a period from 2001 to 2004. Only Soldiers who graduated (86.2%) or failed for academic reasons (13.8%) were included in the analysis sample of 376 Soldiers because we assume that non-completion for non-academic reasons is not related to cognitive criteria.

Most of the Soldiers in MOS 91T were female (65%, 35% male), most had a high school diploma but not more education (81%, 19% some college, <1% GED or less), and most were from Regular Army (86%, 14% Army Reserve). The governing AA composite, Skilled Technical (ST), for this MOS has a cutoff score of 92; the sample mean is 111.95 (standard deviation = 9.279). See Appendix for a description of Soldier characteristics for this MOS training sample.

A binary logistic regression model was estimated to explain pass/fail AIT outcomes and focused on the first training attempt. The estimation results are reported in

Table 1. 91T: Results of the binary logistic prediction model

Chi- Square		47.263***	
Log Likelihood		254.937	
Nagelkerke R Square		.214	
Variable	Coefficient	Odds Ratio	Wald
Constant	-13.097	.000	28.034***
GENDER	.690	1.994	4.176*
ST	.134	1.143	34.194***

* = p < .05 *** = p < .001
** = p < .01

Table 1 and indicate that a model, including the ST composite and gender (GENDER = female), accounts for about 21 percent of the variation in the dependent variable. This model is statistically significant ($\chi^2 = 47.263$, $P < .001$), and it has moderate explanatory power (Nagelkerke $R^2 = .214$).

There is a statistically significant effect for the ST composite. The model suggests that having a higher ST composite score increases the odds of passing. At the mean ST score, an increase of one point is associated with an increase of about 14% in the odds of passing the course, and a five-point increase in ST would increase the odds of passing by 95%. The model also suggests that females have increased odds of passing the course (100% greater than males).

Policy Analysis. Table 2 and Figure 1 report the probability that the average Soldier from the larger successful applicant population would pass the course based upon the binary logistic model. These were calculated using the formula for finding probability in a binary logistic model, which is

$$e^{(\beta' x)} / (1 + e^{(\beta' x)}).$$

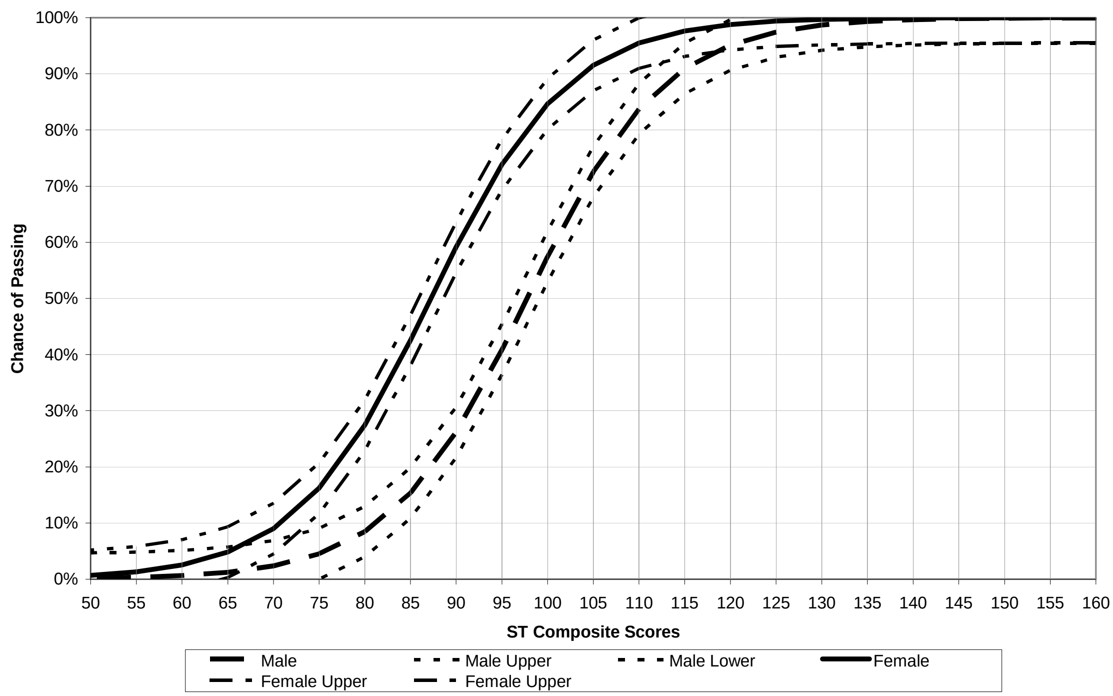
The following analysis is focused upon Soldiers with a high school diploma from the Regular Army. Based on the model, when the cutoff score is at its current level (ST = 92), male Soldiers with a high school diploma and an average ST score (ST = 109.06) have approximately an 82% chance of passing; female soldiers have a 95% chance of passing. Currently, about 89% of Soldiers are eligible for MOS 91T assignment at the current cutoff (ST = 92). Lowering the cutoff by five points (ST = 87) would increase eligibility by 8 percentage points (to 97%) while the average male Soldier who would qualify for training would have a somewhat lower chance of passing (79%); the average female Soldier would have the same passing rate (94%) as at the current cutoff. Raising the cutoff score by five points (ST = 97), the average qualifying male and female Soldiers would have slightly higher chances of passing but eligibility would fall by 11 percentage points.

Table 2. 91T: Probability that a Soldier (from the larger Army contract population) will pass the course based on the binary logistic model

	Cutoff = 82	Cutoff = 87	Cutoff = 92	Cutoff = 97	Cutoff = 102
Percent Eligible (Regular Army)	*99.8%*	*97.1%*	*89.0%*	*78.2%*	*64.9%*
Mean	*106.79*	*107.41*	*109.06*	*111.14*	*113.60%*
Passing Rates:					
Male	77.1%	78.5%	82.0%	85.8%	89.3%
Female	93.2%	93.7%	94.9%	96.1%	97.2%

Figure 1 shows the relationship between ST and the probability of passing for male and female Regular Army Soldiers, including upper and lower bounds based upon the standard error of the estimated ST coefficient. For a particular ST score, trace a vertical line up to the curve, and then a horizontal line over to the axis to determine the corresponding probability of passing. For example, a ST score of 100 corresponds to a passing probability of about 85% for a high school educated, Regular Army female Soldier. One can see that male Soldiers with a low ST score have a low chance of passing the course. As ST scores increase, the chance that a Regular Army Soldier will pass the course increases somewhat quickly. Figure 1, also demonstrates that the chance of a female Soldier passing increase more quickly than that of a male Soldier leading to a large difference at the current cutoff score (ST = 92), where female Soldiers have over a 30% better chance of passing the course than males.

Figure 1: Predicted Probability of Passing: Regular Army Soldiers with a High School Diploma



Appendix: Soldier Characteristics (91T)

Outcome	Gender: Male	Gender: Female
fail	16.2%	12.6%
pass	83.8%	87.4%

	Education Level: GED or less	Education Level: High School Diploma	Education Level: Some College or More
fail	.0%	16.4%	2.8%
pass	100.0%	83.6%	97.2%

	Component: Regular Army	Component: Army Reserve	Component: National Guard
fail	15.8%	1.9%	.0%
pass	84.2%	98.1%	.0%

91W: Health Care Specialist

The final sample included 10,972 Soldiers who were coded as either graduates or academic failures during their first AIT attempt for this MOS during a period from 2001 to 2004. Only Soldiers who graduated (85.7%) or failed for academic reasons (14.3%) were included in the analysis sample of 10,972 Soldiers because we assume that non-completion for non-academic reasons is not related to cognitive criteria.

In the sample, most were male (74%, 26% female), most had a high school diploma but not more education (80%, 17% some college, 3% GED or less), and most were from were from the Regular Army (65%, 19% National Guard, 16% Reserve). The governing AA composites, Skilled Technical (ST) and General Technical (GT), for this MOS have cutoff scores of 102 and 110 respectively; the sample mean is 115.46 (standard deviation = 8.730) for ST and 116.43 (standard deviation = 7.989) for GT. The ST and GT composites are correlated at the .826 level ($p < .001$). See the Appendix for a description of Soldier characteristics for this MOS training sample.

Model Estimation. A binary logistic regression model was estimated to explain pass/fail AIT outcomes and focused on the first training attempt. The estimation results are reported in Table 1 and indicate that the stepwise model[49], including the ST composite, education level (COLLEGE = some college), Army component (GUARD = National Guard; RESERVE = Army Reserve), and gender (GENDER = female), accounts for about 14 percent of the variation in the dependent variable. This model is statistically significant

[49] Initially we estimated a model including ST, GT, GED, COLLEGE, GUARD, RESERVE, and GENDER. This is reported in the Appendix (Table 1a). In that model the coefficient for GT is negative, very small, and non-significant. Given the correlation between ST and GT, such an effect can be indicative of collinearity. The stepwise model retained ST while excluding GT, and thus confirmed this presumption.

Table 1. 91W: Results of the forward stepwise binary logistic prediction model			
Chi- Square		876.763***	
Log Likelihood		8114.123	
Nagelkerke R Square		.137	
Variable	Coefficient	Odds Ratio	Wald
Constant	-9.613	.000	385.898***
COLLEGE	.613	1.846	39.146***
RESERVE	.531	1.700	38.879***
GUARD	.856	2.354	83.340***
GENDER	.481	1.618	48.914***
ST	.097	1.102	500.069***

* = p < .05   *** = p < .001
** = p < .01

(χ^2 =876.763, P < .001), and has moderate explanatory power (Nagelkerke R^2 = .137).

There is a statistically significant effect for the ST composite.[50] The model suggests that having a higher ST composite score increases the odds of passing. At the mean ST score, an increase of one point is associated with an increase of about 10% in the odds of passing the course, and a five-point increase in ST would increase the odds of passing by 62%. There are also statistically significant effects for COLLEGE, GUARD, RESERVE, and GENDER, with increased odds of passing the course at 85%, 135%, 70%, and 62% (for females), respectively.

<u>Policy Analysis.</u> Table 2 reports the probability that the average Soldier from the larger Army contract population would pass the course based upon the binary logistic model. These were calculated using the formula for finding probability in a binary logistic model, which is

[50] There is also a statistically significant effect for the GT composite when inserted in place of the ST composite. See the Appendix (Table 1b).

$$e^{(\beta' x)} / (1 + e^{(\beta' x)}).$$

The following analysis is focused upon male and female Soldiers with a high school diploma or some college education from the Regular Army. Based on the model, when the cutoff score is at its current level (ST = 102, GT = 110), male Soldiers with a high school diploma (the modal categories) and an average ST score (ST = 118.12) have approximately an 86% chance of passing. Currently, about 33% of Soldiers are eligible for MOS 91W assignment at the current cutoff (ST = 102, GT = 110). Lowering the cutoff by five points (ST = 97, GT = 105) would increase eligibility by 14 percentage points (to 47%) and the average male Soldier who would qualify for training would have a slightly lower chance of passing (83%). Raising the ST cutoff score by five points and keeping GT at its current level (ST = 107, GT = 110) leads to only small increases in passing rates, and would reduce eligibility by almost five percentage points.

Table 2. 91W: Probability that a Regular Army Soldier (from the larger successful applicant population) will pass the course based on the binary logistic model

	Cutoff: ST = 92 GT = 100	Cutoff: ST = 97 GT = 105	Cutoff ST = 102 GT = 110	Cutoff ST = 107 GT = 110	Cutoff ST = 112 GT = 110
Percent Eligible (Regular Army)	*65.1%*	*47.2%*	*32.7%*	*28.2%*	*22.7%*
Mean	*112.43*	*115.24*	*118.12*	*119.46*	*121.32*
Passing Rates:					
High School Male	78.5%	82.7%	86.3%	87.8%	89.6%
College Male	87.1%	89.8%	92.1%	93.0%	94.1%
High School Female	85.5%	88.6%	91.1%	92.1%	93.3%
College Female	91.6%	93.5%	95.0%	95.6%	96.3%

Figure 1 shows the relationship between ST and the probability of passing for male Regular Army Soldiers by education, including upper and lower bounds based upon the standard error of the estimated ST coefficient. For a particular ST score, trace a vertical line up to the curve, and then a horizontal line over to the axis to determine the corresponding probability of passing. For example, an ST score of 100 corresponds to a passing probability of about 50% for a high school educated, Regular Army male Soldier. One can see that Soldiers with a low ST score stand very little chance of passing the course. As ST scores increase, the chance that a Soldier will pass the course increases sharply. In addition, the graph illustrates that Soldiers with some college education have a noticeably better chance of passing this course.

Figure 1: Predicted Probability of Passing: Male Soldiers

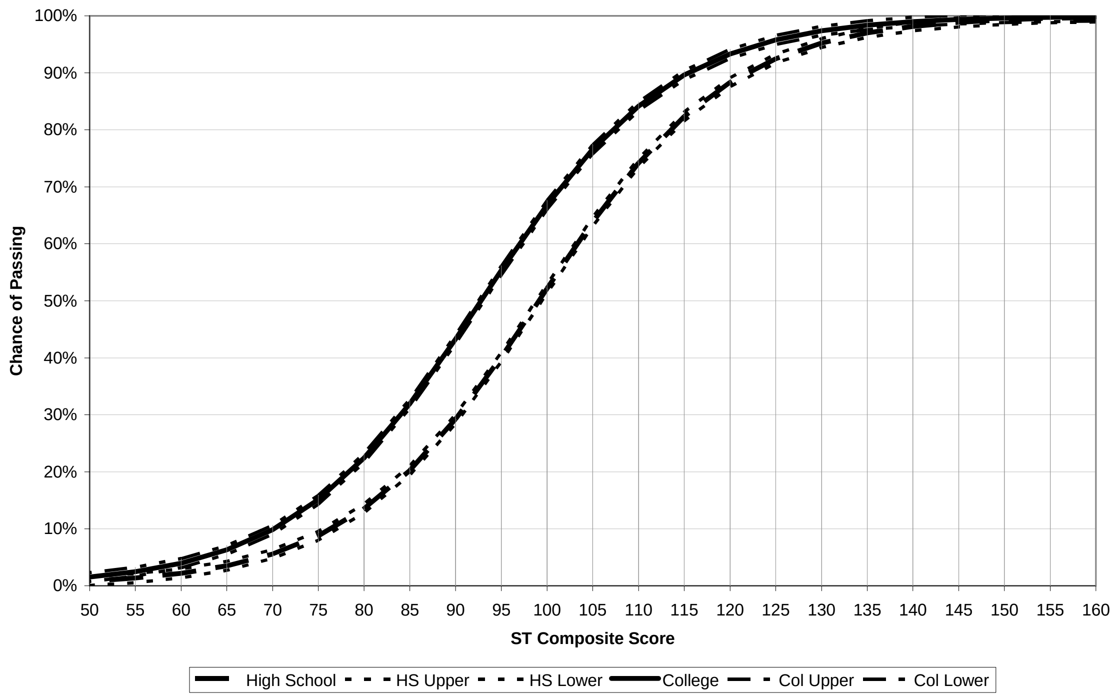


Figure 2 shows the relationship between ST and the probability of passing for high school educated Soldiers by gender, including upper and lower bounds based upon the standard error of the estimated ST coefficient. The graph illustrates that female Soldiers have a noticeably better chance of passing this course.

Figure 2: Predicted Probability of Passing: High School Soldiers

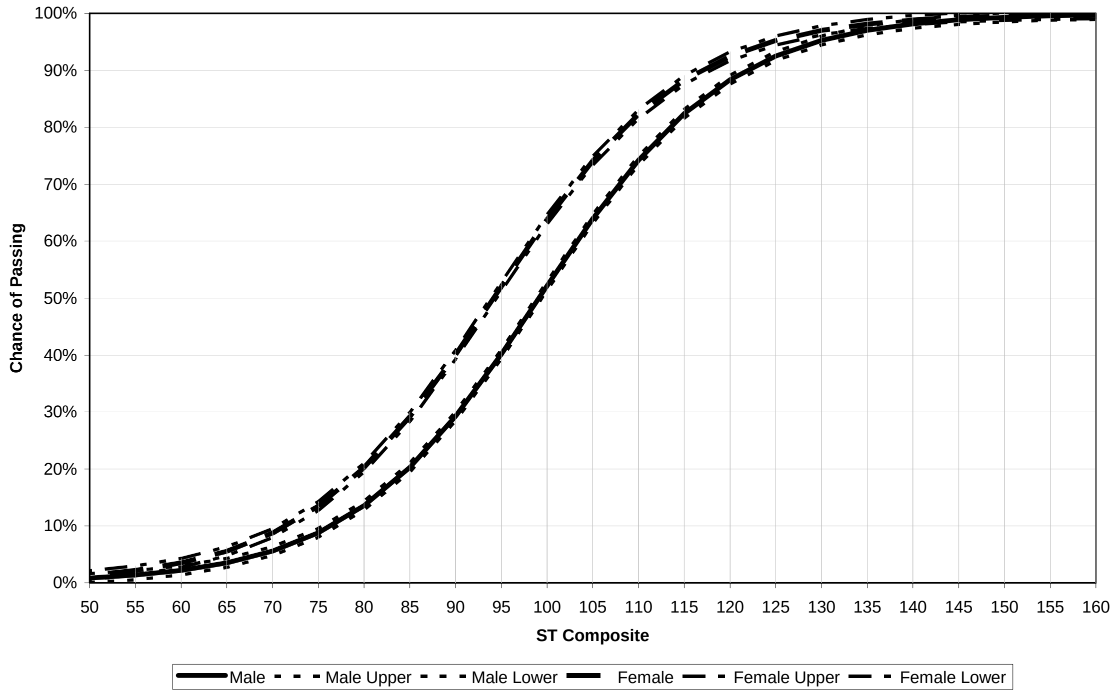
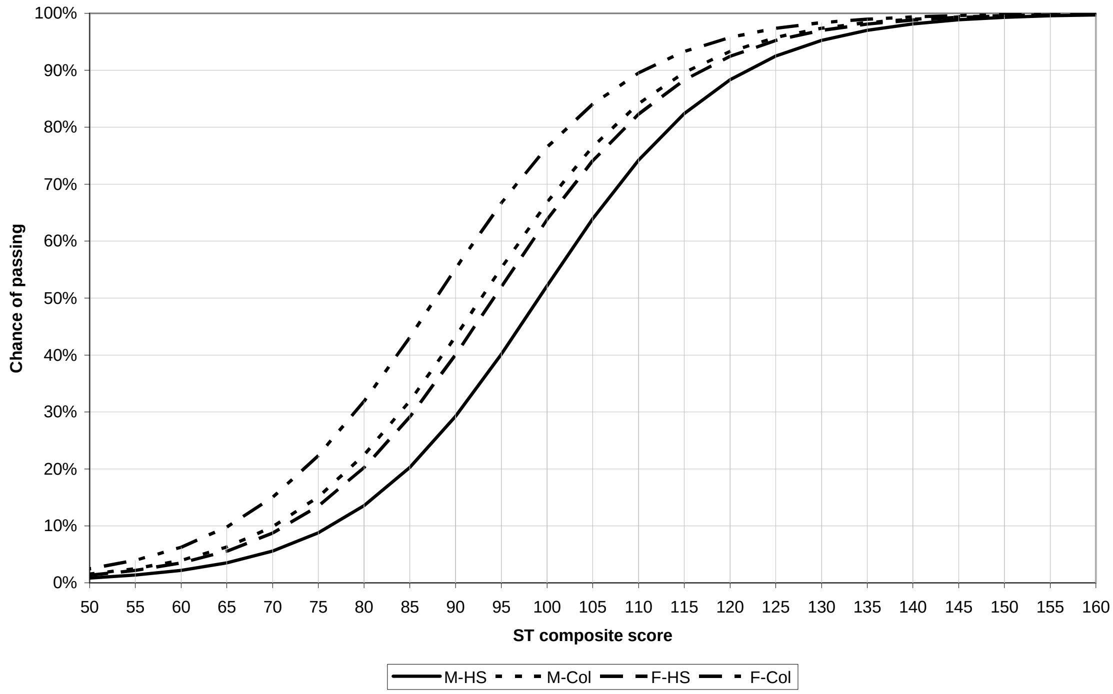


Figure 3 shows the relationship between ST and the probability of passing for Soldiers by education and gender. The graph illustrates that women with some college education have the best chance at passing the course, while high school educated males, the modal students, have the lowest chance of passing. Figure 3 also illustrates the magnitude of the effect brought about by gender and education. At the current cutoff score (ST = 102) college educated female Soldiers have more than a 30 percentage point better chance of passing the course compared to high school educated males. Even at an ST score as high as 120, college educated women still have approximately a 25 percentage point better chance of passing than high school educated males.

Figure 3: HS vs. College & Male vs. Female



Testing a Central Assumption of the Approach

Central to our approach has been the estimation of model parameters using only academic passes and failure cases – we specifically exclude failure cases that have been identified with non-academic reasons for failure. In doing so we assume that non-completion for non-academic reasons is not related to cognitive criteria. In this section we report on efforts to examine the reasonableness of this assumption.

When we include non-academic failure cases in the data sample, we would expect the goodness-of-fit to deteriorate and to see smaller predicted composite effects, if higher scoring Soldiers predominate in these "additional" cases. Alternatively, if lower scoring Soldiers predominate in these cases, it is possible to see little or no deterioration in the fit of the model. In Table 3 we present the regression model results when an additional 2,962 non-academic failure cases are included in the analysis sample (for a total of 13,934 cases). There is a clear deterioration in the explanatory power of the model: the

Table 3. 91W: Results of the forward stepwise binary logistic prediction model including both academic and non-academic failure cases

Chi- Square		605.195***	
Log Likelihood		16965.570	
Nagelkerke R Square		.059	
Variable	Coefficient	Odds Ratio	Wald
Constant	-3.773	.023	136.642***
GED	-.610	.543	40.320***
COLLEGE	.266	1.305	24.801***
RESERVE	.350	1.420	44.422***
GUARD	.681	1.975	152.199***
ST	.048	1.050	153.759***
GT	-.011	.989	5.990*

* = p < .05   ** = p < .01   *** = p < .001

Nagelkerke R^2 declines from 0.137 in the original sample to .059 in the augmented sample. In addition, the ST effect in this data sample is considerably weaker than in the original sample (1.050 versus 1.102).

An even more extreme comparison might be between the original sample and a sample utilizing only the non-academic failure cases – i.e., to replace the academic failure cases in the original sample with non-academic failure cases. The hypothesis is that the latter bring increased randomness to the data set, and that the resulting regression model will not fit as well, and the estimated governing composite effects will be weaker. In Table 4 we present the regression model results when only non-academic failure cases are included (along with academic pass cases). This data sample has a total of 12,369 observations. We find even greater deterioration in the explanatory power of the model: the Nagelkerke R^2 in the "non-academic failure" sample model is only about one-fifth that of the original sample model (.026 versus .137). In addition, the ST composite effect is considerably weaker – 1.029 for the sample including non-academic failures compared to 1.102 for the original sample.

Table 4. 91W: Results of the forward stepwise binary logistic prediction model including non-academic failures only

Chi- Square		220.239***	
Log Likelihood		13397.234	
Nagelkerke R Square		.026	
Variable	Coefficient	Odds Ratio	Wald
Constant	-.341	.711	.983
GED	-.785	.456	58.010***
COLLEGE	.155	1.168	6.897**
GUARD	.585	1.795	86.679***
RESERVE	.262	1.300	19.324***
GENDER	-.117	.890	5.552*
ST	.028	1.029	35.915***
GT	-.016	.984	9.906**

* = p < .05 ** = p < .01 *** = p < .001

Appendix: Additional Regression Models

Table 1a. 91W: Results of the binary logistic prediction model including all variables

Chi- Square		876.979***	
Log Likelihood		8113.906	
Nagelkerke R Square		.137	
Variable	Coefficient	Odds Ratio	Wald
Constant	-9.509	.000	309.804***
GED	-0.35	.965	.040
COLLEGE	.614	1.847	39.114***
GUARD	.858	2.359	81.683***
RESERVE	.532	1.703	37.263***
GENDER	.484	1.623	48.938***
ST	.099	1.104	249.175***
GT	-.003	.997	.190

* = p < .05 *** = p < .001
** = p < .01

Table 1b. 91W: Results of the binary logistic prediction model excluding ST

Chi- Square		605.028***	
Log Likelihood		8385.857	
Nagelkerke R Square		.096	
Variable	Coefficient	Odds Ratio	Wald
Constant	-6.727	.001	183.587***
GED	.074	1.077	.178
COLLEGE	.738	2.092	57.405***
GUARD	.966	2.626	104.868***
RESERVE	.586	1.797	45.871***
GENDER	.191	1.211	8.295**
GT	.071	1.073	267.945***

* = p < .05 *** = p < .001
** = p < .01

Appendix: Soldier Characteristics (91W)

Outcome	Gender: Male	Gender: Female
fail	14.6%	13.2%
pass	85.4%	86.8%

	Education Level: GED or less	Education Level: High School Diploma	Education Level: Some College or More
fail	13.3%	15.8%	7.2%
pass	86.7%	84.2%	92.8%

	Component: Regular Army	Component: Army Reserve	Component: National Guard
fail	17.2%	10.6%	7.1%
pass	82.8%	89.4%	92.9%

91W Risk Analysis of Policy Alternatives

In this section we extend the policy analysis with a risk analysis of the policy alternatives considered using simulation methods. We employ the "@RISK" software package which is designed as an add-in for Microsoft Excel.[51] There are four steps in the risk analysis.

The first step is developing a model. A regression model for predicting the passing rate has been specified and estimated, and the results stored in Excel worksheet format. See Table 1.

The second step is identifying the uncertainty inherent in both the input variables (composite scores, Soldier characteristics) and the corresponding estimated parameters and specifying their possible values with probability distributions.

To approximate the governing composite distribution, we use the larger Army contract population (EAF file: those who contracted from Jan 1992 to Aug 2003). This distribution can be assumed to follow a normal distribution. The mean and standard deviation estimated from the contract population and used as input to the simulations are shown in Table R-1 (before truncation).

Table R-1. Input information for the simulations

	Mean	Std error / deviation
Constant	-9.609	.490
ST var	117.13 (before truncation, but conditioned on GT >= 110	9.133
ST coeff	.097	.004
GENDER var	26.0% (female)	
GENDER coeff	.481	.069
GED var	3.3%	
GED coeff	-.028	.174
COLLEGE var	17.1%	
COLLEGE coeff	.612	.098
RESERVE var	16.6%	
RESERVE coeff	.534	.087
GUARD var	18.7%	
GUARD coeff	.858	.095

[51] Software is available from Palisade Corporation, Newfield, NY.

To approximate the distributions for the demographic variables (GENDER, GED, COLLEGE, RESERVE, and GUARD) we rely on the training data sample used to estimate the regression model. These distributions can be assumed to follow binomial distributions with means estimated from the training data sample as shown in Table R-1.

To approximate the distributions for the estimated parameters in the logit model, we note that, under very general conditions, the estimates will be asymptotically normally distributed.[52] The estimated coefficients (means and standard errors) are shown in Table R-1.

The third step is analyzing the model with simulation to determine the range and probabilities of all possible training outcome results. The results reported represent the simulation of the regression prediction equation for 1000 iterations using a fixed seed.[53] The comparisons are between the baseline case (ST = 102) and the policy cases (ST = 97 and ST = 107). These cases are delineated by the cutoff score level which serves as the lower truncation point in the governing composite input distribution. The simulation results in Table R-2 describe the effect on the mean probability of passing as the ST cutoff score level is varied, and represent an improvement of the policy analysis presented in Table 2 because they reflect the simultaneous effects of all known sources of uncertainty.

Table R-2. 91W simulation results

	ST = 97 GT = 105	ST = 102 GT = 110	ST = 107 GT = 110
Mean governing composite	115.38	118.10	119.40
Mean probability of passing	83.0%	86.2%	87.8%
Std deviation	13.4%	11.9%	10.2%

The frequency distributions of simulated effects are shown below in the histogram graphs. The histogram portrays the full range of outcomes that average to the mean effect as reported. Looking at the histogram for the baseline case (ST = 102), probability of passing is plotted on the horizontal axis and the height of each bar indicates the relative number of Soldiers at that passing probability. The information in the histograms is effectively summarized in Table R-3. In that table we see the percentage of Soldiers

52 The intuition is that logit estimates are derived from maximum likelihood (ML) estimation, and under fairly general conditions ML estimates are consistent and asymptotically normally distributed.

53 Latin Hypercube (LH) sampling is utilized in drawing samples for the input distributions. It is designed to accurately recreate the input distribution through sampling in fewer iterations when compared with the Monte Carlo method. The key to LH sampling is stratification of the input probability distributions.

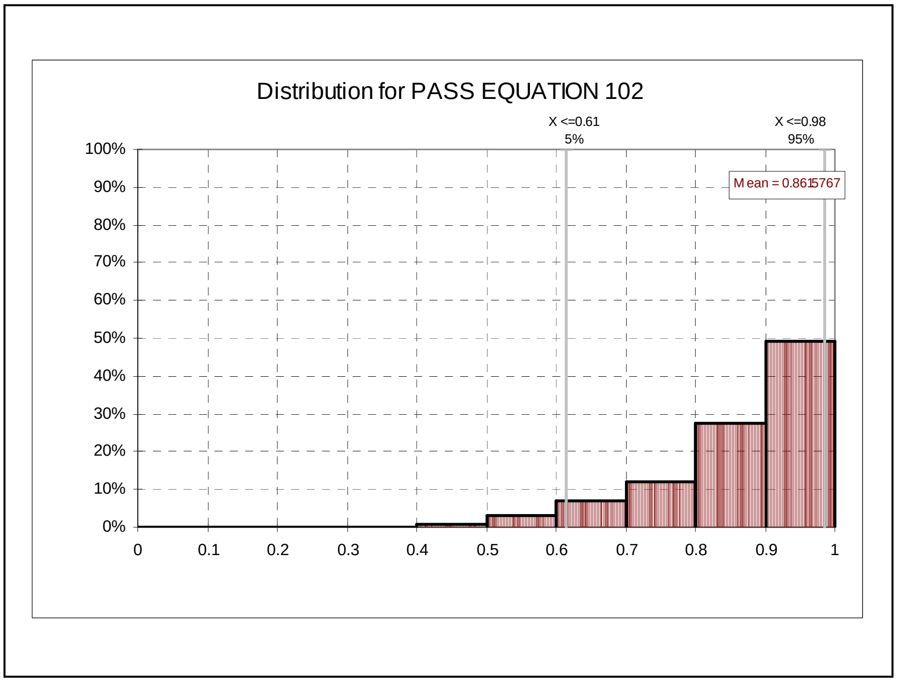
that meet or exceed a given chance of passing. For example, looking at the baseline case (ST = 102), about 88% of Soldiers have a 70% or greater chance of passing.

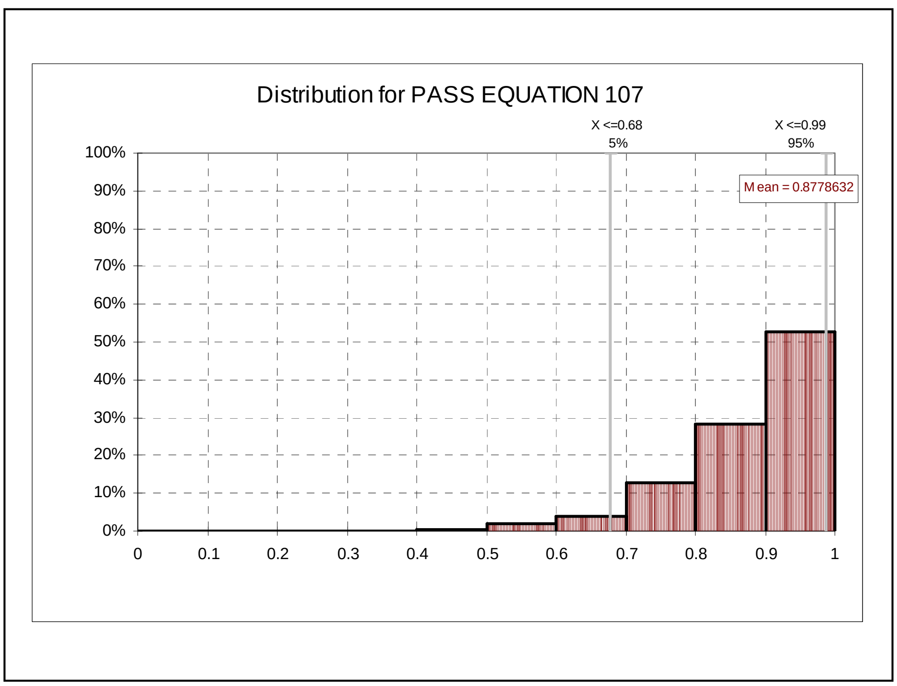
Table R-3.
Percent of simulated Soldiers that meet or exceed given chance of passing

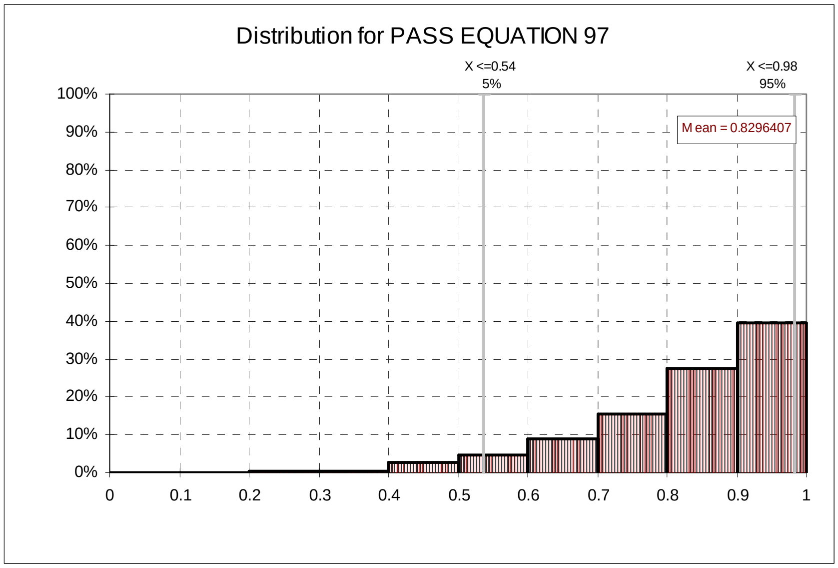
Chance of passing	ST = 97	ST = 102	ST = 107
95.0%	19.3%	26.9%	27.1%
90.0%	39.6%	46.5%	52.7%
85.0%	55.1%	62.1%	69.2%
80.0%	67.4%	74.6%	80.9%
75.0%	77.0%	81.9%	88.8%
70.0%	82.9%	87.5%	93.7%
65.0%	87.8%	92.0%	96.4%
60.0%	91.9%	94.2%	97.5%
55.0%	94.2%	96.3%	98.7%
50.0%	96.4%	98.1%	99.5%

We find that the mean probability of passing in the simulation is 86% (Table R-2, baseline). Looking at the histograms, we see the largest portion of Soldiers in the highest range of passing scores, and the remainder distributed in a stair step into the middle range. We note that the mean simulated passing probability turns out to be about the same as the static prediction at the mean ST score (Table 2). In the simulated predictions we are calculating an average over all Soldiers and taking into account all sources of uncertainty, whereas in the static prediction we are calculating the probability of passing only at the mean ST score, ignoring the distribution of Soldier scores etc. as well as uncertainty. While recognizing this variability is important, we also note that the policy case impacts relative to the baseline are the same in both simulation and static prediction modes.

The fourth step is making a decision based on the results provided and the preferences of the school proponent. This involves the evaluation by the school proponent of the tradeoff between increased eligibility and reduced passing probabilities (and vice-versa).


Distribution for PASS EQUATION 102
X <=0.61
5%
X <=0.98
95%
Mean = 0.8615767
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1


Distribution for PASS EQUATION 107
X <=0.68
5%
X <=0.99
95%
Mean = 0.8778632
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1



Distribution for PASS EQUATION 97
X <=0.54
5%
X <=0.98
95%
Mean = 0.8296407
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1

91X: Mental Health Specialist

The final sample included 678 Soldiers who were coded as either graduates or academic failures during their first AIT attempt for this MOS during a period from 2001 to 2004. Only Soldiers who graduated (84.3%) or failed for academic reasons (15.7%) were included in the analysis sample of 678 Soldiers because we assume that non-completion for non-academic reasons is not related to cognitive criteria.

In the sample, most were male (55%, 45% female), most had a high school diploma but not more education (69%, 29% some college, 2% GED or less), and most were from were from the Regular Army (55%, 7% National Guard, 38% Reserve). The governing AA composite, Skilled Technical (ST)), for this MOS has a cutoff score of 102; the sample mean is 112.90 (standard deviation = 10.227). See the Appendix for a description of Soldier characteristics for this MOS training sample.

A binary logistic regression model was estimated to explain pass/fail AIT outcomes and focused on the first training attempt. The estimation results are reported in

Table 1. 91X: Results of the forward stepwise binary logistic prediction model

Chi- Square		66.845***	
Log Likelihood		524.415	
Nagelkerke R Square		.161	
Variable	Coefficient	Odds Ratio	Wald
Constant	-5.920	.003	11.652**
GED	-.179	.836	.065
COLLEGE	1.331	3.786	16.203***
RESERVE	.554	1.740	5.233*
GUARD	.891	2.437	2.933
GENDER	1.294	3.647	26.314***
ST	.059	1.061	14.725**

* = p < .05   *** = p < .001
** = p < .01

Table 1 and indicate that the model, including the ST composite, education level (GED = GED or less, COLLEGE = some college), Army component (GUARD = National Guard; RESERVE = Army Reserve) and gender (GENDER = female), accounts for about 16 percent of the variation in the dependent variable. This model is statistically significant ($\chi^2 = 66.845$, $P < .001$), and has moderate explanatory power (Nagelkerke $R^2 = .161$).

There is a statistically significant effect for the ST composite. The model suggests that having a higher ST composite score increases the odds of passing. At the mean ST score, an increase of one point is associated with an increase of about 6% in the odds of passing the course, and a five-point increase in ST would increase the odds of passing by 34%. There are also statistically significant effects for COLLEGE, RESERVE, and GENDER, with increased odds of passing the course at 279%, 74%, and 265% (for females), respectively.

Policy Analysis. Table 2 reports the probability that the average Soldier from the larger Army contract population would pass the course based upon the binary logistic model. These were calculated using the formula for finding probability in a binary logistic model, which is

$$e^{(\beta' x)} / (1 + e^{(\beta' x)}).$$

The following analysis is focused upon male and female Soldiers with a high school diploma or some college education from the Regular Army. When the cutoff score is at its current level (ST = 102), male (female) Soldiers with a high school diploma (the modal categories) and an average ST score (ST = 113.60) have approximately a 69% (89%) chance of passing. Currently, about 65% of Soldiers are eligible for MOS 91X assignment at the current cutoff (ST = 102). Lowering the cutoff by five points (ST = 97) would increase eligibility by 13 percentage points (to 78%) and the average male (female) Soldier who would qualify for training would have a somewhat lower chance of passing (65%) (87%). Raising the cutoff score by five points (ST = 107), the average male (female) Soldier would have a somewhat higher chance of passing (72%) (91%), but eligibility would fall by about 15 percentage points.

Table 2. 91X: Probability that a Regular Army Soldier (from the larger Army contract population) will pass the course based on the binary logistic model

	Cutoff: ST = 92	Cutoff: ST = 97	Cutoff ST = 102	Cutoff ST = 107	Cutoff ST = 112
Percent Eligible (Regular Army)	*89.0%*	*78.2%*	*64.5%*	*49.6%*	*34.7%*
Mean	*109.06*	*111.14*	*113.60*	*116.55*	*119.83*
Passing Rates:					
High School Male	62.6%	65.4%	68.6%	72.2%	76.0%
College Male	86.4%	87.7%	89.2%	90.8%	92.3%
High School Female	85.9%	87.3%	88.9%	90.5%	92.0%
College Female	95.8%	96.3%	96.8%	97.3%	97.8%

Figure 1 shows the relationship between ST and the probability of passing for male Regular Army Soldiers by education, including upper and lower bounds based upon the standard error of the estimated ST coefficient. Far a particular ST score, trace a vertical line up to the curve, and then a horizontal line over to the axis to determine the corresponding probability of passing. For example, an ST score of 100 corresponds to a passing probability of about 50% for a high school educated, Regular Army male Soldier. One can see that Soldiers with a low ST score stand very little chance of passing the course. As ST scores increase, the chance that a Soldier will pass the course increases gradually. In addition, the graph illustrates that Soldiers with some college education have a noticeably better chance of passing this course.

Figure 1: Predicted Probability of Passing: Male Soldiers

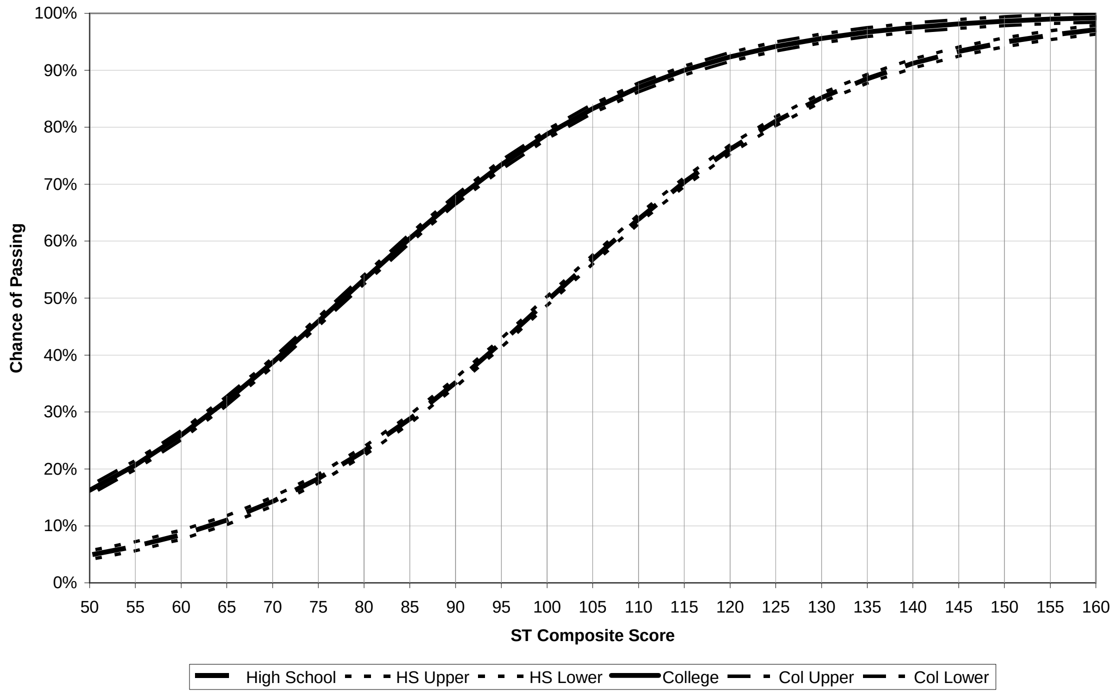


Figure 2 shows the relationship between ST and the probability of passing for high school educated Soldiers by gender, including upper and lower bounds. The graph illustrates that female Soldiers have a noticeably better chance of passing this course.

Figure 2: Predicted Probability of Passing: High School Soldiers

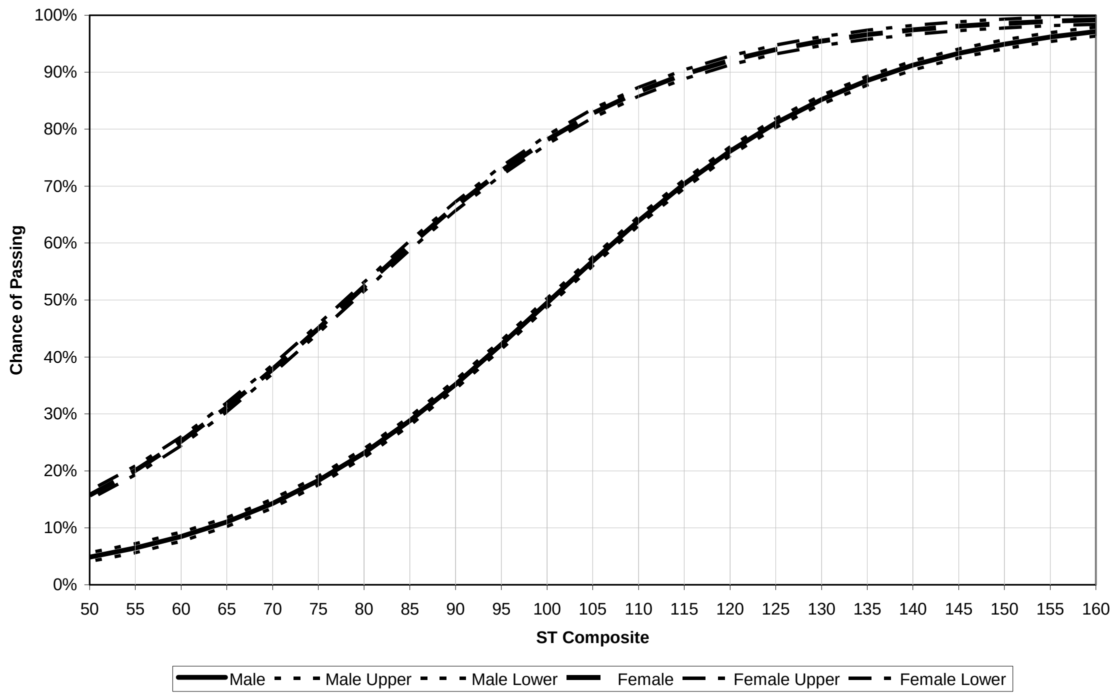
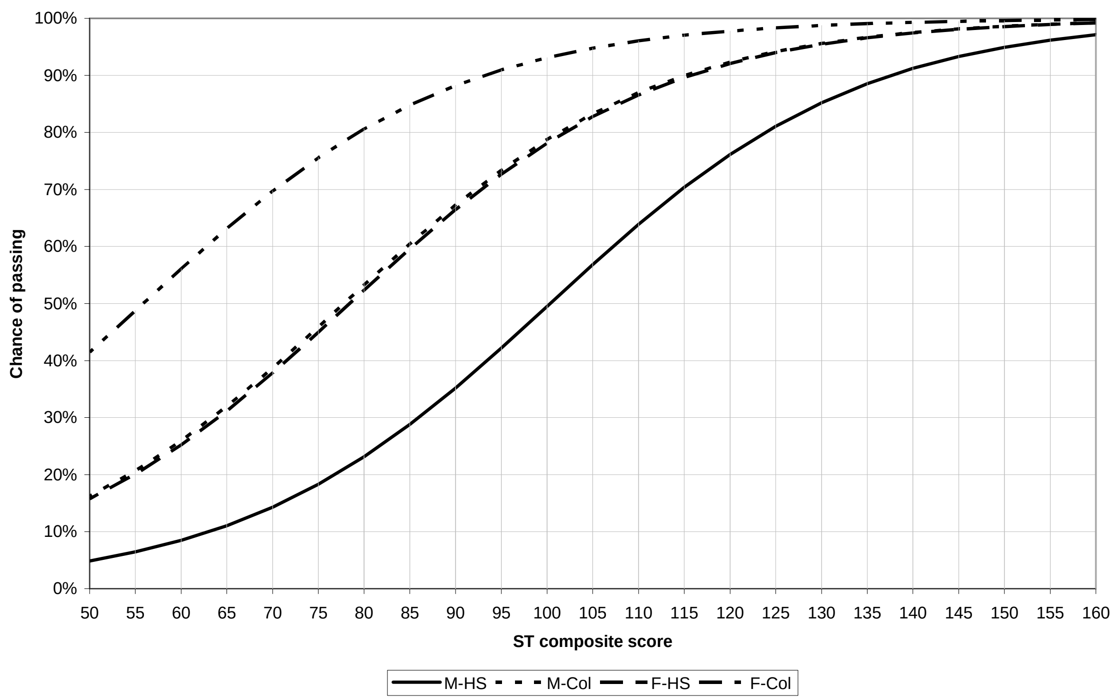


Figure 3 shows the relationship between ST and the probability of passing for Soldiers by education and gender. The graph illustrates that women with some college education have the best chance at passing the course, while high school educated males, the modal students, have the lowest chance of passing. College educated male Soldiers and high school educated female Soldiers have essentially the same scores. Figure 3 also illustrates the magnitude of the effect brought about by gender and education. At the current cutoff score (ST = 102) college educated female Soldiers have more than a 30 percentage point better chance of passing the course compared to high school educated males. Even at a ST score as high as 120, college educated women still have approximately a 20 percentage point better chance of passing than high school educated males.

Figure 3: HS vs. College & Male vs. Female



Appendix: Soldier Characteristics (91X)

	Gender	
	Male	Female
fail	21.3%	8.9%
pass	78.7%	91.1%

	Education Level		
	GED or less	High School Diploma	Some College or More
fail	23.1%	19.7%	6.1%
pass	76.9%	80.3%	93.9%

	Component		
	Regular Army	Army Reserve	National Guard
fail	17.5%	14.0%	11.4%
pass	82.5%	86.0%	88.6%

88M: Motor Transport Operator

The final sample included 14310 Soldiers who were coded as either graduates or academic failures <u>during their first AIT attempt</u> in this MOS during a period from 2001 to 2004. Only Soldiers who graduated (98.6%) or failed for academic reasons (1.4%) were included in the analysis sample of 14310 Soldiers because we assume that non-completion for non-academic reasons is not related to cognitive criteria.

In the sample, most of the Soldiers were male (73%, 27% female), most had a high school diploma but not more education (90%, 8% some college, 2% GED or less), and the greatest number were from National Guard (40%, 34% Regular Army, 26% Army Reserve). The governing AA composite, Operator/Food (OF), for this MOS has a cutoff score of 85; the sample mean is 101.18 (standard deviation = 12.637). See the Appendix for a description of Soldier characteristics for this MOS training sample.

Table 1. 88M: Results of the binary logistic prediction model

Chi- Square		82.021***	
Log Likelihood		2023.329	
Nagelkerke R Square		.042	
Variable	Coefficient	Odds Ratio	Wald
Constant	.484	1.622	.765
GED	.933	2.542	1.532
COLLEGE	.286	1.330	.757
GUARD	.893	2.443	24.104***
RESERVE	.441	1.554	5.850*
GENDER	-.019	.981	.015
OF	.034	1.035	36.060***

* = p < .05   *** = p < .001
** = p < .01

A binary logistic regression model was estimated to explain pass/fail AIT outcomes and focused on the first training attempt. The estimation results are reported in

Table 1 and indicate that a model, including the OF composite, as well as education level (GED = GED or less education; COLLEGE = some college), Army component (GUARD = National Guard, RESERVE = Army Reserve), and gender (GENDER = female), accounts for about four percent of the variation in the dependent variable. This model is statistically significant ($\chi^2 = 36.060$, $P < .001$), but its explanatory power is limited (Nagelkerke $R^2 = .042$).

There is a statistically significant effect for the OF composite. The model suggests that having a higher OF composite score increases the odds of passing. At the mean OF score, an increase of one point is associated with an increase of about 3% in the odds of passing the course, and a five-point increase in OF would increase the odds of passing by 19%. There are also significant effects for Army component, where Guardsmen and Reservists have increased odds of passing (144% and 55%, respectively).

Policy Analysis. Table 2 reports the probability that the average Soldier from the larger Army contract population would pass the course based upon the binary logistic model. These were calculated using the formula for finding probability in a binary logistic model, which is

$$e^{(\beta' x)} / (1 + e^{(\beta' x)}).$$

This analysis is confined to Soldiers from the Regular Army (though results would be similar for other demographic groups). Based on the model, when the cutoff score is at its current level (OF = 85), Regular Army Soldiers with an average OF score (OF = 106.22) have approximately a 98% chance of passing. Currently, about 97% of Soldiers are eligible for MOS 88M assignment at the current cutoff (OF = 85). Lowering the cutoff by five points (OF = 80) would increase eligibility by two percentage points (to

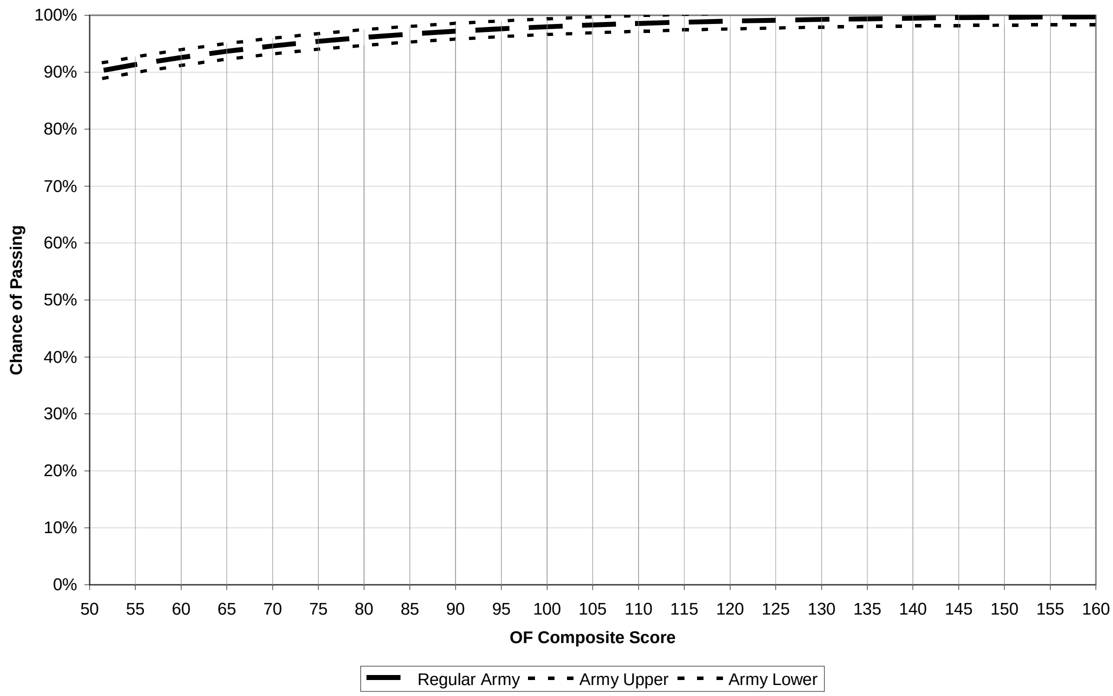
99.5%) and the average Soldier who would qualify for training would practically have the same chance of passing (98%). Raising the cutoff score by five points (OF = 90), the average Soldier would have the same chance of passing (98%) but eligibility would fall by about seven percentage points.

Table 2. 88M: Probability that a Soldier (from the larger Army contract population) will pass the course based on the binary logistic model

	Cutoff = 75	Cutoff = 80	Cutoff = 85	Cutoff = 90	Cutoff = 95
Percent Eligible (Regular Army)	*99.9%*	*99.5%*	*96.9%*	*89.8%*	*7478.5%*
Mean	*105.46*	*105.59*	*106.22*	*107.71*	*109.93*
Passing rate:					
High school male	98.3%	98.3%	98.4%	98.4%	98.6%

Figure 1 shows the relationship between OF and the probability of passing for Male Regular Army Soldiers with a high school diploma, including upper and lower bounds based upon the standard error of the estimated OF coefficient. For a particular OF score, trace a vertical line up to the curve, and then a horizontal line over to the axis to determine the corresponding probability of passing. For example, an OF score of 100 corresponds to a passing probability of about 95% for a high school educated, Regular Army male Soldier. One can see that Soldiers with a relatively low OF score have a very good chance of passing the course. As OF scores increase, the chance that a Soldier will pass the course increases slightly.

Figure 1: Predicted Probalility of Passing: Male High School Soldiers



Appendix: Soldier Characteristics (88M)

	Gender	
	Male	Female
fail	1.3%	1.8%
pass	98.7%	98.2%

	Education Level		
	GED or less	High School Diploma	Some College or More
fail	.6%	1.5%	.9%
pass	99.4%	98.5%	99.1%

	Component		
	Regular Army	Army Reserve	National Guard
fail	2.3%	1.2%	.8%
pass	97.7%	98.8%	99.2%

89B (55B): Ammunition Specialist

The final sample included 2680 Soldiers who were coded as either graduates or academic failures during their first AIT attempt in this MOS during a period from 2001 to 2004. Only Soldiers who graduated (98.8%) or failed for academic reasons (1.2%) were included in the analysis sample because we assume that non-completion for non-academic reasons is not related to cognitive criteria.

In the sample, most were male (65%, 35% female), most had a high school diploma but not more education (90%, 5% some college, 5% GED or less), and most were from the Regular Army (71%, 6% Guard, 23% Reserve). The governing AA composite, Skilled Technical (ST), for this MOS has a cutoff score of 92; the sample mean is 102.54 (standard deviation = 10.658). See the Appendix for a description of Soldier characteristics for this MOS training sample.

Table 1. 89B: Results of the binary logistic prediction model: ST only model

Chi- Square		10.215*	
Log Likelihood		345.583	
Nagelkerke R Square		.031	
Variable	Coefficient	Odds Ratio	Wald
Constant	.089	1.093	.003
RESERVE	1.018	2.767	2.707
GENDER	.098	1.103	.072
ST	.041	1.042	6.657**

* = p < .05 *** = p < .001
** = p < .01

A binary logistic regression model was estimated to explain pass/fail AIT outcomes and focused on the first training attempt. The estimation results are reported in Table 1 and indicate that the model, including the ST composite, Army component

(RESERVE = Army Reserve), and gender (GENDER = female), accounts for about three percent of the variation in the dependent variable. This model is statistically significant (χ^2 = 10.215, P = .017), and has limited explanatory power (Nagelkerke R^2 = .031).

There is a statistically significant effect for the ST composite. The model suggests that having a higher ST composite score increases the odds of passing. At the mean ST score, an increase of one point is associated with an increase of about four percent in the odds of passing the course, and a five-point increase in ST would increase the odds of passing by 23%.

<u>Policy Analysis.</u> Table 2 reports the probability that the average Soldier from the larger Army contract population would pass the course based upon the binary logistic model. These probabilities were calculated using the formula for finding probability in a binary logistic model, which is

$$e^{(\beta' x)} / (1 + e^{(\beta' x)}).$$

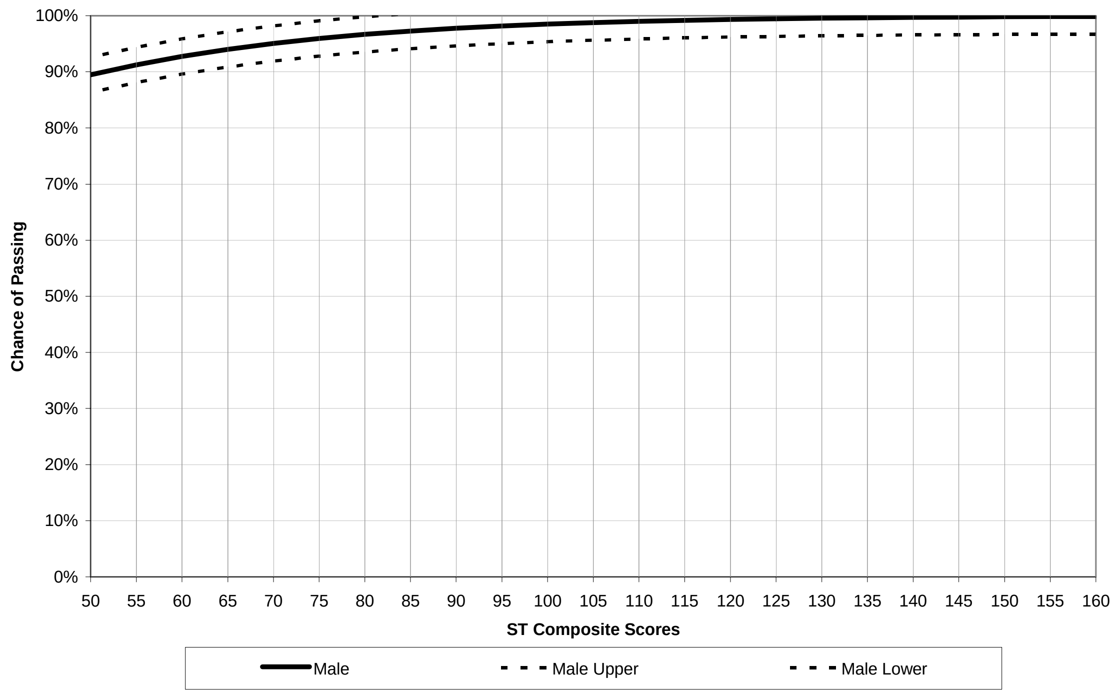
Because GUARD, RESERVE, and GENDER were not statistically significant, this analysis is confined to the modal demographic—Regular Army high school educated Soldiers factored by GENDER (though results would be similar for any demographic combination). Based on the model, when the cutoff score is at its current level (ST = 92), male Soldiers with a high school diploma and an average ST score (ST = 107.60) have approximately a 99% chance of passing. Currently, about 89% of Soldiers are eligible for MOS 89B assignment at the current cutoff. Lowering the ST cutoff by five points (ST = 87) would increase eligibility by eight percentage points, while the average male Soldier who would qualify for training would have essentially the same chance of passing (99%). Raising the ST cutoff scores by five points (ST = 97), the average male Soldier who would still qualify for the MOS would have about the same chance of passing (99%), but fewer Soldiers would be eligible (78%).

Table 2. 89B: Probability that a Soldier (from the larger Army contract population) will pass the course based on the binary logistic model

	Cutoff: ST = 82	Cutoff: ST = 87	Cutoff: ST = 92	Cutoff: ST = 97	Cutoff: ST = 102
Percent Eligible (Regular Army)	*99.8%*	*97.1%*	*89.0%*	*78.2%*	*64.9%*
Mean: ST	*106.79*	*107.41*	*109.06*	*111.14*	*113.60*
Passing rates:					
High School Male	98.9%	98.9%	99.0%	99.0%	99.1%

Figure 1 shows the relationship between ST and the probability of passing for high school educated male Soldiers, including upper and lower bounds based upon the standard error of the estimated ST coefficient. For a particular ST score, trace a vertical line up to the curve, and then a horizontal line over to the axis to determine the corresponding probability of passing. For example, an ST value of 100 corresponds to a passing probability of about 99% for a high school educated male Soldier.

Figure 1: Predicted Probability of Passing: High School Male Soldiers



Appendix A: Soldier Characteristics (89B)

Outcome	Gender: Male	Gender: Female
fail	1.1%	1.4%
pass	98.9%	98.6%

Outcome	Education Level: GED or less	Education Level: High School Diploma	Education Level: Some College or More
fail	0.7%	1.3%	0.7%
pass	99.3%	98.7%	99.3%

Outcome	Component: Regular Army	Component: Army Reserve	Component: National Guard
fail	1.5%	0.5%	0.6%
pass	98.5%	99.5%	99.4%

89D (55D): Explosive Ordinance Disposal Specialists

Phase I Training

The final sample included 445 soldiers who were coded as either graduates or academic failures <u>during their first training attempt</u> for the first phase of this MOS during the period from 2001 to 2004. Only soldiers who graduated (47.5%) or failed for academic reasons (52.8%) were included in the analysis sample because we assume that non-completion for non-academic reasons is not related to cognitive criteria.

In this sample, most were male (91%, 9% female), most had a high school diploma but not more education (87%, 13% some college, < 1% GED or less), and most were Regular Army (98%, 2% National Guard). The governing AA composite, General Maintenance (GM), for this MOS has a cutoff score of 104; the sample mean is 116.13 (standard deviation = 8.738). See the Appendix for a description of Soldier characteristics for this MOS training sample.

A binary logistic regression model was estimated for this MOS and focused on the first training attempt. The estimation results are reported in Table 1 and indicate that

Table 1. 55D: Results of the binary logistic prediction model

Chi- Square		47.893***	
Log Likelihood		567.603	
Nagelkerke R Square		.136	
Variable	Coefficient	Odds Ratio	Wald
Constant	-9.560	.000	41.295***
COLLEGE	-.423	.655	1.804
GENDER	.013	1.013	.001
GM	.082	1.085	40.769***

* = p < .05 ** = p < .01
*** = p < .001

a model including the GM composite, education status (COLLEGE = some college), and gender (GENDER = female) accounts for about 14 percent of the variation in the dependent variable. This model is statistically significant ($\chi^2 = 47.893$, $P < .001$), and has moderate explanatory power (Nagelkerke $R^2 = .136$).

There is a statistically significant effect for the GM composite. The model suggests that having a higher GM composite score increases the odds of passing. At the mean GM score, an increase of one point is associated with an increase of about nine percent in the odds of passing the course, and a five-point increase in GM would increase the odds of passing by 51%.

<u>Policy Analysis.</u> Table 2 reports the probability that the average soldier from the larger Army applicant population would pass the course on the first attempt based upon the binary logistic model. These were calculated using the formula for finding probability in a binary logistic model, which is

$$e^{(\beta' x)} / (1 + e^{(\beta' x)}).$$

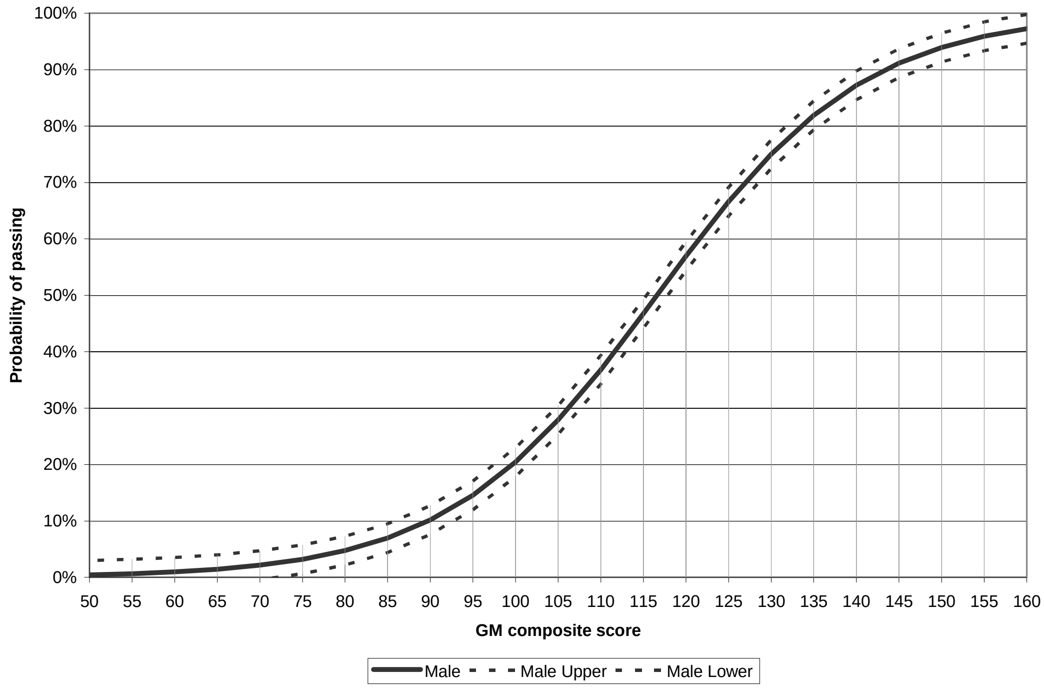
Because GENDER and COLLEGE were not statistically significant, this analysis is confined to the modal demographics—male Soldiers with a high school diploma (though results would be similar for any demographic combination). Based on the model, when the cutoff score is at its current level (GM = 104), regular Army soldiers with an average GM score (GM = 114.57) have approximately a 46% chance of passing. Currently, about 51% of Soldiers are eligible for MOS 55D assignment at the current cutoff (GM = 104). Raising the cutoff by five points (GM = 109), the average Soldier who would qualify for training would have a higher chance of passing (53%), but eligibility would decrease by 14 percentage points (to 37%). Lowering the cutoff score by five points (GM = 99) would increase eligibility by 13 percentage points, but the average Soldier would have an even lower chance of passing (40%).

Table 2. 55D: Probability that a male Soldier (from the larger Army contract population) will pass the course based on the binary logistic model

	Cutoff = 94	Cutoff = 99	Cutoff = 104	Cutoff = 109	Cutoff = 114
Percent Eligible (Regular Army)	*77.7%*	*64.2%*	*51.0%*	*36.8%*	*25.2%*
Mean	*109.15*	*111.78*	*114.57*	*117.88*	*121.13*
Passing rate:					
Male/High School	35.2%	40.1%	45.9%	52.7%	59.2%

Figure 1 shows the relationship between GM and the probability of passing for Regular Army Soldiers, including upper and lower bounds based upon the standard error of the estimated GM coefficient. For a particular GM score, trace a vertical line up to the curve, and then a horizontal line over to the axis to determine the corresponding probability of passing. For example, a GM score of 115 corresponds to a passing probability of about 47% for a high school educated male Soldier.

Figure 1: Predicted Probability of Passing: Male Regular Army



Testing a Central Assumption of the Approach

Central to our approach has been the estimation of model parameters using only academic passes and failure cases – we specifically exclude failure cases that have been identified with non-academic reasons for failure. In doing so we assume that non-completion for non-academic reasons is not related to cognitive criteria. In this section we report on our attempt examine the reasonableness of this assumption.

When we include non-academic failure cases in the data sample, we would expect the goodness-of-fit to deteriorate and to see smaller predicted composite effects, if higher scoring Soldiers predominate in these "additional" cases. Alternatively, if lower scoring Soldiers predominate in these cases, it is possible to see little or no deterioration in the fit of the model. In Table 2a we present the regression model results when an additional 230 non-academic failure cases are included in the analysis sample (for a total of 675 cases). There is a clear deterioration in the explanatory power of the model: the Nagelkerke R^2 declines from 0.136 in the original sample to 0.084 in the augmented sample. In addition, the GM composite effect falls from 1.085 to 1.066 in the augmented sample.

Table 2a. 55D: Results of the binary logistic prediction model including academic failure and non-academic failure cases

Chi- Square		41.726***	
Log Likelihood		795.256	
Nagelkerke R Square		.084	
Variable	Coefficient	Odds Ratio	Wald
Constant	-8.157	.000	42.291***
COLLEGE	-.273	.761	1.039
GENDER	-.151	.860	.227
GM	.063	1.066	35.418***

* = p < .05 ** = p < .01
*** = p < .001

An even more extreme comparison might be between the original sample and a sample utilizing only the non-academic failure cases – i.e., replacing the academic failure cases in the original sample with non-academic failure cases. The hypothesis is that the latter bring increased randomness to the data set, and that the resulting regression model will not fit as well, and the estimated governing composite effects will be weaker. In Table 2b we present the regression model results when only non-academic failure cases are included (along with academic pass cases). This data sample has a total of 440 observations. We find even greater deterioration in the explanatory power of the model: the Nagelkerke R^2 in the "non-academic failure" model is only about half that of the original sample model (.059 versus .136). In addition, GM composite effect is considerably weaker – 1.047 for the sample including non-academic failures compared to 1.085 for the original sample.

Table 2b. 55D: Results of the binary logistic prediction model including only non-academic failure cases

Chi- Square		19.812***	
Log Likelihood		589.248	
Nagelkerke R Square		.059	
Variable	Coefficient	Odds Ratio	Wald
Constant	-5.450	.004	14.249***
COLLEGE	-.132	.877	.183
GENDER	-.339	.713	.948
GM	.046	1.047	14.105***

* = p < .05 ** = p < .01
*** = p < .001

The results of these additional analyses support the approach taken to include only academic pass and failure cases in the data analysis sample. The non-academic failure cases were found to vary in a less predictable way with cognitive criteria and, we conclude, to represent the outcome of a different process.

Appendix: Soldier Characteristics (55D): Phase I

Outcome	Gender	
	Male	Female
fail	51.9%	62.5%
pass	48.1%	37.5%

Outcome	Education Level		
	GED or less	High School Diploma	Some College or More
fail	50.0%	52.8%	52.6%
pass	50.0%	47.2%	47.4%

Outcome	Component		
	Regular Army	Army Reserve	National Guard
fail	53.5%	.0%	12.5%
pass	46.5%	.0%	87.5%

55D (Phase I Training)
Risk Analysis of Policy Alternatives

In this section we extend the policy analysis with a risk analysis of the policy alternatives considered using simulation methods. We employ the "@RISK" software package which is designed as an add-in for Microsoft Excel.[54] There are four steps in the risk analysis.

The first step is developing a model. A regression model for predicting the passing rate has been specified and estimated, and the results stored in Excel worksheet format. See Table 1.

The second step is identifying the uncertainty inherent in both the input variables (composite scores, Soldier characteristics) and the corresponding estimated parameters and specifying their possible values with probability distributions.

To approximate the governing composite distribution, we use the larger Army contract population (EAF file: those who contracted from Jan 1992 to Aug 2003). This distribution can be assumed to follow a normal distribution. The mean and standard deviation estimated from the contract population and used as input to the simulations are shown in Table R-1 (before truncation).

Table R-1. Input information for the simulations

	Mean	Std error / deviation
Constant	-9.560	1.488
GM var	103.96 (before truncation)	12.973
GM coeff	.082	.013
COLLEGE var	12.8%	
COLLEGE coeff	-.423	.315
GENDER var	9%	
GENDER coeff	.013	.360

To approximate the distributions for the demographic variables we rely on the training data sample used to estimate the regression model. These distributions can be assumed to follow binomial distributions with means estimated from the training data sample as shown in Table R-1.

[54] Software is available from Palisade Corporation, Newfield, NY.

To approximate the distributions for the estimated parameters in the logit model, we note that, under very general conditions, the estimates will be asymptotically normally distributed.[55] The estimated coefficients (means and standard errors) are shown in Table R-1.

The third step is analyzing the model with simulation to determine the range and probabilities of all possible training outcome results. The results reported represent the simulation of the regression prediction equation for 1000 iterations using a fixed seed.[56] The comparisons are between the baseline case (GM = 104) and the policy cases (GM = 99 and GM = 109). These cases are delineated by the cutoff score level which serves as the lower truncation point in the governing composite input distribution. The simulation results in Table R-2 describe the effect on the mean probability of passing as the GM cutoff score level is varied, and represent an improvement of the policy analysis presented in Table 2 because they reflect the simultaneous effects of all known sources of uncertainty.

Table R-2. 55D simulation results

	GM = 99	GM = 104	GM = 109
Mean governing composite	111.36	114.32	117.36
Mean probability of passing	42.37%	46.19%	50.30%
Std deviation	32.22%	33.09%	33.15%

The frequency distributions of simulated effects are shown below in the histogram graphs. The histogram portrays the full range of outcomes that average to the mean effect as reported. Looking at the histogram for the baseline case (GM = 104), probability of passing is plotted on the horizontal axis and the height of each bar indicates the relative number of Soldiers at that passing probability. The information in the histograms is effectively summarized in Table R-3. In that table we see the percentage of Soldiers who meet or exceed a given chance of passing. For example, looking at the baseline case (GM = 104), about 31% of Soldiers have a 70% or greater chance of passing.

We find that the mean probability of passing in the simulation is 46% (Table R-2, baseline). Looking at the histograms, we see the largest portion of Soldiers is in the lowest range of passing scores, and the next biggest group is in the highest range of

55 The intuition is that logit estimates are derived from maximum likelihood (ML) estimation, and under fairly general conditions ML estimates are consistent and asymptotically normally distributed.

56 Latin Hypercube (LH) sampling is utilized in drawing samples for the input distributions. It is designed to accurately recreate the input distribution through sampling in fewer iterations when compared with the Monte Carlo method. The key to LH sampling is stratification of the input probability distributions.

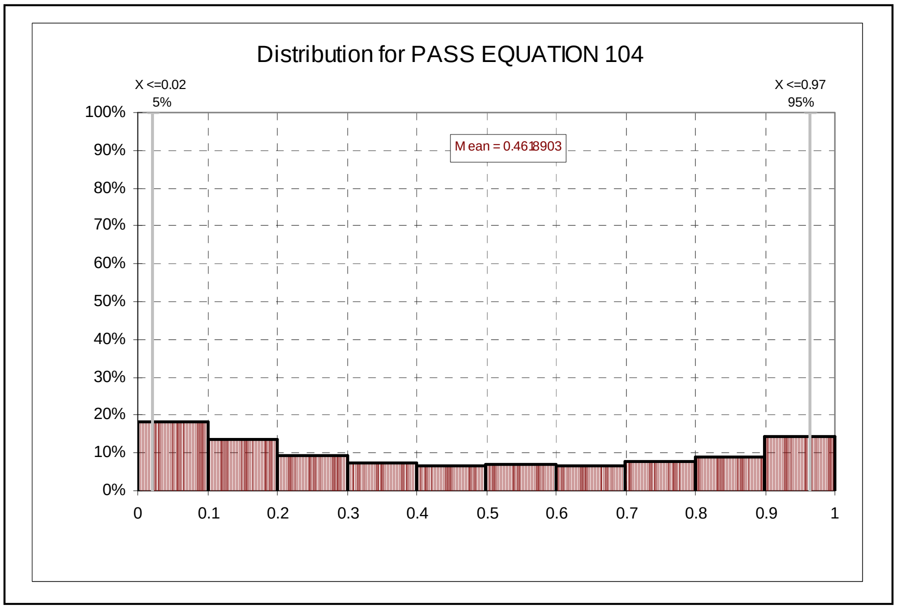
passing scores. We note that the mean simulated passing probability turns out to be essentially the same as the static regression prediction at the mean GM score (Table 2).

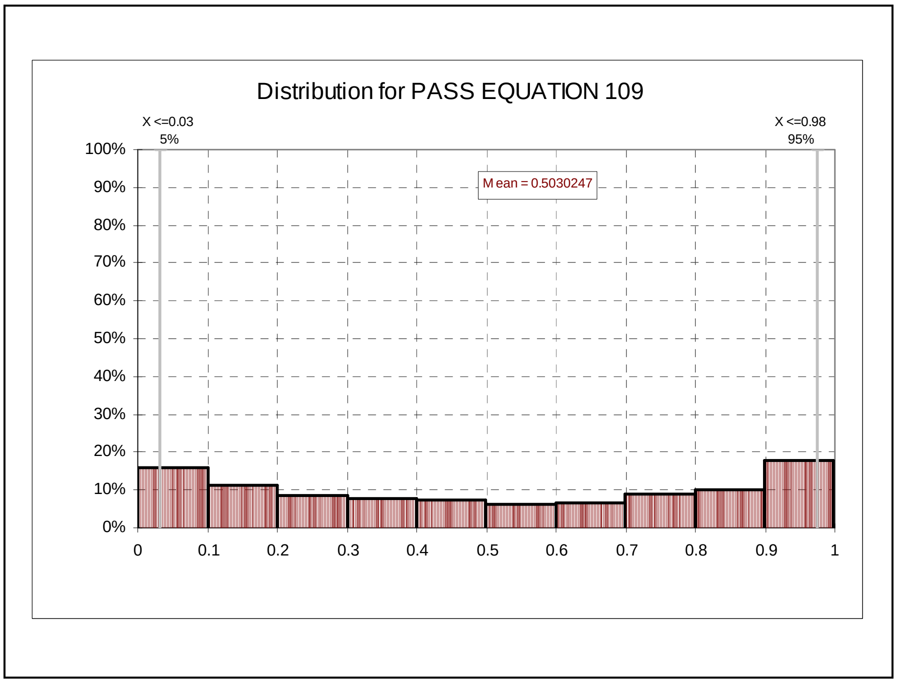
Table R-3.
Percent of simulated Soldiers that meet or exceed given chance of passing

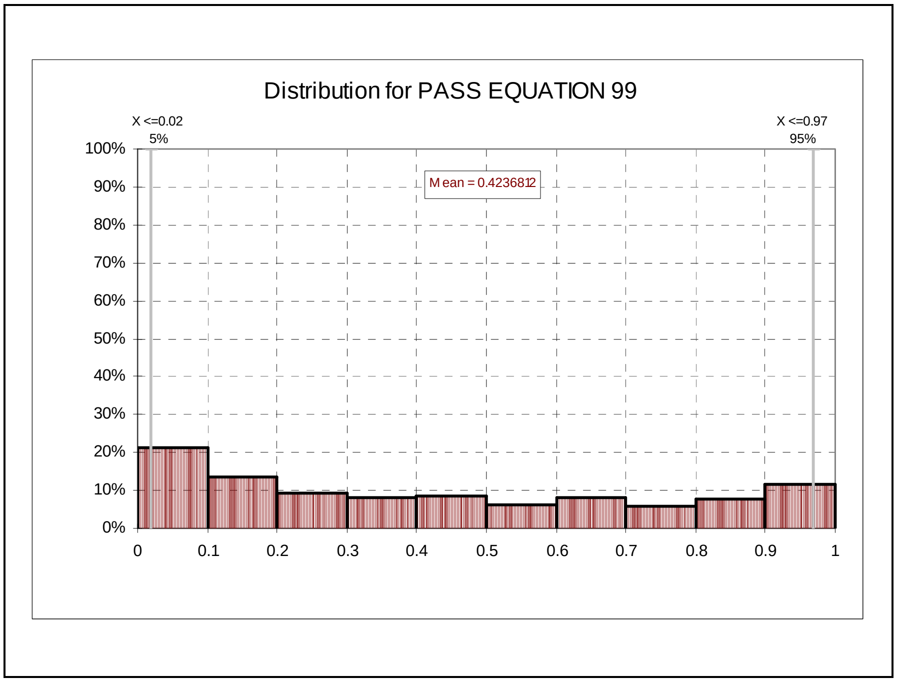
Chance of passing	GM = 99	GM = 104	GM = 109
95.0%	7.1%	7.6%	9.4%
90.0%	11.6%	14.5%	17.6%
85.0%	15.1%	19.6%	22.8%
80.0%	19.3%	23.6%	27.7%
75.0%	22.1%	27.2%	32.0%
70.0%	24.9%	31.3%	36.5%
65.0%	28.7%	34.6%	40.1%
60.0%	33.1%	38.1%	43.1%
55.0%	35.8%	41.5%	46.3%
50.0%	39.0%	44.8%	49.3%

In the simulated predictions we are calculating an average over all Soldiers and taking into account all sources of uncertainty, whereas in the static prediction we are calculating the probability of passing only at the mean GM score, ignoring the distribution of Soldier scores etc. as well as uncertainty. While recognizing this variability is important, we also note that the policy case impacts relative to the baseline are the same in both simulation and static prediction modes.

The fourth step is making a decision based on the results provided and the preferences of the school proponent. This involves the evaluation by the school proponent of the tradeoff between increased eligibility and reduced passing probabilities (and vice-versa).


Distribution for PASS EQUATION 104
X <=0.02
5%
X <=0.97
95%
Mean = 0.4618903
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1


Distribution for PASS EQUATION 109
X <=0.03
5%
X <=0.98
95%
Mean = 0.5030247
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1



Distribution for PASS EQUATION 99
X <=0.02
5%
X <=0.97
95%
Mean = 0.4236812
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1

89D (55D): Explosive Ordinance Disposal Specialists

Phase II Training

The final sample included 178 Soldiers who were coded as either graduates or academic failures during their first training attempt for both first and second phases of this MOS during the period from 2001 to 2004. Only Soldiers that graduated (33.1%) or failed for academic reasons (66.9%) were included in the analysis sample because we assume that non-completion for non-academic reasons is not related to cognitive criteria.

In this sample, most were male (96%, 4% female), most had a high school diploma but not more education (87%, 13% some college[57]), and most were Regular Army (97%, 3% National Guard). The governing AA composite is GM with a cutoff score of 104; in this sample it has a mean of 118.52 (standard deviation = 8.704).

A binary logistic regression model was estimated for Phase II training of this MOS and focused on the first training attempt. The estimation results are reported in Table 1 and indicate that a model including pass / fail in the first attempt of the first phase (S1_PF1), the GM composite, education status (COLLEGE = some college), and gender (GENDER = female) accounts for about four percent of the variation in the dependent variable. This model is not statistically significant (χ^2 = 5.548, P = .236), and its explanatory power is limited (Nagelkerke R^2 =.043).[58]

[57] One Soldier had earned a GED or had not earned a high school diploma, and was subsequently included with the high school graduates for the purpose of analysis.
[58] In the Appendix we report models focused on the unique effects of (a) passing versus failing during the first phase, (b) the GM composite, and (c) the GT composite. The first model is not statistically significant, while the second model is significant. The GT models fits somewhat better than the GM model, but not enough better to make a plausible case for cognitive factors as decisive in successful completion.

There is a statistically significant effect for the GM composite. The model suggests that having a higher GM composite score increases the odds of passing. At the mean GM score, an increase of one point is associated with an increase of about a five percent in the odds of passing the course, and a five-point increase in GM would increase the odds of passing by 25%.

Policy Analysis. Given that the Army does not directly assign Soldiers to the second phase of training, a separate policy analysis is not appropriate. Nevertheless, it is clear that Phase II pass rates are low and that a model utilizing ASVAB predictors has limited explanatory power. Presumably, non-cognitive factors are at work.

Table 1. 55D: Results of the binary logistic prediction model using pass/fail in the first attempt of the first phase to predict success in the second phase

Chi- Square		5.548	
Log Likelihood		220.586	
Nagelkerke R Square		.043	
Variable	Coefficient	Odds Ratio	Wald
Constant	-6.019	.002	2.356**
COLLEGE	-.399	.671	.623
GENDER	.479	1.614	.380
GM	.045	1.046	5.002*
S1_PF1	-.037	.964	.009

$* = p < .05$ $** = p < .01$

Appendix: Additional Regression Models – Phase II

Table 1a. 55D: Results of the binary logistic prediction model using pass/fail in the first attempt of the first phase to predict success in the second phase

Chi- Square	.208		
Log Likelihood	225.926		
Nagelkerke R Square	.002		
Variable	Coefficient	Odds Ratio	Wald
Constant	-.827	.438	6.656**
S1_PF1	.167	1.182	.369

* = p < .05 ** = p < .01
*** = p < .001

Table 1b. 55D: Results of the binary logistic prediction model using the governing composite to predict success in the second phase

Chi- Square	4.3561*		
Log Likelihood	221.573		
Nagelkerke R Square	.035		
Variable	Coefficient	Odds Ratio	Wald
Constant	-5.408	.004	5.800*
GM	.040	1.040	4.451*

* = p < .05 ** = p < .01
*** = p < .001

Table 1c. 55D: Results of the binary logistic prediction model using the GT composite to predict success in the second phase

Chi- Square		6.617**	
Log Likelihood		219.517	
Nagelkerke R Square		.051	
Variable	Coefficient	Odds Ratio	Wald
Constant	-6.295	.002	7.858
GT	.048	1.049	6.304*

* = p < .05 ** = p < .01
*** = p < .001

Appendix: Soldier Characteristics (55D): Phase II

Outcome	Gender	
	Male	Female
fail	67.1%	62.5%
pass	32.9%	37.5%

Outcome	Education Level		
	GED or less	High School Diploma	Some College or More
fail	100.0%	66.2%	69.6%
pass	.0%	33.8%	30.4%

Outcome	Component		
	Regular Army	Army Reserve	National Guard
fail	68.8%	.0%	.0%
pass	31.2%	.0%	100.0%

92A: Automated Logistics Specialist

The final sample included 11458 Soldiers who were coded as either graduates or academic failures during their first AIT attempt for this MOS during a period from 2001 to 2004. Only Soldiers who graduated (96.9%) or failed for academic reasons (3.1%) were included in the analysis sample because we assume that non-completion for non-academic reasons is not related to cognitive criteria.

In the sample, most were male (54%, 46% female), most had a high school diploma but not more education (87%, 7% some college, 6% GED or less), and most were from were from the Regular Army (50%, 25% National Guard, 25% Reserve). The governing AA composites, Clerical (CL), for this MOS has cutoff score of 92; the sample mean is 101.82 (standard deviation = 10.423). See the Appendix for a description of Soldier characteristics for this MOS training sample.

A binary logistic regression model was estimated to explain pass/fail AIT outcomes and focused on the first training attempt. The estimation results are reported in Table 1 and indicate that the model, including the CL composite, education status (GED, = GED or less than a high school diploma, COLLEGE = some college education), Army component (GUARD = National Guard, RESERVE = Army Reserve), and gender (GENDER = Female) accounts for about seven percent of the variation in the dependent variable. This model is statistically significant ($\chi^2 = 197.879$, $P < .001$), and has somewhat limited explanatory power (Nagelkerke $R^2 = .070$).

Table 1. 92A: Results of the binary logistic prediction model

Chi- Square		197.879***	
Log Likelihood		2995.211	
Nagelkerke R Square		.070	
Variable	Coefficient	Odds Ratio	Wald
Constant	-2.118	.120	16.423***
GED	.687	1.987	4.248*
COLLEGE	.833	2.301	6.668**
GUARD	.510	1.665	13.131***
RESERVE	.666	1.946	19.297***
GENDER	1.065	2.901	76.139***
CL	.048	1.050	87.170***

* = $p < .05$ *** = $p < .001$
** = $p < .01$

There is a statistically significant effect for the CL composite. The model suggests that having a higher CL composite score increases the odds of passing. At the mean CL score, an increase of one point is associated with an increase of about five percent in the odds of passing the course, and a five-point increase in CL would increase the odds of passing by 27%. There are also statistically significant effects for GED, COLLEGE, GUARD, RESERVE, and GENDER, with increased odds of passing the course at 99%, 130%, 67%, 95%, and 190% (for females), respectively.

<u>Policy Analysis.</u> Table 2 reports the probability that the average Soldier from the larger Army contract population would pass the course based upon the binary logistic model. These were calculated using the formula for finding probability in a binary logistic model, which is

$$e^{(\beta' x)} / (1 + e^{(\beta' x)}).$$

The following analysis is focused upon male and female Soldiers at all three education levels from the Regular Army. Based on the model, when the cutoff score is at its current level (CL = 92), male (female) Soldiers with a high school diploma and an average CL score (CL = 109.17) have approximately a 96% (99%) chance of passing. Currently, about 92% of Soldiers are eligible for MOS 92A assignment at the current cutoff. Lowering the cutoff by five points (CL = 87) would increase eligibility by seven percentage points (to 99%) and the average male (female) Soldier who would qualify for training would essentially the same chance of passing (95%) (98%). Raising the CL cutoff score by five points (CL = 97) provides about the same in passing rates for the average high school male (female) Soldier (96%) (99%), but fewer Soldiers would be eligible (80%).

Table 2. 92A: Probability that a Regular Army Soldier (from the larger successful applicant population) will pass the course based on the binary logistic model

	Cutoff: CL = 82	Cutoff: CL = 87	Cutoff CL = 92	Cutoff CL = 97	Cutoff CL = 102
Percent Eligible (Regular Army)	*99.9%*	*99.0%*	*91.6%*	*80.0%*	*67.6%*
Mean	*107.49*	*107.69*	*109.17*	*111.37*	*113.62*
Passing Rates:					
GED Male	97.7%	97.7%	97.8%	98.0%	98.2%
GED Female	99.2%	99.2%	99.2%	99.3%	99.4%
High School Male	95.4%	95.5%	95.8%	96.2%	96.6%
High School Female	98.4%	98.4%	98.5%	98.7%	98.8%
College Male	98.0%	98.0%	98.1%	98.3%	98.5%
College Female	99.3%	99.2%	99.3%	99.4%	99.5%

Figure 1 shows the relationship between CL and the probability of passing for high school educated Regular Army Soldiers by gender. For a particular CL score, trace a vertical line up to the curve, and then a horizontal line over to the axis to determine the corresponding probability of passing. For example, a CL score of 100 corresponds to a passing probability of about 98% for a high school educated, Regular Army male Soldier.

Figure 1: Predicted Probability of Passing: High School Soldiers

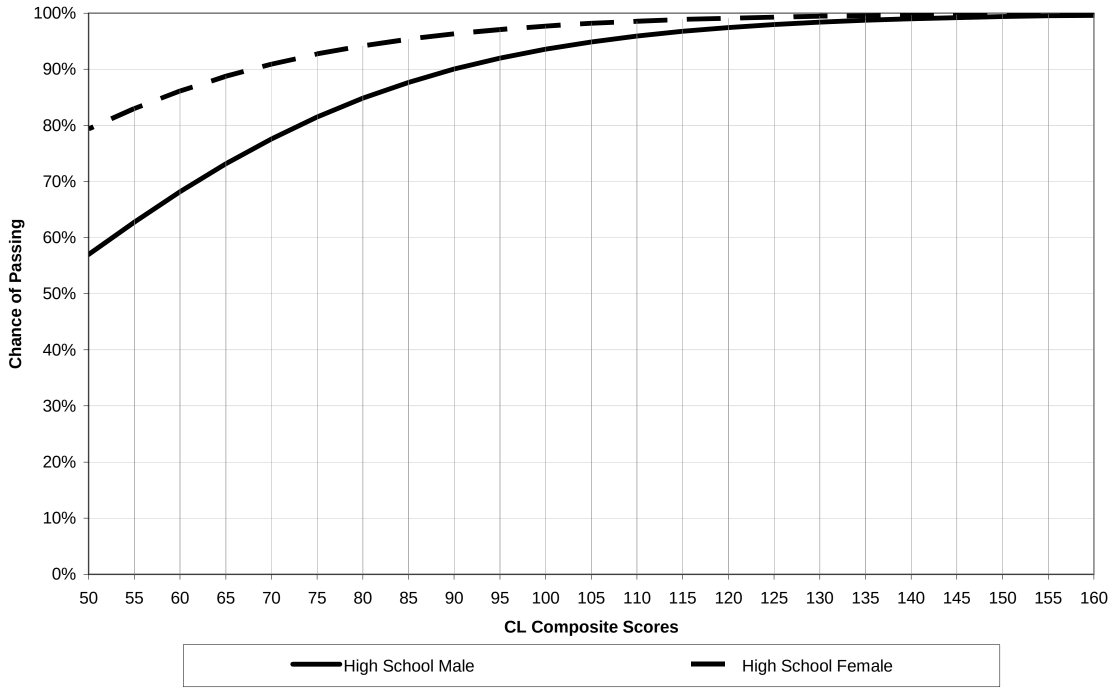


Figure 2 shows the relationship between CL and the probability of passing for male Soldiers by education level. The graph illustrates that college educated Soldiers and GED soldiers have a noticeably better chance of passing this course when compared to those with high school diplomas and no college experience.

Figure 2: Predicted Probability of Passing: Male Soldiers

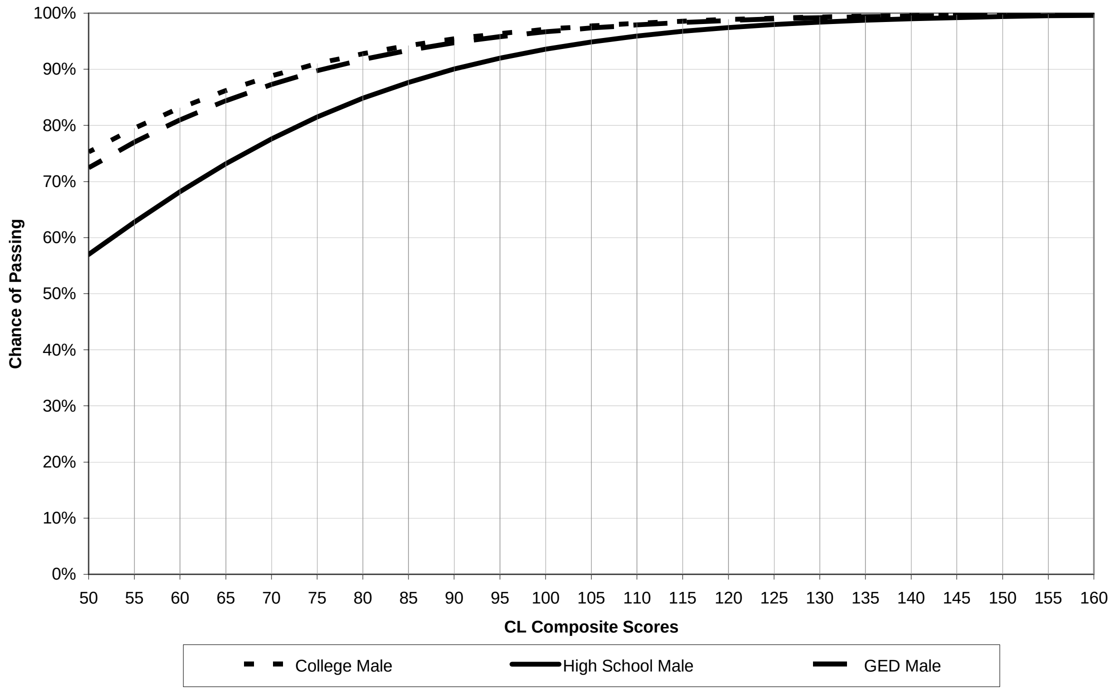
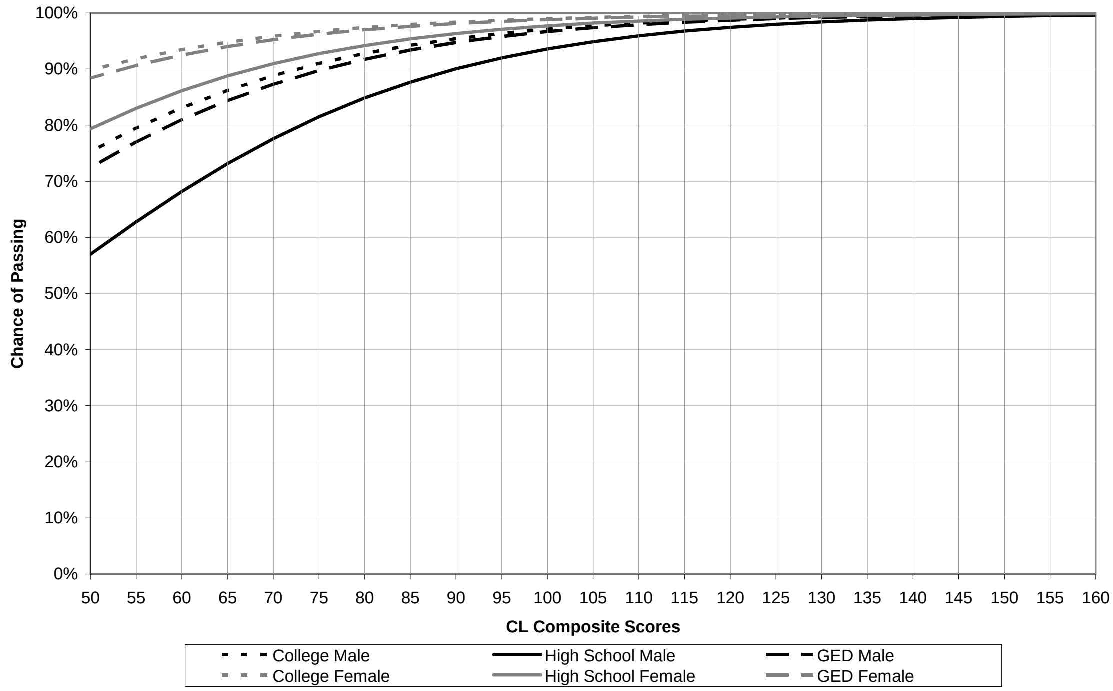


Figure 3 shows the relationship between CL and the probability of passing for Soldiers by education and gender. The graph illustrates that women with some college education have the best chance at passing the course, while high school educated males, the modal students, have the lowest chance of passing.

Figure 3: Predicted Probability of Passing: Education Level by Sex



Appendix: Soldier Characteristics (92A)

Outcome	Gender: Male	Gender: Female
fail	4.2%	1.9%
pass	95.8%	98.1%

Outcome	Education Level: GED or less	High School Diploma	Some College or More
fail	1.5%	3.4%	1.4%
pass	98.5%	96.6%	98.6%

Outcome	Component: Regular Army	Army Reserve	National Guard
fail	4.0%	2.1%	2.5%
pass	96.0%	97.9%	97.5%

92F: Petroleum Supply Specialist

The final sample included 10,491 Soldiers who were coded as either graduates or academic failures during their first AIT attempt in this MOS during a period from 2001 to 2004. Only Soldiers who graduated (98.3%) or failed for academic reasons (1.7%) were included in the analysis sample because we assume that non-completion for non-academic reasons is not related to cognitive criteria.

In this sample, most were male (81%, 19% female), most had a high school diploma but not more education (87%, 7% some college, 6% GED or less), and most were from Regular Army (58%, 16% National Guard, 27% Reserve). The governing AA composites, Operator / Food (OF) and Clerical (CL), for this MOS have cutoff scores of 85 and 88 respectively; the sample mean is 101.51 (standard deviation = 11.750) for OF, and 104.11 (standard deviation = 12.094) for CL. The governing AA composites, OF and CL, are correlated at .783 ($p < .001$). See the Appendix for a description of Soldier characteristics for this MOS training sample.

A binary logistic regression model was estimated to explain pass/fail AIT

Table 1. 92F: Results of the binary logistic prediction model

Chi- Square		94.193***	
Log Likelihood		1677.433	
Nagelkerke R Square		.058	
Variable	Coefficient	Odds Ratio	Wald
Constant	-2.085	.124	5.816*
RESERVE	.880	2.411	12.419***
GUARD	.340	1.406	2.204
GENDER	.880	2.410	11.973**
OF	.043	1.044	10.797**
CL	.016	1.016	1.272

* = p < .05 *** = p < .001
** = p < .005

outcomes and focused on the first training attempt. The estimation results are reported in Table 1 and indicate that a model, including the OF and CL composites, Army component (GUARD = National Guard; RESERVE = Army Reserve) and gender (GENDER = female), accounts for about six percent of the variation in the dependent variable. This model is statistically significant ($\chi^2 = 94.193$, $P < .001$), and has somewhat limited explanatory power (Nagelkerke $R^2 = .058$).

There are statistically significant effects for the OF composite, being female, and Reserve membership. The model suggests that having a higher OF composite score predicts increased odds of passing, but the marginal effect is small: at the mean OF score, an increase of one point is associated with an increase of about four percent in the odds of passing the course, and a five-point increase in OF would increase the odds of passing by 24%.[59] There is also a noteworthy effect for GENDER: the odds of passing the course for female Soldiers are 141% higher. Finally, there is a noteworthy effect for RESERVE: the odds of a Reservist passing this training exceed that of the average active duty soldier by 141%.

Policy Analysis. Table 2 reports the probability that the average Soldier from the larger Army contract population would pass the course on the first attempt based upon the binary logistic model. These were calculated using the formula for finding probability in a binary logistic model, which is

$$e^{(\beta' x)} / (1 + e^{(\beta' x)}).$$

This analysis is confined to the modal demographics factored by GENDER: male and female Soldiers from the Regular Army. Based on the model, when the cutoff score is at

[59] Given the high correlation between OF and CL, similar remarks hold for the effect of CL. See the Appendix for results of separate regressions with OF and CL.

its current level (OF = 85, CL = 88), male soldiers with an average scores (OF = 108.42, CL = 109.32) have approximately a 99% chance of passing, while their female counterparts also have approximately a 99% chance of passing. Currently, about 98% of Soldiers are eligible for MOS 92F assignment at the current cutoff (OF = 85, CL = 88).[60] Raising the cutoff by five points (OF = 90, CL = 93), the average male or female Soldier who would qualify for training would have essentially the same chance of passing, while eligibility would decrease by 8 percentage points (to 90%). Lowering the cutoff score by five points (OF = 80, CL = 83) would increase eligibility to about 100%, and the average Soldier would have essentially the same chance of passing as they have at the current cutoff score.

Table 2. 92F: Probability that a male Soldier (from the larger Army contract population) will pass the course based on the binary logistic model

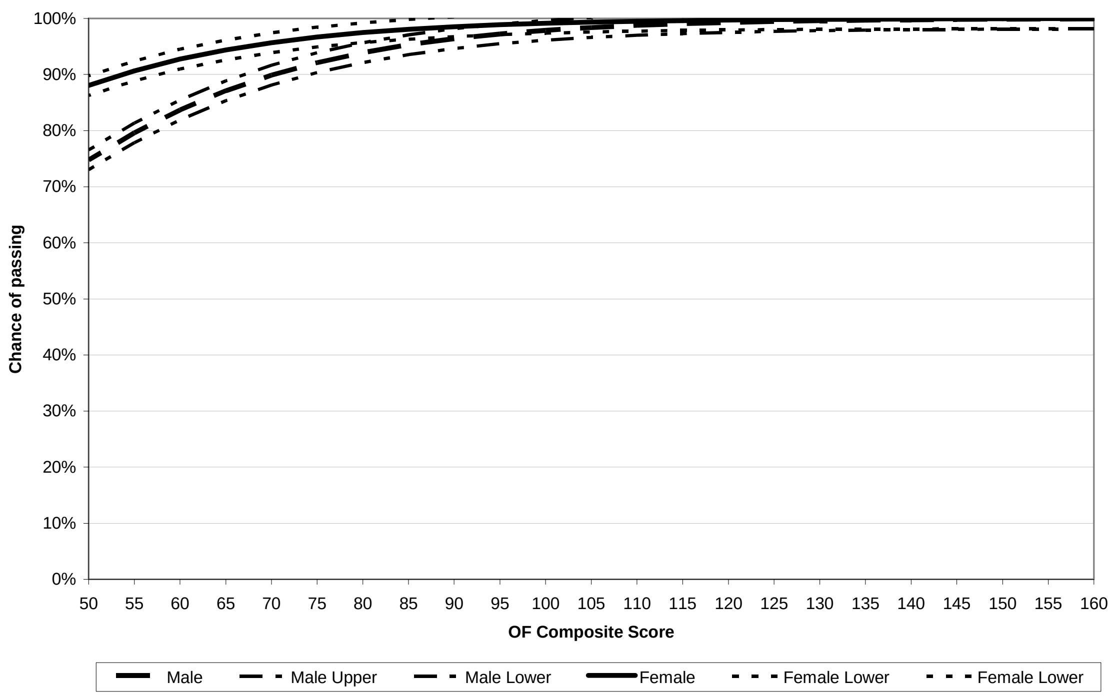
	Cutoff = 75/78	Cutoff = 80/83	Cutoff = 85/88	Cutoff = 90/93	Cutoff = 95/98
Percent Eligible (Regular Army)	*100%*	*99.9%*	*98.4%*	*90.0%*	*77.2%*
Mean: OF	*105.89*	*106.12*	*107.01*	*109.04*	*111.36*
Mean: CL	*107.27*	*107.42*	*108.27*	*110.53*	*112.81*
Passing rates:					
Male	98.5%	98.5%	98.6%	98.8%	98.9%
Female	99.4%	99.4%	99.4%	99.5%	99.5%

Figure 1 shows the relationship between OF and the probability of passing for male and female Regular Army Soldiers, based upon a regression model that excludes CL (see the Appendix) because it is not significant in the reported model. Figure 1 includes upper and lower bounds based upon the standard error of the estimated OF coefficient. For a particular OF score, trace a vertical line up to the curve, and then a horizontal line

[60] The percentage eligible reported in the text and Table 2 reflect only the CL cutoff and not the joint CL and OF cutoff effects. Given the "dominance" of the CL over the OF cutoff scores, this approximation is fully justified.

over to the axis to determine the corresponding probability of passing. For example, an OF score of 100 corresponds to a passing probability of about 98% for a high school educated, Regular Army male Soldier. One can see that male Soldiers with a low OF score stand a reasonably good chance of passing the course; female Soldiers have an even better chance of passing. As the OF (or CL) composite scores increase, the chance that a Soldier will pass the course increases, essentially reaching 100% just above the current cutoff.

Figure 1: Predicted Probability of Passing: Male and Female Students



Appendix: Additional Regression Models

Table 1A. 92F: Results of the binary logistic prediction model excluding CL

Chi- Square		92.879***	
Log Likelihood		1678.747	
Nagelkerke R Square		.057	
Variable	Coefficient	Odds Ratio	Wald
Constant	-1.663	.190	4.638*
RESERVE	.896	2.449	12.884***
GUARD	.329	1.390	2.067
GENDER	.910	2.484	12.954***
OF	.055	1.057	46.507***

* = p < .05 *** = p < .001
** = p < .005

Table 1B. 92F: Results of the binary logistic prediction model excluding OF

Chi- Square		82.986***	
Log Likelihood		1688.640	
Nagelkerke R Square		.051	
Variable	Coefficient	Odds Ratio	Wald
Constant	-1.590	.204	3.510
RESERVE	.914	2.495	13.478***
GUARD	.401	1.493	3.078
GENDER	.748	2.113	8.854**
CL	.053	1.054	37.875***

* = p < .05 *** = p < .001
** = p < .005

Appendix: Soldier Characteristics (92F)

Observed	Gender	
	Male	Female
fail	1.8%	.9%
pass	98.2%	99.1%

Observed	Education Level		
	GED or less	High School Diploma	Some College or More
fail	.3%	1.8%	.5%
pass	99.7%	98.2%	99.5%

Observed	Component		
	Regular Army	Army Reserve	National Guard
fail	2.2%	.7%	1.4%
pass	97.8%	99.3%	98.6%

92G: Food Service Operations

The final sample included 10,206 Soldiers who were coded as either graduates or academic failures during their first AIT attempt in this MOS during a period from 2001 to 2004. Only Soldiers who graduated (99.6%) or failed for academic reasons (0.4%) were included in the analysis sample because we assume that non-completion for non-academic reasons is not related to cognitive criteria.

In this sample, most of the Soldiers were male (63%, 37% female), most had a high school diploma but not more education (90%, 6% some college, 4% GED or less), and most were from Regular Army (65%, 19% National Guard, 16% Army Reserve). The governing AA composite, Operator / Food (OF), for this MOS has a cutoff score of 85; the sample mean is 98.78 (standard deviation = 11.446). See the Appendix for a description of Soldier characteristics for this MOS training sample.

A binary logistic regression model was estimated to explain pass/fail AIT outcomes and focused on the first training attempt. The estimation results are reported in Table 1 and indicate that the model, including the OF composite and gender (GENDER =

Table 1. 92G: Results of the binary logistic prediction model

Chi- Square		12.916**	
Log Likelihood		499.174	
Nagelkerke R Square		.026	
Variable	Coefficient	Odds Ratio	Wald
Constant	.570	1.768	.125
OF	.049	1.050	8.484**
GENDER	1.003	2.727	6.547*

* = p < .05 *** = p < .001
** = p < .005

female), accounts for about three percent of the variation in the dependent variable. This model is statistically significant (χ^2 = 12.916, P = .002), but its explanatory power is limited (Nagelkerke R^2 = .026).

There is a statistically significant effect for the OF composite. The model suggests that having a higher OF composite score increases the odds of passing. At the mean OF score, an increase of one point is associated with an increase of about 5% in the odds of passing the course, and a five-point increase in OF would increase the odds of passing by 28%. There is also a significant effect for GENDER, where women have 173% higher odds of passing than men.

Policy Analysis. Table 2 reports the probability that the average Soldier from the larger Army contract population would pass the course on the first attempt based upon the binary logistic model. These were calculated using the formula for finding probability in a binary logistic model, which is

$$e^{(\beta' x)} / (1 + e^{(\beta' x)}).$$

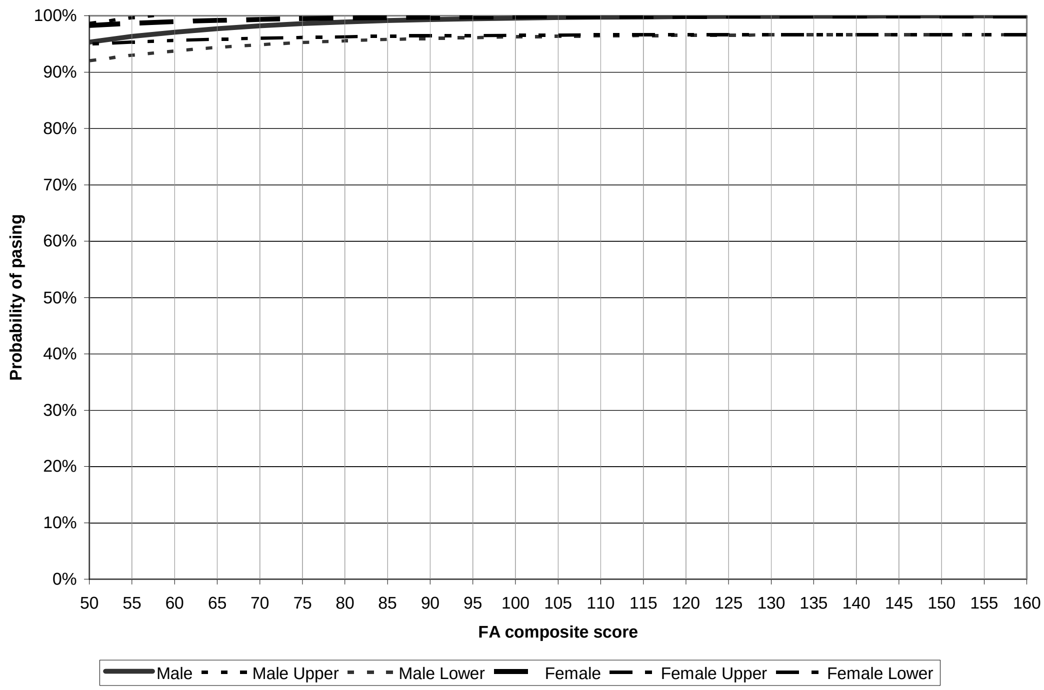
Based on the model, when the cutoff score is at its current level (OF = 85), male Soldiers with an average OF score (OF = 106.76) have approximately a 99.7% chance of passing, while female Soldiers have a 99.9% chance of passing. Currently, about 97% of Soldiers are eligible for MOS 92G assignment at the current cutoff (OF = 85). Lowering the cutoff by five points (OF = 80) would increase eligibility by two percentage points (to 99%) and the average Soldier would have the same chance of passing. Raising the cutoff score by five points (OF = 90), the average Soldier would have the same chance of passing but eligibility would fall by about 7 percentage points (90%).

Table 2. 92G: Probability that a Soldier (from the larger Army contract population) will pass the course based on the binary logistic model

	Cutoff = 75	Cutoff = 80	Cutoff = 85	Cutoff = 90	Cutoff = 95
Percent Eligible (Regular Army)	*99.9%*	*99.3%*	*97.2%*	*91.9%*	*80.9%*
Mean	*105.89*	*106.10*	*106.76*	*108.05*	*110.08*
Passing rates:					
High School Male	99.7%	99.7%	99.7%	99.7%	99.7%
High School Female	99.9%	99.9%	99.9%	99.9%	99.9%

Figure 1 shows the relationship between OF and the probability of passing on the first attempt for male and female Soldiers, including upper and lower bounds based upon the standard error of the estimated OF coefficient. For a particular OF score, trace a vertical line up to the curve, and then a horizontal line over to the axis to determine the corresponding probability of passing. For example, an OF score of 100 corresponds to a passing probability of about 100% for a high school educated, Regular Army male Soldier. One can see that Soldiers with a low OF score have a reasonable chance of passing the course. As OF scores increase, the chance that a Soldier will pass the course increases.

Figure 1: Predicted Probability of Passing: Male vs. Female



Appendix: Soldier Characteristics (92G)

	Gender	
Outcome	Regular or Reserve	Guard
fail	.5%	.2%
pass	99.5%	99.8%

	Education Level		
Outcome	GED or less	High School Diploma	Some College or More
fail	.2%	.4%	.3%
pass	99.8%	99.6%	99.7%

	Component		
Outcome	Regular Army	Army Reserve	National Guard
fail	.5%	.3%	.2%
pass	99.5%	99.7%	99.8%

92Y: Unit Supply Specialist

The final sample included 9970 Soldiers who were coded as either graduates or academic failures during their first AIT attempt for this MOS during a period from 2001 to 2004. Only Soldiers who graduated (98.8%) or failed for academic reasons (1.2%) were included in the analysis sample because we assume that non-completion for non-academic reasons is not related to cognitive criteria.

In the sample, most were male (56%, 44% female), most had a high school diploma but not more education (87%, 7% some college, 6% GED or less), and most were from were from the Regular Army (62%, 23% National Guard, 15% Reserve). The governing AA composites, Clerical (CL), for this MOS has cutoff score of 92; the sample mean is 102.07 (standard deviation = 10.587). See the Appendix for a description of Soldier characteristics for this MOS training sample.

A binary logistic regression model was estimated to explain pass/fail AIT outcomes and focused on the first training attempt. The estimation results are reported in Table 1 and indicate that the model, including the CL composite, education status (GED, = GED or less than a high school diploma, COLLEGE = some college education), Army component (GUARD = National Guard, RESERVE = Army Reserve), and gender (GENDER = Female) accounts for about six percent of the variation in the dependent variable. This model is statistically significant (χ^2 = 76.078, P < .001), and has somewhat limited explanatory power (Nagelkerke R^2 = .061).

Table 1. 92Y: Results of the binary logistic prediction model			
Chi- Square		76.078***	
Log Likelihood		1240.832	
Nagelkerke R Square		.061	
Variable	Coefficient	Odds Ratio	Wald
Constant	-.429	.651	.333
GED	1.147	3.149	2.256
COLLEGE	.822	2.276	1.950
GUARD	.860	2.363	9.621**
RESERVE	1.127	3.085	8.164**
GENDER	1.080	2.946	25.761***
CL	.041	1.042	31.075***

* = p < .05 *** = p < .001
** = p < .01

There is a statistically significant effect for the CL composite. The model suggests that having a higher CL composite score increases the odds of passing. At the mean CL score, an increase of one point is associated with an increase of about four percent in the odds of passing the course, and a five-point increase in CL would increase the odds of passing by 23%. There are also statistically significant effects for GUARD, RESERVE, and GENDER, with increased odds of passing the course at 136%, 209%, and 195% (for females), respectively.

Policy Analysis. Table 2 reports the probability that the average Soldier from the larger Army contract population would pass the course based upon the binary logistic model. These were calculated using the formula for finding probability in a binary logistic model, which is

$$e^{(\beta' x)} / (1 + e^{(\beta' x)}).$$

The following analysis is focused upon male and female Soldiers from the Regular Army. Based on the model, when the cutoff score is at its current level (CL = 92), male (female)

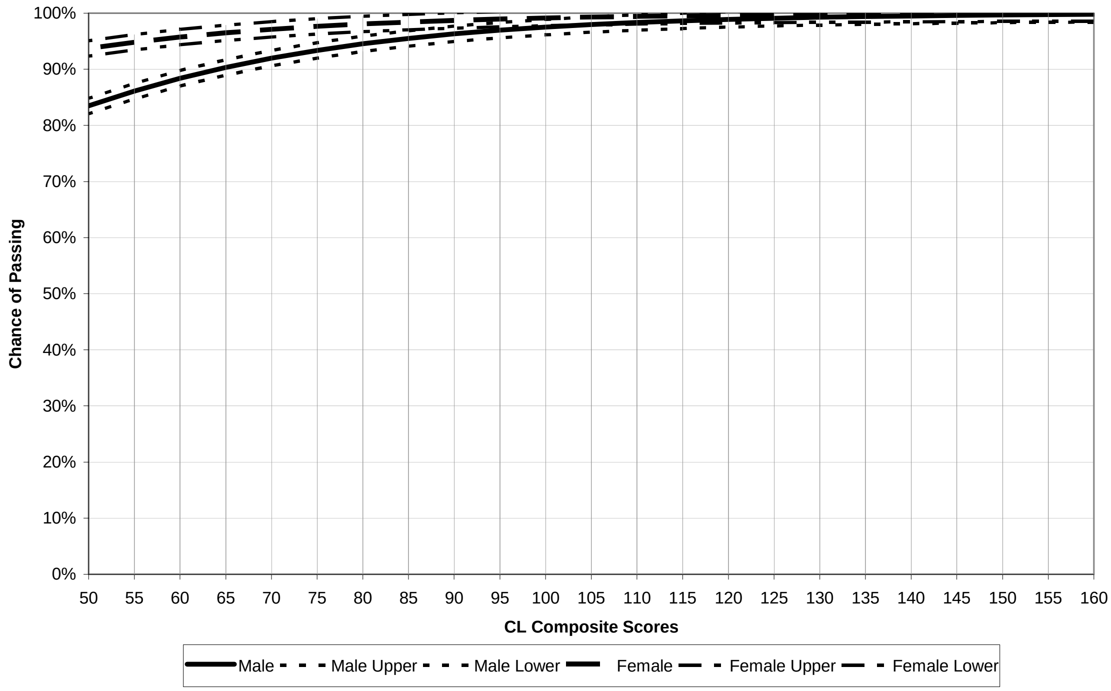
Soldiers with a high school diploma and an average CL score (CL = 109.17) have approximately a 98% (99%) chance of passing. About 92% of Soldiers are eligible for MOS 92Y assignment at the current cutoff. Lowering the cutoff by five points (CL = 87) would increase eligibility by seven percentage points (to 99%) and the average male (female) Soldier who would qualify for training would have essentially the same chance of passing (98%) (99%). Raising the CL cutoff score by five points (CL = 97) provides about the same in passing rates for the average high school male (female) Soldier (98%) (99%), but fewer Soldiers would be eligible (80%).

Table 2. 92Y: Probability that a Regular Army Soldier (from the larger successful applicant population) will pass the course based on the binary logistic model

	Cutoff: CL = 82	Cutoff: CL = 87	Cutoff CL = 92	Cutoff CL = 97	Cutoff CL = 102
Percent Eligible (Regular Army)	*99.9%*	*99.0%*	*91.6%*	*80.0%*	*67.6%*
Mean	*107.49*	*107.69*	*109.17*	*111.37*	*113.62*
Passing Rates:					
High School Male	98.2%	98.2%	98.3%	98.4%	98.6%
High School Female	99.4%	99.4%	99.4%	99.5%	99.5%

Figure 1 shows the relationship between CL and the probability of passing for high school educated Regular Army Soldiers by gender. For a particular CL score, trace a vertical line up to the curve, and then a horizontal line over to the axis to determine the corresponding probability of passing. For example, a CL score of 100 corresponds to a passing probability of about 98% for a high school educated, Regular Army male Soldier.

Figure 1: Predicted Probability of Passing: High School Soldiers



Appendix: Soldier Characteristics (92Y)

Outcome	Gender: Male	Gender: Female
fail	1.6%	0.7%
pass	98.4%	99.3%

Outcome	Education Level: GED or less	Education Level: High School Diploma	Education Level: Some College or More
fail	0.4%	1.3%	0.4%
pass	99.6%	98.7%	99.6%

Outcome	Component: Regular Army	Component: Army Reserve	Component: National Guard
fail	1.6%	0.5%	0.7%
pass	98.4%	99.5%	99.3%

35E: Radio/COMSEC Repairer

The final sample included 1268 Soldiers who were coded as either graduates or academic failures during their first AIT attempt in this MOS during a period from 2001 to 2004. Only Soldiers who graduated (93.0%) or failed for academic reasons (7.0%) were included in the analysis sample because we assume that non-completion for non-academic reasons is not related to cognitive criteria.

In the sample, most were male (87%, 13% female), most had a high school diploma but not more education (82%, 15% some college, 3% GED or less), and most were Regular Army (76%, 9% Army Reserve, 14% National Guard). The governing AA composite, Electronics Repair (EL), for this MOS has a cutoff score of 99; the sample mean is 112.21 (standard deviation = 10.159). See the Appendix for a description of Soldier characteristics for this MOS training sample.

Table 1. 35E: Results of the binary logistic prediction model

Chi- Square		27.995***	
Log Likelihood		616.474	
Nagelkerke R Square		.055	
Variable	Coefficient	Odds Ratio	Wald
Constant	-2.097	.123	2.812
COLLEGE	.389	1.475	1.136
GUARD	1.410	4.096	6.530**
RESERVE	.172	1.187	.174
GENDER	.865	2.375	3.936*
EL	.040	1.041	12.286***

* = p < .05 *** = p < .001
** = p < .01

A binary logistic regression model was estimated to explain pass/fail AIT outcomes and focused on the first training attempt. The estimation results are reported in

Table 1 and indicate that the model, including the EL composite, education status (COLLEGE = some college), Army component (GUARD = National Guard; RESERVE = Army Reserve) and gender (GENDER = female), accounts for about 6% of the variation in the dependent variable. This model is statistically significant ($\chi^2 = 27.995$, $P < .001$), but has limited explanatory power (Nagelkerke $R^2 = .055$).

There are statistically significant effects for the EL composite, having some college education, and National Guard membership. The model suggests that having a higher EL composite score increases the odds of passing. At the mean EL score, an increase of one point is associated with an increase of about four percent in the odds of passing the course, and a five-point increase in EL would increase the odds of passing by 22%. There is a noteworthy effect for GUARD, where the odds of passing for a National Guardsman exceed those of a Regular Army Soldier by 310%. There is also an effect for GENDER, where the odds of a female Soldier passing this training exceed that of the average male Soldier by over 138%.

Policy Analysis. Table 2 reports the probability that the average Soldier from the larger Army contract population would pass the course based upon the binary logistic model. These were calculated using the formula for finding probability in a binary logistic model, which is

$$e^{(\beta' x)} / (1 + e^{(\beta' x)}).$$

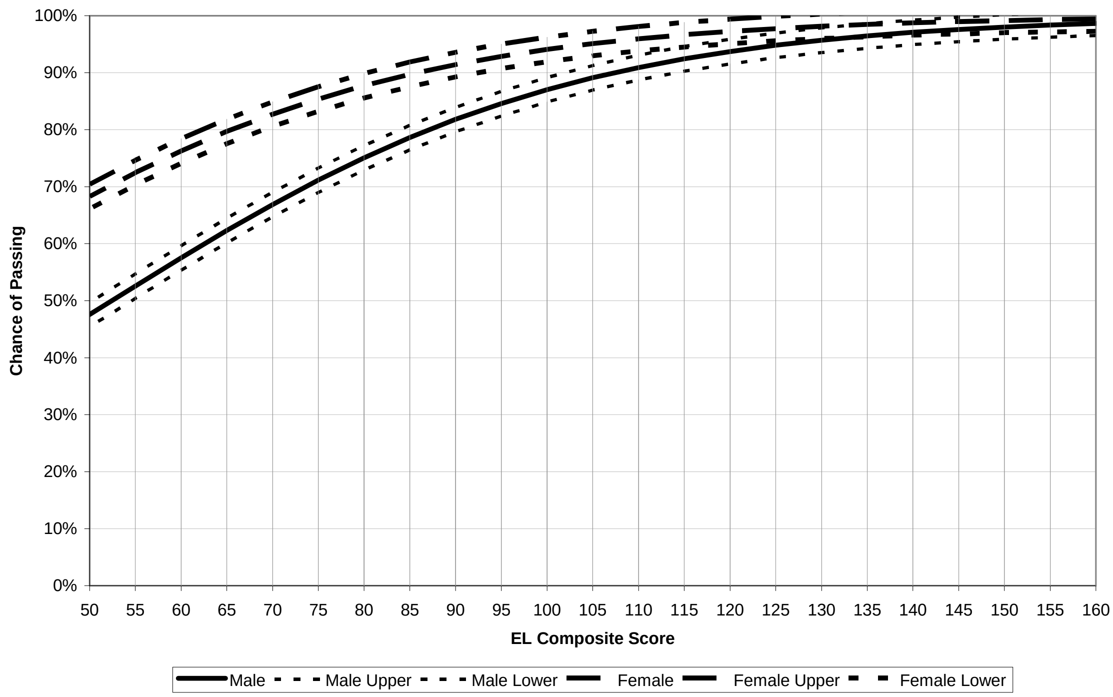
Because GED and COLLEGE were not statistically significant, this analysis is confined to the modal demographics factored by GENDER—high school educated Soldiers from the Regular Army (though results would be similar for any demographic combination). Based on the model, when the cutoff score is at its current level (EL = 99), male Soldiers with a high school diploma and an average EL score (EL = 112.02) have approximately a 92% chance of passing, while their female counterparts have approximately a 96% chance of passing. Currently, about 68% of Soldiers are eligible for MOS 35E assignment at the current cutoff (EL = 99). Lowering the cutoff by five points (EL = 94) would increase eligibility by 13 percentage points, while the average Soldier who would qualify for training would have about the same chance of passing (male = 91%, female = 96%). Raising the cutoff score by five points (EL = 104), the average Soldier who would still qualify for the MOS would have about the same chance of passing (male = 92%, female = 97%), but fewer Soldiers would be eligible (53%).

Table 2. 35E: Probability that a Soldier (from the larger Army contract population) will pass the course based on the binary logistic model

	Cutoff = 89	Cutoff = 94	Cutoff = 99	Cutoff = 104	Cutoff = 109
Percent Eligible (Regular Army)	*91.7%*	*81.2%*	*67.8%*	*53.0%*	*39.8%*
Mean	*107.30*	*109.40*	*112.02*	*115.03*	*118.04*
Passing rates:					
High school male	90.0%	90.7%	91.6%	92.4%	93.2%
High school female	95.5%	95.9%	96.3%	96.7%	97.0%

Figure 1 shows the relationship between EL and the probability of passing for Regular Army Soldiers, including upper and lower bounds based upon the standard error of the estimated EL coefficient. For a particular EL score, trace a vertical line up to the curve, and then a horizontal line over to the axis to determine the corresponding probability of passing. For example, an EL value of 100 corresponds to a passing probability of about 87% for a high school educated male Soldier, and 94% for a high school educated female soldier. One can see that the probability of passing increases gradually over the full range for Soldiers of both genders.

Figure 1: Predicted Probalility of Passing: High School Soldiers



Appendix: Soldier Characteristics (35E)

Outcome	Gender: Male	Gender: Female
fail	7.5%	3.8%
pass	92.5%	96.2%

Outcome	Education Level: GED or less	High School Diploma	Some College or More
fail	.0%	7.7%	4.8%
pass	100.0%	92.3%	95.2%

Outcome	Component: Regular Army	Army Reserve	National Guard
fail	8.0%	5.9%	2.2%
pass	92.0%	94.1%	97.8%

35F: Special Electronic Device Repairer

The final sample included 319 Soldiers who were coded as either graduates or academic failures during their first AIT attempt in this MOS during a period from 2001 to 2004. Only Soldiers who graduated (92.8%) or failed for academic reasons (7.2%) were included in the analysis sample because we assume that non-completion for non-academic reasons is not related to cognitive criteria.

In the sample, most of the Soldiers were male (92%, 8% female), most had a high school diploma but not more education (88%, 8% some college, 4% GED or less), and most were from Regular Army (73%, 20% National Guard, 6% Army Reserve). The governing AA composite, Electrical Repair (EL), for this MOS has a cutoff score of 102; the sample mean for EL is 112.84 (standard deviation = 8.444). See the Appendix for a description of Soldier characteristics for this MOS training sample.

Table 1. 35F: Results of the binary logistic prediction model

Chi- Square		4.494	
Log Likelihood		160.773	
Nagelkerke R Square		.035	
Variable	Coefficient	Odds Ratio	Wald
Constant	-1.568	.634	.226
GED	-.950	.387	1.292
COLLEGE	-.820	.441	1.444
GUARD	.267	1.307	.200
GENDER	-2.80	.755	.170
EL	.038	1.039	1.639

* = p < .05 *** = p < .001
** = p < .01

A binary logistic regression model was estimated to explain pass/fail AIT outcomes and focused on the first training attempt. The estimation results are reported in

Table 1 and indicate that a model, including the EL composite, education status (GED = GED or less education; COLLEGE = some college education), Army component (GUARD = National Guard), and gender (GENDER = female), accounts for about four percent of the variation in the dependent variable. This model is not statistically significant ($\chi^2 = 4.494$, $P = .481$), and it has limited explanatory power (Nagelkerke $R^2 = .035$).

There is no statistically significant effect for the EL composites or any other variable. The model suggests that the EL composite score does not predict increased odds of passing, but there are relatively few failure observations for a definitive conclusion.

Policy Analysis. Given the model's lack of statistical significance and explanatory power, this model is not appropriate for conducting policy analysis.

Appendix: Soldier Characteristics (35F)

Outcome	Gender	
	Male	Female
fail	6.8%	11.1%
pass	93.2%	88.9%

Outcome	Education Level		
	GED or less	High School Diploma	Some College or More
fail	14.3%	6.4%	12.5%
pass	85.7%	93.6%	87.5%

Outcome	Component		
	Regular Army	Army Reserve	National Guard
fail	8.1%	.0%	6.2%
pass	91.9%	100.0%	93.8%

35M: Radar Repairer

The final sample included 245 soldiers who were coded as either graduates or academic failures <u>during their first AIT attempt</u> in this MOS during a period from 2001 to 2004. Only soldiers who graduated (96.3%) or failed for academic reasons (3.7%) were included in the analysis sample because we assume that non-completion for non-academic reasons is not related to cognitive criteria.

In the sample, most were male (93%, 7% female), most had a high school diploma but not more education (89%, 8% some college, 3% GED or less), and most were Regular Army (80%, 2% Army Reserve, 18% National Guard). The governing AA composite, Skilled Technical (EL), for this MOS has a cutoff score of 107; the sample mean is 116.98 (standard deviation = 6.900). See the Appendix for a description of Soldier characteristics for this MOS training sample.

Table 1. 35M: Results of the binary logistic prediction model

Chi- Square		12.305**	
Log Likelihood		64.838	
Nagelkerke R Square		.181	
Variable	Coefficient	Odds Ratio	Wald
Constant	-17.280	.000	4.725*
GUARD	-1.436	.238	3.950*
EL	.184	1.202	6.694**

* = p < .05 *** = p < .001
** = p < .01

A binary logistic regression model was estimated to explain pass/fail AIT outcomes and focused on the first training attempt. The estimation results are reported in Table 1 and indicate that the model, including the EL composite and Army component (GUARD = National Guard), accounts for about 18% of the variation in the dependent variable. This model is statistically significant ($\chi^2 = 12.305$, $P = .010$), with moderate explanatory power (Nagelkerke $R^2 = .181$)[61].

There are statistically significant effects for the EL composite and National Guard membership. The model suggests that having a higher EL composite score increases the odds of passing. At the mean EL score, an increase of one point is associated with an increase of about 20% in the odds of passing the course, and a five-point increase in EL would increase the odds of passing by 151%. There is a noteworthy effect for GUARD, where the odds of a National Guardsman passing this training are 76% lower than that of a Regular Army Soldier.

<u>Policy Analysis.</u> Table 2 reports the probability that the average Soldier from the larger Army contract population would pass the course based upon the binary logistic model. These were calculated using the formula for finding probability in a binary logistic model, which is

$$e^{(\beta' x)} / (1 + e^{(\beta' x)}).$$

This analysis is confined to the modal demographics—Soldiers from the Regular Army (though results would be similar for any demographic combination except National Guardsmen). Based on the model, when the cutoff score is at its current level (EL = 107), Soldiers with an average EL score (EL = 116.86) have approximately a 99% chance of passing. Currently, about 45% of soldiers are eligible for MOS 35M assignment at the current cutoff (EL = 107). Lowering the cutoff by five points (EL = 102) would increase eligibility by 15 percentage points, while eligible Soldiers with an average EL score (EL = 113.67) would have a slightly lower chance of passing (97%). Raising the cutoff score

[61] A caveat to the reliability of this model is the fact that the training sample contains only nine failure cases.

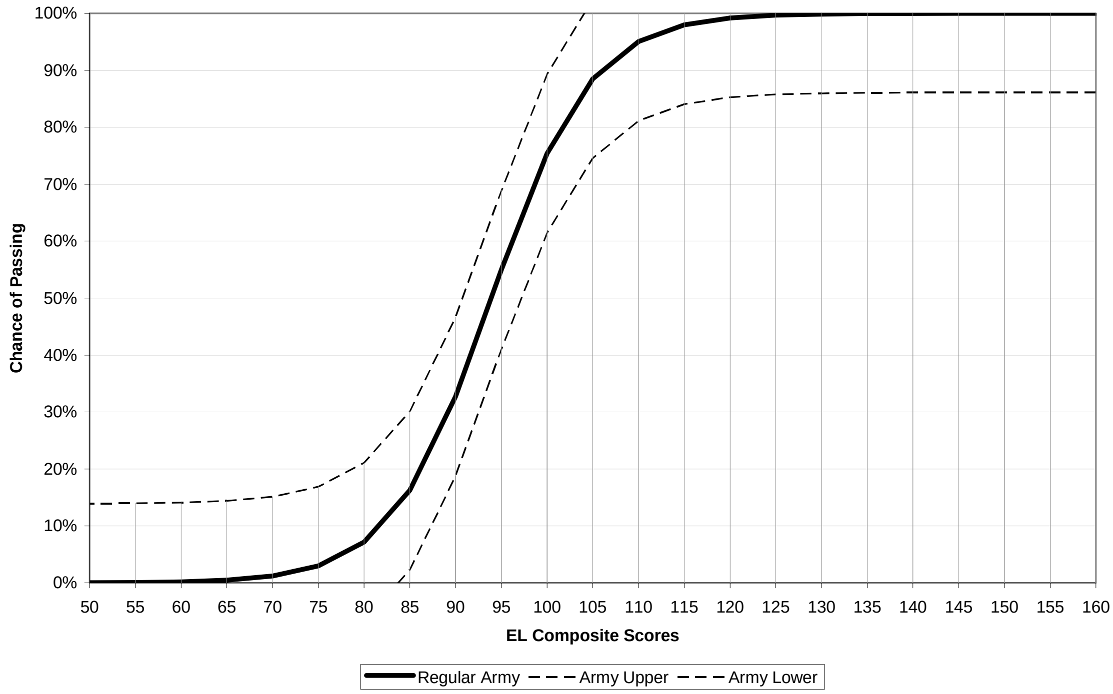
by five points (EL = 112), eligible Soldiers with an average EL score (EL = 120.29) would have essentially the same chance of passing (99%), but fewer Soldiers would be eligible (31%).

Table 2. 35M: Probability that a Soldier (from the larger Army contract population) with mean EL score will pass the course based on the binary logistic model

	Cutoff = 97	Cutoff = 102	Cutoff = 107	Cutoff = 112	Cutoff = 117
Percent Eligible (Regular Army)	*73.9%*	*59.5%*	*44.7%*	*31.1%*	*20.0%*
Mean	*110.81*	*113.67*	*116.86*	*120.29*	*123.76*
Passing rates:					
Regular Army	95.7%	97.4%	98.6%	99.2%	99.6%

Figure 1 shows the relationship between EL and the probability of passing for Regular Army Soldiers, including upper and lower bounds based upon the standard error of the estimated EL coefficient. For a particular EL score, trace a vertical line up to the curve, and then a horizontal line over to the axis to determine the corresponding probability of passing. For example, an EL value of 100 corresponds to a passing probability of about 75% for a Regular Army Soldier. One can see that the probability of passing increases steeply over the full range of the data.

Figure 1: Predicted Probalility of Passing: Regular Army Soldiers



Appendix: Soldier Characteristics (35M)

Outcome	Gender: Male	Gender: Female
fail	4.0%	.0%
pass	96.0%	100.0%

Outcome	Education Level: GED or less	Education Level: High School Diploma	Education Level: Some College or More
fail	.0%	4.1%	.0%
pass	100.0%	95.9%	100.0%

Outcome	Component: Regular Army	Component: Army Reserve	Component: National Guard
fail	2.5%	.0%	9.1%
pass	97.5%	100.0%	90.9%

35M Risk Analysis of Policy Alternatives

In this section we extend the policy analysis with a risk analysis of the policy alternatives considered using simulation methods. We employ the "@RISK" software package which is designed as an add-in for Microsoft Excel.[62] There are four steps in the risk analysis.

The first step is developing a model. A regression model for predicting the passing rate has been specified and estimated, and the results stored in Excel worksheet format. See Table 1.

The second step is identifying the uncertainty inherent in both the input variables (composite scores, Soldier characteristics) and the corresponding estimated parameters and specifying their possible values with probability distributions.

To approximate the governing composite distribution, we use the larger Army contract population (EAF file: those who contracted from Jan 1992 to Aug 2003). This distribution can be assumed to follow a normal distribution. The mean and standard deviation estimated from the contract population and used as input to the simulations are shown in Table R-1 (before truncation).

Table R-1. Input information for the simulations

	Mean	Std error / deviation
Constant	-17.280	7.950
EL var	105.33 (before truncation)	12.525
EL coeff	.184	.071
GUARD var	18.0%	
GUARD coeff	-1.436	.722

To approximate the distributions for the demographic variables (GUARD) we rely on the training data sample used to estimate the regression model. These distributions can be assumed to follow binomial distributions with means estimated from the training data sample as shown in Table R-1.

To approximate the distributions for the estimated parameters in the logit model, we note that, under very general conditions, the estimates will be asymptotically normally distributed.[63] The estimated coefficients (means and standard errors) are shown in Table R-1.

[62] Software is available from Palisade Corporation, Newfield, NY.

[63] The intuition is that logit estimates are derived from maximum likelihood (ML) estimation, and under fairly general conditions ML estimates are consistent and asymptotically normally distributed.

The third step is analyzing the model with simulation to determine the range and probabilities of all possible training outcome results. The results reported represent the simulation of the regression prediction equation for 1000 iterations using a fixed seed.[64] The comparisons are between the baseline case (EL = 107) and the policy cases (EL = 102 and EL = 112). These cases are delineated by the cutoff score level which serves as the lower truncation point in the governing composite input distribution. The results in Table R-2 describe the effect on the mean probability of passing as the EL cutoff score level is varied, and represent an improvement of the policy analysis presented in Table 2 because the simulation results reflect the simultaneous effects of all known sources of uncertainty.

Table R-2. 35M simulation results

	EL = 102	EL = 107	EL = 112
Mean governing composite	113.01	116.12	119.63
Mean probability of passing	61.0%	63.3%	66.0%
Std deviation	45.4%	44.5%	44.3%

The frequency distributions of simulated effects are shown below in the histogram graphs. The histogram portrays the full range of outcomes that average to the mean effect as reported. Looking at the histogram for the baseline case (EL = 107), probability of passing is plotted on the horizontal axis and the height of each bar indicates the relative number of Soldiers at that passing probability. The information in the histograms is effectively summarized in Table R-3. In that table we see the percentage of Soldiers who meet or exceed a given chance of passing. For example, looking at the baseline case (EL = 107), about 61% of Soldiers have a 70% or greater chance of passing.

We find that the mean probability of passing in the simulation is 63% (Table R-2, baseline). Looking at the histograms, we see a large portion of Soldiers in the highest range of passing scores; however, it is also evident that a not insubstantial group of Soldiers has a very low chance of passing. Sensitivity analysis indicates that we can attribute this pattern to the relatively large standard errors on the constant and governing composite terms (especially the former) that come into play in the simulation. The

[64] Latin Hypercube (LH) sampling is utilized in drawing samples for the input distributions. It is designed to accurately recreate the input distribution through sampling in fewer iterations when compared with the Monte Carlo method. The key to LH sampling is stratification of the input probability distributions.

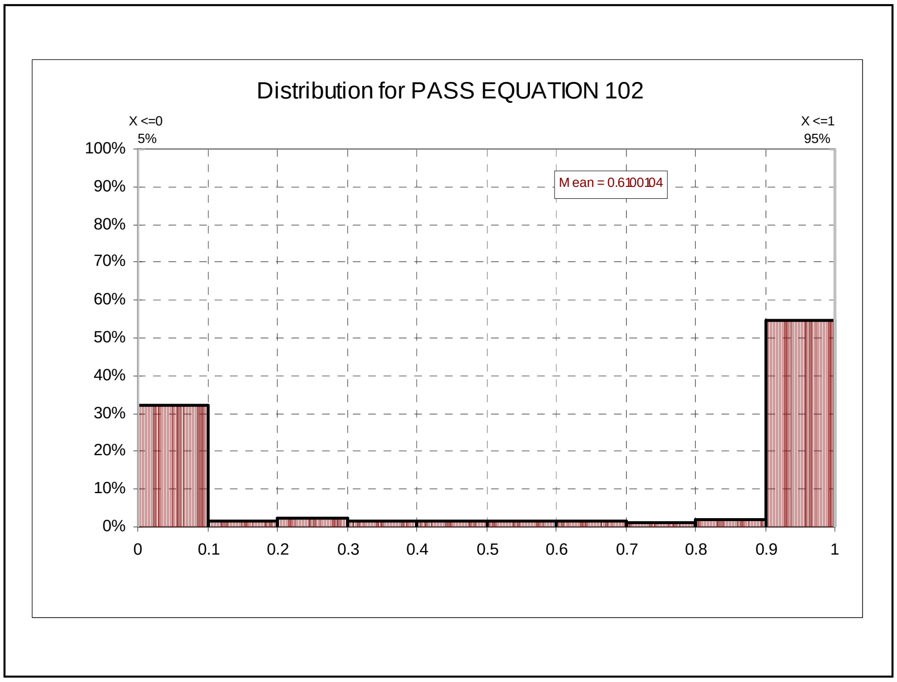
Table R-3.
Percent of simulated Soldiers that meet or exceed given chance of passing

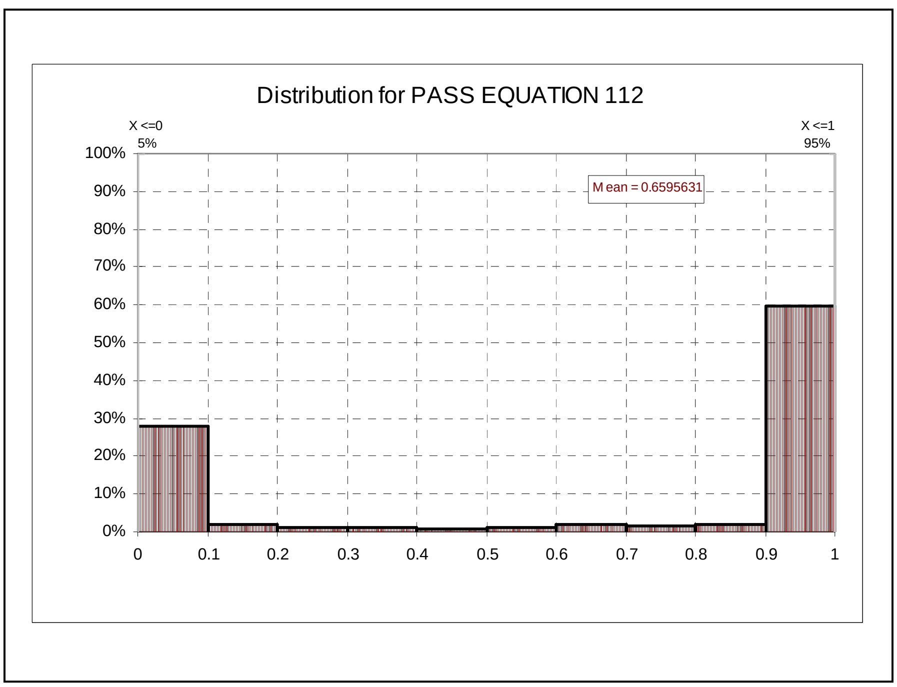
Chance of passing	EL = 102	EL = 107	EL = 112
95.0%	52.3%	52.3%	57.2%
90.0%	54.8%	55.4%	59.8%
85.0%	55.6%	57.1%	61.1%
80.0%	56.6%	58.2%	61.9%
75.0%	57.3%	59.7%	62.7%
70.0%	57.8%	60.7%	63.5%
65.0%	58.7%	61.7%	64.6%
60.0%	59.2%	62.6%	65.3%
55.0%	60.2%	63.4%	66.0%
50.0%	60.8%	63.9%	66.5%

relatively large standard errors introduce variability into the passing probabilities[65]. We note that the mean simulated passing probability turns out to be substantially lower than the static prediction at the mean EL score (Table 2). In the simulated predictions we are calculating an average over all Soldiers and taking into account all sources of uncertainty, whereas in the static prediction we are calculating the probability of passing only at the mean EL score, ignoring the distribution of Soldier scores etc. as well as uncertainty. While recognizing this variability is important, we also note that the policy case impacts relative to the baseline are the same in both simulation and static prediction modes.

The fourth step is making a decision based on the results provided and the preferences of the school proponent. This involves the evaluation by the school proponent of the tradeoff between increased eligibility and reduced passing probabilities (and vice-versa).

[65] The large standard error for the constant allows scores to be more spread out and allows for large groupings at the highest and lowest values. And since the probabilities of passing are calculated from the ratio: $e^{(\beta' x)} / (1 + e^{(\beta' x)})$, as the scores calculated from the equation become extreme, the ratios are more likely to approach zero and one.


Distribution for PASS EQUATION 102
X <=0
5%
X <=1
95%
Mean = 0.6100104
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1


Distribution for PASS EQUATION 112
X <=0
5%
X <=1
95%
Mean = 0.6595631
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
0
0.1
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0.8
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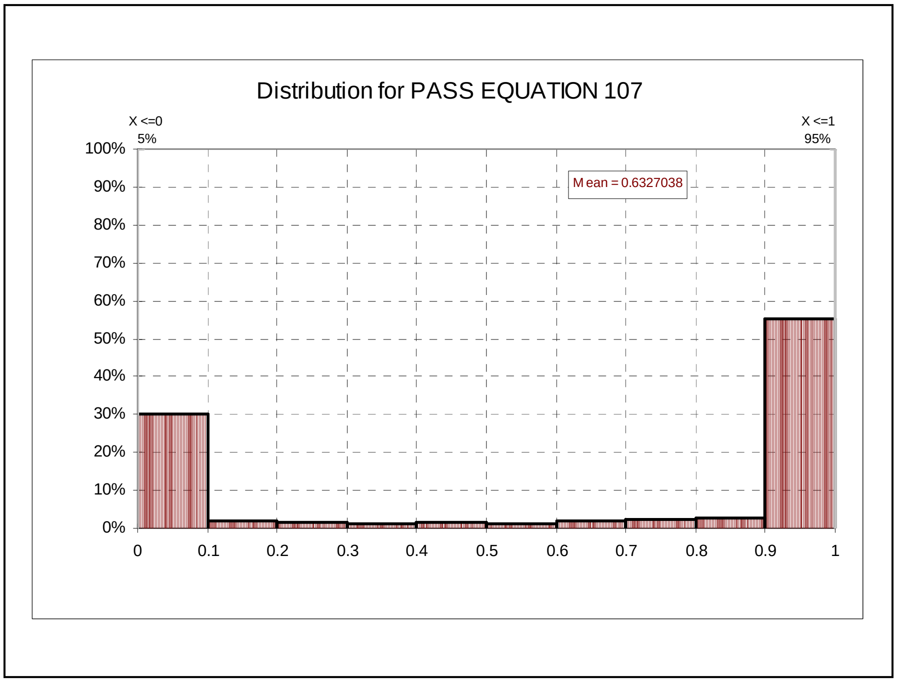

Distribution for PASS EQUATION 107
X <=0
5%
X <=1
95%
Mean = 0.6327038
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1

27M: Multiple Launch Rocket System Repairer

The final sample included 244 Soldiers who were coded as either graduates or academic failures during their first AIT attempt in this MOS during a period from 2001 to 2004. Only Soldiers who graduated (82.8%) or failed for academic reasons (17.2%) were included in the analysis sample because we assume that non-completion for non-academic reasons is not related to cognitive criteria.

In this sample, a majority of the students were male (77%, 23% female), most had a high school diploma but not more education (89%, 6% some college, 5% GED or less), and the greatest number were from the Regular Army (68%, 32% National Guard). The governing AA composite, Electrical Repair (EL), for this MOS has a cutoff score of 95; the sample mean is 103.42 (standard deviation = 9.199). See the Appendix for a description of Soldier characteristics for this MOS training sample.

Table 1. 27M: Results of the binary logistic prediction model

Chi- Square		25.393***	
Log Likelihood		198.721	
Nagelkerke R Square		.164	
Variable	Coefficient	Odds Ratio	Wald
Constant	-7.860	.000	6.974**
GUARD	1.193	3.298	5.377*
GENDER	.936	2.549	3.745*
EL	.089	1.093	8.868**

* = p < .05 *** = p < .001
** = p < .01

A binary logistic regression model was estimated to explain pass/fail AIT outcomes and focused on the first training attempt. The estimation results are reported in Table 1 and indicate that a model, including the EL composite, Army component

(GUARD = National Guard), and GENDER (GENDER = Female), accounts for about 16 percent of the variation in the dependent variable. This model is statistically significant ($\chi^2 = 25.393$, $P < .001$), and has moderate explanatory power (Nagelkerke $R^2 = .164$).

There is a statistically significant effect for the EL composite, GUARD, and GENDER. The model suggests that having a higher EL composite score increases the odds of passing. At the mean EL score, an increase of one point is associated with an increase of about 9% in the odds of passing the course, and a five-point increase in EL would increase the odds of passing by 56%. National Guard membership increases the odds of passing by 230%. Female Soldiers have 155% higher odds of passing than male Soldiers do.

Policy Analysis. Table 2 reports the probability that the average Regular Army Soldier from the larger Army contract population would pass the course based upon the binary logistic model. These were calculated using the formula for finding probability in a binary logistic model, which is

$$e^{(\beta' x)} / (1 + e^{(\beta' x)}).$$

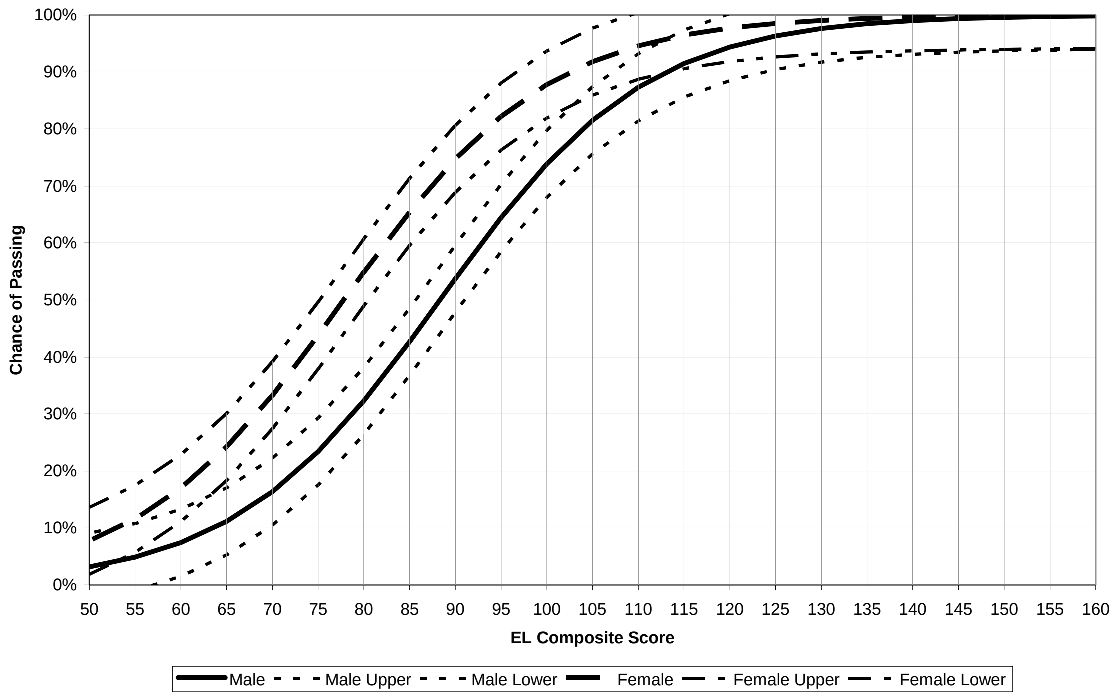
The following analysis will be based upon Regular Army Soldiers. Based on the model, when the cutoff score is at its current level (EL = 95), male Soldiers with an average EL score (EL = 109.93) have approximately an 87% chance of passing, while female Soldiers have approximately a 95% chance of passing. Currently, about 77% of Soldiers are eligible for MOS 27M assignment at the current cutoff. Lowering the cutoff by five points (EL = 90) would increase eligibility by 14 percentage points (to 90%) and the average male Soldier who would qualify for training would have a slightly lower chance of passing (85%), as would the average female Soldier (93%). Raising the cutoff score by five points (EL = 100), the average male Soldier would have a slightly higher chance of passing (89%), as would the average female Soldier (96%). However, eligibility would fall by about 13 percentage points.

Table 2. 27M: Probability that a Regular Army Soldier (from the larger Army contract population) will pass the course based on the binary logistic model

	Cutoff = 85	Cutoff = 90	Cutoff = 95	Cutoff = 100	Cutoff = 105
Percent Eligible (Regular Army)	*96.9%*	*89.8%*	*78.5%*	*65.9%*	*51.1%*
Mean	*106.22*	*107.71*	*109.93*	*112.38*	*115.44*
Passing Rate:					
Male	83.1%	84.9%	87.3%	89.5%	91.8%
Female	92.6%	93.5%	94.6%	95.6%	96.6%

Figure 1 shows the relationship between EL and the probability of passing for Regular Army Soldiers, including upper and lower bounds based upon the standard error of the estimated EL coefficient. For a particular EL score, trace a vertical line up to the curve, and then a horizontal line over to the axis to determine the corresponding probability of passing. For example, an EL score of 100 corresponds to a passing probability of about 75% for a male Soldier and 88% for a female soldier. One can see that high school educated Soldiers with “low” EL scores have a poor chance of passing, but the chance of passing increases somewhat quickly as scores increase.

Figure 1: Predicted Probability of Passing: Regular Army Soldiers



Appendix: Soldier Characteristics (27M)

Outcome	Gender	
	Male	Female
fail	19.0%	10.9%
pass	81.0%	89.1%

Outcome	Education Level		
	GED or less	High School Diploma	Some College or More
fail	.0%	19.0%	7.1%
pass	100.0%	81.0%	92.9%

Outcome	Branch of Army		
	Regular Army	Army Reserve	National Guard
fail	22.3%	.0%	6.4%
pass	77.7%	.0%	93.6%

27M Risk Analysis of Policy Alternatives

In this section we extend the policy analysis with a risk analysis of the policy alternatives considered using simulation methods. We employ the "@RISK" software package which is designed as an add-in for Microsoft Excel.[66] There are four steps in the risk analysis.

The first step is developing a model. A regression model for predicting the passing rate has been specified and estimated, and the results stored in Excel worksheet format. See Table 1.

The second step is identifying the uncertainty inherent in both the input variables (composite scores, Soldier characteristics) and the corresponding estimated parameters and specifying their possible values with probability distributions.

To approximate the governing composite distribution, we use the larger Army contract population (EAF file: those who contracted from Jan 1992 to Aug 2003). This distribution can be assumed to follow a normal distribution. The mean and standard deviation estimated from the contract population and used as input to the simulations are shown in Table R-1 (before truncation).

Table R-1. Input information for the simulations

	Mean	Std error / deviation
Constant	-7.860	2.976
EL var	105.33 (before truncation)	12.57
EL coeff	.089	.030
GENDER var	22.5%(female)	
GENDER coeff	.936	.484
GUARD var	32%	
GUARD coeff	1.193	.515

To approximate the distributions for the demographic variables (GENDER, and GUARD) we rely on the training data sample used to estimate the regression model. These distributions can be assumed to follow binomial distributions with means estimated from the training data sample as shown in Table R-1.

To approximate the distributions for the estimated parameters in the logit model, we note that, under very general conditions, the estimates will be asymptotically normally

[66] Software is available from Palisade Corporation, Newfield, NY.

distributed.[67] The estimated coefficients (means and standard errors) are shown in Table R-1.

The third step is analyzing the model with simulation to determine the range and probabilities of all possible training outcome results. The results reported represent the simulation of the regression prediction equation for 1000 iterations using a fixed seed.[68] The comparisons are between the baseline case (EL = 95) and the policy cases (EL = 90 and EL = 100). These cases are delineated by the cutoff score level which serves as the lower truncation point in the governing composite input distribution. The simulation results in Table R-2 describe the effect on the mean probability of passing as the EL cutoff score level is varied, and represent an improvement of the policy analysis presented in Table 2 because they reflect the simultaneous effects of all known sources of uncertainty.

Table R-2. 27M simulation results

	EL = 90	EL = 95	EL = 100
Mean governing composite	107.76	109.53	111.90
Mean probability of passing	73.9%	75.0%	76.1%
Std deviation	33.3%	32.8%	32.3%

The frequency distributions of simulated effects are shown below in the histogram graphs. The histogram portrays the full range of outcomes that average to the mean effect as reported. Looking at the histogram for the baseline case (EL = 95), probability of passing is plotted on the horizontal axis and the height of each bar indicates the relative number of Soldiers at that passing probability. The information in the histograms is effectively summarized in Table R-3. In that table we see the percentage of Soldiers that meet or exceed a given chance of passing. For example, looking at the baseline case (EL = 95), about 69% of Soldiers have a 70% or greater chance of passing.

67 The intuition is that logit estimates are derived from maximum likelihood (ML) estimation, and under fairly general conditions ML estimates are consistent and asymptotically normally distributed.
68 Latin Hypercube (LH) sampling is utilized in drawing samples for the input distributions. It is designed to accurately recreate the input distribution through sampling in fewer iterations when compared with the Monte Carlo method. The key to LH sampling is stratification of the input probability distributions.

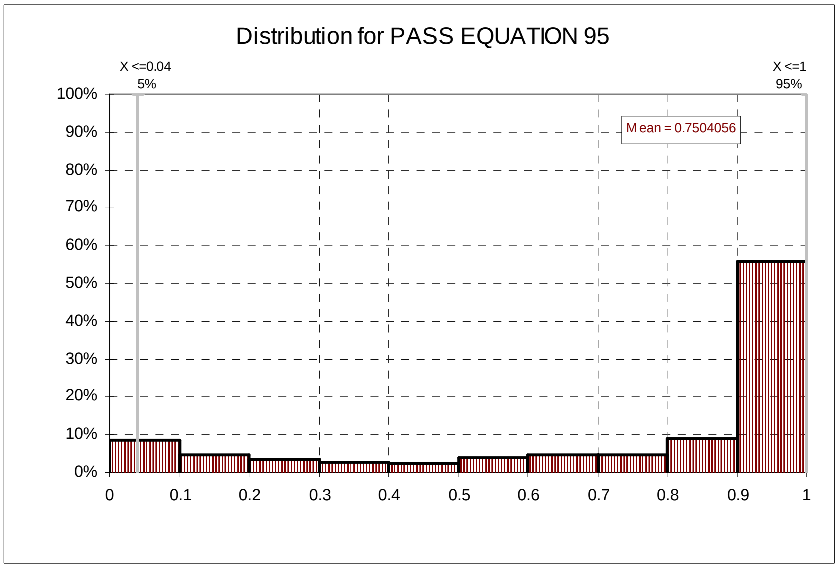
We find that the mean probability of passing in the simulation is 75% (Table R-2, baseline). Looking at the histograms, we see a large portion of Soldiers in the highest range of passing scores, and the remainder spread out over the entire range. Sensitivity analysis indicates that we can attribute this pattern to the relatively large standard errors on the governing composite and constant terms that come into play in the simulation. The relatively large standard errors introduce variability into the passing probabilities[69]. We note that the mean simulated passing probability turns out to be about ten percentage points lower than the static prediction at the mean EL score (Table 2). In the simulated predictions we are calculating an average over all Soldiers and taking into account all sources of uncertainty, whereas in the static prediction we are calculating the probability of passing only at the mean EL score, ignoring the distribution of Soldier scores etc. as well as uncertainty. Recognizing this variability is important, but we also note that the policy case impacts relative to the baseline are the same in both simulation and static prediction modes.

Table R-3. Percent of simulated Soldiers that meet or exceed given chance of passing

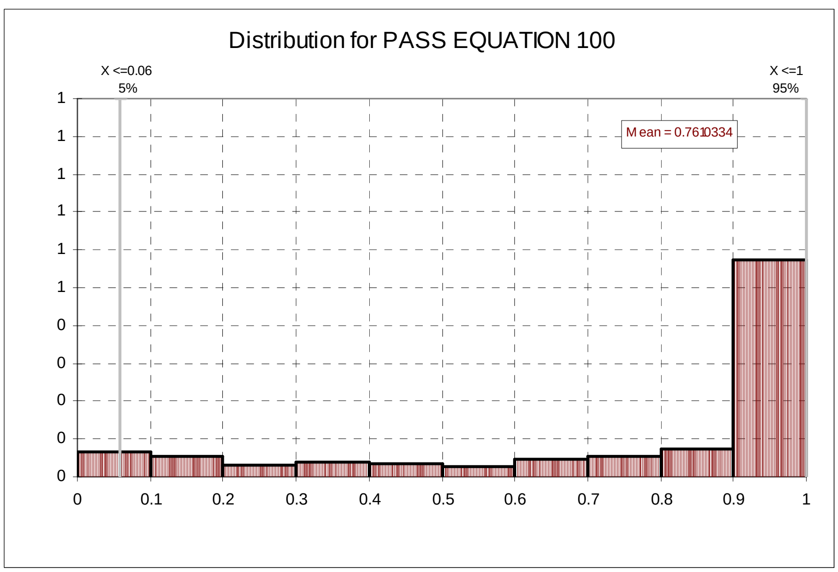
Chance of passing	EL = 90	EL = 95	EL = 100
95.0%	44.3%	47.0%	50.8%
90.0%	53.2%	55.8%	57.4%
85.0%	58.5%	60.5%	61.9%
80.0%	62.8%	64.6%	64.7%
75.0%	67.0%	67.3%	68.4%
70.0%	68.6%	69.3%	70.3%
65.0%	70.6%	71.7%	72.8%
60.0%	72.3%	74.0%	74.9%
55.0%	74.6%	76.1%	76.0%
50.0%	76.4%	77.9%	77.6%

The fourth step is making a decision based on the results provided and the preferences of the school proponent. This involves the evaluation by the school proponent of the tradeoff between increased eligibility and reduced passing probabilities (and vice-versa).

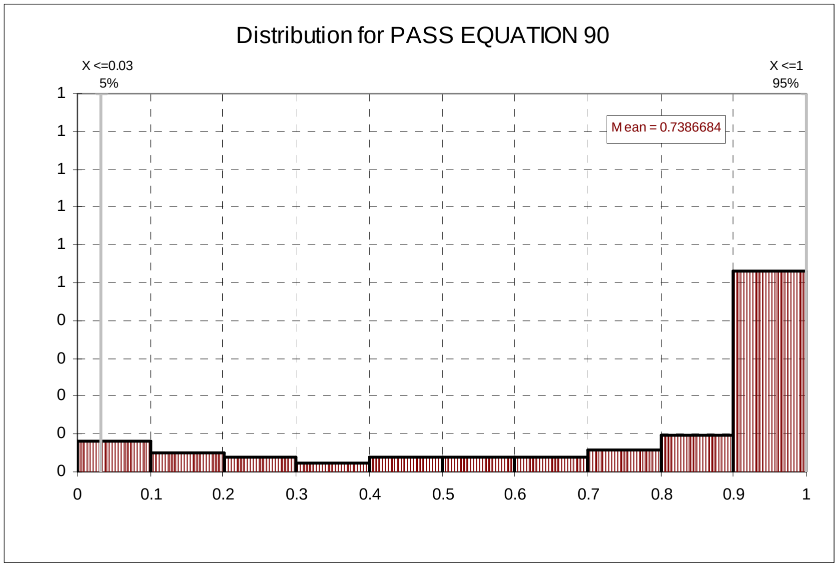
[69] The large standard error for the constant allows scores to be more spread out and allows for large groupings at the highest and lowest values. And since the probabilities of passing are calculated from the ratio: $e^{(\beta' x)} / (1 + e^{(\beta' x)})$, as the scores calculated from the equation become extreme, the ratios are more likely to approach zero and one.



Distribution for PASS EQUATION 95
X <=0.04
5%
X <=1
95%
Mean = 0.7504056
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1



Distribution for PASS EQUATION 100
X <=0.06
5%
X <=1
95%
Mean = 0.7610334
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1


Distribution for PASS EQUATION 90
X <=0.03
5%
X <=1
95%
Mean = 0.7386684
1
1
1
1
1
1
0
0
0
0
0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1

96B: Intelligence Analyst

The final sample included 2863 Soldiers who were coded as either graduates or academic failures during their first AIT attempt in this MOS during a period from 2001 to 2004. Only Soldiers who graduated (78.4%) or failed for academic reasons (21.6%) were included in the analysis sample of 1621 Soldiers because we assume that non-completion for non-academic reasons is not related to cognitive criteria.

In the sample, most were male (76%, 24% female), most had a high school diploma but not more education (79%, 18% some college, 3% GED or less), and most were from were from the Regular Army (72%, 19% National Guard, 9% Reserve). The governing AA composite, Skilled Technical (ST), for this MOS has a cutoff score of 102; the sample mean is 116.53 (standard deviation = 8.844). See the Appendix for a description of Soldier characteristics for this MOS training sample.

A binary logistic regression model was estimated to explain pass/fail AIT outcomes and focused on the first training attempt. The estimation results are reported in

Table 1. 96B: Results of the binary logistic prediction model

Chi- Square		295.374***	
Log Likelihood		2688.809	
Nagelkerke R Square		.151	
Variable	Coefficient	Odds Ratio	Wald
Constant	-9.433	.000	152.297***
GED	.730	2.075	3.399
COLLEGE	.400	1.491	7.352**
RESERVE	.494	1.639	6.113*
GUARD	.624	1.867	19.595***
GENDER	.374	1.454	10.724**
ST	.091	1.095	184.318***

* = p < .05 *** = p < .001
** = p < .01

Table 1 and indicate that a model, including the ST composite, education level (GED = GED or less than high school diploma; COLLEGE = some college), Army component (GUARD = National Guard; RESERVE = Army Reserve) and gender (GENDER = female), accounts for about 15% of the variation in the dependent variable. This model is statistically significant ($\chi^2 = 295.374$, $P < .001$), and has moderate explanatory power (Nagelkerke $R^2 = .151$).

There is a statistically significant effect for the ST composite. The model suggests that having a higher ST composite score increases the odds of passing. At the mean ST score, an increase of one point is associated with an increase of about 10% in the odds of passing the course (on the first attempt), and a five-point increase in ST would increase the odds of passing by 58%. There are also statistically significant effects for COLLEGE, GENDER, RESERVE, and GUARD, with increased odds of passing the course at 49%, 45% (for females), 64%, and 87%, respectively.

<u>Policy Analysis.</u> Table 2 reports the probability that the average Soldier from the larger Army contract population would pass the course based upon the binary logistic model. These were calculated using the formula for finding probability in a binary logistic model, which is

$$e^{(\beta' x)} / (1 + e^{(\beta' x)}).$$

The following analysis is focused upon male and female Soldiers with a high school diploma or some college education from the Regular Army. When the cutoff score is at its current level (ST = 102), male Soldiers with a high school diploma (the modal categories) and an average ST score (ST = 114.16) have approximately a 72% chance of passing (on the first attempt). Currently, about 65% of Soldiers are eligible for MOS 96B assignment at the current cutoff (ST = 102). Lowering the cutoff by five points (ST = 97) would increase eligibility by 13 percentage points (to 78%), while the average male Soldier who would qualify for training would have a somewhat lower chance of passing (67%). Raising the cutoff score by five points (ST = 107), the average male Soldier would have a higher chance of passing (77%) but eligibility would fall by about 15 percentage points.

Table 2. 96B: Probability that a Regular Army Soldier (from the larger Army contract population) will pass the course based on the binary logistic model

	Cutoff = 92	Cutoff = 97	Cutoff = 102	Cutoff = 107	Cutoff = 112
Percent Eligible (Regular Army)	*89.0%*	*78.2%*	*64.9%*	*49.6%*	*34.7%*
Mean	*109.45*	*111.59*	*114.16*	*117.18*	*120.51*
Passing Rates:					
High School Male	62.9%	67.3%	72.2%	77.4%	82.3%
College Male	71.6%	75.4%	79.5%	83.6%	87.4%
High School Female	71.1%	74.9%	79.1%	83.3%	87.1%
College Female	78.5%	81.7%	84.9%	88.1%	90.9%

Figure 1 shows the relationship between ST and the probability of passing for male Regular Army Soldiers by education, including upper and lower bounds based upon the standard error of the estimated ST coefficient. For a particular ST score, trace a vertical line up to the curve, and then a horizontal line over to the axis to determine the corresponding probability of passing. For example, an ST score of 100 corresponds to a passing probability of about 40% for a high school educated, Regular Army male Soldier. One can see that Soldiers with a low ST score stand very little chance of passing the course. As ST scores increase, the chance that a Soldier will pass the course increases sharply. In addition, the graph illustrates that Soldiers with some college education have a noticeably better chance of passing this course.

Figure 1: Predicted Probalility of Passing: Male Soldiers

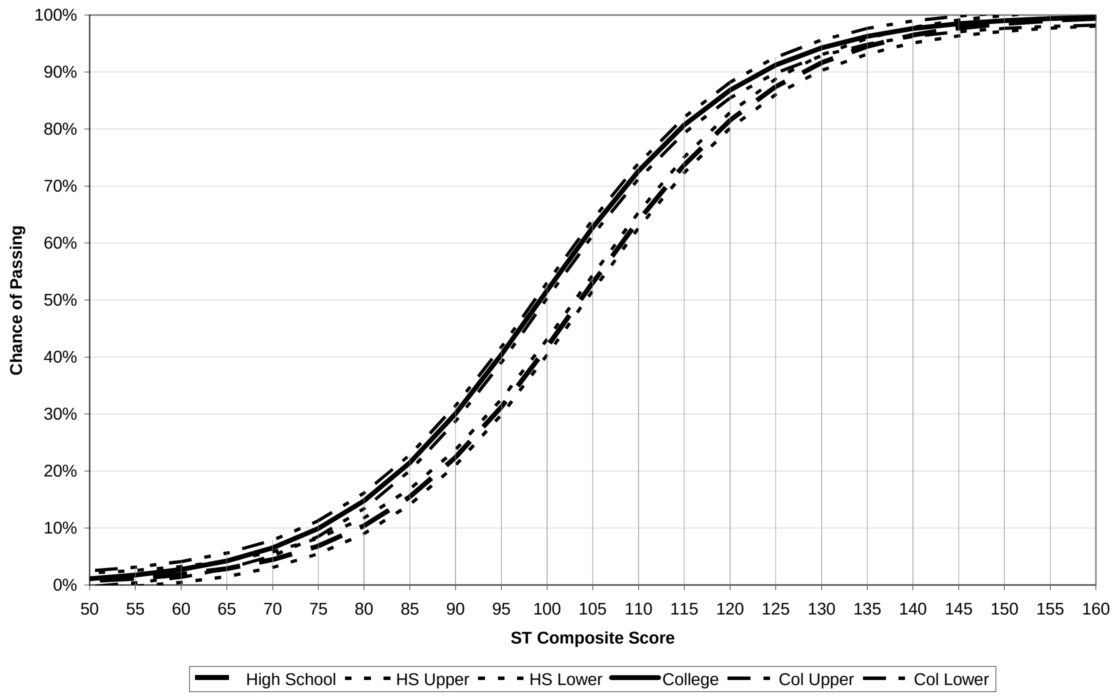


Figure 2 shows the relationship between ST and the probability of passing for high school educated Soldiers by gender, including upper and lower bounds based upon the standard error of the estimated ST coefficient. One can see that Soldiers with a low ST score stand very little chance of passing the course. As ST scores increase, the chance that a Soldier will pass the course increases sharply. In addition, the graph illustrates that female Soldiers have a noticeably better chance of passing this course.

Figure 2: Predicted Probalility of Passing: High School Soldiers

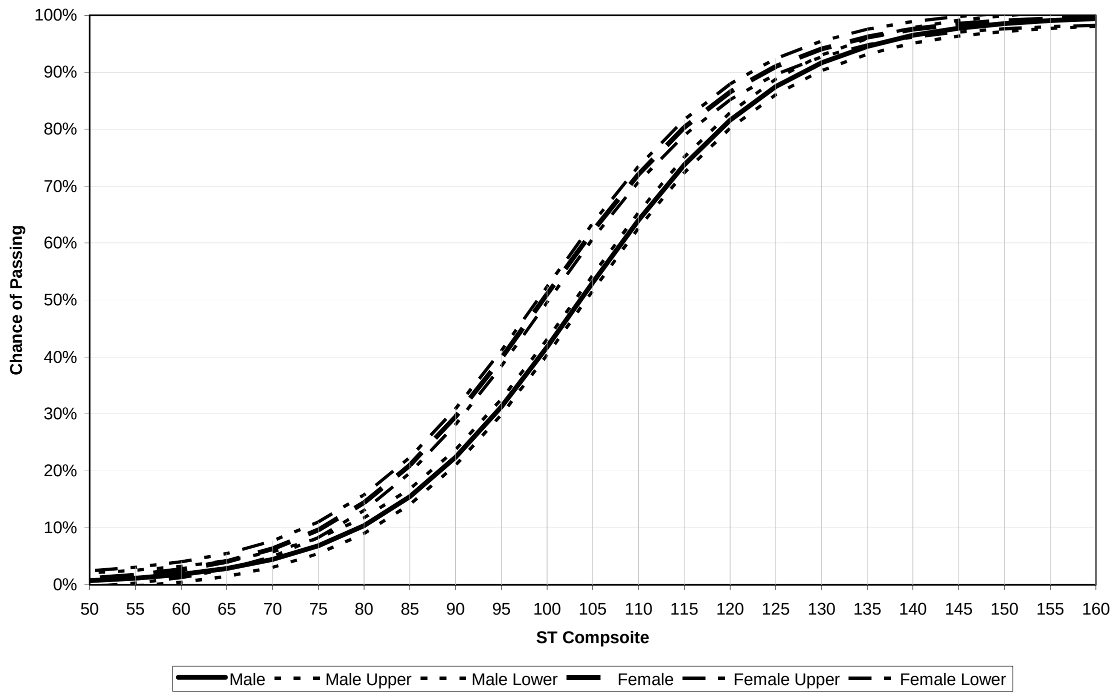
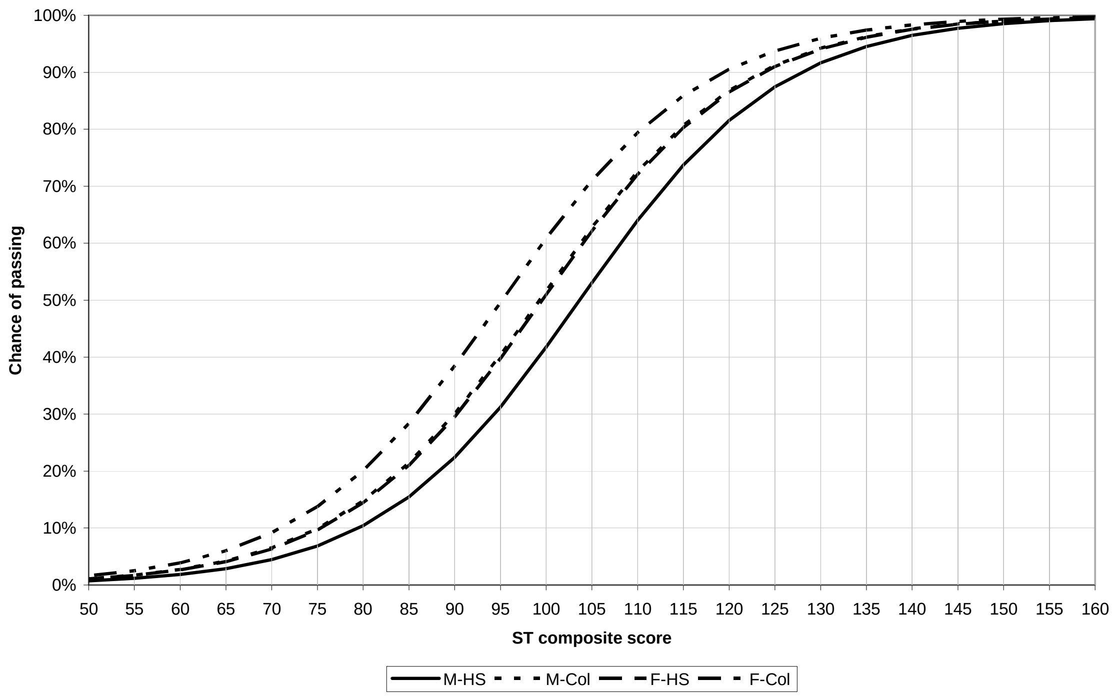


Figure 3 shows the relationship between ST and the probability of passing for Soldiers by education and gender. The graph illustrates that women with some college education have the best chance at passing the course, while high school educated males, the modal students, have the lowest chance of passing. Males with some college education and females with a high school education have essentially the same chances of passing. Figure 3 also illustrates the magnitude of the effect brought about by gender and education. At the current cutoff score (ST = 102) college educated female Soldiers have more than a 15% better chance of passing the course compared to high school educated males. Even at a ST score as high as 120, college educated women still have approximately a 10% better chance of passing than high school educated males.

Figure 3: HS vs. College & Male vs. Female



Appendix: Soldier Characteristics (96B)

Outcome	Gender: Male	Gender: Female
fail	21.0%	23.4%
pass	79.0%	76.6%

	Education Level: GED or less	High School Diploma	Some College or More
fail	9.9%	24.0%	12.8%
pass	90.1%	76.0%	87.2%

	Component: Regular Army	Army Reserve	National Guard
fail	24.6%	13.2%	14.1%
pass	75.4%	86.8%	85.9%

Appendix:
A note on the relationship between academic failure and non-academic failure
Example – 96B

Background

In previous work, we estimated a binary logistic regression model to predict passing versus failing. The analysis was restricted to so-called academic cases, and excluded failure cases for non-academic reasons. The explanatory variables were the ST composite, education status (i.e., some college and GED or less education), Army component (i.e., Army Reserve or National Guard), and Soldier's gender. The estimation results are reported in Table 1 and indicate that this model accounts for about 15% of the variation in passing vs. failing. This model is statistically significant ($\chi^2 = 295.374$, $p < .001$), and has moderate explanatory power (Nagelkerke $R^2 = .151$).

We now proceed to examine the implicit assumption made by excluding non-academic failure cases – i.e., that non-academic failure cases are fundamentally different from academic failure cases.

Table 1. 96B: Results of the binary logistic prediction model

Chi- Square		295.374***	
Log Likelihood		2688.809	
Nagelkerke R Square		.151	
Variable	Coefficient	Odds Ratio	Wald
Constant	-9.433	.000	152.297***
GED	.730	2.075	3.399
COLLEGE	.400	1.491	7.352**
RESERVE	.494	1.639	6.113*
GUARD	.624	1.867	19.595***
GENDER	.374	1.454	10.724**
ST	.091	1.095	184.318***

* = p < .05 *** = p < .001
** = p < .01

Multinomial model

A multinomial logistic regression was estimated in order to examine the relationship between academic failure, non-academic failure, and passing. Academic failure was used as the reference category, which means that non-academic failure and passing are contrasted to it and not to each other. A model including the ST composite score, education level (i.e., GED and COLLEGE), gender, and Army component (GUARD and RESERVE) significantly fit the data, χ^2 (12) = 316.724, p < .001. The Nagelkerke R^2 equals .110 as compared to a Nagelkerke R^2 of .151 from the binary logistic model. This difference of four percentage points suggests that adding the non-academic failure category produces a weaker overall model. In other words, the variables included in the model predict passing better than they predict both passing and non-academic failure.

Table 2 shows summary statistics for the multinomial model. When the significance of the Chi-square statistic for the variables is compared to the significance of the Wald statistic in Table 1, it is notable that the same variables are significant. This demonstrates that adding a third category to the dependent variable in the logistic regression does not affect the overall utility of the logistic comparison between academic failure and passing.

Table 2. Multinomial model: summary statistics

Chi-square		316.734***
Nagelkerke R Square		.110
Variable	-2 Log Likelihood	χ^2
Intercept	1588.391	.000
GED	1793.480	5.834
COLLEGE	1602.950	14.559***
RESERVE	1597.032	8.641*
GUARD	1611.560	23.169***
GENDER	1621.566	33.175***
ST	1793.480	205.088***

* p < .05 ***p < .001
** p < .01

Table 3 presents the coefficients for the model's prediction of passing vs. academic failure as estimated in the multinomial logistic model. The results are essentially the same as those from the binary logistic model reported in Table 1.[70]

[70] SPSS allows the user to assign the reference group for binary logistic regression. Because of this, the demographic variables were coded as dummy variables with the modal categories (i.e., more than a GED; less than some college education; not in the Army Reserve; not in the National Guard; and male) coded as zero. In contrast, the multinomial logistic function in SPSS automatically sets the highest category of an

Table 3. Multinomial model: passing versus academic failure

Variable	Coefficient	Odds Ratio	Wald
Intercept	-8.945	NA	143.922***
GED	.710	2.034	3.248
COLLEGE	.444	1.554	9.011**
RESERVE	.554	1.740	7.847**
GUARD	.638	1.893	20.481***
GENDER	.348	1.416	9.472**
ST	.086	1.090	176.081***

* p < .05 ***p < .001
** p < .01

Table 4 presents the coefficients for the model's prediction of non-academic failure vs. academic failure (the reference category). The model for predicting non-academic failure closely resembles that for predicting passing. This implies several things. First, non-academic failures are different from academic failures; if they were similar, this model would be expected to have many fewer significant predictors. However, the only changes are new significance for GED and lack of significance for RESERVE. Most importantly the ST composite is still significant, where a higher ST score predicts non-academic failure! This suggests that when Soldiers with high ST scores leave the school, it is not for cognitive reasons. The fact that the model does resemble the model for graduates so closely suggests that non-academic failure is fundamentally different from academic failure.

Table 4. Multinomial model: non-academic versus academic failure

Variable	Coefficient	Odds Ratio	Wald
Intercept	-8.893	N/A	88.371***
GED	1.031	2.804	5.529*
COLLEGE	.646	1.907	13.549***
RESERVE	.456	1.578	3.551
GUARD	.398	1.489	4.191*
GENDER	.812	2.251	32.760***
ST	.072	1.075	77.287***

* p < .05 ***p < .001
** p < .01

independent dichotomous variable to be the reference category. Thus, we recoded the variables so that the modal categories equal one.

96B Risk Analysis of Policy Alternatives

In this section we extend the policy analysis with a risk analysis of the policy alternatives considered using simulation methods. We employ the "@RISK" software package which is designed as an add-in for Microsoft Excel.[71] There are four steps in the risk analysis.

The first step is developing a model. A regression model for predicting the passing rate has been specified and estimated, and the results stored in Excel worksheet format. See Table 1.

The second step is identifying the uncertainty inherent in both the input variables (composite scores, Soldier characteristics) and the corresponding estimated parameters and specifying their possible values with probability distributions.

To approximate the governing composite distribution, we use the larger Army contract population (EAF file: those who contracted from Jan 1992 to Aug 2003). This distribution can be assumed to follow a normal distribution. The mean and standard deviation estimated from the contract population and used as input to the simulations are shown in Table R-1 (before truncation).

Table R-1. Input information for the simulations

	Mean	Std error / deviation
Constant	-9.433	.764
ST var	107.02 (before truncation)	12.157
ST coeff	.091	.007
GED var	2.8%	
GED coeff	.730	.396
COLLEGE var	18.2%	
COLLEGE coeff	.400	.147
GUARD var	19.3%	
GUARD coeff	.624	.141
RESERVE var	9.0%	
RESERVE coeff	.494	.200
GENDER var	24.2%	
GENDER coeff	.374	.114

[71] Software is available from Palisade Corporation, Newfield, NY.

To approximate the distributions for the demographic variables we rely on the training data sample used to estimate the regression model. These distributions can be assumed to follow binomial distributions with means estimated from the training data sample as shown in Table R-1.

To approximate the distributions for the estimated parameters in the logit model, we note that, under very general conditions, the estimates will be asymptotically normally distributed.[72] [73] The estimated coefficients (means and standard errors) are shown in Table R-1.

The third step is analyzing the model with simulation to determine the range and probabilities of all possible training outcome results. The results reported represent the simulation of the regression prediction equation for 1000 iterations using a fixed seed.[74] The comparisons are between the baseline case (ST = 102) and the policy cases (ST = 97 and ST = 107). These cases are delineated by the cutoff score level which serves as the lower truncation point in the governing composite input distribution. The simulation results in Table R-2 describe the effect on the mean probability of passing as the ST cutoff score level is varied, and represent an improvement of the policy analysis presented in Table 2 because they reflect the simultaneous effects of all known sources of uncertainty.

Table R-2. 96B simulation results

	ST = 97	ST = 102	ST = 107
Mean governing composite	111.36	113.76	116.71
Mean probability of passing	67.81%	71.68%	76.01%
Std deviation	23.65%	21.69%	19.99%

The frequency distributions of simulated effects are shown below in the histogram graphs. The histogram portrays the full range of outcomes that average to the mean effect as reported. Looking at the histogram for the baseline case (ST = 102), probability

[72] The intuition is that logit estimates are derived from maximum likelihood (ML) estimation, and under fairly general conditions ML estimates are consistent and asymptotically normally distributed.
[73] An alternative to relying on asymptotics is to utilize a bootstrap procedure to estimate the distribution of the logit estimates. We found the bootstrap estimates for the standard error of the governing composite coefficient to be virtually identical with the original estimate. We did find small differences for the other standard error estimates vis-à-vis the original estimates but the simulation results with the revised standard errors were unaffected.
[74] Latin Hypercube (LH) sampling is utilized in drawing samples for the input distributions. It is designed to accurately recreate the input distribution through sampling in fewer iterations when compared with the Monte Carlo method. The key to LH sampling is stratification of the input probability distributions.

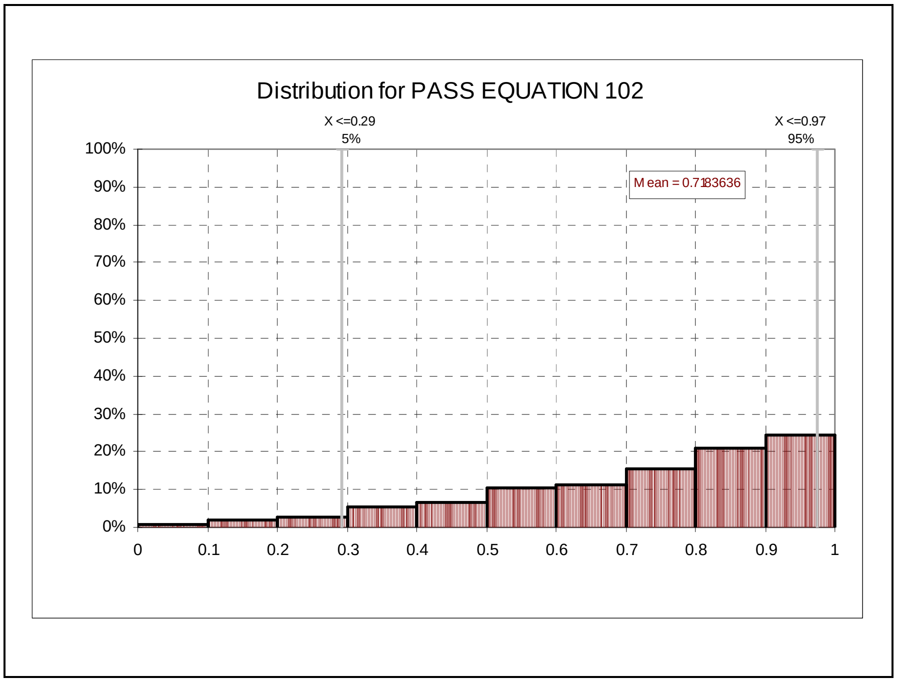
of passing is plotted on the horizontal axis and the height of each bar indicates the relative number of Soldiers at that passing probability. The information in the histograms is effectively summarized in Table R-3. In that table we see the percentage of Soldiers who meet or exceed a given chance of passing. For example, looking at the baseline case (ST = 102), about 61% of Soldiers have a 70% or greater chance of passing.

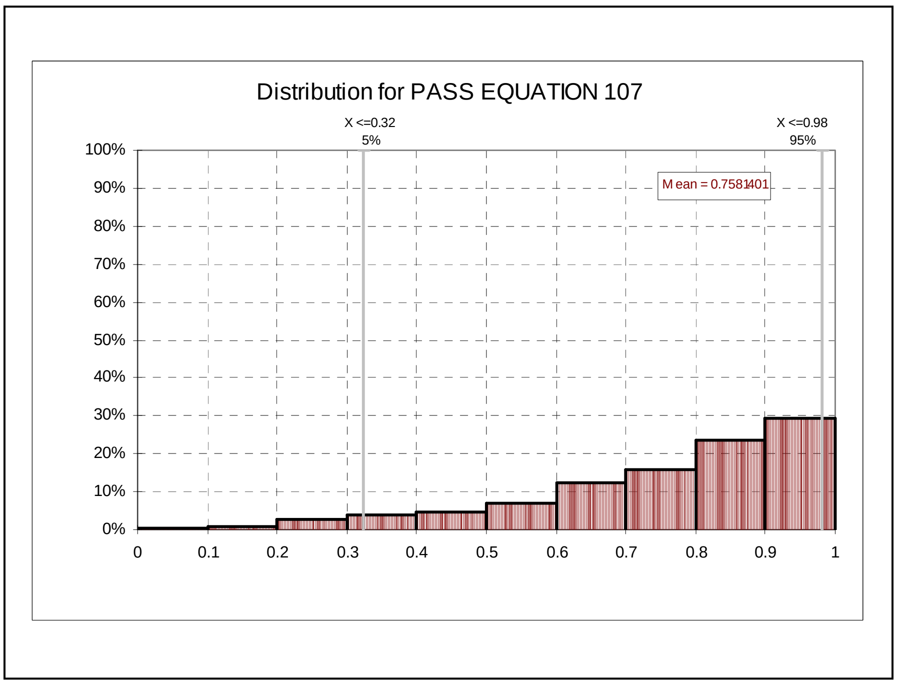
Table R-3.
Percent of simulated Soldiers that meet or exceed given chance of passing

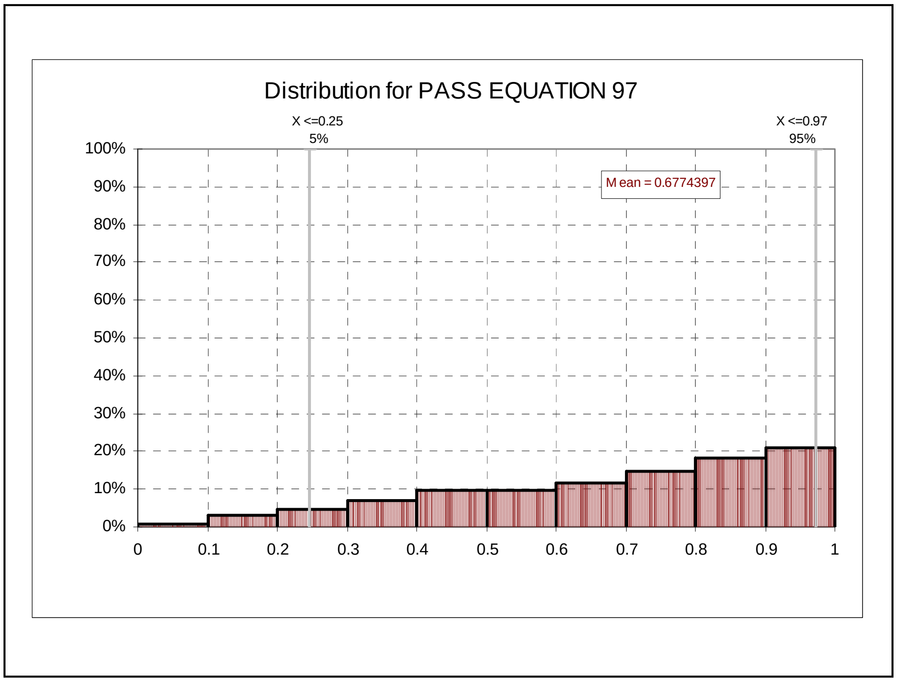
Chance of passing	ST = 97	ST = 102	ST = 107
95.0%	9.3%	12.6%	14.7%
90.0%	21.3%	22.7%	30.4%
85.0%	30.6%	34.1%	42.5%
80.0%	39.2%	44.6%	52.9%
75.0%	47.2%	53.8%	62.1%
70.0%	54.0%	60.9%	70.0%
65.0%	60.1%	68.1%	75.2%
60.0%	65.9%	73.1%	79.8%
55.0%	70.8%	77.8%	84.6%
50.0%	76.2%	82.1%	88.4%

We find that the mean probability of passing in the simulation is 72% (Table R-2, baseline). Looking at the histograms, we see the largest portion of Soldiers is in the highest range of passing scores, and with a consistent decline as the probability of passing approaches zero. We note that the mean simulated passing probability turns out to be only slightly lower than the static prediction at the mean ST score (Table 2). In the simulated predictions we are calculating an average over all Soldiers and taking into account all sources of uncertainty, whereas in the static prediction we are calculating the probability of passing only at the mean ST score, ignoring the distribution of Soldier scores etc. as well as uncertainty. While recognizing this variability is important, we also note that the policy case impacts relative to the baseline are the same in both simulation and static prediction modes.

The fourth step is making a decision based on the results provided and the preferences of the school proponent. This involves the evaluation by the school proponent of the tradeoff between increased eligibility and reduced passing probabilities (and vice-versa).


Distribution for PASS EQUATION 102
X <=0.29
5%
X <=0.97
95%
Mean = 0.7183636
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1


Distribution for PASS EQUATION 107
X <=0.32
5%
X <=0.98
95%
Mean = 0.7581401
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1



Distribution for PASS EQUATION 97
X <=0.25
5%
X <=0.97
95%
Mean = 0.6774397
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1

96D: Imagery Analyst

The final sample included 529 Soldiers who were coded as either graduates or academic failures during their first AIT attempt for this MOS during a period from 2001 to 2004. Only Soldiers who graduated (86.2%) or failed for academic reasons (13.8%) were included in the analysis sample because we assume that non-completion for non-academic reasons is not related to cognitive criteria.

In the sample, most were male (69%, 31% female), most had a high school diploma but not more education (80%, 20% some college), and most were from were from the Regular Army (85%, 5% National Guard, 10% Reserve). The governing AA composite, Skilled Technical (ST), for this MOS has cutoff score of 102; the sample mean is 114.66 (standard deviation = 8.366). See the Appendix for a description of Soldier characteristics for this MOS training sample.

A binary logistic regression model was estimated to explain pass/fail AIT outcomes and focused on the first training attempt. The estimation results are reported in Table 1 and indicate that the model, including the ST composite, education status (COLLEGE = some college education), Army component (GUARD = National Guard, RESERVE = Army Reserve), and gender (GENDER = Female) accounts for about nine percent of the variation in the dependent variable. This model is statistically significant (χ^2 = 26.633, P < .001), and has moderate explanatory power (Nagelkerke R^2 = .089).

Table 1. 96D: Results of the binary logistic prediction model

Chi- Square	26.633***		
Log Likelihood	397.952		
Nagelkerke R Square	.089		
Variable	Coefficient	Odds Ratio	Wald
Constant	-7.252	.001	10.626***
COLLEGE	.221	1.247	.310
GUARD	-.127	.881	.048
RESERVE	.193	1.213	.148
GENDER	-.176	.839	.409
ST	.081	1.084	16.510***

* = p < .05 *** = p < .001
** = p < .01

There is a statistically significant effect for the ST composite. The model suggests that having a higher ST composite score increases the odds of passing. At the mean ST score, an increase of one point is associated with an increase of about eight percent in the odds of passing the course, and a four-point increase in ST would increase the odds of passing by 50%.

<u>Policy Analysis.</u> Table 2 reports the probability that the average Soldier from the larger Army contract population would pass the course based upon the binary logistic model. These calculations were made using the formula for finding probability in a binary logistic model, which is

$$e^{(\beta' x)} / (1 + e^{(\beta' x)}).$$

Because COLLEGE, GUARD, RESERVE, and GENDER were not statistically significant, this analysis is confined to the modal—high school educated male Soldiers from the Regular Army (though results would be similar for any demographic combination). Based on the model, when the cutoff score is at its current level (ST =

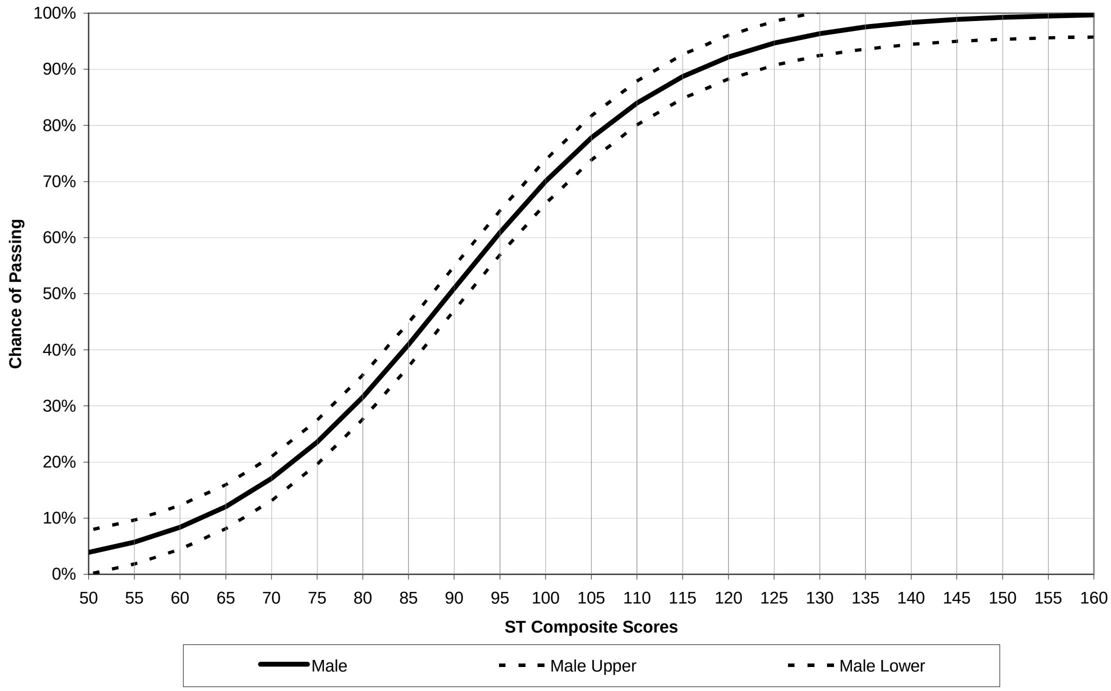
102), male Soldiers with a high school diploma and an average ST score (ST = 114.66) have approximately an 88% chance of passing. Currently, about 65% of Soldiers are eligible for MOS 96D assignment at the current cutoff. Lowering the cutoff by five points (ST = 97) would increase eligibility by seven percentage points (to 13%) and the average male Soldier who would qualify for training would have a slightly lower chance of passing (85%). Raising the ST cutoff score by five points (ST = 107) provides slightly higher passing rates for the average high school male Soldier (90%), but fewer Soldiers would be eligible (50%).

Table 2. 96D: Probability that a Regular Army Soldier (from the larger successful applicant population) will pass the course based on the binary logistic model

	Cutoff: ST = 92	Cutoff: ST = 97	Cutoff ST = 102	Cutoff ST = 107	Cutoff ST = 112
Percent Eligible (Regular Army)	*89.0%*	*78.2%*	*64.9%*	*49.6%*	*34.7%*
Mean	*109.06*	*111.14*	*113.60*	*116.55*	*119.83*
Passing Rates:					
High School Male	82.9%	85.2%	87.5%	89.9%	92.1%

Figure 1 shows the relationship between ST and the probability of passing for high school educated male Regular Army Soldiers. For a particular ST score, trace a vertical line up to the curve, and then a horizontal line over to the axis to determine the corresponding probability of passing. For example, a ST score of 100 corresponds to a passing probability of about 70% for a high school educated, Regular Army male Soldier.

Figure 1: Predicted Probability of Passing: High School Soldiers



Appendix: Soldier Characteristics (96D)

Outcome	Gender: Male	Gender: Female
fail	11.8%	18.2%
pass	88.2%	81.8%

Outcome	Education Level: GED or less	High School Diploma	Some College or More
fail	50.0%	14.8%	8.5%
pass	50.0%	85.2%	91.5%

Outcome	Component: Regular Army	Army Reserve	National Guard
fail	14.2%	9.6%	15.4%
pass	85.8%	90.4%	84.6%

96H: Common Ground Station Operator

The final sample included 521 Soldiers who were coded as either graduates or academic failures during their first AIT attempt for this MOS during a period from 2001 to 2004. Only Soldiers who graduated (93.1%) or failed for academic reasons (6.9%) were included in the analysis sample because we assume that non-completion for non-academic reasons is not related to cognitive criteria.

In the sample, most were male (80%, 20% female), most had a high school diploma but not more education (84%, 15% some college, 1% GED or less), and most were from were from the Regular Army (94%, 6% National Guard). See the Appendix for a description of Soldier characteristics for this MOS training sample. The governing AA composites, Skilled Technical (ST) and Surveillance/Communications (SC), for this MOS both have cutoff scores of 102 and 93 respectively; the sample mean is 115.16 (standard deviation = 8.501) for ST and 112.75 (standard deviation = 8.971) for SC. ST and SC are correlated at the .867 level. See the Appendix for a description of Soldier characteristics for this MOS training sample.

A binary logistic regression model was estimated to explain pass/fail AIT outcomes and focused on the first training attempt. The estimation results are reported in Table 1 and indicate that the model, including the ST composite, education status (COLLEGE = some college education) and gender (GENDER = Female) accounts for about 6% percent of the variation in the dependent variable. This model is statistically significant (χ^2 = 12.457, P = .006), and has weak explanatory power (Nagelkerke R^2 = .060)[75].

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[75] A model was estimated using only the ST composite due to the dominance of the ST cutoff over the SC cutoff in determining eligible Soldiers for assignment. In the Appendix we report models estimated with

Table 1. 96H: Results of the binary logistic prediction model including ST			
Chi- Square		12.457**	
Log Likelihood		249.396	
Nagelkerke R Square		.060	
Variable	Coefficient	Odds Ratio	Wald
Constant	-5.197	.006	3.937*
COLLEGE	-.871	.419	4.323*
GENDER	.458	1.580	1.011
ST	.069	1.072	8.885**

* = p < .05 *** = p < .001
** = p < .01

There is a statistically significant effect for the ST composite. The model suggests that having a higher ST composite score increases the odds of passing. At the mean ST score, an increase of one point is associated with an increase of about seven percent in the odds of passing the course, and a five-point increase in SC would increase the odds of passing by 41%. There is also a significant effect for COLLEGE where those with some college education have 42% lower odds of passing.

Policy Analysis. Table 2 reports the probability that the average Soldier from the larger Army contract population would pass the course based upon the binary logistic model. These were calculated using the formula for finding probability in a binary logistic model, which is

$$e^{(\beta' x)} / (1 + e^{(\beta' x)}).$$

Because component and gender were not statistically significant, this analysis is confined to the modal—high school (college) educated male Regular Army Soldiers (though results would be similar for any demographic combination). Based on the model, when

both SC and ST composites, and with SC by itself. These models fit noticeably better than the ST-only model.

the cutoff scores are at its current level (SC = 93, ST = 102), male Soldiers with high school and an average ST score (ST = 113.68) have approximately a 93% chance of passing. Currently, about 63% of Soldiers are eligible for MOS 96H assignment at the current cutoff. Lowering the cutoffs by five points (SC = 88, ST = 102) would increase eligibility by nine percentage points (to 77%) and the average male Soldier who would qualify for training would have a about the same chance of passing at 92%. Raising the cutoff scores by five points (SC = 98, ST = 107) provides slightly higher passing rates for

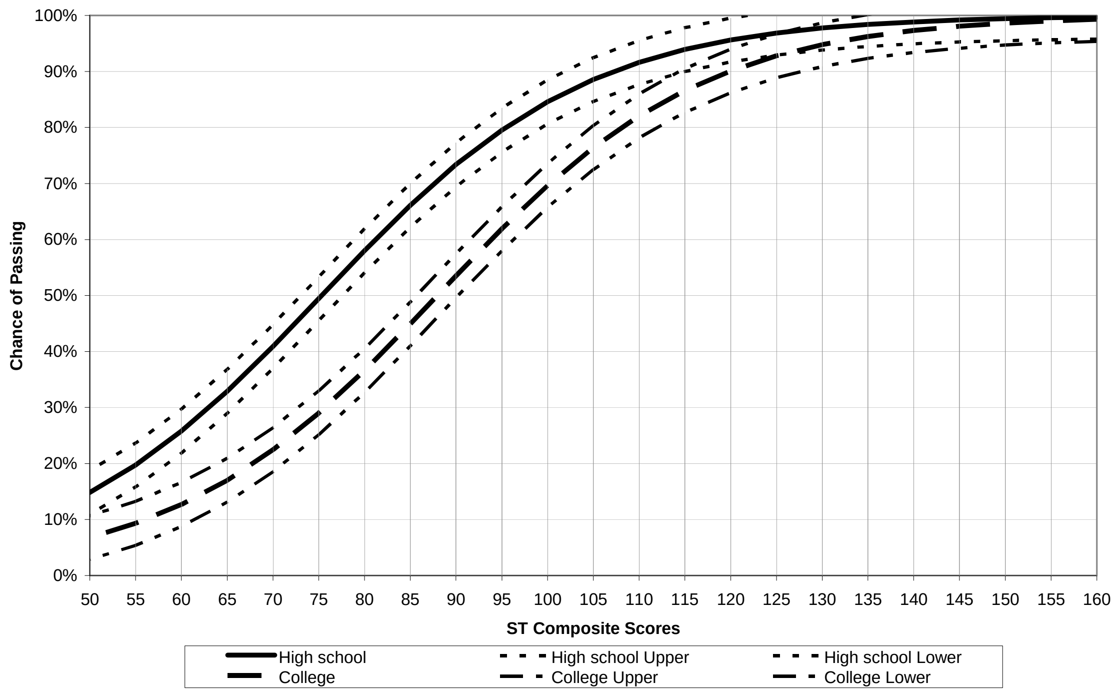
Table 2. 96H: Probability that a Regular Army Soldier (from the larger successful applicant population) will pass the course based on the binary logistic model

	Cutoff: SC = 83 ST = 92	Cutoff: SC = 88 ST = 97	Cutoff: SC = 93 ST = 102	Cutoff: SC = 98 ST = 107	Cutoff: SC = 103 ST = 112
Percent Eligible (Regular Army)	*85.3%*	*77.4%*	*63.0%*	*48.1%*	*34.6%*
Mean	*109.04*	*111.15*	*113.68*	*116.64*	*119.96*
Passing Rates:					
High School Male	91.1%	92.2%	93.4%	94.5%	95.6%
College Male	81.1%	83.2%	85.5%	87.9%	90.1%

the average male Soldier at 95%, but fewer Soldiers would be eligible (48%).

Figure 1 shows the relationship between ST and the probability of passing for high school educated male Regular Army Soldiers. For a particular ST score, trace a vertical line up to the curve, and then a horizontal line over to the axis to determine the corresponding probability of passing. For example, an ST score of 100 corresponds to a passing probability of about 85% for a high school educated, Regular Army male Soldier. College educated male Soldiers consistently have a lower chance of passing than high school educated male Soldiers

Figure 1: Predicted Probability of Passing: High School Soldiers



Appendix: Additional Regression Models

Table 1. 96H: Results of the binary logistic prediction model including SC

Chi- Square		26.500***	
Log Likelihood		235.354	
Nagelkerke R Square		.126	
Variable	Coefficient	Odds Ratio	Wald
Constant	-9.394	.000	12.349***
COLLEGE	-.845	.429	3.860*
GENDER	.818	2.267	3.053
SC	.109	1.115	19.629***

* = p < .05 *** = p < .001
** = p < .01

Table 1. 96H: Results of the binary logistic prediction model including ST and SC

Chi- Square		28.808***	
Log Likelihood		233.046	
Nagelkerke R Square		.136	
Variable	Coefficient	Odds Ratio	Wald
Constant	-7.686	.000	7.325***
COLLEGE	-.797	.451	3.350
GENDER	.884	2.420	3.460
SC	.153	1.165	16.610***
ST	-.058	.944	2.384

* = p < .05 *** = p < .001
** = p < .01

Appendix: Soldier Characteristics (96H)

Outcome	Gender	
	Male	Female
fail	7.0%	6.5%
pass	93.0%	93.5%

Outcome	Education Level		
	GED or less	High School Diploma	Some College or More
fail	0.0%	6.2%	11.4%
pass	100.0%	93.8%	88.6%

Outcome	Component		
	Regular Army	Army Reserve	National Guard
fail	7.2%	0.0%	2.9%
pass	92.8%	0.0%	97.1%

96U: Unmanned Aerial Vehicle Operator

The final sample included 116 soldiers who were coded as either graduates or academic failures during their first AIT attempt in this MOS during a period from 2001 to 2004. Only soldiers who graduated (74.4%) or failed for academic reasons (26.6%) were included in the analysis sample because we assume that non-completion for non-academic reasons is not related to cognitive criteria.

In the sample, most were male (92%, 9% female), most had a high school diploma but not more education (91%, 7% some college, 2% GED or less), and all were Regular Army. The governing AA composite, Surveillance/Communications(SC), for this MOS has a cutoff score of 105; the sample mean is 121.84 (standard deviation = 6.262). See the Appendix for a description of Soldier characteristics for this MOS training sample.

Table 1. 96U: Results of the binary logistic prediction model

Chi- Square		25.119***	
Log Likelihood		107.495	
Nagelkerke R Square		.286	
Variable	Coefficient	Odds Ratio	Wald
Constant	-20.658	.000	14.728***
COLLEGE	-1.418	.242	2.318
GENDER	.136	1.146	.032
SC	.195	1.216	15.871***

* = p < .05 *** = p < .001
** = p < .01

A binary logistic regression model was estimated to explain pass/fail AIT outcomes and focused on the first training attempt. The estimation results are reported in Table 1 and indicate that the model, including the SC composite, education status

(COLLEGE = some college), and gender (GENDER = female), accounts for about 29% of the variation in the dependent variable. This model is statistically significant (χ^2 = 25.119, P < .001), with moderate explanatory power (Nagelkerke R^2 = .286).

There is a statistically significant effect for the SC composite. The model suggests that having a higher SC composite score increases the odds of passing. At the mean SC score, an increase of one point is associated with an increase of about 22% in the odds of passing the course, and a five-point increase in SC would increase the odds of passing by 165%.

<u>Policy Analysis.</u> Table 2 reports the probability that the average soldier from the larger Army contract population would pass the course based upon the binary logistic model. These were calculated using the formula for finding probability in a binary logistic model, which is

$$e^{(\beta' x)} / (1 + e^{(\beta' x)}).$$

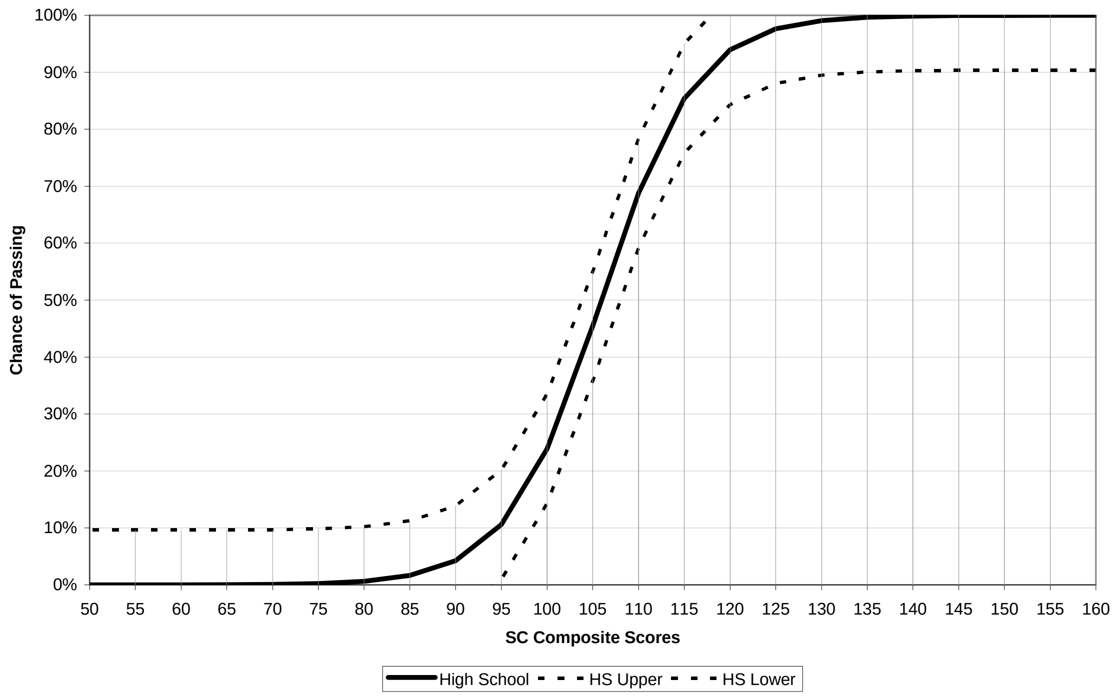
Because GENDER was not statistically significant, this analysis is confined to the modal demographics—high school educated male Soldiers from the Regular Army (though results would be similar for any demographic combination). Based on the model, when the cutoff score is at its current level (SC = 105), Soldiers with an average SC score (SC = 120.51) have approximately an 87% chance of passing. Currently, about only 51% of soldiers are eligible for MOS 96U assignment at the current cutoff (SC = 105). Lowering the cutoff by five points (SC = 100) would increase eligibility by 13 percentage points, while the average Soldier who would qualify for training would have a substantially lower chance of passing (79%). Raising the cutoff score by five points (SC = 110), the average Soldier who would still qualify for the MOS would have a higher chance of passing (92%), but considerably fewer Soldiers would be eligible (37%).

Table 2. 96U: Probability that a Soldier (from the larger Army contract population) will pass the course based on the binary logistic model

	Cutoff = 95	Cutoff = 100	Cutoff = 105	Cutoff = 110	Cutoff = 115
Percent Eligible (Regular Army)	*77.0%*	*63.7%*	*50.8%*	*36.8%*	*25.1%*
Mean	*110.10*	*112.80*	*115.52*	*118.74*	*121.85*
Passing rates:					
High school male	69.2%	79.2%	86.6%	92.4%	95.7%

Figure 1 shows the relationship between SC and the probability of passing for Regular Army Soldiers with high school education, including upper and lower bounds based upon the standard error of the estimated SC coefficient. For a particular SC score, trace a vertical line up to the curve, and then a horizontal line over to the axis to determine the corresponding probability of passing. For example, a SC value of 100 corresponds to a passing probability of about 25% for a high school educated male Soldier. One can see that the probability of passing increases steeply over the full range of the data.

Figure 1: Predicted Probalility of Passing: Male Soldiers With a High School Diploma



Appendix: Soldier Characteristics (96U)

Outcome	Gender: Male	Gender: Female
fail	25.2%	30.0%
pass	74.8%	70.0%

Outcome	Education Level: GED or less	High School Diploma	Some College or More
fail	100.0%	23.6%	37.5%
pass	.0%	76.4%	62.5%

Outcome	Component: Regular Army	Army Reserve	National Guard
fail	25.6%	.0%	.0%
pass	74.4%	.0%	.0%

97B: Counterintelligence Analyst

The final sample included 1162 Soldiers who were coded as either graduates or academic failures during their first AIT attempt for this MOS during a period from 2001 to 2004. Only Soldiers who graduated (90.8%) or failed for academic reasons (9.2%) were included in the analysis sample because we assume that non-completion for non-academic reasons is not related to cognitive criteria.

In the sample, most were male (74%, 26% female), most had a high school diploma but not more education (61%, 37% some college, 2% GED or less), and most were from were from the Regular Army (67%, 18% National Guard, 15% Reserve). The governing AA composites, Skilled Technical (ST), for this MOS has cutoff score of 102; the sample mean is 119.05 (standard deviation = 8.931). See the Appendix for a description of Soldier characteristics for this MOS training sample.

A binary logistic regression model was estimated to explain pass/fail AIT outcomes and focused on the first training attempt. The estimation results are reported in Table 1 and indicate that the model, including the ST composite, education status (GED = GED or less than a high school diploma, COLLEGE = some college education), Army component (GUARD = National Guard, RESERVE = Army Reserve), and gender (GENDER = Female) accounts for about 21% of the variation in the dependent variable. This model is statistically significant ($\chi^2 = 117.832$, $P < .001$), and has moderate explanatory power (Nagelkerke $R^2 = .210$).

Table 1. 97B: Results of the binary logistic prediction model

Chi- Square	117.832***		
Log Likelihood	596.403		
Nagelkerke R Square	.210		
Variable	Coefficient	Odds Ratio	Wald
Constant	-14.072	.000	61.306***
GED	.430	1.538	.370
COLLEGE	.827	2.286	9.510**
GUARD	-.249	.780	.779
RESERVE	.226	1.254	.456
GENDER	.973	2.645	13.511***
ST	.138	1.148	76.208***

* = p < .05 *** = p < .001
** = p < .01

There is a statistically significant effect for the ST composite. The model suggests that having a higher ST composite score increases the odds of passing. At the mean ST score, an increase of one point is associated with an increase of about 15% in the odds of passing the course, and a five-point increase in ST would increase the odds of passing by 99%. There are also statistically significant effects for COLLEGE and GENDER, with increased odds of passing the course at 129% (some college) and 165% (females), respectively.

Policy Analysis. Table 2 reports the probability that the average Soldier from the larger Army contract population would pass the course based upon the binary logistic model. These were calculated using the formula for finding probability in a binary logistic model, which is

$$e^{(\beta' x)} / (1 + e^{(\beta' x)}).$$

The following analysis is focused upon male and female Soldiers with a high school diploma or some college education from the Regular Army. Based on the model, when the cutoff score is at its current level (ST = 102), male (female) Soldiers with a high school diploma and an average ST score (ST = 119.05) have approximately an 84% (93%) chance of passing. Currently, about 65% of Soldiers are eligible for MOS 97B assignment at the current cutoff. Lowering the cutoff by five points (ST = 97) would increase eligibility by 14 percentage points (to 79%) and the average male (female) Soldier who would qualify for training would have a lower chance of passing (79%) (91%). Raising the ST cutoff score by five points (ST = 107) leads to an increase in passing rates for the average high school male (female) Soldier (89%) (96%), but fewer Soldiers would be eligible (50%).

Table 2. 97B: Probability that a Regular Army Soldier (from the larger successful applicant population) will pass the course based on the binary logistic model

	Cutoff: ST = 92	Cutoff: ST = 97	Cutoff ST = 102	Cutoff ST = 107	Cutoff ST = 112
Percent Eligible (Regular Army)	*89.3%*	*78.8%*	*64.8%*	*49.6%*	*36.2%*
Mean	*109.34*	*111.36*	*114.05*	*117.08*	*120.08*
Passing Rates:					
High School Male	73.4%	78.5%	84.1%	88.9%	92.4%
High School Female	88.0%	90.6%	93.3%	95.5%	97.0%
College Male	86.3%	89.3%	92.4%	94.8%	96.5%
College Female	94.4%	95.7%	97.0%	98.0%	98.7%

Figure 1 shows the relationship between ST and the probability of passing for high school educated Regular Army Soldiers by gender. For a particular ST score, trace a vertical line up to the curve, and then a horizontal line over to the axis to determine the corresponding probability of passing. For example, a ST score of 100 corresponds to a passing probability of about 43% for a high school educated, Regular Army male Soldier.

Figure 1: Predicted Probability of Passing: High School Soldiers

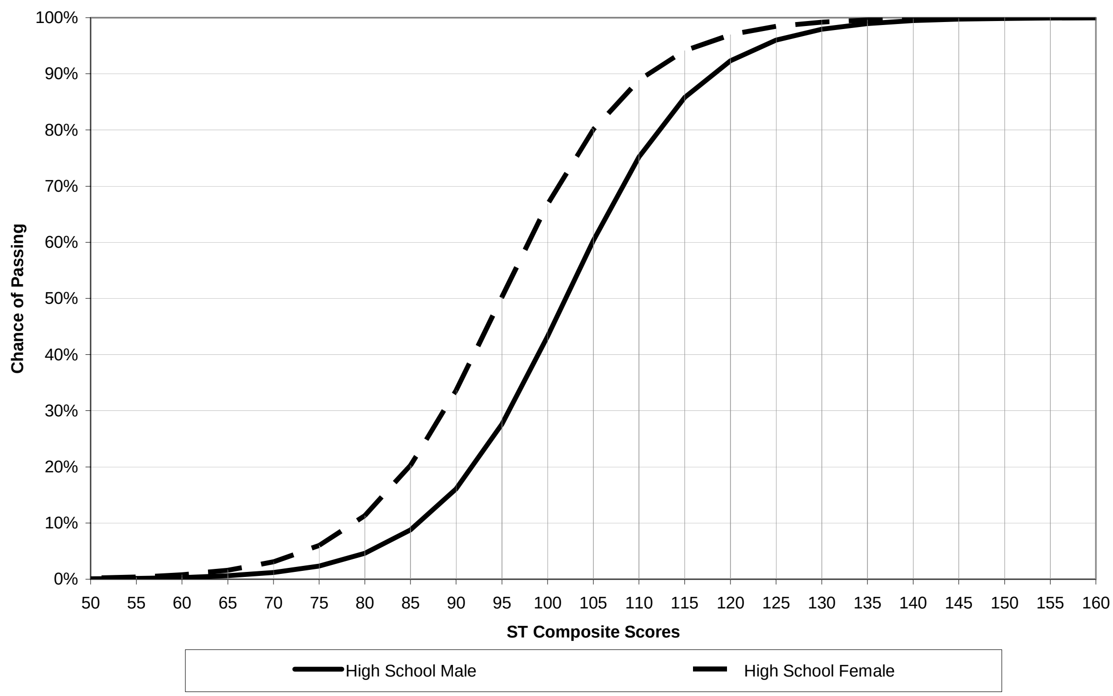


Figure 2 shows the relationship between ST and the probability of passing for male Soldiers by education level. The graph illustrates that college educated Soldiers have a noticeably better chance of passing this course.

Figure 2: Predicted Probability of Passing: Male Soldiers

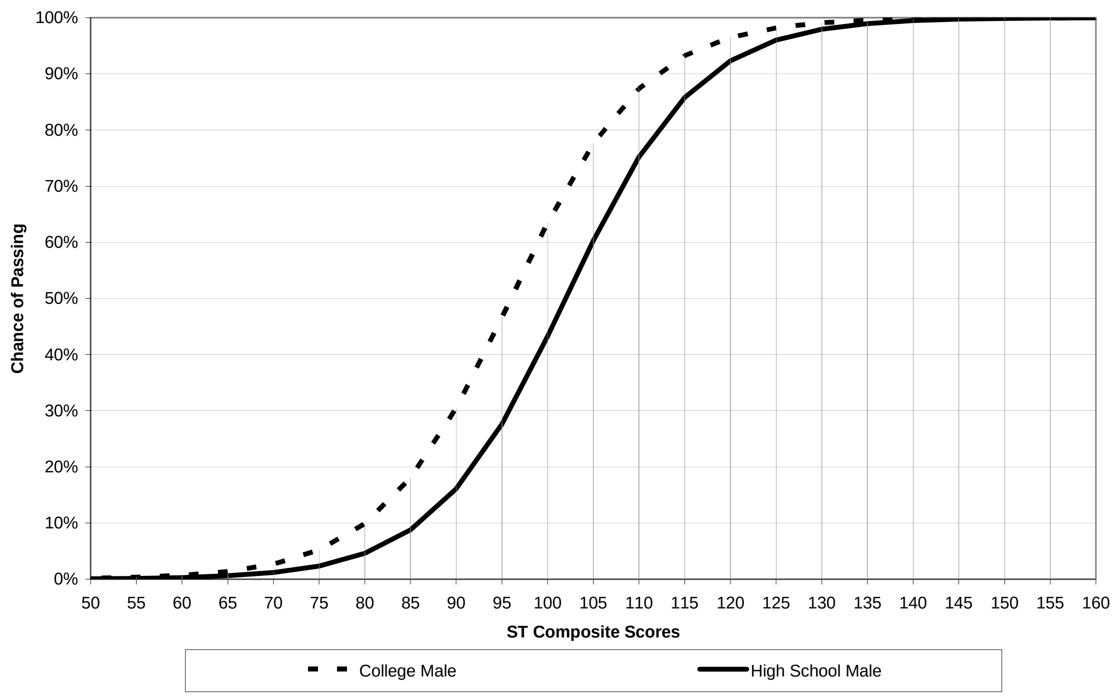
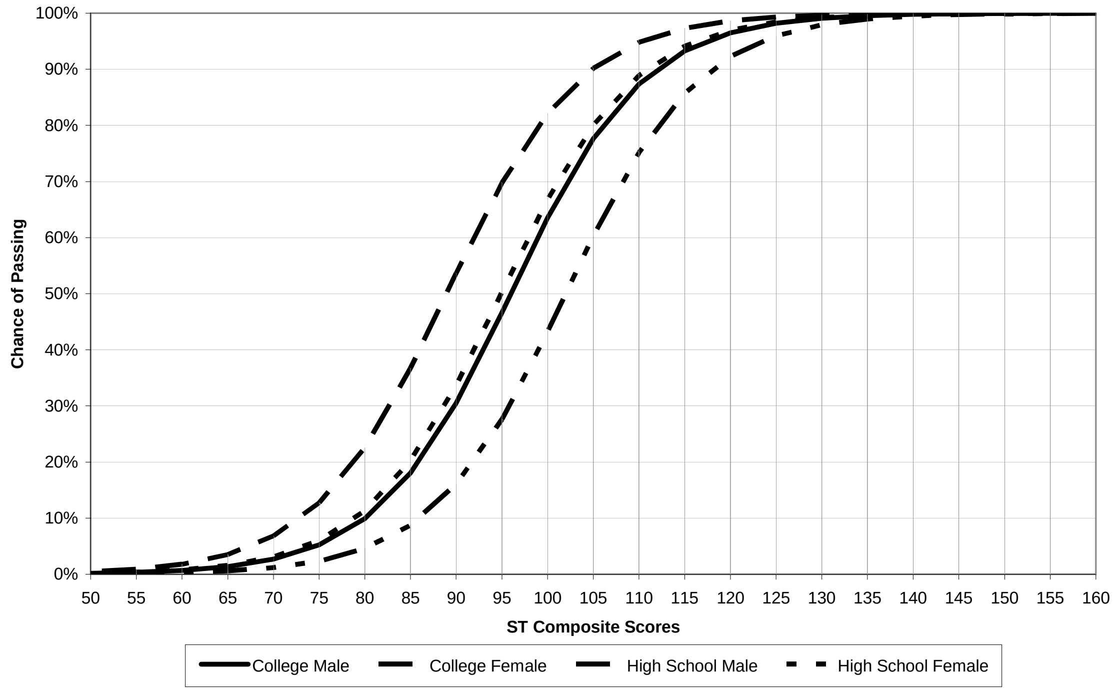


Figure 3 shows the relationship between ST and the probability of passing for Soldiers by education and gender. The graph illustrates that women with some college education have the best chance at passing the course, while high school educated males, the modal students, have the lowest chance of passing. Figure 3 also illustrates the magnitude of the effect brought about by gender and education. At the current cutoff score (ST = 102) college educated female Soldiers have about a 40 percentage point better chance of passing the course compared to high school educated males.

Figure 3: Predicted Probability of Passing: Education Level by Sex



Appendix: Soldier Characteristics (97B)

Outcome	Gender	
	Male	Female
fail	9.6%	8.1%
pass	90.4%	91.9%

Outcome	Education Level		
	GED or less	High School Diploma	Some College or More
fail	14.3%	11.9%	4.6%
pass	85.7%	88.1%	95.4%

Outcome	Component		
	Regular Army	Army Reserve	National Guard
fail	9.3%	7.6%	10.1%
pass	90.7%	92.4%	89.9%

97E: Human Intelligence Collector

The final sample included 748 Soldiers who were coded as either graduates or academic failures <u>during their first AIT attempt</u> in this MOS during a period from 2001 to 2004. Only Soldiers who graduated (81.3%) or failed for academic reasons (18.7%) were included in the analysis sample of 748 Soldiers because we assume that non-completion for non-academic reasons is not related to cognitive criteria.

In the sample, most of the Soldiers were male (69%, 31% female), most had a high school diploma but not more education (59%, 40% some college, 1% GED or less), and the greatest number were from Regular Army (84%, 11% National Guard, 5% Army Reserve). The governing AA composite, Skilled Technical (ST), for this MOS has a cutoff score of 92; the sample mean is 121.01 (standard deviation = 10.275). See the Appendix for a description of Soldier characteristics for this MOS training sample.

Table 1. 97E: Results of the binary logistic prediction model

Chi- Square		92.634***	
Log Likelihood		628.568	
Nagelkerke R Square		.188	
Variable	Coefficient	Odds Ratio	Wald
Constant	-7.721	.000	43.122***
GED	.452	1.572	.300
COLLEGE	.618	1.855	7.402**
GUARD	1.521	4.575	12.610***
RESERVE	.733	2.081	1.371
GENDER	.292	1.339	1.756
ST	.073	1.076	54.871***

* = p < .05 *** = p < .001
** = p < .01

A binary logistic regression model was estimated to explain pass/fail AIT outcomes and focused on the first training attempt. The estimation results are reported in

Table 1 and indicate that a model, including the ST composite, as well as education level (GED = GED or less education; COLLEGE = some college), Army component (GUARD = National Guard, RESERVE = Army Reserve), and gender (GENDER = female), accounts for about 19% of the variation in the dependent variable. This model is statistically significant ($\chi^2 = 92.634$, $P < .001$), with moderate explanatory power (Nagelkerke $R^2 = .188$).

There is a statistically significant effect for the ST composite. The model suggests that having a higher ST composite score increases the odds of passing. At the mean ST score, an increase of one point is associated with an increase of about eight percent in the odds of passing the course, and a five-point increase in ST would increase the odds of passing by 44%. There are also significant effects for COLLEGE where those with some college have 86% increased odds of passing, and Army component where Guardsmen and Reservists have increased odds of passing (356% and 108%, respectively).

<u>Policy Analysis.</u> Table 2 reports the probability that the average Soldier from the larger Army contract population would pass the course based upon the binary logistic model. These were calculated using the formula for finding probability in a binary logistic model, which is

$$e^{(\beta' x)} / (1 + e^{(\beta' x)}).$$

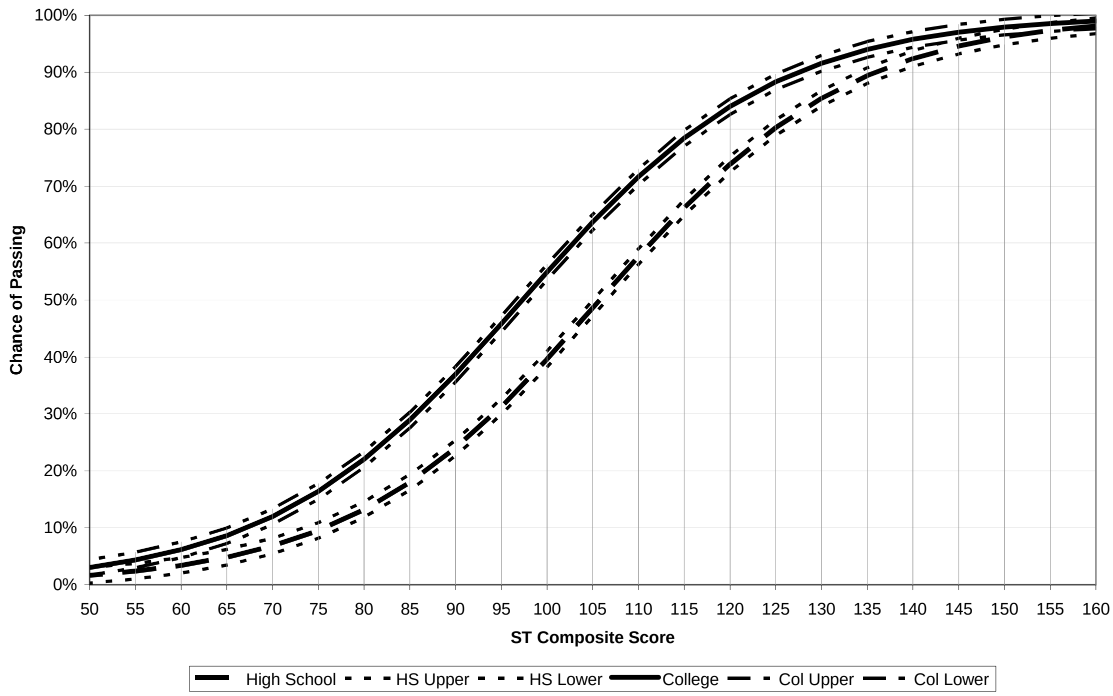
This analysis is confined to male Soldiers from the Regular Army with a high school or college education (though results would be similar for other demographic groups). Based on the model, when the cutoff score is at its current level (ST = 92), regular Army Soldiers with a high school diploma and an average ST score (ST = 109.34) have approximately a 56% chance of passing; college students have a 71% chance. Currently, about 89% of Soldiers are eligible for MOS 97E assignment at the current cutoff (ST = 92). Lowering the cutoff by five points (ST = 87) would increase eligibility by ten percentage points (to 97%) and the average Soldier with a high school diploma who would qualify for training would have a slightly lower chance of passing (54%); the same is true for those with some college (68%). Raising the cutoff score by five points (ST = 97), the average Soldier with a high school diploma would have a slightly higher chance of passing (60%), as would the average Soldier with some college (74%), but eligibility would fall by about ten percentage points.

Table 2. 97E: Probability that a Regular Army Soldier (from the larger Army contract population) will pass the course based on the binary logistic model

	Cutoff = 82	Cutoff = 87	Cutoff = 92	Cutoff = 97	Cutoff = 102
Percent Eligible (Regular Army)	*99.5%*	*96.8%*	*89.3%*	*78.8%*	*64.8%*
Mean	*107.14*	*107.78*	*109.34*	*111.36*	*114.05*
Passing rate:					
High school male	52.5%	53.7%	56.5%	60.1%	64.7%
College male	67.2%	68.2%	70.7%	73.6%	77.3%

Figure 1 shows the relationship between ST and the probability of passing for Male Regular Army Soldiers, including upper and lower bounds based upon the standard error of the estimated ST coefficient. For a particular ST score, trace a vertical line up to the curve, and then a horizontal line over to the axis to determine the corresponding probability of passing. For example, an ST score of 100 corresponds to a passing probability of about 50% for a high school educated, Regular Army male Soldier. One can see that Soldiers with a relatively low ST score have a low chance of passing the course. As ST scores increase, the chance that a Soldier will pass the course increases sharply.

Figure 1: Predicted Probalility of Passing: Male Soldiers



Appendix: Soldier Characteristics (97E)

	Gender	
	Male	Female
fail	18.4%	19.5%
pass	81.6%	80.5%

	Education Level		
	GED or less	High School Diploma	Some College or More
fail	18.2%	23.5%	11.7%
pass	81.8%	76.5%	88.3%

	Component		
	Regular Army	Army Reserve	National Guard
fail	20.7%	8.8%	8.2%
pass	79.3%	91.2%	91.8%

97E Risk Analysis of Policy Alternatives

In this section we extend the policy analysis with a risk analysis of the policy alternatives considered using simulation methods. We employ the "@RISK" software package which is designed as an add-in for Microsoft Excel.[76] There are four steps in the risk analysis.

The first step is developing a model. A regression model for predicting the passing rate has been specified and estimated, and the results stored in Excel worksheet format. See Table 1.

The second step is identifying the uncertainty inherent in both the input variables (composite scores, Soldier characteristics) and the corresponding estimated parameters and specifying their possible values with probability distributions.

To approximate the governing composite distribution, we use the larger Army contract population (EAF file: those who contracted from Jan 1992 to Aug 2003). This distribution can be assumed to follow a normal distribution. The mean and standard deviation estimated from the contract population and used as input to the simulations are shown in Table R-1 (before truncation).

Table R-1. Input information for the simulations

	Mean	Std error / deviation
Constant	-7.721	1.176
ST var	107.02 (before truncation)	12.157
ST coeff	.073	.010
GED var	1.5%	
GED coeff	.452	.825
COLLEGE var	39.8%	
COLLEGE coeff	.618	.227
GUARD var	11.4%	
GUARD coeff	1.521	.428
RESERVE var	4.5%	
RESERVE coeff	.733	.626
GENDER var	30.9%	
GENDER coeff	.292	.220

[76] Software is available from Palisade Corporation, Newfield, NY.

To approximate the distributions for the demographic variables we rely on the training data sample used to estimate the regression model. These distributions can be assumed to follow binomial distributions with means estimated from the training data sample as shown in Table R-1.

To approximate the distributions for the estimated parameters in the logit model, we note that, under very general conditions, the estimates will be asymptotically normally distributed.[77] The estimated coefficients (means and standard errors) are shown in Table R-1.

The third step is analyzing the model with simulation to determine the range and probabilities of all possible training outcome results. The results reported represent the simulation of the regression prediction equation for 1000 iterations using a fixed seed.[78] The comparisons are between the baseline case (ST = 92) and the policy cases (ST = 87 and ST = 97). These cases are delineated by the cutoff score level which serves as the lower truncation point in the governing composite input distribution. The simulation results in Table R-2 describe the effect on the mean probability of passing as the ST cutoff score level is varied, and represent an improvement of the policy analysis presented in Table 2 because they reflect the simultaneous effects of all known sources of uncertainty.

Table R-2. 97E simulation results

	ST = 87	ST = 92	ST = 97
Mean governing composite	108.32	109.54	111.35
Mean probability of passing	67.90%	69.33%	71.99%
Std deviation	26.16%	27.20%	27.98%

The frequency distributions of simulated effects are shown below in the histogram graphs. The histogram portrays the full range of outcomes that average to the mean effect as reported. Looking at the histogram for the baseline case (ST = 92), probability of passing is plotted on the horizontal axis and the height of each bar indicates the relative number of Soldiers at that passing probability. The information in the histograms is effectively summarized in Table R-3. In that table we see the percentage of Soldiers

[77] The intuition is that logit estimates are derived from maximum likelihood (ML) estimation, and under fairly general conditions ML estimates are consistent and asymptotically normally distributed.

[78] Latin Hypercube (LH) sampling is utilized in drawing samples for the input distributions. It is designed to accurately recreate the input distribution through sampling in fewer iterations when compared with the Monte Carlo method. The key to LH sampling is stratification of the input probability distributions.

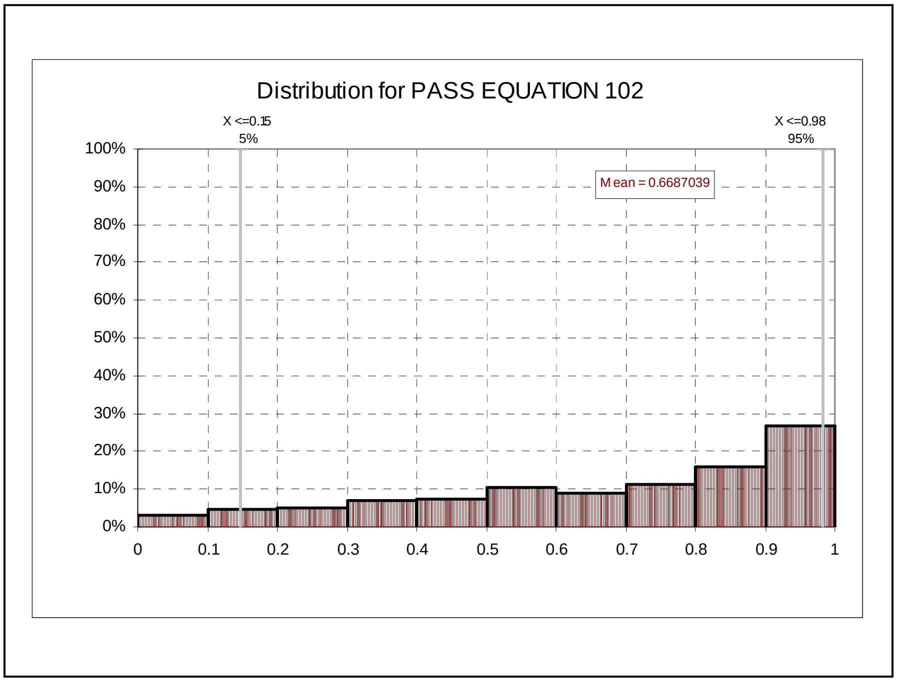
who meet or exceed a given chance of passing. For example, looking at the baseline case (ST = 92), about 58% of Soldiers have a 70% or greater chance of passing.

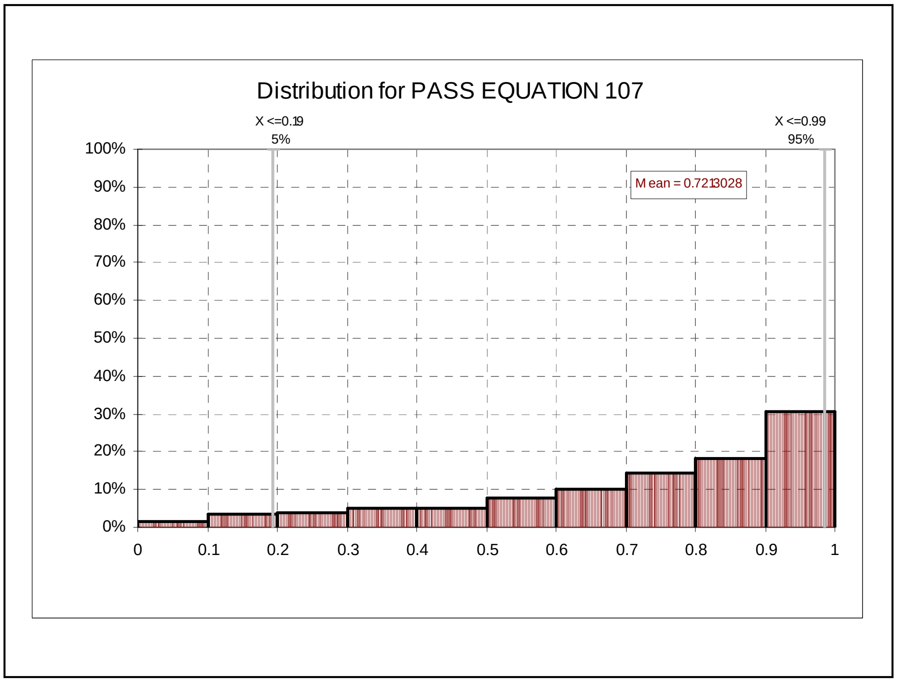
Table R-3.
Percent of simulated Soldiers that meet or exceed given chance of passing

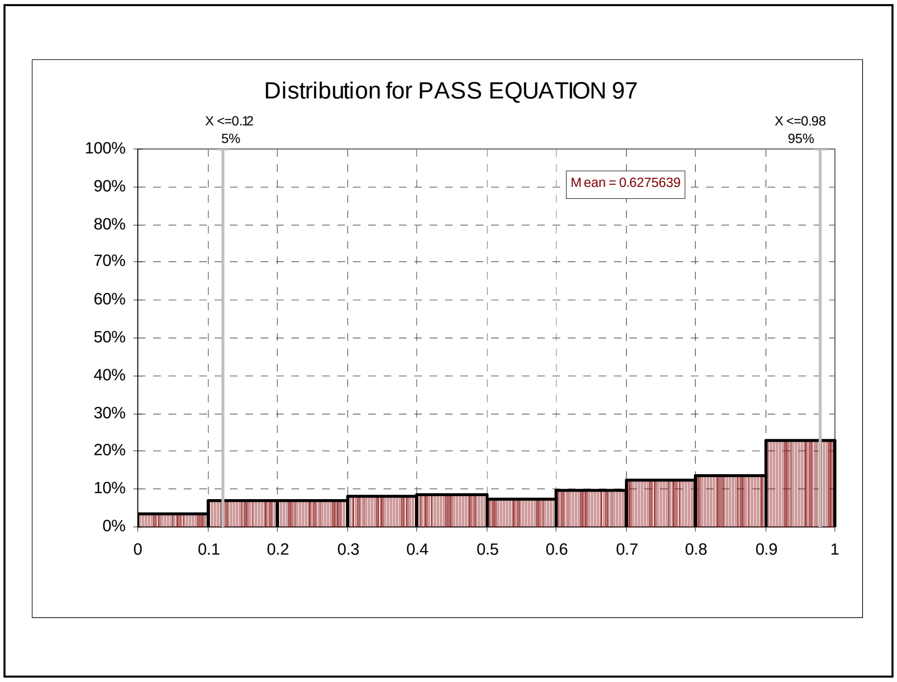
Chance of passing	ST = 87	ST = 92	ST = 97
95.0%	17.63%	18.58%	20.63%
90.0%	29.90%	33.43%	33.56%
85.0%	38.82%	41.39%	43.45%
80.0%	47.21%	46.65%	50.65%
75.0%	53.33%	52.63%	56.98%
70.0%	58.34%	57.75%	61.65%
65.0%	62.18%	62.29%	66.05%
60.0%	66.93%	66.39%	70.10%
55.0%	71.40%	70.47%	73.50%
50.0%	53.33%	52.63%	56.98%

We find that the mean probability of passing in the simulation is 69% (Table R-2, baseline). Looking at the histograms, we see the largest portion of Soldiers is in the highest range of passing scores, trending downward as the probability of passing approaches zero. We note that the mean simulated passing probability is higher but comparable to the static prediction at the mean ST score (Table 2). For the static prediction we reported the mean probability of passing at 56.5% for male high school and at 70% for male with (some) college. The simulation prediction is strongly boosted by COLLEGE and GUARD composition and effects (and to a lesser extent by RESERVE and GENDER effects). In the simulated predictions we are calculating an average over all Soldiers and taking into account all sources of uncertainty, whereas in the static prediction we are calculating the probability of passing only at the mean ST score, ignoring the distribution of Soldier scores etc. as well as uncertainty. While recognizing this variability is important, we also note that the policy case impacts relative to the baseline are the same in both simulation and static prediction modes.

The fourth step is making a decision based on the results provided and the preferences of the school proponent. This involves the evaluation by the school proponent of the tradeoff between increased eligibility and reduced passing probabilities (and vice-versa).


Distribution for PASS EQUATION 102
X <=0.15
5%
X <=0.98
95%
Mean = 0.6687039
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1


Distribution for PASS EQUATION 107
X <=0.19
5%
X <=0.99
95%
Mean = 0.7213028
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1


Distribution for PASS EQUATION 97
X <=0.12
5%
X <=0.98
95%
Mean = 0.6275639
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1

98C: Signals Intelligence Analyst

The final sample included 1621 Soldiers who were coded as either graduates or academic failures during their first AIT attempt in this MOS during a period from 2001 to 2004. Only Soldiers who graduated (81.4%) or failed for academic reasons (18.6%) were included in the analysis sample of 1621 Soldiers because we assume that non-completion for non-academic reasons is not related to cognitive criteria.

In the sample, most were male (76%, 24% female), most had a high school diploma but not more education (74%, 25% some college, 1% GED or less), and almost all were Regular Army (97%, 1% National Guard, 2% Reserve). The governing AA composite, Skilled Technical (ST), for this MOS has a cutoff score of 102; the sample mean is 119.16 (standard deviation = 9.0). See the Appendix for a description of Soldier characteristics for this MOS training sample.

A binary logistic regression model was estimated to explain pass/fail AIT outcomes and focused on the first training attempt. The estimation results are reported in

Table 1. 98C: Results of the binary logistic prediction model

Chi- Square		199.353***	
Log Likelihood		1359.466	
Nagelkerke R Square		.187	
Variable	Coefficient	Odds Ratio	Wald
Constant	-11.818	.000	121.259
GED	-.910	.402	1.948
COLLEGE	.045	1.047	.069
RESERVE	-.928	.395	2.874
GUARD	-.479	.620	.546
GENDER	.292	1.339	3.277
ST	.113	1.120	149.195***

* = p < .05 *** = p < .001
** = p < .005

Table 1 and indicate that the model, including the ST composite, education level (GED = GED or less than high school diploma; COLLEGE = some college) , Army component (GUARD = National Guard; RESERVE = Army Reserve) and gender (GENDER = female), accounts for about 19% of the variation in the dependent variable. This model is statistically significant (χ^2 = 199.353, P < .001), and has moderate explanatory power (Nagelkerke R^2 = .187).

There is a statistically significant effect for the ST composite. The model suggests that having a higher ST composite score increases the odds of passing. At the mean ST score, an increase of one point is associated with an increase of about 12% in the odds of passing the course, and a five-point increase in ST would increase the odds of passing by 76%.

<u>Policy Analysis.</u> Table 2 reports the probability that the average Soldier from the larger Army contract population would pass the course based upon the binary logistic model. These were calculated using the formula for finding probability in a binary logistic model, which is

$$e^{(\beta' x)} / (1 + e^{(\beta' x)}).$$

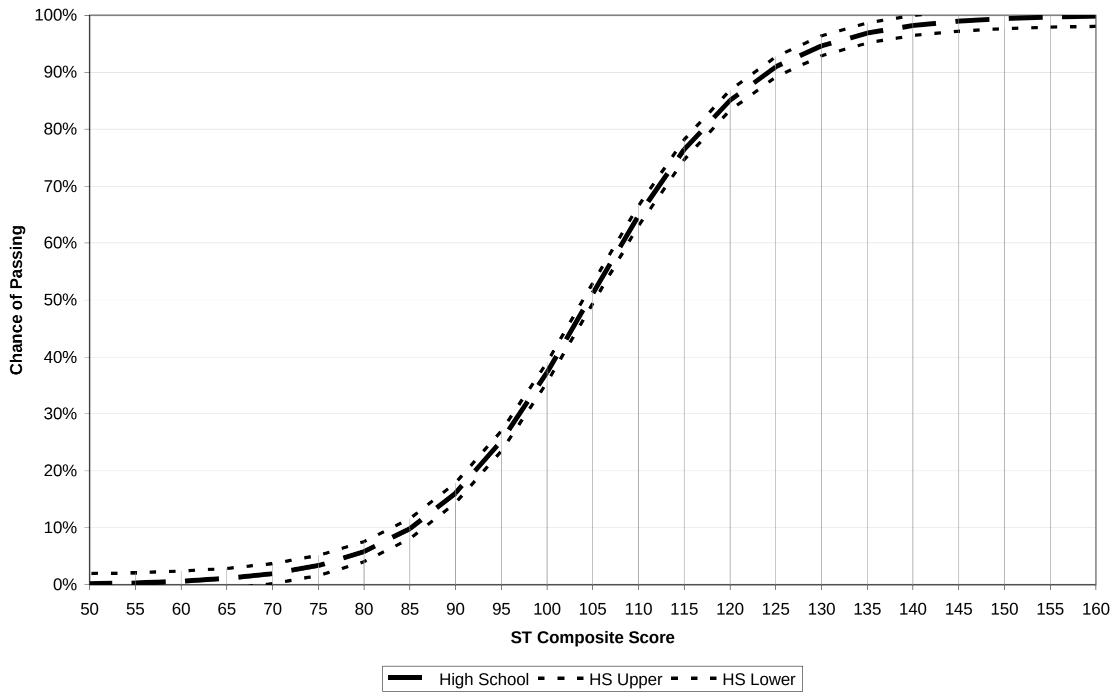
Because GED, COLLEGE, GUARD, RESERVE, and GENDER were not statistically significant, this analysis is confined to male Soldiers with a high school diploma from the Regular Army (though results would be similar for other demographic groups). Based on the model, when the cutoff score is at its current level (ST = 102), regular Army Soldiers with an average ST score (ST = 114.16) have approximately a 75% chance of passing. Currently, about 65% of Soldiers are eligible for MOS 98C assignment at the current cutoff (ST = 102). Lowering the cutoff by five points (ST = 97) would increase eligibility by 13 percentage points (to 78%) while the average Soldier who would qualify for training would have a lower chance of passing (69%). Raising the cutoff score by five points (ST =107), the average Soldier would have a higher chance of passing (81%) but eligibility would fall by about 15 percentage points (50%).

Table 2. 98C: Probability that a Soldier (from the larger Army contract population) will pass the course based on the binary logistic model

	Cutoff = 92	Cutoff = 97	Cutoff = 102	Cutoff = 107	Cutoff = 112
Percent Eligible (Regular Army)	*89.0%*	*78.2%*	*64.9%*	*49.6%*	*34.7%*
Mean	*109.45*	*111.59*	*114.16*	*117.18*	*120.51*
Passing rate:					
High School, Male, Regular Army	63.4%	68.8%	74.7%	80.6%	85.8%

Figure 1 shows the relationship between ST and the probability of passing for Regular Army Soldiers, including upper and lower bounds based upon the standard error of the estimated ST coefficient. For a particular ST score, trace a vertical line up to the curve, and then a horizontal line over to the axis to determine the corresponding probability of passing. For example, an ST score of 100 corresponds to a passing probability of about 37% for a high school educated, Regular Army male Soldier. One can see that Soldiers with a low ST score stand very little chance of passing the course. As ST scores increase, the chance that a Soldier will pass the course increases sharply.

Figure 1: Predicted Probalility of Passing: High School Male Regular Army Soldiers



Appendix: Soldier Characteristics (98C)

Outcome	Gender: Male	Female
fail	17.3%	23.0%
pass	82.7%	77.0%

	Education Level: GED or less	High School Diploma	Some College or More
fail	36.4%	20.1%	13.8%
pass	63.6%	79.9%	86.2%

	Component: Regular Army	Army Reserve	National Guard
fail	18.4%	30.0%	22.2%
pass	81.6%	70.0%	77.8%

98C Risk Analysis of Policy Alternatives

In this section we extend the policy analysis with a risk analysis of the policy alternatives considered using simulation methods. We employ the "@RISK" software package which is designed as an add-in for Microsoft Excel.[79] There are four steps in the risk analysis.

The first step is developing a model. A regression model for predicting the passing rate has been specified and estimated, and the results stored in Excel worksheet format. See Table 1.

The second step is identifying the uncertainty inherent in both the input variables (composite scores, Soldier characteristics) and the corresponding estimated parameters and specifying their possible values with probability distributions.

To approximate the governing composite distribution, we use the larger Army contract population (EAF file: those who contracted from Jan 1992 to Aug 2003). This distribution can be assumed to follow a normal distribution. The mean and standard deviation estimated from the contract population and used as input to the simulations are shown in Table R-1 (before truncation).

Table R-1. Input information for the simulations

	Mean	Std error / deviation
Constant	-11.818	1.073
ST var	107.02 (before truncation)	12.157
ST coeff	.113	.009
GED var	0.6%	
GED coeff	-.910	.652
COLLEGE var	25.7%	
COLLEGE coeff	.045	.173
GUARD var	1.3%	
GUARD coeff	-.479	.648
RESERVE var	1.5%	
RESERVE coeff	-.928	.548
GENDER var	24.4%	
GENDER coeff	.292	.161

[79] Software is available from Palisade Corporation, Newfield, NY.

To approximate the distributions for the demographic variables we rely on the training data sample used to estimate the regression model. These distributions can be assumed to follow binomial distributions with means estimated from the training data sample as shown in Table R-1.

To approximate the distributions for the estimated parameters in the logit model, we note that, under very general conditions, the estimates will be asymptotically normally distributed.[80] The estimated coefficients (means and standard errors) are shown in Table R-1.

The third step is analyzing the model with simulation to determine the range and probabilities of all possible training outcome results. The results reported represent the simulation of the regression prediction equation for 1000 iterations using a fixed seed.[81] The comparisons are between the baseline case (ST = 102) and the policy cases (ST = 97 and ST = 107). These cases are delineated by the cutoff score level which serves as the lower truncation point in the governing composite input distribution. The simulation results in Table R-2 describe the effect on the mean probability of passing as the ST cutoff score level is varied, and represent an improvement of the policy analysis presented in Table 2 because they reflect the simultaneous effects of all known sources of uncertainty.

Table R-2. 98C simulation results

	ST = 97	ST = 102	ST = 107
Mean governing composite	111.36	113.76	116.71
Mean probability of passing	62.8%	66.9%	72.1%
Std deviation	28.5%	27.0%	24.7%

The frequency distributions of simulated effects are shown below in the histogram graphs. The histogram portrays the full range of outcomes that average to the mean effect as reported. Looking at the histogram for the baseline case (ST = 102), probability of passing is plotted on the horizontal axis and the height of each bar indicates the relative number of Soldiers at that passing probability. The information in the histograms is effectively summarized in Table R-3. In that table we see the percentage of Soldiers

[80] The intuition is that logit estimates are derived from maximum likelihood (ML) estimation, and under fairly general conditions ML estimates are consistent and asymptotically normally distributed.
[81] Latin Hypercube (LH) sampling is utilized in drawing samples for the input distributions. It is designed to accurately recreate the input distribution through sampling in fewer iterations when compared with the Monte Carlo method. The key to LH sampling is stratification of the input probability distributions.

who meet or exceed a given chance of passing. For example, looking at the baseline case (ST = 102), about 54% of Soldiers have a 70% or greater chance of passing.

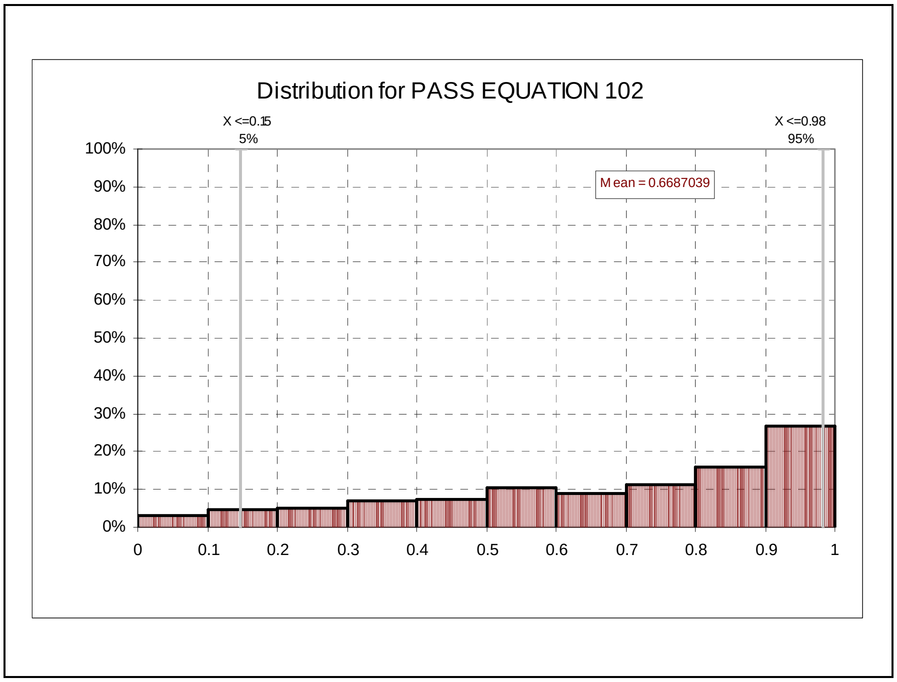
Table R-3.
Percent of simulated Soldiers that meet or exceed given chance of passing

Chance of passing	ST = 97	ST = 102	ST = 107
95.0%	11.8%	15.5%	19.3%
90.0%	23.0%	26.6%	30.6%
85.0%	29.8%	35.7%	40.8%
80.0%	36.6%	42.4%	48.9%
75.0%	42.9%	49.0%	56.3%
70.0%	48.9%	53.5%	63.2%
65.0%	54.8%	57.3%	68.0%
60.0%	58.6%	62.6%	73.1%
55.0%	62.7%	68.2%	77.5%
50.0%	65.7%	73.2%	81.0%

We find that the mean probability of passing in the simulation is 67% (Table R-2, baseline). Looking at the histograms, we see the largest portion of Soldiers is in the highest range of passing scores, trending downward as the probability of passing approaches zero. We note that the mean simulated passing probability is lower but comparable to the static prediction at the mean ST score (Table 2: 75% for male high school Soldiers). In the simulated predictions we are calculating an average over all Soldiers and taking into account all sources of uncertainty, whereas in the static prediction we are calculating the probability of passing only at the mean ST score, ignoring the distribution of Soldier scores etc. as well as uncertainty.[82] While recognizing this variability is important, we also note that the policy case impacts relative to the baseline are the same in both simulation and static prediction modes.

The fourth step is making a decision based on the results provided and the preferences of the school proponent. This involves the evaluation by the school proponent of the tradeoff between increased eligibility and reduced passing probabilities (and vice-versa).

[82] For several other MOS sensitivity analysis indicates that we can attribute this difference (between simulation and static predictions) to the relatively large standard errors on the constant and governing composite terms that come into play in the simulation. In the present case, however, the standard errors are not especially large and so the causes of the difference are not apparent.


Distribution for PASS EQUATION 102
X <=0.15
5%
X <=0.98
95%
Mean = 0.6687039
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
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0.1
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0.8
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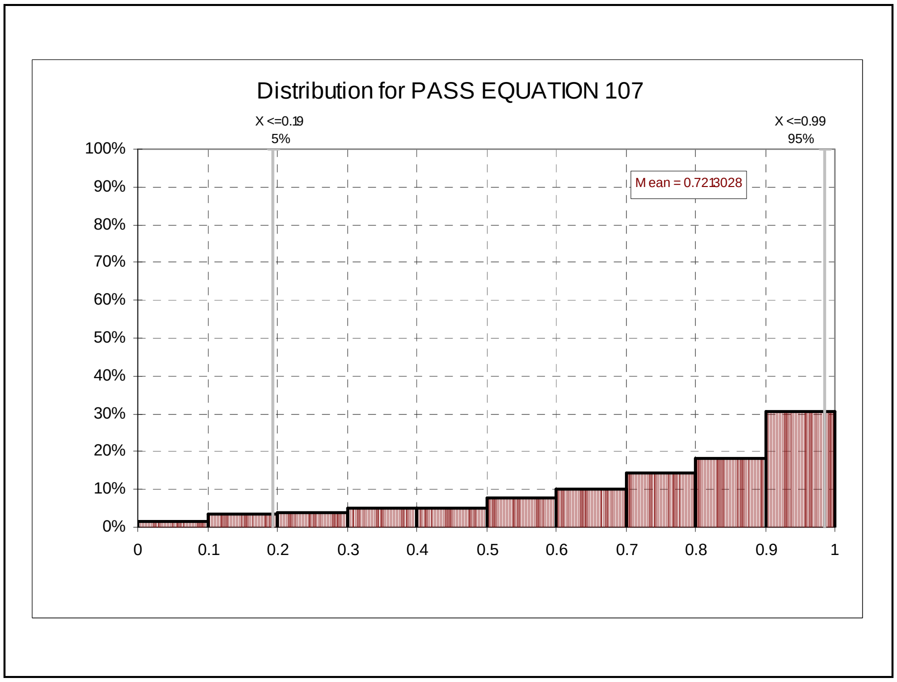
1


Distribution for PASS EQUATION 107
X <=0.19
5%
X <=0.99
95%
Mean = 0.7213028
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
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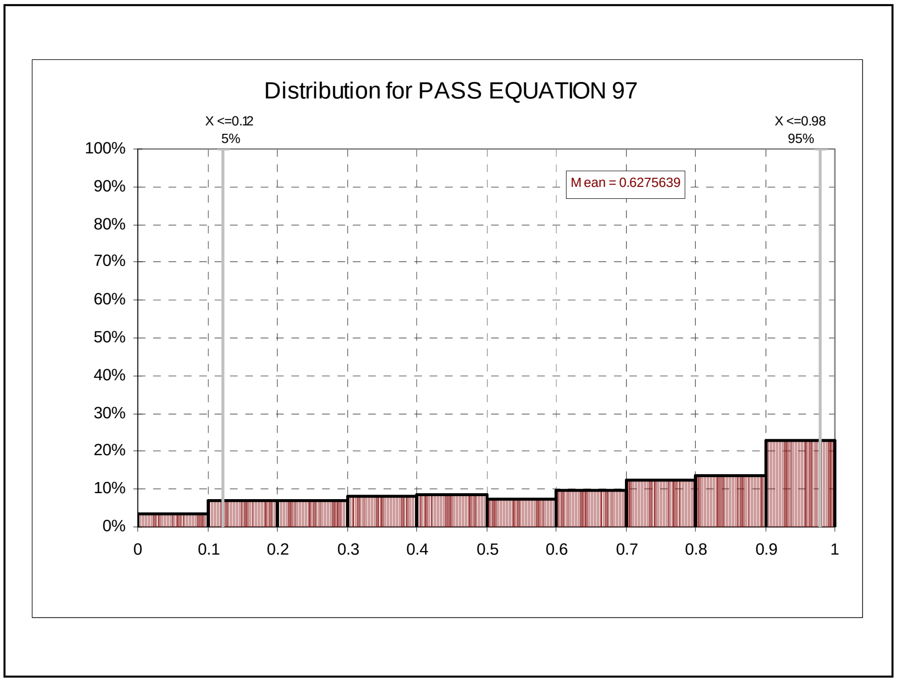
0.9
1


Distribution for PASS EQUATION 97
X <=0.12
5%
X <=0.98
95%
Mean = 0.6275639
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
0
0.1
0.2
0.3
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0.5
0.6
0.7
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0.9
1

98G: Voice Interceptor

The final sample included 1461 Soldiers who were coded as either graduates or academic failures during their first AIT attempt in this MOS during a period from 2001 to 2004. Only Soldiers who graduated (92.3%) or failed for academic reasons (7.7%) were included in the analysis sample because we assume that non-completion for non-academic reasons is not related to cognitive criteria.

In the sample, most were male (67%, 33% female), most had a high school diploma but not more education (65%, 34% some college, 1% GED or less), and greatest number were from Regular Army (96%, 4% National Guard, < 1% Reserve). The governing AA composite, Skilled Technical (ST), for this MOS has a cutoff score of 92; the sample mean is 122.21 (standard deviation = 9.697). See the Appendix for a description of Soldier characteristics for this MOS training sample.

A binary logistic regression model was estimated to explain pass/fail AIT outcomes and focused on the first training attempt. The estimation results are reported in

Table 1. 98G: Results of the binary logistic prediction model

Chi- Square		5.385	
Log Likelihood		790.085	
Nagelkerke R Square		.009	
Variable	Coefficient	Odds Ratio	Wald
Constant	2.030	7.614	2.360
GED	-1.520	.219	3.196
COLLEGE	-.306	.737	2.260
GUARD	-.040	.961	.006
GENDER	-1.69	.844	.603
ST	.005	1.005	.241

* = p < .05 *** = p < .001
** = p < .005

Table 1 and indicate that a model, including the ST, education level (GED = GED or less than high school diploma; COLLEGE = some college) and Army component (GUARD = National Guard), accounts for almost one percent of the variation in the dependent variable. This model is not statistically significant (χ^2 = 53.85, P < .001), and has little explanatory power (Nagelkerke R^2 = .009).

Policy Analysis. Because the model estimated for 98G is not statistically significant and has little explanatory power, no policy analysis can be developed from the existing data.

Appendix: Soldier Characteristics (98G)

Outcome	Gender	
	Male	Female
fail	7.3%	8.5%
pass	92.7%	91.5%

Outcome	Education Level		
	GED or less	High School Diploma	Some College or More
fail	25.0%	6.9%	9.0%
pass	75.0%	93.1%	91.0%

Outcome	Component		
	Regular Army	Army Reserve	National Guard
fail	7.7%	.0%	8.8%
pass	92.3%	100.0%	91.2%

98H: Communications Interceptor/Locator

The final sample included 474 Soldiers who were coded as either graduates or academic failures during their first AIT attempt in this MOS during a period from 2001 to 2004. Only Soldiers who graduated (41.7%) or failed for academic reasons (58.6%) were included in the analysis sample because we assume that non-completion for non-academic reasons is not related to cognitive criteria.

In the sample, most were male (58%, 43% female), most had a high school diploma but not more education (89%, 10% some college, 1% GED or less), and virtually all were from the Regular Army (99%, 1% National Guard). The governing AA composite, Skilled Technical (ST), for this MOS has a cutoff score of 92; the sample mean is 104.55 (standard deviation = 11.011). See the Appendix for a description of Soldier characteristics for this MOS training sample.

Table 1. 98H: Results of the binary logistic prediction model

Chi- Square		17.968***	
Log Likelihood		626.242	
Nagelkerke R Square		.050	
Variable	Coefficient	Odds Ratio	Wald
Constant	-4.532	.011	16.188***
COLLEGE	.042	1.043	.016
GENDER	-.001	.999	.000
ST	.040	1.041	14.642***

* = p < .05 *** = p < .001

A binary logistic regression model was estimated to explain pass/fail AIT outcomes and focused on the first training attempt. The estimation results are reported in Table 1 and indicate that the model, including the ST composite, education status (COLLEGE) and gender (GENDER = female), accounts for about 5% of the variation in the dependent variable. This model is statistically significant ($\chi^2 = 17.968$, $P < .001$), but has limited explanatory power (Nagelkerke $R^2 = .050$).

There are statistically significant effects for the ST composite. The model suggests that having a higher ST composite score increases the odds of passing. At the mean ST score, an increase of one point is associated with an increase of about 4 percent in the odds of passing the course, and a five-point increase in ST would increase the odds of passing by 22%.

Policy Analysis. Table 2 reports the probability that the average Soldier from the larger Army contract population would pass the course based upon the binary logistic model. These were calculated using the formula for finding probability in a binary logistic model, which is

$$e^{(\beta' x)} / (1 + e^{(\beta' x)}).$$

Because COLLEGE and GENDER were not statistically significant, this analysis is confined to the modal demographic—high school educated male Soldiers (though results would be similar for any demographic combination). Based on the model, when the cutoff score is at its current level (ST = 92), male Soldiers with a high school diploma and an average ST score (ST = 109.34) have approximately a 46% chance of passing. Currently, about 89% of Soldiers are eligible for MOS 98H assignment at the current cutoff (ST = 92). Lowering the cutoff by five points (ST = 87) would increase eligibility by eight percentage points, while the average male Soldier who would qualify for training would have a slightly lower chance of passing (male = 45%). Raising the cutoff score by five points (ST = 97), the average male Soldier who would still qualify for the MOS

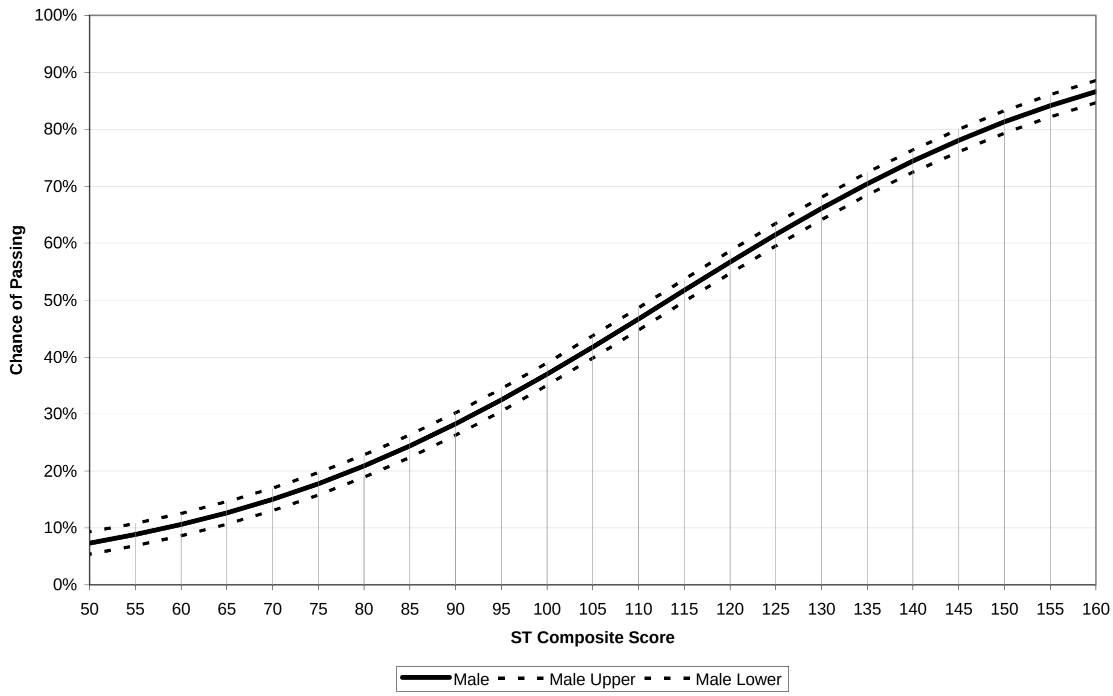
Table 2. 98H: Probability that a Soldier (from the larger Army contract population) will pass the course based on the binary logistic model

	Cutoff = 82	Cutoff = 87	Cutoff = 92	Cutoff = 97	Cutoff = 102
Percent Eligible (Regular Army)	*99.5%*	*96.8%*	*89.3%*	*78.8%*	*64.8%*
Mean	*107.14*	*107.78*	*109.34*	*111.36*	*114.05*
Passing rates:					
Male High School	43.9%	44.5%	46.0%	48.1%	50.7%

would have a slightly higher chance of passing (48%), but fewer Soldiers would be eligible (79%).

Figure 1 shows the relationship between ST and the probability of passing for male Soldiers, including upper and lower bounds based upon the standard error of the estimated ST coefficient. For a particular ST score, trace a vertical line up to the curve, and then a horizontal line over to the axis to determine the corresponding probability of passing. For example, an ST value of 100 corresponds to a passing probability of about 37% for a male Soldier. One can see that the probability of passing increases steadily through the range of the data.

Figure 1: Predicted Probalility of Passing: Male High School Soldiers



Appendix: Soldier Characteristics (98H)

Outcome	Gender: Male	Gender: Female
fail	55.7%	61.9%
pass	44.3%	38.1%

Outcome	Education Level: GED or less	High School Diploma	Some College or More
fail	20.0%	59.4%	51.1%
pass	80.0%	40.6%	48.9%

Outcome	Component: Regular Army	Army Reserve	National Guard
fail	58.2%	.0%	75.0%
pass	41.8%	.0%	25.0%

98J: Electronic Intelligence Analyst

The final sample included 503 Soldiers who were coded as either graduates or academic failures during their first AIT attempt in this MOS during a period from 2001 to 2004. Only Soldiers who graduated (88.7%) or failed for academic reasons (11.3%) were included in the analysis sample because we assume that non-completion for non-academic reasons is not related to cognitive criteria.

In the sample, most were male (70%, 30% female), most had a high school diploma but not more education (86%, 12% some college, 2% GED or less), and most were from the Regular Army (93%, 1% Guard, 6% Reserve). The governing AA composite, Skilled Technical (ST), for this MOS has a cutoff score of 102; the sample mean is 115.36 (standard deviation = 8.708). See the Appendix for a description of Soldier characteristics for this MOS training sample.

Table 1. 98J: Results of the binary logistic prediction model

Chi- Square		23.411***	
Log Likelihood		332.081	
Nagelkerke R Square		.090	
Variable	Coefficient	Odds Ratio	Wald
Constant	-7.222	.001	9.461**
GED	-.359	.698	.153
COLLEGE	1.278	3.590	2.971
RESERVE	-.106	.899	.026
GENDER	.241	1.273	.567
ST	.081	1.084	15.125***

* = p < .05 *** = p < .001
** = p < .01

A binary logistic regression model was estimated to explain pass/fail AIT outcomes and focused on the first training attempt. The estimation results are reported in

Table 1 and indicate that the model, including the ST composite, education level (GED = GED or less education, COLLGE = some college), Army component (RESERVE = Army Reserve), and gender (GENDER = female), accounts for about 9% of the variation in the dependent variable. This model is statistically significant ($\chi^2 = 23.411$, $P < .001$), and has moderate explanatory power (Nagelkerke $R^2 = .090$).

There are statistically significant effects for the ST composite. The model suggests that having a higher ST composite score increases the odds of passing. At the mean ST score, an increase of one point is associated with an increase of about eight percent in the odds of passing the course, and a five-point increase in ST would increase the odds of passing by 50%.

Policy Analysis. Table 2 reports the probability that the average Soldier from the larger Army contract population would pass the course based upon the binary logistic model. These were calculated using the formula for finding probability in a binary logistic model, which is

$$e^{(\beta' x)} / (1 + e^{(\beta' x)}).$$

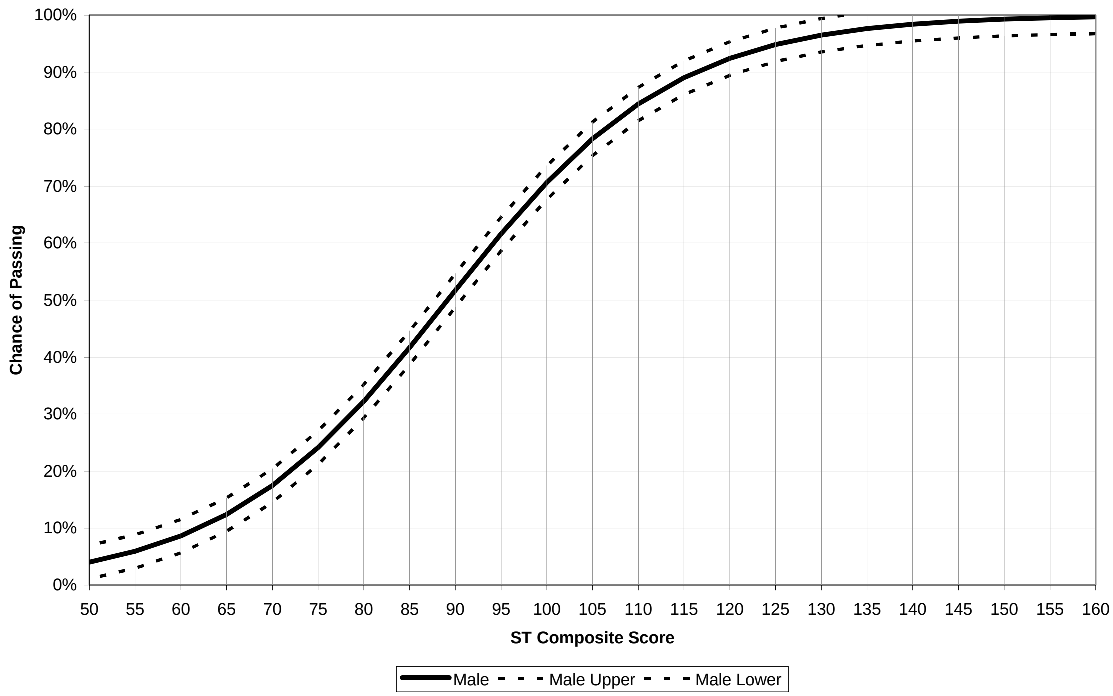
Because GED, COLLEGE, and GENDER were not statistically significant, this analysis is confined to the modal demographic—high school educated male Soldiers (though results would be similar for any demographic combination). Based on the model, when the cutoff score is at its current level (ST = 102), male Soldiers with a high school diploma and an average ST score (ST = 114.05) have approximately an 88% chance of passing. Currently, about 65% of Soldiers are eligible for MOS 98J assignment at the current cutoff (ST = 102). Lowering the cutoff by five points (ST = 97) would increase eligibility by six percentage points, while the average male Soldier who would qualify for training would have a slightly lower chance of passing (male = 86%). Raising the cutoff score by five points (ST = 107), the average male Soldier who would still qualify for the MOS would have a slightly higher chance of passing (91%), but fewer Soldiers would be eligible (50%).

Table 2. 98J: Probability that a Soldier (from the larger Army contract population) will pass the course based on the binary logistic model

	Cutoff = 92	Cutoff = 97	Cutoff = 102	Cutoff = 107	Cutoff = 112
Percent Eligible (Regular Army)	*89.3%*	*78.8%*	*64.8%*	*49.6*	*36.2*
Mean					
Passing rates:	*109.34*	*111.36*	*114.05*	*117.08*	*123.08*
High school male	83.7%	85.6%	88.2%	90.6%	94.0%

Figure 1 shows the relationship between ST and the probability of passing for high school educated male Soldiers, including upper and lower bounds based upon the standard error of the estimated ST coefficient. For a particular ST score, trace a vertical line up to the curve, and then a horizontal line over to the axis to determine the corresponding probability of passing. For example, an ST value of 100 corresponds to a passing probability of about 70% for a high school educated male Soldier. One can see that the probability of passing increases through the data range.

Figure 1: Predicted Probalility of Passing: Male High School Soldiers



Appendix: Soldier Characteristics (98J)

Outcome	Gender: Male	Gender: Female
fail	10.8%	12.7%
pass	89.2%	87.3%

Outcome	Education Level: GED or less	Education Level: High School Diploma	Education Level: Some College or More
fail	20.0%	12.2%	3.4%
pass	80.0%	87.8%	96.6%

Outcome	Component: Regular Army	Component: Army Reserve	Component: National Guard
fail	11.3%	13.8%	.0%
pass	88.7%	86.2%	100.0%

98K: Signal Collector & Identifier

The final sample included 374 Soldiers who were coded as either graduates or academic failures during their first AIT attempt in this MOS during a period from 2001 to 2004. Only Soldiers who graduated (90.4%) or failed for academic reasons (9.6%) were included in the analysis sample because we assume that non-completion for non-academic reasons is not related to cognitive criteria.

In the sample, most were male (59%, 41% female), most had a high school diploma but not more education (86%, 13% some college, 1% GED or less), and all were from Regular Army. The governing AA composite, Skilled Technical (ST), for this MOS has a cutoff score of 92; the sample mean is 104.17 (standard deviation = 9.618). See the Appendix for a description of Soldier characteristics for this MOS training sample.

Table 1. 98K: Results of the binary logistic prediction model

Chi- Square		18.685***	
Log Likelihood		218.266	
Nagelkerke R Square		.104	
Variable	Coefficient	Odds Ratio	Wald
Constant	-9.570	.000	8.517***
GENDER	.236	1.266	.412
ST	.116	1.123	12.507**

* = p < .05 *** = p < .001
** = p < .01

A binary logistic regression model was estimated to explain pass/fail AIT outcomes and focused on the first training attempt. The estimation results are reported in Table 1 and indicate that the model, including the ST composite and gender (GENDER = female), accounts for about 10% of the variation in the dependent variable. This model is statistically significant (χ^2 = 18.685, P < .001), and has moderate explanatory power (Nagelkerke R^2 = .104).

There are statistically significant effects for the ST composite. The model suggests that having a higher ST composite score increases the odds of passing. At the mean ST score, an increase of one point is associated with an increase of about twelve percent in the odds of passing the course, and a five-point increase in ST would increase the odds of passing by 79%.

Policy Analysis. Table 2 reports the probability that the average Soldier from the larger Army contract population would pass the course based upon the binary logistic model. These were calculated using the formula for finding probability in a binary logistic model, which is

$$e^{(\beta' x)} / (1 + e^{(\beta' x)}).$$

Because GENDER was not statistically significant, this analysis is confined to the modal demographic—male Soldiers (though results would be similar for any demographic combination). Based on the model, when the cutoff score is at its current level (ST = 92), male Soldiers with a high school diploma and an average ST score (ST = 109.34) have approximately a 96% chance of passing. Currently, about 89% of Soldiers are eligible for MOS 98K assignment at the current cutoff. Lowering the cutoff by five points (ST = 87) would increase eligibility by eight percentage points, while the average Soldier who

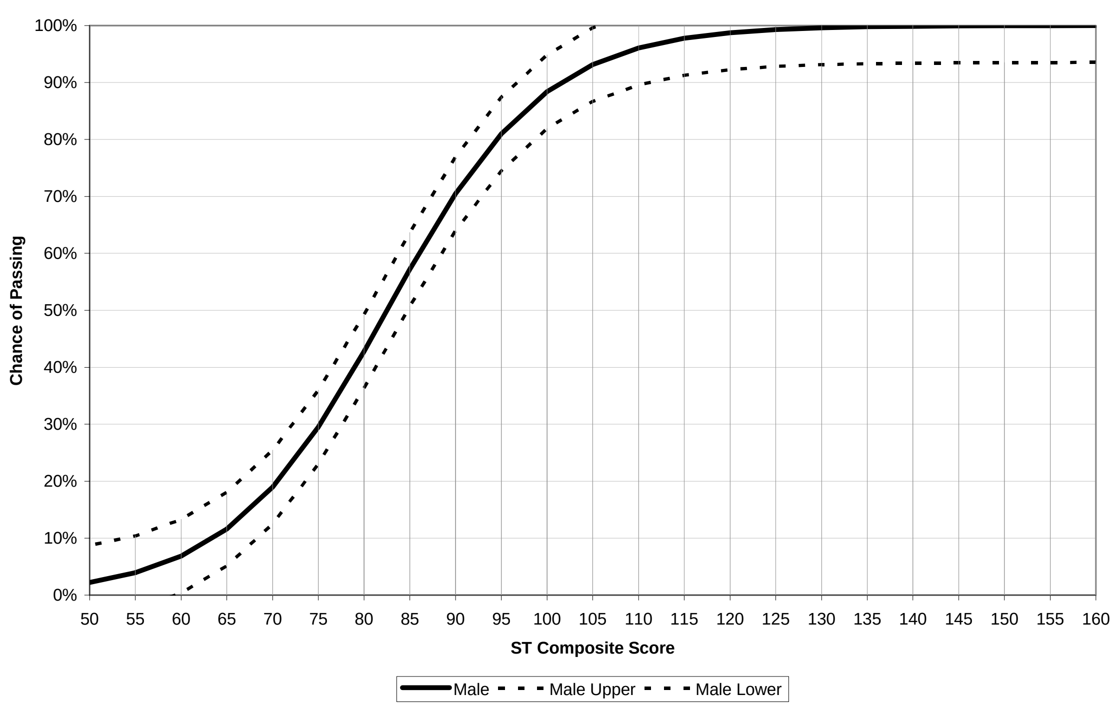
Table 2. 98K: Probability that a Soldier (from the larger Army contract population) will pass the course based on the binary logistic model

	Cutoff = 82	Cutoff = 87	Cutoff = 92	Cutoff = 97	Cutoff = 102
Percent Eligible (Regular Army)	*99.5%*	*96.8%*	*89.3%*	*78.8%*	*64.8%*
Mean					
Passing rates:	*107.14*	*107.78*	*109.34*	*111.36*	*114.05*
High school male	94.6%	95.0%	95.7%	96.6%	97.5%

would qualify for training would have about the same chance of passing (male = 95%). Raising the cutoff score by five points (ST = 97), the average Soldier who would still qualify for the MOS would have about the same chance of passing (97%), but fewer Soldiers would be eligible (79%).

Figure 1 shows the relationship between ST and the probability of passing for male Soldiers, including upper and lower bounds based upon the standard error of the estimated ST coefficient. For a particular ST score, trace a vertical line up to the curve, and then a horizontal line over to the axis to determine the corresponding probability of passing. For example, an ST value of 100 corresponds to a passing probability of about 88% for a male Soldier. One can see that the probability of passing increases sharply through the bottom of the data range.

Figure 1: Predicted Probalility of Passing: Male Soldiers



Appendix: Soldier Characteristics (98K)

Outcome	Gender	
	Male	Female
fail	9.1%	10.4%
pass	90.9%	89.6%

Outcome	Education Level		
	GED or less	High School Diploma	Some College or More
fail	.0%	10.6%	4.0%
pass	100.0%	89.4%	96.0%

Outcome	Component		
	Regular Army	Army Reserve	National Guard
fail	9.6%	.0%	.0%
pass	90.4%	.0%	.0%