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CROSS-VALIDATION OF PREDICTOR EQUATIONS FOR ARMOR CREWMAN PERFORMANCE

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Cross-validation of armor crewman performance predictor equations was carried out on a sample of 335 trainees of the First Training Brigade, Fort Knox, Ky. Testing took place during and immediately following training. Some trainees were retested at their unit of first assignment. The predictor equations were also used with a sample of experienced tank crewmen, who were tested at the time of the trainee retesting.

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20. The predictor measures were computed from subtest scores of the Armed Services Vocational Aptitude Battery, which were available in each enlistee's personnel records. Criterion measures were hands-on tests designed to measure crewmen's ability to perform the basic tasks (either driving the tank or firing the gun) as well as other MOS-specific tasks in maintenance and weapons preparation. A total of 130 drivers and 205 gunner/loaders were tested in Phase I, and 20 drivers and 60 gunner/loaders were retested in Phase II.

Phase I results indicated that the predictors were valid for driver and gunner/loader performance at the end of training. Phase II results indicated that the predictors were successful in most portions of the criterion measures for former trainees who were retested. Use of the predictors for the performance of experienced crewmen showed mixed results.

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Armor Training

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FOREWORD

A major research area for the U.S. Army Research Institute for the Behavioral and Social Sciences (ARI) is performance-oriented individual training. The ARI Field Unit at Fort Knox, Ky., in its work unit area "Individual Readiness in Armor Training and Performance" (Army Project 2Q162722A766), is concerned with improving methods used to assign personnel to training and service in tank crew duty positions. The long-range program includes developing and validating predictor tests to improve assignment practices and to enhance tank crew combat proficiency.

This report describes the cross-validation of predictor equations that can be used to assign tank crewmen to the positions of tank commander, gunner/loader, and driver on the basis of objective measures of their aptitudes and performance. ARI Technical Report 391 describes the development and initial validation of these predictors, which use subtests from the Armed Services Vocational Aptitude Battery (ASVAB), other selected paper-and-pencil tests, and interim training performance measures. ARI Research Report 1240 describes the usefulness of these predictors and shows how to use them to aid assignment decisions.

The project was designed in response to requests by the USA Armor Center and the USA Armor School.

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CROSS-VALIDATION OF PREDICTOR EQUATIONS FOR ARMOR CREWMAN PERFORMANCE

BRIEF

Requirement:

To cross-validate previously developed predictors of tank driver and gunner/loader performance using a new, larger sample of Army enlistees. The validation was to be conducted at the end of training and again in the unit of first assignment.

Procedure:

The predictor scores were computed from subtest scores of the Armed Service Vocational Aptitude Battery (ASVAB), available in each enlistee's personnel records. Criterion measures were hands-on tests designed to measure crewmen's ability to perform the basic tasks of driving or firing the tank's guns as well as other MOS-specific tasks in maintenance and weapons preparation.

In Phase I, 335 trainees were tested immediately following training (130 drivers and 205 gunner/loaders), and in Phase II, 20 drivers and 60 gunners were tested in their units of first assignment.

Findings:

The results of Phase I indicate that two of the predictors evaluated (labeled driving UMO and gunnery UMO) were valid predictors of driver and gunner performance at the end of training and would be useful in assigning enlistees to training programs.

The results of Phase II indicate that the performance of trainees who were retested in the field was again successfully predicted by the combination of ASVAB subtest scores being used. An attempt to extend the predictors to experienced crewmen (those in service approximately 3 years) met with mixed success and indicated the need for further research.

Utilization of Findings:

The predictor formula is potentially useful for allowing an early determination of those enlistees who would most benefit from training as a driver or a gunner/loader. Since the formulas use available test scores, the benefits of more efficient assignment to training programs are achieved at no additional cost to the government.

CROSS-VALIDATION OF PREDICTOR EQUATIONS FOR ARMOR CREWMAN PERFORMANCE

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INTRODUCTION

The purpose of this research was to determine whether specific paper-and-pencil test predictors of tank driver and tank gunner/loader job performance would cross-validate from previous research to a new, larger sample of armor trainees. The research was in response to the continuing need of the armor community to assign personnel to the duty position in which they can best perform. The need for such research has been expressed to the Army Research Institute (ARI) each year since 1975. In response, ARI has conducted several projects, both with armor trainees at Fort Knox, Ky., and with armor crewmen in operational units.

Greenstein and Hughes (1977) used a battery of aptitude tests, taken from Kaplan (1965) and Thomas (1964), as potential predictors of Armor Advanced Individual Training (AIT) driving and gunnery performance. In addition, they obtained Armed Forces Qualification Test (AFQT) and Army Classification Battery (ACB) Combat, Field Artillery, and Motor Maintenance aptitude area scores for their research participants. They found numerous suggestive relationships between their aptitude measures and driving and gunnery performance. None was of sufficient magnitude, however, to permit their use without further validation. The primary finding of their research was the independence of driving and gunnery measures.

Eaton (1978) administered a battery of paper-and-pencil aptitude tests chosen from tests suggested by Kaplan (1965), Thomas (1964), and Greenstein and Hughes (1977). He also measured performance on a training simulator (Burst-on-Target Trainer DVC 17-58, DA Pamphlet 310-12), subcaliber firing (Mini-Tank Range Complex, Training Circular TC 17-12-6), and critical performance component (or "job sample") tests, such as ranging and gun-laying. The paper-and-pencil aptitude measures and the simulator, subcaliber firing, and job sample measures were then tried as predictors of later Table VIII tank gunnery performance. Data analysis provided a potentially useful equation relating gunnery performance to tank commander's scores on four aptitude tests. For gunners and drivers, several individual aptitude tests showed some promise of predictive success. Further, both simulator and job sample measures showed potential for tank commanders and gunners. Because of the relatively small size of the sample (fewer than 40 crewmen in each position) the research could best suggest the potential for objective, test-based assignment rather than specify the contents of the test battery to be used.

Eaton, Bessemer, and Kristiansen (1979) evaluated the relationship between paper-and-pencil predictor tests and performance of trainee tank drivers and gunners at Fort Knox and armor gunners and tank commanders in operational units. At Fort Knox, predictor variables included Armed Services Vocational Aptitude Battery (ASVAB) subscores, additional paper-and-pencil tests (Eaton, 1978), and performance measures from the training program. In the operational units only the additional paper-and-pencil tests were used. ASVAB scores were not on record for the gunners and tank commanders because the ASVAB had not been routinely administered when most of them entered the Army; at that time, the ASVAB could not be administered in the field due to personnel and support restraints.

The research with gunners and tank commanders yielded disappointing results and did not confirm the previous results with armor crewmen. The research with armor trainees, however, provided many potentially useful predictor/performance relationships. The relationships were evaluated between a set of predictor variables and two measures of criterion performance: a tank driving course and a main-gun tank gunnery exercise. The predictor variables included ASVAB subscores, additional paper-and-pencil tests, and performance measures from the training program.

The analysis considered the set of ASVAB scores alone, ASVAB plus additional tests, and ASVAB plus additional tests plus performance variables. This three-step procedure was chosen to help determine the cost of adding the tests and performance measures to the readily available ASVAB scores would markedly improve predictive efficiency. The results indicated some gain from additional paper-and-pencil tests, but little gain from the performance measures. Although a follow-up project (Phase II) did not confirm the Phase I results, the presence of numerous control problems prevented any clear interpretation of results.

In January 1978, the need for armor performance predictors was again indicated. A major change in the initial training of armor crewmen was instituted. In place of the former concept--to produce a soldier who was a licensed driver and a familiarized gunner/loader--the training program was changed to produce a soldier who was a proficient driver or a proficient gunner/loader. Rather than have all trainees follow the same path through basic armor training to a Military Occupational Specialty (MOS) of 11E (Armor crewman), two tracks were established: one leading to an MOS of 19E (M60A1 gunner/loader) and the other to an MOS of 19F (tank driver).

The concept of position-specific training for gunner/loaders and drivers required that enlistees be separated for differential training before training began. To support this requirement, the Office of the Deputy Chief of Staff for Personnel tasked ARI to establish and validate a technique for predicting driver and gunner/loader performance and to test the prediction technique in the unit of first assignment.

The best predictors available appeared to be those from Phase I of the previous research (Eaton, Bessemer, & Kristiansen, 1979). Consideration of their results suggested the potential for two cross-validation strategies. The first was to attempt to cross-validate the selection formulas which they had derived by multiple-regression techniques. The second strategy was to attempt to cross-validate selection formulas derived from a unit-weighted model and the same data.

Unit-weighted formulas are simply the composites of standardized scores of tests where the direction of the correlation is known. (Use of raw scores would weight the variables in proportion to the ratio of their standard deviations.) Unit weight models have received some attention recently as alternatives to multiple-regression procedures when predictor-to-subject ratios are relatively small (see Cascio, Valenzi, & Silbey, 1978; Einhorn & Hogarth, 1975; and Schmidt, 1971 for detailed discussion of this topic).

In this discussion and throughout this report, the following conventions have been adopted to label formulas. Formulas based on multiple-regression techniques will begin with MR, while those based on unit-weighted models will begin with UM. Formulas incorporating only ASVAB tests will end in O, for "only," while those including ASVAB and additional tests will end in A, for "additiona`." Thus the driving MRA formula will predict driving performance based on a multiple-regression analysis of ASVAB and additional tests. To understand the text, the reader must remember only four combinations: MRA, MRO, UMA, and UMO.

The multiple-regression (MR) formulas from Eaton et al. (1979) are shown in Table 1, with one modification. Their driving MRA formula had included a fifth test that was time consuming to administer and score. Further, the test increased the R by only .03 (from .50 to .53). Consequently, that test is omitted from the driving formula shown in the table, and appropriate b-weight corrections were made.

The unit-weighted (UM) formulas based on the previous research are shown in Table 2. In developing these formulas, only tests with significant positive correlations with the criteria were considered. The formulas deviate from those shown by Eaton et al., in that two of their additional tests were dropped from consideration, one because it was correlated with both driving and gunnery, and the other because it required a relatively long time to administer and score. From the remaining tests, unit-weighted formulas were developed to correspond with those developed from the multiple-regression analyses. These formulas and their correlations with the criteria data from Eaton, Bessemer, and Kristiansen (1979) are shown in Table 2.

By comparing Tables 1 and 2, one can see that for the Eaton et al. data the correlations between the multiple-regression formulas and the criteria (Table 1) were numerically higher than those based on the unit-weighted model (Table 2). The research by Einhorn and Hogarth (1975) and Schmidt (1971), however, suggests that in a cross-validation with a larger sample size the formulas from the unit-weighted model would yield higher correlations. It was therefore decided to use all available predictors derived from the Eaton Phase I data and to test the efficiency of both sets of predictors in the new and larger sample.

OBJECTIVES

The objectives of this research were (a) to provide validity coefficients for predictor equations developed in earlier research and (b) to determine the validity of the predictors in soldiers' unit of first assignment. These objectives are addressed in Phases I and II, respectively.

Table 1

FORMULAS BASED ON MULTIPLE-REGRESSION ANALYSES
(from Eaton, Bessemer, & Kristiansen, 1979)

Predictor Labeling Conventions

Gunnery MRA	Gunnery predictor from multiple regression (MR) with ASVAB and additional (A) tests.
Gunnery MRO	Gunnery predictor from multiple regression (MR) with ASVAB only (O).
Driving MRA	Driving predictor from multiple regression (MR) with ASVAB and additional (A) tests.
Driving MRO	Driving predictor from multiple regression (MR) with ASVAB only (O).

Predictor Label	Formula	Correlation with Criterion
Gunnery MRA	3.56MC + 1.78VR + 2.69MK - 2.18CC - 1.19LP - 2.15EI + 199.92	.46
Gunnery MRO	3.25MC - 1.98CC + 198.88	.30
Driving MRA	3.42AI + 3.58CE + 1.51LP - 3.40CA + 116.14	.50
Driving MRO	5.63AI + 3.73CE - 3.99GI + 1.32NO - 2.86SI - 3.55CA + 174.67	.53

Test Designations (from Armed Services Vocational Aptitude Battery, unless otherwise noted).

MC Mechanical Comprehension	AI Automotive Information
VR Visual Recognition (additional test)	CE Classification Inventory (Electronics)
MK Mathematics Knowledge	CA Classification Inventory (Attentiveness)
CC Classification Inventory (Combat)	GI General Information
LP Lateral Perception (additional test)	NO Numerical Operations
EI Electronics Information	SI Shop Information

Table 2

FORMULAS BASED ON UNIT-WEIGHTED MODEL
(from Eaton, Bessemer, & Kristiansen, 1979)

Predictor Labeling Conventions

Gunnery UMA	Gunnery predictor from unit-weighted model (UM) with ASVAB and additional (A) tests.
Gunnery UMO	Gunnery predictor from unit-weighted model (UM) with ASVAB only (O).
Driving UMA	Driving predictor from unit-weighted model (UM) with ASVAB and additional (A) tests.
Driving UMO	Driving predictor from unit-weighted model (UM) with ASVAB only (O).

Predictor Label	Formula	Correlation with Criterion
Gunnery UMA	WK' + MK' + MC' + VR'	.33
Gunnery UMO	WK' + MK' + MC'	.29
Driving UMA	NO' + AR' + EI' + AI' + CE' + LP'	.44
Driving UMO	NO' + AR' + EI' + AI' + CE'	.40

Test Designations (all test scores standardized with $\overline{X} = 100$ $s = 15$).

WK'	Word Knowledge	AR'	Arithmetic Reasoning
MK'	Mathematics Knowledge	EI'	Electronics Information
MC'	Mechanical Comprehension	AI'	Automotive Information
VR'	Visual Recognition	CE'	Classification Inventory (Electronics)
NO'	Numerical Operations	LP'	Lateral Perception

PHASE I

Method

Participants

All participants were enlisted personnel undergoing basic armor training in the 1st AIT/One Station Unit Training (OSUT) Brigade, Armor, Fort Knox, Ky. From the 10 companies available for testing between January and August 1978, research participants were chosen who met three criteria: (a) all scores necessary to compute predictor variables were available, (b) the participant was scheduled for initial assignment to either Fort Hood, Tex., or Europe (for ease in follow-up research), and (c) the participant was available for testing during the appropriate period of training. A total of 205 participants were tested as gunner/loaders and 130 were tested as drivers.

Test Material

Predictors. The formulas for computing predicted driver and gunnery scores required ASVAB subscores and scores on two additional tests: PT 5088 Lateral Perception and PT 5089 Visual Recognition. All enlistees destined for training as M60A1 crewmen were administered the additional tests by personnel at the Fort Knox Armed Forces Examining and Entrance Station (AFEES), who supplied those scores to ARI researchers along with the ASVAB worksheet (Form DD 1304) containing the needed subtest scores. Variable lists and methods of computation are shown in Tables 1 and 2.

Performance. Trainees who had received driver training were tested for driving skills as they negotiated Tank Obstacle Course A (Area 6, Fort Knox). They were tested for other driver skills during administration of the Tank Crewman Readiness Test. Obstacle course performance was scored on a specially developed check sheet that included a subjective rating of how well the driver negotiated each obstacle and an overall rating of the driver's ability in relation to his peers. Briefly, the obstacles were start tank, drive in reverse, cross shallow water, descend vertical wall, cross ditch, run at high speed, and park.

Gunners were tested for main gun firing skills on a specially designed gunnery exercise (Table VI) that required firing at moving and stationary targets from a stationary tank. Scores were number of hits on four two-round engagements. The engagements were chosen to test a variety of gunnery situations and included firing at a stationary target at 1,000m using the telescope, a moving target at 700m using the periscope, a stationary target at 1,400m using the periscope, and a moving target at 700m using the telescope. Other gunner/loader skills were tested during administration of the Tank Crewman Readiness Test.

The Tank Crewman Readiness Test (O'Brien, Crum, Healy, Harris, & Osborn, 1978) was used to evaluate hands-on performance of subtasks in a selected group of standard operating procedures required of tank crew members in specific duty positions. The driving skills portion tested the following: vehicle pre-operation checks, target acquisition, .45 caliber pistol, M3A1 submachine

gun, and first-aid. The gunnery skills portion included: M219 machine gun, load/misfire procedures, breech-block, boresight procedures, .45 caliber pistol, M3A1 submachine gun, and first-aid. Trained evaluators scored participants as GO/NO GO on each subtask.

Copies of the obstacle course check sheet, the Table VI score sheet, and the skills check sheet for drivers and for gunners/loaders are in Appendix A.

Test Procedures

Assignment Procedures. Prediction equations (using driving MRA and gunnery MRA) for driver and gunner/loader positions were used by the Reception Station at Fort Knox. Prediction scores for both positions were computed for each trainee during the early days of his stay at the Reception Station, and these scores, together with U.S. Military Personnel Center (MILPERCEN) requirements for drivers and gunner/loaders at the trainee's post of first assignment, were used to designate the type of training the enlistee was to receive.

Criterion Data Collection. To minimize the disruption to training schedules, driving and gunnery tests were conducted while the trainees were at those ranges as part of their normal training cycle. Driver testing took place during the 11th week of training on the third day of drivers' experience on the course. Gunner testing took place during the 12th week of training and was the first time the gunner-trainee had fired the main gun with full-caliber ammunition. Readiness testing was administered during the week after trainees graduated from their training program.

Scorers. Driver performance on the tank obstacle course was scored by three experienced armor noncommissioned officers (NCOs) assigned to the ARI Fort Knox Field Unit for the duration of the research. These NCOs and one ARI researcher were also responsible for scoring gunnery performance on Table VI. Also, four experienced tank crewman NCOs were assigned to the field unit to assist in the skills tests. Scoring personnel and technique, therefore, were constant across the 10 companies sampled in the study.

Ranges. Driver testing took place on Tank Obstacle Course A. Although course content varied from week to week due to weather and terrain difficulties, scores were tabulated and analyzed only for obstacles that were common to drivers in all 10 companies tested (the high-speed run was dropped).

Gunnery testing took place on Steele's Range (except for one company, which used Boydston Range). Targets were 6' x 6' plywood panels for the stationary engagements and 21' flank tank silhouettes (also plywood) for the moving engagements. Rounds were scored from raised stands behind the firing tanks where scorers, who were in voice contact with the firing tank, sensed rounds using binoculars (scorer A) and BC scopes (scorer B). When the scorers agreed on the sensing of each round, the sensed score was recorded.

Skills testing took place in a designated area of Potts Motor Park, where three tanks and a small indoor area for written testing were available.

Results

Predictor Variables

All necessary subscores were collected from AFEES worksheets (Form DD 1304). For each trainee who completed testing, eight predictor variables were computed, four for gunnery performance and four for driving performance (multiple-regression model with and without additional tests, and unit-weighted model with and without additional tests). Summary statistics for the two groups of trainees are presented in Table 3.

Examination of the differences between trainees in the two training programs on the gunnery MRA predictor and the driving MRA predictor indicated that the Reception Station selection procedure resulted in statistically significant differences in the groups on those measures. However, the three other gunner predictors did not differentiate between the two groups. All driver prediction equations, on the other hand, showed significant differences between those chosen for driver training and those chosen for gunner/loader training.

Criterion Variables

Drivers. Driver criterion scores were gathered at the obstacle driving course during training and the motor pool testing after training. Scores from the driving course were based on subjective judgments made by the scorers as the trainee traversed each obstacle. The subjective judgments were made on a 10-point scale, which reflected the adequacy of the trainee's performance on each obstacle. These judgments were summed across obstacles for each trainee and converted to a standard score among all trainees. Each trainee also was judged on a 7-point scale for overall performance. This score was standardized across all trainees and added to the standard score for the individual obstacles. This sum of standardized judgments was designated as the driving course score in the analysis. Summary statistics for all judgments and an intercorrelation matrix are in Appendix B.

Driver performance on the driving skills test was measured on the percentage of GO ratings on the tasks attempted in the two stations of the test, subject to equipment availability and useability. This percentage was converted to a standard score across all drivers tested. Standardized driving skills test scores were added to standardized driving course scores to yield a driving composite score.

Gunner/Loaders. Gunnery skill was evaluated on Tank Table VI, where main gun hits were scored. Two measures were used: gunnery hits was a count of the number of hits each gunner achieved with the eight rounds of ammunition fired, while gunnery score was a computed score that assigned double weight to first-round hits in the four two-round engagements. This computation reflects the Army doctrine that stresses first-round hits and requires correction of firing procedures based on visual sensing of first-round effect. Mean and standard deviations and a correlation matrix for hits on each round of the Table VI are in Appendix B.

Table 3

COMPARISON OF PREDICTOR SCORES BETWEEN
ENLISTEES ASSIGNED TO GUNNER/LOADER AND DRIVER TRAINING

Predictor Label[a]	Type of Training Received						
	Gunner/Loader			Driver			
	N	$\bar{X}$	s	N	$\bar{X}$	s	t
Gunnery MRA	202	203.618	20.745	130	188.437	18.799	6.886*
Gunnery MRO	204	194.912	12.120	130	192.481	12.635	1.740
Gunnery UMA	203	401.561	40.373	130	399.341	43.101	0.469
Gunnery UMO	205	295.966	35.452	130	297.528	39.029	0.036
Driving MRA	204	189.932	22.565	130	209.468	22.154	7.793*
Driving MRO	196	191.996	24.888	128	210.014	25.358	6.298*
Driving UMA	196	587.884	49.072	128	614.537	48.126	4.835*
Driving UMO	196	490.695	44.147	128	513.350	46.651	4.364*

*$p < .01$.

[a]MR indicates formula based on multiple-regression model, while UM indicates formula based on unit-weighted model. Suffix O indicates formula uses ASVAB only; A indicates formula uses ASVAB and additional tests.

Performance of gunner/loaders on the four stations of the gunnery skills test was calculated as the percentage of GO ratings each trainee received, expressed as a standard score across all trainees. A composite gunnery score was computed by adding standardized skills test scores to standardized gunnery scores.

Predictor-Criterion Relationships

The set of predictor variables and criterion variables was entered into a Pearson Product Moment correlational anaysis using the SPSS package through the ARI computer center. The resulting intercorrelation matrices, containing the full set of predictors and criterion variables for drivers and gunners separately, are presented in Tables 4 and 5.

Because there was evidence of differences between groups on several predictors (Table 3), the possibility existed that restriction in range may have attenuated the correlations. This effect was evaluated by applying a correction for restriction in range to the primary analyses. Because the correction did not change the value of the correlations more than ±.01 (see Appendix C), the effect was deemed too small to warrant further consideration. More complete intercorrelation matrices will be found in the appendixes; Appendix D contains the correlations between ASVAB subtests and performance variables, and Appendix E contains the intercorrelations between all predictors and criterion variables.

Examination of the driver results, shown in Table 4, does not support the use of the formulas based on the multiple-regression analysis as a predictor of driver performance. All correlations between those predictors and the various criterion variables are too low to allow rejection of the null hypothesis. The predictors based on the unit-weighted model, however, show a pattern of consistently higher correlations. Five of the six allow rejection of the null hypothesis at the .01 level of significance.

Results from the gunner analyses yield similar observations. Both predictors based on the unit-weighted model correlate significantly with all criteria. Only one variable based on the multiple-regression model (gunnery MRO) correlated significantly with a gunnery criterion (the gunnery skills test). However, it failed to reach significance with gunnery score or the gunnery composite.

Discussion of Phase I

This research attempted to cross-validate on a new and larger group the prediction equations developed on an earlier sample. The use of more than 300 trainees provided an adequate sample for this purpose.

Trainees assigned to gunner/loader training had a significantly higher mean value on the previous gunnery predictor (gunnery MRA) than did driver trainees, while those assigned to driver training had a significantly higher mean on the previous driving predictor (driving MRA) than did gunner/loaders. This indicated that assignment to appropriate training programs apparently can be made in the context of ongoing military operations.

Table 4

DRIVER INTERCORRELATION MATRIX

Predictor Label[a]	DVR MRA	DVR MRO	DVR UMA	DVR UMO	DVR COURSE	DVR SKILLS
Driving MRA						
Driving MRO	756**					
Driving UMA	683**	477**				
Driving UMO	631**	480**	983**			
Driving Course	092	081	199	216*		
Driving Skills	150	036	245*	243*	148	
Driving Composite	098	010	267*	278*	765**	750**

*$p < .01$.

**$p < .001$.

[a]MR indicates formula based on multiple-regression model, while UM indicates formula based on unit-weighted model. Suffix O indicates formula uses ASVAB only; A indicates formula uses ASVAB and additional tests.

N = 130.

Table 5

GUNNER/LOADER INTERCORRELATION MATRIX

Predictor Label[a]	GNR MRA	GNR MRO	GNR UMA	GNR UMO	GNR HITS	GNR SCORE	GNR SKILLS
Gunnery MRA							
Gunnery MRO	719**						
Gunnery UMA	558**	609**					
Gunnery UMO	484**	637**	953**				
Gunnery Hits	072	072	234**	198*			
Gunnery Score	072	055	235**	189*	980**		
Gunnery Skills	052	187*	239**	252**	025	020	
Gunnery Composite	083	159	325**	294**	697**	709**	719**

*$p < .01$.

**$p < .001$.

[a]MR indicates formula based on multiple-regression model, while UM indicates formula based on unit-weighted model. Suffix O indicates formula uses ASVAB only; A indicates formula uses ASVAB and additional tests.

N = 205.

Analysis of the relationship between criterion measures and predictor scores based on the multiple-regression model indicated that those predictors were not valid. In Table 6, the results of Eaton, Bessemer, and Kristiansen (1979) are compared to those of this research. The predictors based on the unit-weighted model showed statistically significant correlation with criterion performance in both samples, but the predictors based on the multiple-regression analysis failed to replicate their previous high correlations with performance. These results indicate that the unit-weighted formulas are to be preferred for predicting enlistee performance during and immediately following basic armor training.

It would be more economical to use the driving and gunnery unit-weighted predictor formulas based on ASVAB only (driving UMO and gunnery UMO) than their counterparts based on ASVAB plus additional tests (driving UMA and gunnery UMA). Fortunately, the data revealed only a minor, inconsequential change in prediction when the additional tests were used (.29 to .32 for gunnery, and .28 to .27 for driving). It would appear, therefore, that the unit-weighted prediction equations without additional tests (driving UMO and gunnery UMO) provide the best method available for predicting performance of trainees in position-specific tank crewman training programs.

PHASE II

The second objective of this research was to cross-validate the predictor equations using trainee performance in the unit of first assignment. Because of the dispersion of trainees across the continental United States and Europe and the limited resources for retesting, it was decided that only places with large concentrations of recent trainees would be effective follow-up sites. In the past, the largest concentration of armor trained crewmen in the United States was at Fort Hood, Tex. Overseas participants were scattered across West Germany, but most used the Grafenwoehr training area for annual tank gunnery exercises. Therefore, these two locations were chosen for the retesting phase.

As planning for Grafenwoehr testing progressed, it became clear that the number of Fort Knox trainees who could be tested in a reasonable amount of time was extremely limited. It was decided that the battalions of the 8th Infantry Division, who were to use the Grafenwoehr training area during the follow-up test period and whose former Fort Knox trainees were to be retested, would also supply several more experienced tank crewmen for testing in the cross-validation. Test results for these "add-on" personnel would serve as an additional cross-validation sample, one representing crewmen from various backgrounds and time in service. This sample would provide an opportunity to test the predictors on soldiers in an operational armor unit and evaluate their potential usefulness outside the training environment.

Table 6

COMPARISON OF CORRELATION COEFFICIENTS IN STANDARDIZATION AND CROSS-VALIDATION SAMPLES

Predictor Label[a]	Standardization Sample (N = 95)	Cross-Validation Sample (N = 205 GNR,130 DVR)
Multiple-Regression Formulas		
Gunnery MRA	.46**	.08
Gunnery MRO	.30**	.16
Driving MRA	.50**	.10
Driving MRO	.53**	.01
Unit-Weighted Formulas		
Gunnery UMA	.33**	.32**
Gunnery UMO	.29**	.29**
Driving UMA	.44**	.27*
Driving UMO	.40**	.28*

*$p < .01$.

**$p < .001$.

[a]MR indicates formula based on the multiple-regression model, while UM indicates formula based on unit-weighted model. Suffix A indicates formula uses ASVAB and additional tests, while O indicates ASVAB only.

Method

Participants

At Fort Hood, the retested soldiers were drawn from units of the 1st Cavalry Division and the 2d Armored Division. A total of 22 driver-trained and 36 gunner/loader-trained individuals who had been tested in Phase I of this research were located and retested.

At Grafenwoehr, the soldiers tested were drawn from units of the 8th Infantry Division during their annual tank gunnery training. A total of 8 driver-trained and 28 gunner/loader-trained individuals from Phase I of this research were retested along with 24 experienced drivers and 46 experienced gunners. The latter drivers and gunners were selected by the battalions in response to a request for 5 drivers and 10 gunners per battalion who had between 1 and 3 years of Army service. These individuals were job incumbents who were experienced at the duties for which they were to be tested.

Testing

Predictors. Sample predictor scores were available from Phase I of this research for all persons in the follow-up test. For those in the add-on group, the nonavailability of their ASVAB subtest scores, with which to compute the predictors, required administration of the 3-1/2 hour ASVAB test. The ASVAB tests were administered to the add-on crewmen by ARI personnel at Grafenwoehr, West Germany.

Ranges. At Fort Hood and Grafenwoehr, driving courses and Table VI firing ranges were established that closely approximated the conditions at Fort Knox. Driving course obstacles and difficulty, and firing distances and targets, were similar to those of the initial testing.

Scorers. At Fort Hood, a cadre of experienced tank crewmen scorers was made available by the 1st Cavalry Division Training Assistance Team. Scorers were constant across all testing. At Grafenwoehr, scorers were supplied by the Combined Arms Training Directorate. Due to other requirements during the test period, different scorers were used with different battalions.

Timing. Testing at Fort Hood took place during the week of 21 November 1978, at which time follow-up personnel had been in their units an average of 24 weeks.

Testing at Grafenwoehr took place from 16 October to 30 November 1978, at which time follow-up personnel had been in their units a mean of 21 weeks. Add-on crewmen had a mean of 36 months of Army experience.

Materials. Score sheets and testing procedures used in Phase I of this research were used again. All efforts were made to make Phase II testing identical to Phase I testing.

Results

Criterion Variables

Drivers. Performance measures for drivers in Phase II were computed in exactly the same manner as in Phase I. A driver's score on the follow-up driving course was the sum of the total value of judgments received on the obstacle course (expressed as a standard score among all soldiers tested on that course) and the overall judgment received at that same testing (also expressed as a standard score). A driver's score on the follow-up skills test was a standardized score representing the individual's performance on the two applicable stations of the Tank Crewman's Readiness Test. The follow-up driving composite was the sum of the driver's follow-up driving course score and follow-up skills test score.

In addition to the follow-up performance measures, a composite measure was created to reflect both test occasions: end of training and follow-up. The total driving course score was the sum of driver's course performance at Fort Knox and in the field, either at Fort Hood or Grafenwoehr; the total driving skills score was the sum of skills test scores at both sites; and the total driving composite was the sum of end-of-training and follow-up composites.

Gunner/Loaders. Performance measures for gunner/loaders were also similar in Phases I and II. Follow-up hits, gunnery score, gunnery skills, and gunnery composite had the same meaning as they did in Phase I. The sum of end-of-training and follow-up performance measures was designated total hits, total gunnery score, total gunnery skills score, and total gunnery composite.

The set of predictor variables previously computed and follow-up performance variables were entered into a Pearson Product Moment correlational analysis for drivers and gunners who were retested in the field.

Add-on Drivers and Gunner/Loaders. Criterion variables for additional crewmen in Europe were computed in the same manner as those of the follow-up crewmen. In all cases, standardization of criterion variables was accomplished within comparable groups only; Europe follow-up drivers, Europe add-on drivers, and Fort Hood follow-up drivers formed three separate standardization groups. The same procedure was used with gunners.

Predictor-Criterion Relationships

The results of the correlational analyses for follow-up and add-on drivers are presented in Table 7. The correlations between driver predictors and Fort Knox performance were recomputed for drivers who were retested in their unit of first assignment. The driving UMO predictor again showed a consistent pattern of significant correlation with the criteria. When driving UMO was correlated with follow-up scores, an even higher degree of relationship with performance was found. Driving UMA also showed some consistency in its significant relationship to some Fort Knox and follow-up performance measures, whereas driving MSO and MRA were inconsistent, relating only to some follow-up performance measures.

Almost all correlations for add-on drivers were too small to allow rejection of the null hypothesis. The two exceptions achieved only the .05 level of significance.

Pearson Product Moment correlations for follow-up and add-on gunners' predictors and criteria are presented in Table 8. Although gunnery UMO was significantly related to all Fort Knox performance criteria, in the follow-up performance measures only gunnery skills scores were significantly related to that predictor. Within the add-on sample of gunners, gunnery UMO was significantly related to both the gunnery skills and composite.

When performance measures from Fort Knox were added to similar measures in the soldiers' unit of first assignment (total performance), a high degree of interrelationship was found between driving UMO and the driver criteria and between UMO and the gunnery criteria.

Complete intercorrelation matrices for Phase I (Knox) and Phase II (follow-up) performance of both drivers and gunners are provided in Appendix F. Test-retest reliability of scores on driving course (Knox:follow-up) was $\underline{r}$ = .07, $\underline{n}$ = 33; gunnery score (Knox:follow-up) was $\underline{r}$ = .06, $\underline{n}$ = 64. Reliability of the hands-on testing was much greater: driving skills (Knox:follow-up) $\underline{r}$ = .36; gunnery skills (Knox:follow-up) $\underline{r}$ = .37. It may be noted that the more reliable follow-up tests (the driving skills and gunnery skills tests) were successfully predicted by driving UMO and gunnery UMO.

Discussion of Phase II

Efforts to retest the 130 drivers and 205 gunner/loaders of the first phase of this research in their unit of first assignment resulted in a follow-up sample of approximately 20 drivers and 60 gunners. Although the driver sample size is smaller than needed for an adequate follow-up, the gunner sample is sufficient to indicate the usefulness of the predictors in a field setting. The addition of 17 drivers and 46 gunners to the field testing permitted an evaluation of the predictor-performance relationships with the experienced crewmen. Although the analysis of their performance was comparable to that of the follow-up crewmen, it was not possible to combine the groups because the add-on crewmen had an average 36 months of service, presumably in armor, and had achieved their current duty positions through a process of selection and training.

The results with the unit-weighted ASVAB-only predictor of driving performance (driving UMO) indicated a significant relationship with all of the criteria for the crewmen in the follow-up testing. This would indicate that it is possible to use that formula to predict an enlistee's performance when he reaches his first unit of assignment following driver training. The failure of driving UMO to predict the performance of experienced drivers would appear to limit the generalizability of the driver predictor to recent basic armor training graduates.

Table 7

FOLLOW-UP AND ADD-ON DRIVER CORRELATIONS

CRITERION VARIABLE	DRIVING PREDICTOR VARIABLE [a]			
	MRA	MRO	UMA	UMO
FOLLOW-UP SAMPLE (N = 20)				
Knox Performance				
Driving course	184	051	301*	319*
Driving skills	059	-061	255	293*
Driving composite	075	-109	329*	369*
Follow-Up Performance				
Driving course	364*	537**	289	366*
Driving skills	346*	178	332*	375**
Driving composite	515**	376*	427*	489**
Total Performance				
Driving course	465*	562**	544**	594**
Driving skills	251	013	386*	425**
Driving composite	570**	354	633**	665**
ADD-ON SAMPLE (N = 17)				
Driving course	571*	404*	267	159
Driving skills	-127	-099	036	035
Driving composite	351	321	318	275

*$p < .05$.

**$p < .01$.

[a]MR indicates predictor formula based on multiple-regression model, while UM indicates formula based on unit-weighted model. Suffix A indicates formula includes ASVAB and additional tests; O indicates ASVAB only.

Table 8

FOLLOW-UP AND ADD-ON GUNNER CORRELATIONS

CRITERION VARIABLE	GUNNERY PREDICTOR VARIABLE[a]			
	MRA	MRO	UMA	UMO
FOLLOW-UP SAMPLE (N = 60)				
Knox Performance				
Gunnery score	175	065	361***	257**
Gunnery skills	271**	301**	312**	329**
Gunnery composite	343***	275**	491***	423***
Follow-Up Performance				
Gunnery score	070	139	041	042
Gunnery skills	155	200	305**	242*
Gunnery composite	132	212*	198	168
Total Performance				
Gunnery score	154	098	290**	202*
Gunnery skills	260*	315**	409***	378**
Gunnery composite	308**	307**	491***	404***
ADD-ON SAMPLE (N = 46)				
Gunnery score	116	121	216	210
Gunnery skills	295*	217	305*	322*
Gunnery composite	274	219	357*	346*

*$p < .05$.

**$p < .01$.

***$p < .001$.

[a]MR indicates predictor formula based on multiple-regression model, while UM indicates formula based on unit-weighted model. Suffix A indicates formula includes ASVAB and additional tests; O indicates ASVAB only.

Among follow-up gunners, the gunnery predictor was less successful. The unit-weighted ASVAB-only gunnery predictor (gunnery UMO) showed no relationship with follow-up gunnery scores, only a moderate relationship to follow-up gunnery skills, and a nonsignificant relationship with the follow-up gunnery composite scores. For add-on gunners, however, that formula successfully predicted gunnery skills test scores and the gunnery composite score.

Interpretation of these results requires consideration of the sample size, length and reliability of the test, and the size of the demonstrated relationship. In the case of the follow-up and add-on drivers, the sample size is too small to allow confidence in any results. The fact that a significant degree of relationship is found among one small sample of drivers and no relationship among another small sample only indicates that the validity of the driver predictor in operational units must be considered uncertain until a more adequate sample can be attempted.

The sample sizes among the follow-up (60) and add-on gunners (46) are more adequate for generalization, but the reliability of the test may be questioned. Gunnery score is the criterion score based on a very short (8-item) test. This test is unreliable, as seen in the test-retest correlation of .06. The inability of the gunnery UMO formula to predict the follow-up gunnery score may be due to this weakness. When both administrations of the Table VI tests were combined (total gunnery score), making a 16-item test, the relationship between predictor and criterion reached significance. For the add-on sample only the 8-item test score was available, and an insignificant result was obtained.

The skills test is a lengthy and relatively reliable procedure (test-retest $\underline{r}$ = .37) and was successfully predicted in both gunner samples.

The results of Phase II testing, therefore, must be considered with caution for the driver predictors because of the inadequate sample size, but the results can be considered for the gunner predictor when an adequately reliable test is used (e.g., the skills test). The gunner predictor is seen to be effective in both a follow-up sample of recent OSUT graduates and an add-on sample of experienced gunners.

GENERAL DISCUSSION

An accurate interpretation of the research results rests on an evaluation of some seemingly inconsistent results. Accepting the findings at face value would lead to the following statements:

1. With a sample of 130 newly trained drivers, the predictor called driving UMO proved to be a valid predictor of the driving course (.216), driving skills (.243), and a driving composite (.278).

2. With a sample of 205 newly trained gunners, the predictor called gunnery UMO proved a valid predictor of gunnery score (.189), gunnery skills (.252), and gunner composite (.294).

3. With a sample of 20 follow-up drivers, driving UMO proved a valid predictor of follow-up driving course (.366), follow-up driving skills (.375), and a follow-up driving composite (.489).

4. With a sample of 60 follow-up gunners, gunnery UMO was a valid predictor of follow-up gunnery skills (.242) but was not a valid predictor of follow-up gunnery score or of a follow-up gunnery composite.

5. With a sample of 17 experienced drivers, driving UMO was not a valid predictor of the driving course, skills, or composite.

6. With a sample of 46 experienced gunners, gunnery UMO was not a valid predictor of gunnery score but was a valid predictor of gunnery skills (.322) and a valid predictor of the gunnery composite criterion (.346).

These results would lead us to believe that driving UMO is a valid predictor of driver performance in training (1) and unit of first assignment (3) but not for experienced drivers (5), and that gunnery UMO is a valid predictor of gunner performance in training (2) but an invalid predictor of gunnery score in unit of first assignment (4) and not a valid predictor of gunnery score for experienced gunners (6). The inconsistency of statements 4, 5, and 6 requires further analysis.

Two important considerations affect the interpretation of results of any research: the reliability of the sampling and reliability of the testing. In the case of (4) and (6) we find problems in predicting gunnery score, and in (5) we find a problem predicting the performance of 17 experienced drivers. Quite possibly, the problems in those statements are not brought about by the lack of a relationship between the predictor and the criteria but by sampling or testing inadequacy.

Gunnery score is a performance score based on an individual's ability to hit targets in main-gun tank gunnery. The score is based on the results of eight rounds fired, making it an 8-item test. It is well established that the reliability of a test is proportional to its length (Gulliksen, 1950). While the same short test was adequately predicted in Phase I of this research, the failure of prediction in Phase II need not be considered evidence against the efficacy of the predictor. Note that when the two administrations of the test are summed (thereby creating a 16-item test), the validity coefficient jumps to .202, which is significant at the .05 level. With this in mind, we could change (4) and (6) to read:

4a. With a sample of 60 follow-up gunners, gunnery UMO was found to be a valid predictor of follow-up gunnery skills (.242) and indeterminate with respect to follow-up gunnery score and composite.

6a. With a sample of 46 experienced gunners, gunnery UMO was a valid predictor of follow-up gunnery skills (.322) and indeterminate with respect to follow-up gunnery score and composite.

In the case of (5), the lack of a significant validity coefficient may be due to inadequate sample size. With only 17 drivers, the power of a .05 level test is only about one-third when the true population correlation (rho) is .30 (Cohen, 1977). Consequently, even with rho = .30, sample $\underline{r}$'s would not

have permitted rejecting the null hypothesis in two out of three samples with N = 17. A larger sample size would increase the power of tests and perhaps result in a significant coefficient. Our result, therefore, may be restated as:

5a. Due to an inadequate sample size, the relationship was indeterminate between driving UMO and the follow-up criteria for experienced drivers.

The findings of this research may, therefore, be stated as follows:

- The performance of newly trained drivers can be predicted both in training and in the field by the predictor formula labeled driving UMO.
- The performance of newly trained gunner/loaders can be predicted both in training and in the field by gunnery UMO, provided a sufficiently reliable criterion test is used (e.g., gunnery skills).
- The performance of experienced tank crewmen may be predicted by the formulas tested, but sample size and criteria test problems preclude definitive statements. The gunner/loader predictor (gunnery UMO) shows a promising relationship to gunnery skills.

SUMMARY AND CONCLUSIONS

Prediction equations were developed for tank drivers and gunner/loaders to predict their level of performance after suitable training. The evaluation of tank crewman performance was attempted, using first a short and very direct test (e.g., drivers drive a tank over obstacles and gunners shoot at targets), and second, a more lengthy and comprehensive test (e.g., of other skills not directly related to driving or shooting). It was believed that together these would encompass the range of skills required and yield a composite score indicating the crewman's ability. To that end, the scores were combined to form a driving composite and a gunnery composite. These scores represent our best estimate of the crewman's ability.

The results of the research to cross-validate the predictor equations indicated that the predictor of driver performance labeled driving UMO (based on the unit-weighted model, using only readily available ASVAB scores) was a valid predictor of driver performance immediately following training, and in the follow-up test ($\underline{r}$ = .278 and .489, respectively). The gunner predictor equation labeled gunnery UMO (also based on the unit-weighted model and ASVAB scores only) was a valid predictor of gunner performance immediately following training and of follow-up gunnery skills ($\underline{r}$ = .294 and .242) but was indeterminate with respect to overall performance in the follow-up. Prediction of the performance of experienced crewmen appears to be a promising additional use of the equations, but their validity has not yet been sufficiently demonstrated in the samples and methods employed in this research.

These results indicate the potential usefulness of the predictor formulas for determining which enlistees would benefit most from training as a driver or a gunner/loader and for providing a rational basis for assignment to training programs before training has started. These formulas allow existing information (ASVAB subtest scores) to be used to predict future performance (both immediately following training and in the unit of first assignment) and represent a powerful tool for personnel selection at no additional cost to the Army.

The success of the predictors with newly trained crewmen and the partial success with experienced crewmen indicates the fruitfulness of this line of research and the need for additional testing in operational armor units with adequate sample sizes. Utilization of the predictors is discussed in ARI Research Report 1240, "Using Predictor Equations to Assess Potential Performance of Armor Enlistees" (Maitland, 1980).

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APPENDIX A

SCORE SHEETS

APPENDIX A-I

DRIVING COURSE A
SCORE SHEET

DRIVER NAME_____ LAST 4 SSAN_____

SCORER NAME_____ TC NAME_____

DATE_____

WEATHER CONDITIONS_____ GROUND CONDITIONS_____

PREPARE TANK BEFORE ARRIVAL OF DRIVER:

1. Transmission lever in "N"
2. Master battery switch "OFF"
3. Master fuel pump switch "OFF"
4. Driver seat "ON THE FLOOR"
5. Open crew compartment drain valve

TASK 1. Start Tank and Move Out	Done Smoothly	Done Poorly	Not Done
Cleans vision blocks	____	____	____
Adjust driver's seat	____	____	____
Shift to "P"	____	____	____
Closed crew compartment drain valve	____	____	____
Turn on Master Battery switch	____	____	____
Turns on gas particulate switch	____	____	____
Turn on fuel pump switch	____	____	____
Starts engine	____	____	____
Idle at 750 rpm	____	____	____
Release brake	____	____	____
Shift to "R"	____	____	____
Accelerate in reverse	____	____	____

On a 10 scale, how well did Driver perform in this task? [ ]

TASK 2. Back Through Barrels

Keeps constant speed	____	____	____
Follows command left	____	____	____
Follows command right	____	____	____
Stops tank	____	____	____
Shifts to "L"	____	____	____
Accelerate forward	____	____	____

On a 10 scale, how well did Driver perform in this task? [ ]

TASK 3. Shallow Water Crossing	Done Smoothly	Done Poorly	Not Done
Come to stop			
Move emergency heater switch to "OFF"			
Close hull-turret seal air valve			
Inflate hull-turret seal to 5-7 PSI			
Check that crew compartment drain valve closed			
Check that engine compartment drain valve closed			
Check operation of bilge pump			
Increase engine speed to about 1000 RPM			
Entered water slowly			
Maintained low speed-high rpm through water			
Deflate hull-turret seal			
Open crew compartment drain valve then reclose			
Open engine compartment drain valve then reclose			

On a 10 scale, how well did Driver perform in this task? [ ]

TASK 4. Cross MLR			
Line up tank to bridge			
Tracks meet grooves on first attempt			
Crossed bridge without over-steering			
Exit bridge			

On a 10 scale, how well did Driver perform in this task? [ ]

TASK 5. Vertical Wall Descent			
Line up tank to obstacle			
Eased tank to bottom of wall			
Accelerated slowly after tank touched bottom			

On a 10 scale, how well did Driver perform in this task? [ ]

TASK 6. Ditch Crossing			
Decelerated as tank entered ditch			
Eased tank to bottom			
Met bottom of ditch with both tracks simultaneously			
Accelerate as tank reached bottom			

On a 10 scale, how well did Driver perform in this task? [ ]

TASK 7. High Speed Run	Done Smoothly	Done Poorly	Not Done
Accelerated	____	____	____
Shifted to "H"	____	____	____
Maintained constant speed after acceleration	____	____	____
Controlled tank's forward motion	____	____	____
Maintained high rpm on turn	____	____	____
Shift to "L"	____	____	____

On a 10 scale, how well did Driver perform in this task? [ ]

TASK 8. Park Tank			
Follow direction for parking place	____	____	____
Stops tank	____	____	____
Locks parking brake	____	____	____
Shift to "P"	____	____	____
Idle at 1000-1200 for 2-5 minutes	____	____	____
Lift fuel shut-off switch	____	____	____
Turn off electrical equipment	____	____	____
Turn off Master Fuel Pump switch	____	____	____
Turn Master Battery Switch "OFF"	____	____	____
Open crew compartment drain valve	____	____	____
Exit driver's seat	____	____	____
Dismount of tank	____	____	____

On a 10 scale, how well did Driver perform in this task? [ ]

Of all the trainees you have seen, where would you rate this man based on the experience you just had in the tank he was driving. (Circle one)

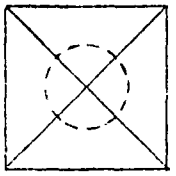
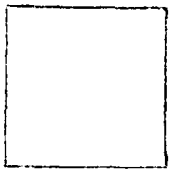
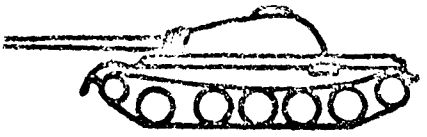
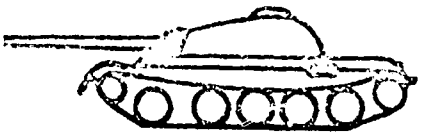
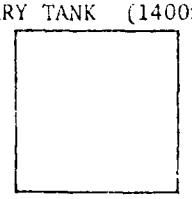
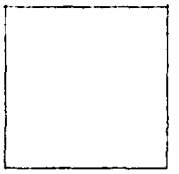
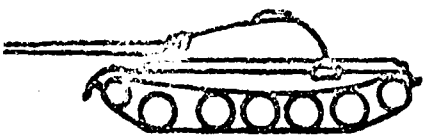
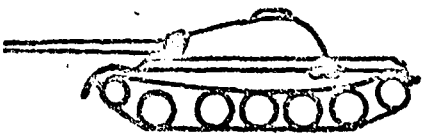
Among the worst	Much worse than most	Worse than most	About average	Better than most	Much better than most	Among the best
1	2	3	4	5	6	7

APPENDIX A-II

TABLE VI

GUNNER NAME _____ SCORER NAME _____

DATE _____ WEATHER _____ TANK _____

TARGET (RANGE)	SIGHT TO BE USED (AMMO)
1. ZERO PANEL (1200m) 	PERISCOPE (HEAT)
2. STATIONARY TANK (1000m) Rd 1 H M 	TELESCOPE (HEAT) Rd 2 H M 
3. MOVING TANK (BATTLESIGHT) Rd 1  H M	PERISCOPE (SABOT) Rd 2  H M
4. STATIONARY TANK (1400m) Rd 1 H M 	PERISCOPE (SABOT) Rd 2 H M 
5. MOVING TANK (700m) Rd 1  H M	TELESCOPE (HEAT) Rd 2  H M
First Round Hits 0 1 2 3 4 5	Second Round Hits 0 1 2 3 4 5
Total Number of Hits_____	Verified by Hole Count? YES_____ NO_____

APPENDIX A-III

DRIVER
STATION 1

NAME _____

SSAN __ __ __ __ __ __ __ __ __

SCORER NAME _____

DATE _____

TANK CREWMAN READINESS TEST

DRIVER

STATION 1

CONDITIONS. Fully operational M60A1 situated on level ground with main gun over rear deck and drain valves open. Tank has following deficiencies: track tension loose; M24 and M27 periscopes dirty.

INSTRUCTIONS TO DRIVER. "Prepare the tank for driving on a night mission in an NBC environment. Your activities will include (read list of tasks). Perform each task when I instruct you to do so. You may use your TM. I will observe your performance and serve as the other crew members as needed. Do you have any questions? Work quickly, but carefully. Ready... begin."

TASKS.

1. Perform before-operation checks and services on M27 periscope.
2. Remove M27 periscope.
3. Perform before-operation checks and services on M24 (IR) periscope.
4. Install M24 (IR) periscope.
5. Place M24 (IR) periscope into operation.
6. Perform before-operation checks and services on the gas particulate unit.
7. Perform main gun prepare-to-fire checks from Driver's station.
8. Check track tension (Driver requirements.)

PERFORMANCE MEASURES.

	Yes	No
1. PERFORM BEFORE-OPERATION MAINTENANCE CHECKS AND SERVICES ON THE M27 PERISCOPE.		
. Inspected M27 periscope and spare for cracks and dirty lenses.	___	___
. Cleaned dirty lenses.	___	___
2. REMOVE THE M27 PERISCOPE.		
. Loosened wing nuts on both sides of the periscope.	___	___
. Rotated retainers until clear of the periscope mounting lugs.	___	___
. Removed periscope from the bracket.	___	___

	Yes	No
3. PERFORM BEFORE-OPERATION MAINTENCE CHECKS AND SERVICES ON THE M24 (IR) PERISCOPE.		
. Pulled periscope holder lid handle down.	___	___
. Opened lid.	___	___
. Unlatched both catches on IR periscope stowage box.	___	___
. Removed the periscope from stowage box.	___	___
. Inspected the M24 (IR) periscope and spare head for cracked or dirty lenses and completeness.	___	___
. Cleaned dirty lenses.	___	___
4. INSTALL THE M24 (IR) PERISCOPE.		
. Closed the Driver's hatch.	___	___
. Placed the Master Battery switch in the OFF position.	___	___
. Instructed crew member to rotate the turret so the gun tube is forward.	___	___
. Pulled up (rearward) on the elevation adjustment lever to insure bind (tension) has been released on elevation clamp and elevation clamp pivots.	___	___
. Loosened the jam nut on the front (forward) inside of the elevation clamp.	___	___
. Positioned the periscope in the periscope holder.	___	___
. Pushed up on periscope until it locked in the holder. (Insured the periscope was locked in the holder before released.)	___	___
. Insured the elevation clamp is positioned in the periscope holder detent.	___	___
. Tightened the adjustment screw on the front right hand inside of the elevation clamp until the elevation clamp was firmly seated in the periscope holder detent.	___	___
. Tightened the elevation clamp adjustment screw jam nut.	___	___
. Pushed elevation adjustment lever downward (forward) and locked periscope.	___	___
. Unscrewed dust cap from power receptacle (center) location.	___	___
. Unscrewed power cable connecting plug from stowage receptacle on right-hand side of compartment.	___	___
. Threaded power cable connecting plug into periscope receptacle and hand tightened.	___	___
. CONFIRM: Did soldier expose periscope to direct sunlight?	___	___
5. PLACE THE M24 (IR) PERISCOPE INTO OPERATION.		
. Turned the Master Battery switch ON.	___	___
. Placed the Blackout Selector switch in BO DRIVE.	___	___

	Yes	No
. Turned the IR switch ON.	___	___
. Turned the Lighting Control switch handle to the left.	___	___
. Pulled the elevation adjustment lever up.	___	___
. Adjusted periscope elevation angle to a comfortable position.	___	___
. Pushed elevation adjustment lever down to lock the periscope in position.	___	___
. Loosened the two inner wingnuts on the headrest until the proper eye distance is obtained, then retightened (handtight) both wingnuts.	___	___
. Bent headrest to fit head contour by pulling, pushing, or twisting on each side of the headrest.	___	___
. Allowed periscope to warm up for 5 minutes before adjusting focus.	___	___
. Unscrewed left and right dust caps from bottom focus controls.	___	___
. Rotated left and right focus control knobs until the view through each eyepiece appeared with maximum sharpness.	___	___
. Screwed left and right dust covers back over focus control knobs and tightened finger tight.	___	___
6. PERFORM BEFORE-OPERATIONS CHECKS AND SERVICES ON THE GAS PARTICULATE UNIT.		
. Inspected precleaner, particulate filter unit, housing, gas filter cannisters and air header for dents, missing or loose control knob, pinched or blocked air hose.	___	___
. Wiped precleaner, particulate filter unit housing, gas filter cannisters and airheater clean with a damp rag.	___	___
. Tightened hose assemblies and electrical cables.	___	___
. Removed spring clip from air inlet openings.	___	___
. Turned Gas Particulate switch ON.	___	___
. Disconnected air duct hose from Driver's orifice connector and checked air flow.	___	___
. Rotated air heater knob to ON and checked for indicator lamp operation.	___	___
. Checked air flow through the hose.	___	___
. Allowed air to warm up at least five minutes.	___	___
. Checked air temperature.	___	___
. Adjusted protective mask and attached air hose.	___	___
. Requested other crew members to check gas particulate operation.	___	___
. Removed and stowed air hose and protective mask.	___	___

	Yes	No
. Rotated air heater knob to OFF.	___	___
. Turned Gas Particulate switch OFF.	___	___
. Replaced spring clip to air inlet openings.	___	___

7. PERFORM PREPARE-TO-FIRE CHECKS FROM DRIVER'S STATION

. Started engine on TC's command, "CHECK FIRING SWITCHES."	___	___
. Reported "DRIVER READY" on TC's command, "REPORT".	___	___

8. CHECK TRACK TENSION.

. Moved vehicle forward on level hard surface, and when signaled by Loader, coasted to a stop without applying brakes.	___	___
. Make final forward adjustments (without applying brakes) in response to Loader signals.	___	___

SCORING.

To pass, a solder must have:

a. Installed the M24 (IR) periscope without exposing it to direct sunlight. (CONFIRM - "NO")

b. Been checked "YES" on each performance item.

PASS	FAIL

APPENDIX A-IV

LOADER/GUNNER
STATION 1

NAME _____

SSAN ___ ___ ___ ___ ___ ___ ___ ___ ___

SCORER NAME _____

DATE _____

TANK CREWMAN READINESS TEST

LOADER/GUNNER

STATION 1

CONDITIONS. M60A1 tank complete with BII, situated on level ground. An ammunition stowage plan and dummy rounds (including 3 APDS, 3 HEP, 2 HEAT and 1 APERS) are located next to tank. All ammunition stowage areas are blocked off with exception of 7 slots in the ready rack, 1 slot in the tubular stowage rack and 1 in the turret bustle; empty slots should correspond to stowage plan and types of dummy rounds. Tank has track tension loose. Dummy 7.62-mm round loaded by hand in chamber of coax with belt of dummy rounds loaded on top so that chambered round won't extract when weapon is charged. Rounds will be passed to the loader base down unless told otherwise by the loader.

INSTRUCTIONS TO LOADER/GUNNER. "This test will be given in two parts. Part 1 is a test of your ability to prepare the tank for a combat mission in an NBC environment; part 2 tests your ability to perform the duties of a loader under simulated conditions of an extended fire mission. During part 1, you are to perform the following loader tasks:

1. Perform before-operations checks and services on engine and transmission oil levels. (I will ask you whether the oil levels are acceptable.)
2. Check track tension.
3. Adjust track tension.
4. Check operation of M3 heater (gas particulate unit).
5. Stow main gun rounds.

I realize you would normally perform some additional tasks as the loader in this situation, but these are the ones you are being tested on today. Perform each task when I instruct you to do so. You may use your TM. I will observe your performance and serve as the other crew members as needed. Do you have any questions? Work quickly, but carefully. Ready... begin."

PART ONE

PERFORMANCE MEASURES.	Yes	No
1. PERFORM BEFORE-OPERATIONS CHECKS AND SERVICES ON TANK ENGINE AND TRANSMISSION OIL LEVELS.		
. Checked engine oil level.	___	___
. Responded correctly when asked if engine oil level was acceptable.	___	___
. Checked transmission oil level.	___	___
. Responded correctly when asked if transmission oil level was acceptable.	___	___
. Told Driver to start engine and idle at 700-750 RPM.	___	___
. Waited until engine was warm.	___	___

	Yes	No
. Checked engine oil level.	___	___
. Responded correctly when asked if engine oil level was acceptable.	___	___
. Checked transmission oil level.	___	___
. Responded correctly when asked if transmission oil level was acceptable.	___	___

2. CHECK TRACK TENSION.

. Directed Driver to coast to a stop so that a track link was centered on the #2 support roller.	___	___
. Coordinated with Driver by arm and hand signals so that tank coasted to a stop with track link in proper position.	___	___
. Removed dirt and mud from outboard end connectors between first and second support rollers.	___	___
. Placed string with weights on both ends over the end connectors.	___	___
. Measured the distance between the string and the end connector at the mid point between support rollers to ensure that the distance is between 7/16 to 1/2 inches.	___	___

3. ADJUST TRACK TENSION.

. Removed the track and adjusting link screw and washer from the top of the track adjusting link.	___	___
. Used the track adjusting wrench on the track adjusting link and pulled up to increase track tension (right side) or pushed down to decrease track tension (right side). (Reversed directions for the left side.) [Track adjusting link must not extend beyond the red painted groove.]	___	___
. Adjusted track tension to 1/4-5/16 inch in tolerance.	___	___
. Installed lockwasher and lockscrew and tightened with wrench until fully seated on the shoulder.	___	___

4. CHECK OPERATION OF M3 HEATER (GAS PARTICULATE UNIT).

On Driver's request, "CHECK GAS PARTICULATE UNIT":

. Rotated air heater knob to ON.	___	___
. Checked air flow through hose.	___	___
. Allowed air to warm up for at least five minutes.	___	___
. Adjusted protective mask and attached air hose.	___	___
. Removed and stowed air hose and protective mask.	___	___
. Rotated air heater switch to OFF.	___	___
. Reported status of M3 Heater to the driver.	___	___

	Yes	No
5. STOW MAIN GUN ROUNDS IN THE TANK.		
. Determined, by reference to Ammunition Stowage Plan and present load, how many of each type of round is needed.	___	___
. Called out to assisting crewman how many of a given type of round is wanted.	___	___
. Insisted that round be handed in through turret nose down.	___	___
. Stowed round in:		
- Ready rack by placing primer end down, swinging hingeof holder up and to the left, pulling out spring loaded knob on rod of holder, sliding hinge slot over rod behind knob, and releasing the knob.	___	___
- Tubular stowage rack by pushing round in nose first, swinging handle lock over primer end of round, and rotating handle lock securely in place.	___	___
- Turret bustle by seating round with nose toward inside of turret, swinging hinge up and to the left, pulling up clamp and slotting hinge in place below clamp, and pulling clamp down.	___	___
. Completed stowage of rounds one type at a time.	___	___

PART TWO

INSTRUCTIONS TO LOADER/GUNNER. "Remember, Part 2 is a test of your ability to perform the duties of a loader under simulated conditions of an extended fire mission. We will be carrying APDS in the tube for battlesight engagements, so you will begin by loading a SABOT round. From then on, listen to the fire commands and react accordingly. Since you will be working with dummy rounds, you will have to unload rounds between firings. But wait until I give you the command to unload, then quickly remove the round and be ready for the next command. O.K...., take up your position in the Loader's Station and load a round of SABOT. I will observe your performance and serve as the other crew members as needed. Do you have any questions? Work quickly, but carefully. Ready... begin."

TASKS.

6. Load main gun in response to fire commands.
7. Ready coax in response to fire commands.
8. Rotate round in main gun misfire procedure.
9. Unload misfired main gun round.
10. Apply immediate action to reduce stoppage of an M219 machinegun.

NOTES.

a. For Performance Measures 6 and 7, give the following fire commands, at about 15 second intervals:
   1. Gunner, SABOT tank.
   2. Gunner, HEP, antitank.
   3. Gunner, HEAT, tank.
   4. Gunner, COAX, troops.
   5. Gunner, HEP, antitank,... MISFIRE.
      Note. Reload SABOT for battlesight.
   6. Gunner, BEEHIVE, TIME 1000 METERS troops.
   7. Gunner, SABOT, tank (NO "CEASE FIRE").
   8. Gunner, SABOT, tank.
   9. Gunner, HEAT, tank.
   10. Gunner, COAX, troops,... STOPPAGE.

b. The MISFIRE command provides a break in the sequence. After you go through MISFIRE checks, tell Loader to rotate the round. Next, tell Loader to unload the round, and assist him in doing so.

c. Loading should be timed with a stop watch. Timing should begin with announcement of ammunition element and end with Loader's announcement of "UP". Time should be cumulated for each series of five commands.

	Yes	No
PERFORMANCE MEASURES.		
6. LOADS MAIN GUN IN RESPONSE TO FIRE COMMANDS.		
a. Battlesight, SABOT Loaded.		
. Stood clear of path of recoil.	___	___
. Placed firing safety switch in FIRE.	___	___
. Announced "UP".	___	___
. Prepared to load a second round in case no "CEASE FIRE" is given.	___	___
b. Main Gun Not Loaded.		
. Placed firing safety switch in SAFE position.	___	___
. [Check replenisher tape.]	___	___
. Opened breech.	___	___
. Selected announced ammunition.	___	___
. Unlocked ammunition ready rack.	___	___
. [Set range on APERS ammunition fuze when "BEEHIVE TIME" is announced in fire command.]	___	___
. Inserted appropriate round into chamber by placing the round 2/3rds into chamber and pushing it the rest of the way with the heel of the fist, swinging arm up and away from closing breech.	___	___
. Stood clear of path of recoil.	___	___
. Placed firing safety switch in FIRE position.	___	___
. Announced "UP".	___	___

		Yes	No
	. Prepared to load a second round in case no "CEASE FIRE" is given.	___	___
c.	SABOT Loaded, Different Ammunition Element Given.		
	. Placed firing safety switch in SAFE position.	___	___
	. [Checked replenisher tape.]	___	___
	. Unloaded SABOT round.	___	___
	. Placed and locked SABOT round in ready rack.	___	___
	. Selected announced ammunition.	___	___
	. Unlocked ammunition ready rack.	___	___
	. [Set range on APERS ammunition fuze when "BEEHIVE TIME" is announced in fire command.]	___	___
	. Inserted appropriate round into chamber by placing round 2/3rds into chamber, and pushing it the rest of the way with the heel of the fist, swinging arm up and away from closing breech.	___	___
	. Stood clear of path of recoil.	___	___
	. Placed firing safety switch in FIRE position.	___	___
	. Announced "UP".	___	___
	. Prepared to load a second round in case no "CEASE FIRE" is given.	___	___
7.	READY COAX IN RESPONSE TO FIRE COMMANDS.		
	. Placed coax safety in FIRE position.	___	___
	. Announced "UP".	___	___
8.	ROTATED ROUND IN MAIN GUN MISFIRE PROCEDURE.		
	On Gunner's command "ROTATE ROUND":		
	. Placed firing safety switch in SAFE position.	___	___
	. Opened breech slowly enough to extract round about 1/2 way.	___	___
	. Rotated round 1/2 turn.	___	___
	. Pushed round into chamber with heel of the fist, swinging arm up and away from closing breech.	___	___
	. Stood clear of path of recoil.	___	___
	. Placed firing safety switch in FIRE position.	___	___
	. Announced "UP."	___	___
9.	UNLOAD MISFIRED MAIN GUN ROUND.		
	. Told Gunner to turn main gun turret power switches OFF.	___	___
	. Placed firing safety switch in SAFE position.	___	___
	. Opened breech.	___	___
	. Held breech operating handle down while TC (Gunner) pried round out of chamber.	___	___
	. Returned breech operating handle to latched position.	___	___

	Yes	No
10. APPLY IMMEDIATE ACTION TO REDUCE STOPPAGE OF AN M219 MACHINEGUN.		
On Command "STOPPAGE":		
. Waited 5 seconds to allow for a hangfire.	___	___
. Charged the machinegun, locking the recoiling parts to the rear.	___	___
. Checked to see if the ammunition is feeding into the weapon.	___	___
. Announced "UP."	___	___
On Command "STOPPAGE":		
. Pulled barrel extension to the rear.	___	___
. Placed safety in SAFE.	___	___
. Raised cover and removed the ammunition.	___	___
. Removed "misfired" round from chamber.	___	___
. Placed safety in FIRE and hand functioned the weapon one cycle.	___	___
. Reloaded the weapon.	___	___
. Announced "UP."	___	___

SCORING.

To pass, soldier must have:

a. Correctly responded to engine and transmission dip stick reading.
b. Detected that track tension was loose and adjusted it.
c. Stowed dummy rounds according to ammunition stowage plan.
d. Executed the first five fire commands in a total time of 35 seconds, and the second five commands (five loading reactions) in 1 minute 35 seconds.
   Elapsed Time:
   Commands 1 - 5 _____seconds
   Commands 6 - 10 _____seconds
e. Responded to "MISFIRE", including unloading the misfired round, within 2 1/2 minutes.
   Elapsed Time: _____seconds
f. Responded to STOPPAGE by removing misfired round within 10 seconds of command, and completing procedure within 15 seconds.
   Elapsed Time:
   Removed round _____seconds
   Announced UP _____seconds
g. Selected the correct round in response to each fire command.
h. Checked replenisher tape at least once during the test.
i. Correctly responded to replenisher reading.
   . Added oil if tape indicated two rough edges.
   . Continued to load if tape indicated one rough and one smooth edge.
   . Drained oil if tape indicated two smooth edges.
j. Set correct range on BEEHIVE round.
k. Been checked "YES" on each performance measures.

PASS ____ FAIL ____

APPENDIX A - V

LOADER/GUNNER
STATION 2

NAME _____

SSAN __ __ __ __ __ __ __ __ __

SCORER NAME _____

DATE _____

TANK CREWMAN READINESS TEST

LOADER/GUNNER

STATION 2

CONDITIONS. Fully operational M60A1 situated on level ground. The M219 machinegun is mounted and loaded with dummy ammunition. A complete gun-tool roll is stowed according to unit loading plan. Boresight panel is at appropriate range (1200 meters). Gun tube is above horizontal.

INSTRUCTIONS TO LOADER/GUNNER. "The test at this station will be conducted in two parts. During Part 1 you will perform some loader tasks; in Part 2 you will perform some gunner tasks. As the loader, you are to clear, remove, disassemble, assemble, mount, and load the M219 machinegun, then disassemble and assemble the breechblock. Some of the tasks will be timed. You will have 30 seconds to clear the machinegun, 2 minutes to disassemble the machinegun, and 2 minutes to assemble it. You will have 10 minutes to remove and disassemble the breechblock, and 10 minutes to assemble and install it. Perform each task when I instruct you to do so. I will alert you before I start timing on each of these tasks. I will not assist you during the test. You may use your TM, but remember, you will be timed on some tasks. I will observe your performance and serve as the other crew members as needed. Do you have any questions? Work quickly, but carefully. Ready... begin."

TASKS.

1. Clear M219 machinegun.
2. Remove M219 machinegun from tank.
3. Disassemble M219 machinegun.
4. Assemble M219 machinegun.
5. Check operation of an M219 machinegun.
6. Mount M219 machinegun in tank.
7. Load an M219 machinegun.
8. Disassemble breechblock.
9. Assemble breechblock.

PART ONE

	Yes	No
PERFORMANCE MEASURES.		
1. CLEAR AN M219 MACHINEGUN (30 SECONDS).		
. Place safety in FIRE position.	___	___
. Charged weapon to lock moving parts to the rear.	___	___
. Directed gunner to place machinegun switch in the OFF position.	___	___
. Placed safety in the SAFE position.	___	___
. Open cover assembly.	___	___
. Removed ammunition belt from the machinegun.	___	___

	Yes	No
. Raised feed tray.	___	___
. Looked for ammunition.	___	___
. Place safety in FIRE position.	___	___
. Move bolt forward.	___	___
. Place safety in SAFE position.	___	___
. Close feed tray and cover.	___	___

Elapsed Time: _____ seconds.

2. REMOVE M219 MACHINEGUN FROM TANK (NOT TIMED).

. Disconnected electrical lead from solenoid.	___	___
. Loosened three support set screws in collar on gun mount cover shield.	___	___
. Removed machinegun retainer.	___	___
. Removed the machinegun.	___	___
. Removed the spent cartridge bag.	___	___
. Removed the case ejection shield.	___	___

3. DISASSEMBLE M219 MACHINEGUN (2 MINUTES).

. Removed barrel and jacket assembly from receiver.	___	___
. Separated barrel from jacket assembly.	___	___
. Removed cover assembly.	___	___
. Removed feed tray.	___	___
. Removed guide rod springs while holding barrel extension forward.	___	___
. Separated guide rods from guide rod springs.	___	___
. Removed backplate assembly.	___	___
. Retracted barrel assembly.	___	___
. Depressed buffer support lever and removed barrel extension.	___	___
. Removed breechblock from barrel extension assembly.	___	___
. Removed retainer clip and charger assembly from projecting stud.	___	___

Elapsed Time: _____ seconds.

4. ASSEMBLE M219 MACHINEGUN (2 MINUTES).

. Installed charger assembly.	___	___
. Placed breechblock assembly in barrel extension.	___	___
. Installed barrel extension.	___	___
. Installed backplate assembly.	___	___
. Joined guide rods and guide rod springs.	___	___
. Installed feed tray.	___	___
. Installed cover assembly.	___	___
. Joined barrel to the jacket assembly.	___	___
. Joined barrel and jacket assembly with the receiver.	___	___

Elapsed Time: _____ seconds.

	Yes	No
5. CHECK OPERATION OF M219 MACHINEGUN (NOT TIMED).		
. Placed safety in FIRE position.	___	___
. Charged weapon to lock moving parts to the rear.	___	___
. Allowed barrel extension to ease forward by keeping tension on the charging handle and depressing the manual firing trigger.	___	___
6. MOUNT M219 MACHINEGUN IN TANK (NOT TIMED).		
. Backed-off the three support set screws on the gun mount cover shield flush with the collar of the gun port.	___	___
. Had the gunner depress the gun tube so that it was horizontal or slightly below.	___	___
. Placed the shell ejection shield on the shield support and fastened the six snap fasteners which hold it in place.	___	___
. Installed the spent cartridge bag on the empty cartridge bag support by fastening the eight snap fasteners which hold it in place.	___	___
. Slid the machinegun into the machinegun port until the rearmost portion of the jacket assembly (the disconnector holes) were flush with the machinegun bracket assembly.	___	___
. Inserted the two cap screws and lock washers in their respective holes and tightened them down.	___	___
. Plugged in the machinegun electrical lead to the solenoid on the machinegun's backplate assembly.	___	___
7. LOAD M219 MACHINEGUN (NOT TIMED).		
. Pushed forward on the rear of the left cover latch rod assembly and raised the cover.	___	___
. Raised the feed tray.	___	___
. Placed the machinegun safety in the FIRE position.	___	___
. Charged (cocked) the machinegun by pulling the charger handle to the rear.	___	___
. Inspected the chamber for obstructions by looking and feeling in the chamber.	___	___
. Placed safety in the SAFE position.	___	___
. Lowered feed tray.	___	___
. Fed ammunition belt through chute of ammunition box.	___	___
. Placed first round of ammunition belt in feed tray slot with the open side of ammunition link loops facing down.	___	___
. Closed machinegun cover assuring that lock rod is engaged.	___	___

	Yes	No
8. DISASSEMBLE MAIN GUN BREECHBLOCK (10 MINUTES).		
a. Removal:		
. Placed the main gun safety switch in the SAFE position.	___	___
. Placed breechblock crank stop in the REAR position.	___	___
. Opened the breech and looked for obstruction.	___	___
. Closed the breech manually by tripping the extractors with an empty cartridge case or a wooden block.	___	___
. Removed firing pin spring by depressing plunger, moving plunger to the right, twisting firing pin spring retainer counter-clockwise until the lug alined with the groove in the breech-block, and removing the retainer and spring.	___	___
. Removed firing pin and retractor guide with firing pin retractor by inserting screwdriver blade into retractor guide slot and prying outward.	___	___
. Screwed eye bolt into top of breechblock.	___	___
. Suspended chain hoist from hook on the turret ceiling and connected chain hoist to eye bolt.	___	___
. Took up slack with the chain hoist to support breechblock.	___	___
. Applied tension on closing spring by turning adjuster clockwise with spanner wrench.	___	___
. Removed tension from the closing spring by depressing plunger from its notch with a screwdriver and allowing adjuster to turn counterclockwise under control of the spanner wrench.	___	___
. Inserted small screwdriver into hold in breech-block crank stop and slid stop forward.	___	___
. Started breechblock downward by rotating operating handle rearward and down, and with chain hoist let the breechblock begin descending.	___	___
. Returned the operating handle to the latched position.	___	___
. Lowered the breechblock until breechblock crank pivot was free of the T-slot, and removed pivot.	___	___
. Lowered breechblock until breechblock was on the turret floor.	___	___
. Released chain hoist from the eye bolt.	___	___
. Removed right and left extractors from the breech ring.	___	___

	Yes	No
b. Disassembly:		
. Depressed firing contact plate plunger and turned firing contact plate counterclockwise until arrows on plate and breechblock were alined with each other.	___	___
. Removed firing contact plate, firing contact plate plunger, and spring.	___	___
. Removed plastic washer, firing contact, and firing contact sleeve.	___	___
. Removed retractor pivot pin and firing pin retractor from retractor guide.	___	___
. Removed screw, washers, and clamp securing the retractor driver to the bottom of the breech-block. (Use Allen wrench to remove screws.)	___	___
. Removed retractor driver, retractor driver shaft, and spring.	___	___

Elapsed Time: _____minutes.

9. ASSEMBLE MAIN GUN BREECHBLOCK (10 MINUTES).

a. Assembly:		
. Installed retractor driver spring, shaft, and retractor driver into the bottom of the breechblock.	___	___
. Affixed the retractor group to the bottom of breechblock by installing securing clamp, washers, and screw with the Allen wrench.	___	___
. Inserted firing contact sleeve, firing contact, plastic washer, spring, and firing contact plate plunger into the breechblock.	___	___
. Installed firing pin retractor into retractor guide and secured it with the retractor pivot pin.	___	___
. Replaced firing contact plate by alining the arrow and depressing and rotating the plate clockwise until firing contact plate plunger engaged locking note in plate.	___	___
b. Installation:		
. Installed right and left extractors into extractor pivots in the breech ring.	___	___
. Inserted chain hoist into eye bolt on breechblock.	___	___
. Raised breechblock and guided it into breech ring until breechblock came in contact with extractor plungers.	___	___
. Depressed plungers and moved breechblock upward.	___	___
. Installed breechblock crank pivots in breech-block crank.	___	___
. Inserted pivot in breechblock T-slot.	___	___
. Tripped extractors with the screwdriver and raised the breechblock to the closed position.	___	___

	Yes	No
. Inserted small screwdriver or rod into the hole in breechblock crank stop and slid stop to the rear position.	___	___
. Jiggled the crank stop back and forth to assure that the plunger was seated in its recess.	___	___
. Released the tension on the chain hoist.	___	___
. Turned adjuster clockwise until plunger entered the first recess.	___	___
. Removed chain hoist and eye bolt.	___	___
. Installed retractor guide with firing pin retractor and firing pin in its well by pushing guide forward until it was flush with inner surface of the well.	___	___
. Installed firing pin spring and firing pin spring retainer.	___	___
. Depressed plunger, and twisted retainer clockwise until plunger was seated in its recess.	___	___
. Opened and closed breech several times to test for binding or shock.	___	___
. Adjusted tension on the closing spring to counteract any binding or shock in breech operation.	___	___

Elapsed Time: _____ minutes.

SCORING.

To pass, soldier must have:

a. Checked operation of the M219 (without being told) after assembling it.

b. Cleared the M219 within the time specified.

c. Completed disassembly and assembly of the M219 and breechblock within the time specified.

d. Been checked "Yes" on all performance measures.

PASS FAIL

PART TWO

INSTRUCTIONS TO LOADER/GUNNER. "In Part 2 of this test, you will perform the following tasks from the Gunner's station to prepare the tank for a tactical mission in a nuclear environment:

10. Check operation of M3 heater (gas particulate unit).
11. Charge manual elevation system.
12. Place turret into power operation.
13. Prepare Gunner's telescope for operation.
14. Prepare Gunner's periscope for daylight operation.

Perform each task when I instruct you to do so. You may use your TM. I will observe your performance and serve as other crew members as needed. Do you have any questions? Work quickly, but carefully. Ready... begin."

	Yes	No
PERFORMANCE MEASURES.		
10. CHECK OPERATION OF M3 HEATER.		
On Driver's request, "CHECK GAS PARTICULATE UNIT":		
. Rotated air heater knob to ON and check for Indicator lamp operation.	___	___
. Checked air flow through hose.	___	___
. Allowed air to warm up for at least five minutes.	___	___
. Checked air temperature.	___	___
. Adjusted protective mask and attached air hose.	___	___
. Removed and stowed air hose and protective mask.	___	___
. Rotated air heater switch to OFF and listened for audible click.	___	___
. Reported status of M3 heater to Driver.	___	___
11. CHARGE MANUAL ELEVATION SYSTEM.		
. Rotated the manual elevation handle to depress the main gun until the handle could no longer be rotated with one hand.	___	___
12. PLACE TURRET INTO POWER OPERATION.		
. Performed zero pressure check to insure accumulator charge of 450-500 PSI.	___	___
. Checked hydraulic power pack oil level.	___	___
. Insured the tank and surrounding area are clear of obstruction.	___	___
. Insured crew is in safe position and Driver has lowered his seat and has his head down.	___	___
. Instructed Loader to release gun tube from travel lock.	___	___
. Unlocked turret lock.	___	___
. Announced POWER to alert the crew.	___	___

	Yes	No
. Asked driver if engine was running and set at 800 to 900 RPM.	___	___
. Placed manual traversing handle locking lever in the detent position.	___	___
. Turned TURRET POWER switch ON.	___	___
. Squeezed magnetic brake switch and rotated Gunner's control handle to traverse turret.	___	___
. Rotated handles rearward and forward to elevate and depress gun.	___	___
13. PREPARE GUNNER'S TELESCOPE FOR OPERATION.		
. Tightened eyepiece hanger and screws.	___	___
. Seated pin on the telescope and the slot on the holder assembly.	___	___
. Adjusted headrest by loosening adjusting nut and sliding headrest to desired position and tightening nut.	___	___
. Cleaned lenses.	___	___
. Focused eyepiece by rotating diopter to th maximum plus reading and then rotating back.	___	___
. Set reticle illumination by rotating the rheostat knob on instrument light M50.	___	___
. Removed filters from filter box.	___	___
. Attached filter to telescope eyepiece.	___	___
. Viewed through eyepiece and moved reticle selector to each position checking to see that both reticles are visible.	___	___
14. PREPARE GUNNER'S PERISCOPE FOR DAYLIGHT OPERATION.		
. Adjusted the daylight and IR headrest for proper fit.	___	___
. Opened ballistic shield.	___	___
. Adjusted diopter on the daylight sight by rotating the diopter to the maximum-plus reading and then back.	___	___
. Set the reticle illumination by rotating the light source control knob until reticle appears with desired brightness.	___	___

SCORING.

To pass, soldier must have been checked "Yes" on each performance item.

PASS	FAIL

APPENDIX A - VI

LOADER/GUNNER
STATION

NAME _____

SSAN __ __ __ __ __ __ __ __ __

SCORER NAME _____

DATE _____

TANK CREWMAN READINESS TEST

LOADER/GUNNER

STATION 3

CONDITIONS. Fully operational M60A1 situated on level ground with coaxial machinegun mounted. Boresight panel is at appropriate range (1200 meters). Gun tube is aimed at boresight target, but slightly out of alinement with respect to target. Gunner's direct fire sights are dirty and instrument lights are inoperative.

INSTRUCTIONS TO LOADER/GUNNER. "This test will be conducted in two parts. During Part 1 you will perform some loader tasks; in Part 2 you will perform some gunner tasks. As the loader you will.

1. Prepare tank for boresighting.
2. Boresight M219 machinegun.
3. Check boresight alinement of main gun.
4. Perform main gun prepare-to-fire checks from Loader's station.

Perform each task when I instruct you to do so. You may use your TM. I will observe your performance and serve as the other crew members as needed. Do you have any questions? Work quickly, but carefully. Ready... begin."

PART ONE

	Yes	No
PERFORMANCE MEASURES.		
1. PREPARE TANK FOR BORESIGHTING.		
. Placed back thread over witness lines on muzzle end of main gun and secured thread tautly.	___	___
. Removed firing mechanism from breechblock.	___	___
2. BORESIGHT M219 MACHINEGUN MOUNTED ON TANK.		
. Removed the solenoid electrical lead from the machinegun backplate assembly by pulling the solenoid plug down.	___	___
. Pulled the right disconnector ring rearward to disengage the disconnector pin from the disconnector hole.	___	___
. Rotated the receiver downward and pulled rearward until disengaged from mounting block.	___	___
. Loosened support setscrews located in the gun mounted cover shield collar approximately 1 1/2 turns.	___	___
. Selected the target employed to boresight the main gun.	___	___

	Yes	No
. Alined the machinegun bore vertically on target while viewing the aiming point through the right binocular M17A1 so as to adjust the machinegun elevation alinement with the bore of the main gun by loosening or tightening the adjusting screws.	___	___
. Alined the machinegun bore horizontally while viewing the aiming point through the right binocular M17A1 so as to adjust the machinegun azimuth alinement with the bore of the main gun by loosening or tightening the front end and rear horizontal adjusting screws.	___	___
. Tightened all lock and jam nuts.	___	___
. Adjusted support setscrews in the gun mount cover shield collar until they contact the flash suppressor body then backed them off 1/4 to 1/2 turn.	___	___

3. CHECK BORESIGHT ALINEMENT OF MAIN GUN.

On request from Gunner to confirm that muzzle cross threads are on aiming point:

. Checked alinement of main gun by sighting through firing pin hole with M17A1 binocular to see if cross threads lay on aiming point.	___	___
. Reported gun out of alinement and assisted Gunner to aline it.	___	___

4. PERFORM MAIN GUN PREPARE-TO-FIRE CHECKS FROM LOADER'S STATION.

On command "PREPARE TO FIRE":

. Checked recoil oil by feeling replenisher indicator tape for one rough and one smooth edge.	___	___
. Opened breech and looked in chamber for obstruction.	___	___
. Tightened M219 machinegun mounting bolts.	___	___
. Plugged electrical lead into solenoid.	___	___

On command "CHECK FIRING SWITCHES":

. Placed main gun safety switch in FIRE POSITION.	___	___
. Installed circuit tester between breechblock and face of chamber.	___	___

	Yes	No
. Observed for lighting of circuit tester bulb each time Gunner or TC announced "ON THE WAY", and announced "NO FIRE" any time bulb failed to light.	___	___
. Closed the cover on the coaxial machinegun, charged it, and listened for forward action of barrel and barrel extension when Gunner and TC activated firing switches (recharging coax before each check.)	___	___
. Removed and stowed circuit tester.	___	___
On command "REPORT":		
. Reported "LOADER READY."	___	___

SCORING.

To pass, soldier must have:

a. Reported that main gun was not alined with boresight target and correctly assisted the Gunner to aline it.

b. Alined M219 with boresight target.

c. Been checked "Yes" on all performance measures.

PASS	FAIL

PART TWO

INSTRUCTIONS TO LOADER/GUNNER. "In Part 2 of this test you will perform the following tasks from the Gunner's station:

5. Perform main gun prepare-to-fire checks from Gunner's station.
6. Prepare tank for boresighting.
7. Prepare azimuth indicator for operation.
8. Operate elevation quadrant (elevate main gun to +15).
9. Boresight Gunner's telescope.
10. Boresight daylight sight of Gunner's periscope during daylight.
11. Boresight IR sight of Gunner's periscope during daylight
12. Boresight tank searchlight using alternate method.
13. Boresight M219 machinegun.

Perform each task when I instruct you to do so. You may use your TM. I will observe your performance and serve as the other crew members as needed. Do you have any questions? Work quickly, but carefully. Ready... begin."

	Yes	No

PERFORMANCE MEASURES.

5. PERFORM PREPARE-TO-FIRE CHECKS FROM GUNNER'S STATION.

On command PREPARE-TO-FIRE:

. Cleaned interior direct fire sights.	___	___
. Opened and closed ballistic shield.	___	___
. Checked instrument lights and indicated they were inoperative.	___	___

On command CHECK FIRING SWITCHES:

. Turned main gun switch ON.	___	___
. Depressed firing trigger on power control handle and trigger on manual elevating control handle.	___	___
. Rotated main gun manual firing device T-handle.	___	___

Note: Announced ON THE WAY each time a trigger is checked for the main gun or the manual firing device is actuated.)

. Turned main gun switch OFF.	___	___
. Turned coaxial machinegun switch ON.	___	___
. Depressed firing trigger on manual elevating control handle.	___	___
. Turned coaxial machinegun switch OFF.	___	___

	Yes	No
On command CHECK FIRING CONTROLS:		
. Set range correction knob of ballistic computer at zero.	___	___
. Turned superelevation handcrank.	___	___
. Pushed RESET button on computer	___	___
. Index various ranges into computer.	___	___
. Turned range correction knob of ballistic computer to proper setting.	___	___
. Reported GUNNER READY on command REPORT.	___	___
6. PREPARE TANK FOR BORESIGHTING.		
After "LOADER" removed firing mechanism from breechblock:		
. Centered right telescope of binocular M17A1 over firing pinhole.	___	___
. Alined axis of 105mm gun bore on right angle of aiming point by operating the manual traversing and elevating handles according to the Loader's directions.	___	___
7. PREPARE AZIMUTH INDICATOR FOR OPERATION.		
. Rotated rheostat knob until desired brightness is obtained.	___	___
. Placed the aiming cross of the periscope on the reference point.	___	___
. Performed accuracy tests by manually traversing turret 360 degrees to return to original reference point.	___	___
. Set the micrometer and azimuth points on zero.	___	___
. Performed slippage test by traversing the turret rapidly in power and stopping suddenly.	___	___
. Repeated this operation two or more times in same direction.	___	___
. Traversed turret manually in opposite direction to return to original reference point.	___	___
. Insured that both the micrometer and azimuth points are [illegible]	___	___
8. OPERATE [illegible] AND ELEVATE MAIN GUN TO +.5°		
. [illegible] enter of the target [illegible]	___	___
. Measured the [illegible] gun tube by rotating the [illegible] meter knob until the bubble is centered in the level vial.	___	___

	Yes	No
. Announced elevation by reading from the elevation and micrometer scales.	___	___
CONFIRM +15	___	___

9. BORESIGHT GUNNER'S TELESCOPE.

. Set superelevation counter on the ballistic computer to zero.	___	___
. Moved reticle selector switch until reticle corresponding to type of ammunition that will be used to zero can be seen through the eyepiece.	___	___
. Unlocked telescope mount elevation and deflection boresight knobs.	___	___
. Rotated the boresight knobs until the boresight aiming point is in the same position as the muzzle cross threads.	___	___
. Moved elevation and deflection knob locking levers to the lock position.	___	___
. Rotated slip scales on the elevation and deflection knobs to read 3 and 3.	___	___
. Told Loader to confirm that the muzzle cross threads are on the aiming point.	___	___
CONFIRM	___	___

10. BORESIGHT DAYLIGHT SIGHT OF GUNNER'S PERISCOPE.

. Sighted through the eyepiece, disengaged the elevation and deflection boresight knobs, and rotated the knobs until the aiming cross is on the same aiming point as the muzzle cross threads.	___	___
. Rotated slip scale on the elevation and deflection boresight knobs to read 4 and 4.	___	___
. Placed daylight sight reticle on the aiming point.	___	___
. Told Loader to confirm that the muzzle cross threads are on the aiming point.	___	___
CONFIRM	___	___

	Yes	No
11. BORESIGHT IR SIGHT OF GUNNER'S PERISCOPE DURING DAYLIGHT.		
. Opened the ballistic shield.	___	___
. Placed opaque material over the periscope head assembly with a 3/4 inch hole in line with the IR body.	___	___
. Placed the IR switch in the 1.5 volt position.	___	___
. Viewed through the IR eyepiece and rotated the IR diopter to the maximum plus reading then back until the grain on the converter tube surface as seen through the eyepiece appears clear and sharp.	___	___
. Rotated the light source control until the reticle illumination has the desired brightness.	___	___
. Sighted through the eyepiece and rotated focusing ring until the target appears with the maximum sharpness.	___	___
. Disengaged and rotated the elevation and deflection boresight knobs until the aiming cross of the reticle is alined on the same aiming point as the muzzle cross threads.	___	___
. Rotated slip scale on the elevation and deflection boresight knobs to read 4 and 4.	___	___
. Placed aiming cross on the reticle of the daylight scope on the aiming point.	___	___
. Told Loader to confirm that the muzzle cross threads are on the aiming point.	___	___
CONFIRM	___	___
12. BORESIGHT TANK SEARCHLIGHT USING THE ALTERNATE METHOD.		
After "TC" laid the bottom of the searchlight beam above and just touching the reference mark:		
. Removed superelevation from fire control system using computer's handcrank.	___	___
. Boresighted main gun of lower cross.	___	___
. Centered the bubble on the elevation quadrant using the micrometer knob.	___	___
. Applied plus 5 mils to elevation quadrant using the micrometer knob.	___	___
. Manually elevated the gun until the bubble is centered.	___	___
CONFIRM	___	___

	Yes	No
13. BORESIGHT AN M219 MACHINEGUN MOUNTED ON A TANK.		
After "LOADER" tightened both horizontal adjustment screws:		
. Rotated, either to the left or right, the rheostat knob on the infinity sight M44C for periscope M31 or the rheostate knob of the light source control for periscope M32 in order to adjust brightness of reticle.	___	___
. Rotated both the elevation and deflection boresight knobs on the infinity sight so as to aline the center reticle on aiming point of target.	___	___
CONFIRM	___	___

SCORING.

To pass:

a. The soldier must have been checked "Yes" on each performance measure.

b. The scorer must verify that optics and weapons are boresighted by confirming that reticle aiming crosses are on same aiming points as muzzle cross threads.

c. The main gun must be elevated to +15.

PASS FAIL

APPENDIX A - VII

STATION 4

NAME _____

SSAN __ __ __ __ __ __ __ __ __

SCORER NAME _____

DATE _____

STATION 4

ACTIVITY 1: Target Acquisition

CONDITIONS. Give each soldier an answer sheet, a test booklet, and a pencil. A chair and a writing surface must be available for each soldier. A stopwatch will be necessary to time the task.

INSTRUCTIONS TO SOLDIER. "During this activity you will take a written test on some target acquisition subjects. These include: 'Target Acquisition Scanning Techniques', 'Locating and Reporting Targets', and 'Target Range Estimation'. Write all your answers on the separate answer sheet. You will have 15 minutes to complete the test. If you have any questions during the test, raise your hand. Before we begin, write your name, your SSAN, and the date in the spaces on your answer sheet . . . . Are there any questions about what you are to do? . . . . You have 15 minutes . . . Begin."

PERFORMANCE MEASURES.

This written test covers three target acquisition subjects:

1. Target Acquisition Scanning Techniques (8 Questions, 15 Answers).
2. Locating and Reporting Targets (3 Questions, 14 Answers).
3. Target Range Estimation (5 Questions, 13 Answers).

SCORING.

A PASS/FAIL score will be given for each target acquisition subject. The PASS/FAIL cutoff for each is:

1. Target Acquisition Scanning Techniques (12 correct answers, 80%).
2. Locating and Reporting Targets (11 correct answers, 80%).
3. Target Range Estimation (9 correct answers, 70%).

STATION 4

ACTIVITY 2: Replenisher Tape

CONDITIONS. Replenisher tape mock-up positioned forward of the soldier in the same relative position as in the loader's station. The tape can be set in any one of four positions: (1) one rough edge and one smooth (2) two rough edges (3) two smooth edges, and (4) two long notches. Present each of the four settings twice in a series of eight settings in random order to soldier.

INSTRUCTIONS TO SOLDIER. "In this part of the test I am going to give you some different settings of the replenisher tape, and you are to feel the tape and tell me what action you would take if you got that reading (a) during firing, and (b) before firing (during mission preparation). I will set up the tape and say "Before firing" ("During firing"), "Ready," you should then reach up into the mock-up, feel the tape and immediately report what action is called for."

TASK.

Determine corrective action required by replenisher tape.

PERFORMANCE MEASURES.	Yes	No
. Reached up with left hand behind the rangefinder and to the left end of the replenisher cylinder and felt tape.	___	___
. Took no action if felt one rough edge and one smooth edge.	___	___
. Added oil to replenisher (after announcing "CEASE FIRE," if during firing) if felt rough edges on both sides of tape.	___	___
. Continued to check tape frequently during firing if felt smooth edges on both sides of tape, but drained oil from replenisher at first opportunity.	___	___
. Drained oil from replenisher (after announcing "CEASE FIRE," if during firing) if felt two long notches in tape.	___	___

SCORING.

To pass, soldier must have:

a. Stated the correct action for <u>each</u> of the eight test trials for during-firing and before-firing conditions.

b. Responded in each trial without hesitation, immediately after feeling the tape.

PASS ___ FAIL ___

STATION 4

ACTIVITY 3: Caliber .45 Pistol

CONDITIONS. Caliber .45 pistol and magazine loaded with dummy caliber .45 ammunition is on a table in front of the soldier. The weapon is cleared. These conditions are necessary for the first performance measure. The conditions for the remaining performance measures follow from each preceding one. If the soldier performs a performance measure incorrectly, set up the test conditions for the next one.

INSTRUCTIONS TO SOLDIER. "You will perform five tasks during this activity. They are:

1. Load the caliber .45 pistol.
2. Clear the caliber .45 pistol.
3. Disassemble the caliber .45 pistol.
4. Assemble the caliber .45 pistol.
5. Perform immediate action on caliber .45

I will give you specific instructions for each task. Located in front of you is a loaded magazine and a cleared caliber .45 pistol. You must load the pistol. You will have five seconds. Do you have any questions concerning this requirement? Ready . . . begin."

PERFORMANCE MEASURES.	Yes	No
1. LOAD THE CALIBER .45 PISTOL.		
. Inserted magazine.	___	___
. Pulled slide to the rear then released.	___	___

Elapsed Time: _____ seconds

NOTE: Tell soldier to put pistol down. If soldier did not load pistol correctly, you must do so.

INSTRUCTIONS TO SOLDIER: "Your next requirement is to clear the weapon. You will have ten seconds. Do you have any questions concerning this requirement? Ready . . . begin."

2. CLEAR THE CALIBER .45 PISTOL.

	Yes	No
. Kept weapon in RAISED PISTOL position.	___	___
. Removed magazine.	___	___
. Pulled slide to the rear and locked slide.	___	___
. Looked and felt into chamber.	___	___
. Allowed slide to go forward.	___	___
. Pulled trigger.	___	___

Elapsed Time: _____ seconds

NOTE: Tell soldier to put pistol down. If soldier did not clear pistol correctly, you must do so.

INSTRUCTIONS TO SOLDIER: "You have one minute to field disassemble the weapon. Do you have any questions concerning this requirement? Ready . . . begin."

3. DISASSEMBLE THE CLAIBER .45 PISTOL.

	Yes	No
. Removed recoil spring plug.	___	___
. Removed slide top.	___	___
. Removed receiver group.	___	___
. Removed recoil spring and recoil spring guide.	___	___
. Removed barrel bushing.	___	___
. Removed barrel and slide group.	___	___

Elapsed Time: _____ seconds

NOTE: If soldier did not disassemble pistol correctly, you must do so.

INSTRUCTIONS TO SOLDIER: "Now assemble the pistol and perform a function check. You will have two minutes. Do you have any questions concerning this requirement? Ready . . . begin."

4. ASSEMBLE THE CALIBER .45 PISTOL.

	Yes	No
. Inserted barrel in slide group.	___	___
. Inserted barrel bushing.	___	___
. Replaced recoil spring and recoil spring guide.	___	___
. Replaced receiver group.	___	___
. Replaced slide stop.	___	___
. Inserted magazine.	___	___
. Performed a function check.	___	___

Elapsed Time: _____ seconds

NOTE: If soldier did not assemble pistol correctly, you must do so.

INSTRUCTIONS TO SOLDIER: "Pick up the weapon and point it down range as in firing. Assume the weapon failed to fire. Perform immediate action required when the slide is forward. Be sure you wait the required time for the hang fire. You will have 20 seconds. Do you have any questions concerning this requirement? Ready . . . begin."

5. PERFORM IMMEDIATE ACTION ON CALIBER .45 PISTOL.	Yes	No
. Recocked hammer and attempted to fire.	___	___
. Waited ten seconds for hang fire.	___	___
. Pulled slide to the rear.	___	___
. Allowed slide to go forward.	___	___
. Attempted to fire.	___	___

Elapsed Time: _____ seconds

SCORING.

To pass, soldier must have:

a. Completed each task within the time specified.

b. Been checked "Yes" on all performance measures.

STATION 4

ACTIVITY 4: M3A1 Submachinegun

CONDITIONS. M3A1 Submachinegun and magazine loaded with dummy caliber .45 ammunition is on a table in front of the soldier. The weapon is cleared. These conditions are necessary for the first performance measure. The conditions for the remaining performance measures follow from each preceding one. If the soldier performs a performance measure incorrectly, set up the test conditions for the next one.

INSTRUCTIONS TO SOLDIER. "You will perform five tasks during this activity. They are:

1. Load the M3A1 Submachinegun.
2. Clear the M3A1 Submachinegun.
3. Disassemble the M3A1 Submachinegun.
4. Assemble the M3A1 Submachinegun.
5. Perform immediate action on the M3A1 Submachinegun.

I will give you specific instructions for each task. Located in front of you is a loaded magazine and a cleared M3A1 Submachinegun. You must load the submachinegun. You will have five seconds. Do you have any questions concerning this requirement? Ready . . . begin."

PERFORMANCE MEASURES.	Yes	No
1. LOAD THE M3A1 SUBMACHINEGUN.		
. Opened cover.	___	___
. Pulled bolt to the rear.	___	___
. Closed cover.	___	___
. Inserted magazine.	___	___

Elapsed Time: _____ seconds

NOTE: Tell soldier to put submachinegun down. If soldier did not load submachinegun correctly, you must do so.

INSTRUCTIONS TO SOLDIER: "Your next requirement is to clear the submachinegun. You will have ten seconds. Do you have any questions concerning this requirement? Ready . . . begin."

2. CLEAR THE M3A1 SUBMACHINEGUN.

	Yes	No
. Pressed magazine catch and removed magazine.	___	___
. Opened cover.	___	___
. Pulled bolt to rear, looked and felt into chamber.	___	___
. Squeezed trigger and allowed bolt to go forward.	___	___
. Closed cover.	___	___

Elapsed Time: _____ seconds

NOTE: Tell soldier to put submachinegun down. If soldier did not clear submachinegun correctly, you must do so.

INSTRUCTIONS TO SOLDIER: "You have one minute to field disassemble the submachinegun. Do you have any questions concerning this requirement? Ready . . . begin."

3. DISASSEMBLE THE M3A1 SUBMACHINEGUN.

	Yes	No
. Removed stock.	___	___
. Removed trigger guard.	___	___
. Removed housing assembly.	___	___
. Removed magazine catch assembly.	___	___
. Removed barrel.	___	___
. Removed bolt and guide group.	___	___
. Removed sear pin.	___	___
. Removed trigger pin.	___	___
. Removed trigger and sear group.	___	___

Elapsed Time: _____ seconds

NOTE: If soldier did not disassemble submachinegun correctly, you must do so.

INSTRUCTIONS TO SOLDIER: "Now assemble the submachinegun and perform a function check. You will have two minutes. Do you have any questions concerning this requirement? Ready . . . begin."

4. ASSEMBLE THE M3A1 SUBMACHINEGUN.

	Yes	No
. Connected trigger and sear group.	___	___
. Inserted trigger pin.	___	___
. Inserted sear pin.	___	___
. Inserted bolt and guide group.	___	___
. Inserted barrel.	___	___
. Inserted magazine catch assembly.	___	___
. Inserted housing assembly.	___	___
. Inserted trigger guard.	___	___
. Inserted stock.	___	___
. Performed a function check.	___	___

Elapsed Time: _____ seconds

NOTE: If soldier did not assemble submachinegun correctly, you must do so.

INSTRUCTIONS TO SOLDIER: "Pick up the submachinegun and point it down range as in firing. Assume the weapon failed to fire. Perform immediate action required when the slide is forward. Be sure you wait the required time for the hang fire. You will have 20 seconds. Do you have any questions concerning this requirement? Ready . . . begin."

5. PERFORM IMMEDIATE ACTION ON M3A1 SUBMACHINEGUN.	Yes	No
. Removed the magazine.	___	___
. Retracted the bolt.	___	___
. Looked and felt into chamber.	___	___
. Closed the cover, replaced the magazine, opened the cover and attempted to fire.	___	___

Elapsed Time: _____ seconds

SCORING.

To pass, soldier must have:

a. Completed each task within the time specified.

b. Been checked "Yes" on all performance measures.

STATION 4

ACTIVITY 5: First Aid

CONDITIONS. A first aid dummy and first aid kit will be provided.

INSTRUCTIONS TO SOLDIER: "You are a member of a tank crew and your company is conducting a main gun firing exercise. One of the other men in the crew was burned on the thigh when a hot shell casing was ejected from the main gun. Tell me and show me on the dummy what the proper first aid treatment is for this burn. You will have three minutes. Any questions? Ready . . . begin."

PERFORMANCE MEASURES.	Yes	No
1. GIVE FIRST AID TO BURN VICTIM.		
Soldier must say or do the following:		
. Cut and gently lift away clothing covering burn without touching burn.	___	___
. Avoid removing clothing touching burn and avoid cleaning burn.	___	___
. Avoid pulling clothing over burn area.	___	___
. Avoid breaking blisters.	___	___
. Avoid putting ointments or medications on burn.	___	___
. Place and secure sterile dressing over burned area.	___	___
. If casualty is conscious, prepare and give salt solution over 1-hour period.	___	___
. Stop giving solution if casualty becomes nauseated.	___	___

Elapsed Time: _____ seconds

INSTRUCTIONS TO SOLDIER: "You are still a member of a tank crew and your company is conducting a main gun firing exercise. A member of your crew received a broken arm when a main gun shell case was ejected from the main gun. Tell me and show me on the dummy what the proper first aid treatment is for this injury. You will have three minutes to complete this requirement. Any questions? Ready . . . begin."

2. GIVE FIRST AID TO FRACTURE VICTIM.

	Yes	No
Soldier must say or do the following:		
. Avoid moving the casualty.	___	___
. Use available material to pad splints.	___	___
. Place a minimum of two tiers above the break and two tiers below the break.	___	___
. Place a splint on each side of the break to immobilize fracture and adjacent joints.	___	___
. Secure splints with tiers, ensuring that knots are on splints and not on casualty's limb.	___	___
. Ensure that no tiers are directly over break.	___	___

Elapsed Time: _____ seconds

SCORING.

To pass, soldier must:

a. Perform each task within the time specified.

b. Have been checked "Yes" on each performance measure.

APPENDIX B

INTERCORRELATION MATRICES FOR COMPONENTS OF COMPOSITE PERFORMANCE SCORES

PHASE I

APPENDIX B - I

ABBREVIATIONS

START	OBS1 - START TANK AND MOVE OUT
BACK	OBS2 - BACK THROUGH BARRELS
WATER	OBS3 - SHALLOW WATER CROSSING
WALL	OBS4 - VERTICAL WALL DESCENT
DITCH	OBS5 - DITCH CROSSING
SPEED	OBS6 - HIGH SPEED RUN
PARK	OBS7 - PARK TANK
OVERALL	- OVERALL DRIVING RATING
DVRCRS	- DRIVING COURSE SCORE
ST 1	- DRIVING SKILLS SCORE - STATION 1
ST 4	- DRIVING SKILLS SCORE - STATION 2
DVRCRT	- DRIVING SKILLS SCORE

These variables correspond to those shown in score sheets provided in Appendix A.

APPENDIX B - I

DRIVER INTERCORRELATION MATRIX

	OBS1	OBS2	OBS3	OBS4	OBS5	OBS6	OBS7	OVERALL	DVR CRS	ST1	ST4	DVR CRT
START OBS1												
BACK OBS2	290											
WATER OBS3	-012	182										
WALL OBS4	176	290	213									
DITCH OBS5	437	188	1 5	321								
SPEED OBS6	261	215	166	435	312							
PARK OBS7	227	318	276	372	154	466						
OVERALL	419	531	239	390	383	465	463					
DVRCRS	393	592	428	596	446	551	663	889				
ST 1	144	129	103	116	051	260	197	101	167			
ST 4	123	-161	094	-043	-091	053	095	-059	-030	080		
DVRCRT	182	051	099	099	013	258	198	079	148	927	483	
MEAN	8.80	8.68	6.91	7.82	9.21	8.60	8.03	3.99	--	36.48	88.86	62.92
STANDARD DEVIATION	1.46	2.09	1.94	2.81	1.93	2.50	1.88	.64	--	26.37	12.96	14.97

Decimal Omitted from Correlation Matrix.

APPENDIX B - II

ABBREVIATIONS

E1R1	- ROUND ONE OF 1000m TELESCOPE ENGAGEMENT AGAINST STATIONARY TARGET
E1R2	- ROUND TWO OF ABOVE ENGAGEMENT
E2R1	- ROUND ONE OF 700m BATTLESIGHT ENGAGEMENT AGAINST MOVING TARGET
E2R2	- ROUND TWO OF ABOVE ENGAGEMENT
E3R1	- ROUND ONE OF 1400m PERISCOPE ENGAGEMENT AGAINST STATIONARY TARGET
E3R2	- ROUND TWO OF ABOVE ENGAGEMENT
E4R1	- ROUND ONE OF 700m TELESCOPE ENGAGEMENT AGAINST MOVING TARGET
E4R2	- ROUND TWO OF ABOVE ENGAGEMENT
GNR HIT	- GUNNERY HITS
GNR SCORE	- GUNNERY SCORE
ST 1	- STATION ONE OF GUNNERY SKILLS TEST
ST 2	- STATION TWO OF GUNNERY SKILLS TEST
ST 3	- STATION THREE OF GUNNERY SKILLS TEST
ST 4	- STATION FOUR OF GUNNERY SKILLS TEST
GNR SKILLS	- GUNNERY SKILLS SCORE

APPENDIX B - II

GUNNER INTERCORRELATION MATRIX

	E1R1	E1R2	E2R1	E2R2	E3R1	E3R2	E4R1	E4R2	GNR HIT	GNR SCORE	ST1	ST2	ST3	ST4	GNR SKILLS
E 1 RD 1										N = 205					
2	276														
E 2 RD 1	-035	112													
2	085	080	357												
E 3 RD 1	257	240	077	102											
2	067	087	-016	133	339										
E 4 RD 1	035	072	250	170	-046	016									
2	-020	058	111	181	-001	113	279								
GNR HIT	432	514	510	569	448	388	495	469							
GNR SCORE	497	450	567	499	482	315	553	374	978						
ST 1	026	-048	061	110	085	048	-006	-076	046	056					
ST 2	-020	-087	-034	-055	086	029	-001	006	-029	-017	319				
ST 3	088	014	034	173	003	-024	-063	163	109	082	392	232			
ST 4	-031	029	-088	007	-040	-023	-057	-035	-061	-077	122	128	245		
GNR SKILLS	033	-048	002	086	066	014	-042	050	039	033	671	745	745	385	
MEAN	.375	.489	.432	.506	.165	.165	.568	.528	3.23	23.83	76.32	79.19	35.82	92.18	70.88
STANDARD DEVIATION	.485	.501	.497	.501	.372	.372	.197	.501	1.80	15.67	11.99	20.53	18.41	6.60	9.89

Decimal Omitted from Correlation Matrix.

APPENDIX C

PHASE I
CORRECTION OF CORRELATIONS FOR RESTRICTION IN RANGE

	GUNNERS			DRIVERS			POPULATION			$r_{x \cdot com}$	R corrected
	N	Mean	SD	N	Mean	SD	N	Mean	SD		
GUNNERY MRA	202	203.618	20.745	130	188.437	18.799	332	197.674	21.310	.0830	.0852
GUNNERY MRO	204	194.912	12.120	130	192.481	12.635	334	193.966	12.361	.1595	.1625
GUNNERY UMA	203	401.561	40.373	130	399.341	43.100	333	400.694	41.409	.3246	.3320
GUNNERY UMO	205	295.966	35.452	130	297.528	39.029	335	296.572	36.831	.2944	.3048
GUNNERY UMS	205	36.951	10.886	130	37.769	11.965	335	37.268	11.306	.3030	.3135
DRIVING MRA	204	189.932	22.565	130	209.468	22.154	334	197.536	24.321	.0976	.1070
DRIVING MRO	196	191.996	24.888	128	210.014	25.358	324	199.114	26.544	.0097	.0101
DRIVING UMA	196	587.884	49.071	128	614.537	48.126	324	598.413	50.346	.2667	.2780
DRIVING UMO	196	490.695	44.147	128	513.350	46.651	324	499.645	46.426	.2780	.2767
DRIVING UMS	196	75.724	15.658	128	82.977	16.398	324	78.589	16.320	.2843	.2830

APPENDIX D

INTERCORRELATIONS BETWEEN ARMED SERVICES VOCATIONAL APTITUDE BATTERY (ASVAB) SUBTEST SCORES AND CRITERION MEASURES

PHASE I

APPENDIX D

ABBREVIATIONS

ASVAB SUBTESTS

GI - GENERAL INFORMATION

NO - NUMERICAL OPERATIONS

AD - ATTENTION TO DETAIL

WK - WORD KNOWLEDGE

AR - ARITHMETIC REASONING

SP - SPACE PERCEPTION

MK - MATHEMATICAL KNOWLEDGE

El - ELECTRONICS INFORMATION

MC - MECHANICAL COMPREHENSION

GS - GENERAL SCIENCE

SI - SHOP INFORMATION

AI - AUTOMOTIVE INFORMATION

GSB - GENERAL SCIENCE/BIOLOGY

CM - CLASSIFICATION INVENTORY - MAINTENANCE SCALE

CA - CLASSIFICATION INVENTORY - ATTENTIVENESS SCALE

CE - CLASSIFICATION INVENTORY - ELECTRONICS SCALE

CC - CLASSIFICATION INVENTORY - COMBAT SCALE

CRITERION MEASURES

DVRCRS - DRIVING COURSE SCORE

DVRCRT - DRIVING SKILLS SCORE

DVRCOM - DRIVING COMPOSITE SCORE

GNRHIT - GUNNERY HITS

GNRT6 - GUNNERY SCORE

GNRCRT - GUNNERY SKILLS SCORE

GNRCOM - GUNNERY COMPOSITE SCORE

PREDICTOR FORMULAE

DVRUMO - DRIVING PREDICTOR BASED ON UNIT WEIGHTED MODEL OF ASVAB TESTS ONLY

GNRUMO - GUNNERY PREDICTOR BASED ON UNIT WEIGHTED MODEL OF ASVAB TESTS ONLY

APPENDIX D - I

DRIVERS INTERCORRELATION MATRIX

	GI	NO	AD	WK	AR	SP	MK	EI	MC	GS	SI	AI	GSB	CM	CA	CE	CC	DVR CRS	DVR CRT	DVR COM
GI																				
NO	45																			
AD	-07	28																		
WK	68	36	-16																	
AR	44	44	-04	47																
SP	31	11	-16	30	33															
MK	55	53	-05	58	68	28														
EI	61	34	-19	57	47	36	51													
MC	57	28	-14	58	56	49	52	60												
GS	62	32	-14	70	48	30	57	58	62											
SI	58	26	-14	66	45	24	49	64	61	60										
AI	56	20	-15	56	44	25	40	54	54	52	62									
GSB	51	21	-17	59	37	24	44	49	48	83	58	43								
CM	20	-10	-13	19	04	-08	08	12	05	06	21	40	03							
CA	09	12	-05	08	13	01	18	04	-09	07	-04	00	00	17						
CE	-05	04	00	-06	04	-01	18	-04	-09	-03	-05	-06	-06	37	46					
CC	42	22	-15	34	19	18	28	25	26	41	30	28	25	19	06	-15				
DVRCRS	23	15	-07	21	21	09	18	13	17	17	17	27	17	-04	02	-10	18			
DVRCRT	21	20	-20	22	14	-05	31	25	22	33	28	15	36	05	02	04	15	15		
DVRCOM	27	21	-16	23	26	00	28	22	21	31	29	23	36	-04	06	-04	18	76	75	
DVRUMO	63	59	-04	61	79	34	74	76	62	60	64	70	46	30	23	31	25	21	24	28
MEAN	9.5	29.5	15.2	18.3	11.4	12.7	9.3	19.5	10.2	10.5	13.9	12.4	6.2	14.6	9.4	10.1	20.0			
STANDARD DEVIATION	3.1	8.2	3.8	6.2	3.9	3.2	4.0	4.6	3.9	3.7	3.7	4.5	2.3	3.3	3.0	4.4	5.1			

Decimal Omitted from Correlation Matrix.

APPENDIX D - II

GUNNERS INTERCORRELATION MATRIX

	GI	NO	AD	WK	AR	SP	MK	EI	MC	GS	SI	AI	GSB	CM	CA	CE	CC	GNR HIT	GNR T6	GNR CRT	GNR COM
GI																					
NO	32																				
AD	01	34																			
WK	62	25	-05																		
AR	43	44	03	53																	
SP	14	13	01	07	08																
MK	41	54	14	44	52	17															
EI	53	21	-09	58	35	24	30														
MC	45	20	07	48	44	23	46	42													
GS	59	21	-01	67	44	13	44	53	56												
SI	45	06	-15	53	34	15	19	62	44	49											
AI	48	07	02	50	34	11	23	49	48	48	61										
GSB	49	20	-02	57	43	03	33	45	49	82	41	42									
CM	10	02	02	-01	-01	-02	-06	18	-01	11	14	32	08								
CA	08	20	02	16	26	10	28	16	06	13	02	02	10	99							
CE	-04	15	12	-13	11	09	11	-07	-07	-01	-14	-06	-04	31	43						
CC	41	10	-13	33	20	00	17	33	23	33	27	25	26	19	21	-09					
GNRHIT	26	17	04	21	25	01	12	17	15	19	15	18	11	11	-01	-06	12				
GNRT6	26	16	04	19	24	02	13	18	13	19	14	18	11	12	00	-04	12	98			
GNRCRT	15	08	10	23	24	14	14	20	24	20	17	24	22	-01	10	10	10	02	02		
GNRCOM	28	17	10	30	33	11	18	27	24	27	19	28	24	07	06	05	14	70	71	72	
GNRUMO	62	41	06	80	62	20	79	54	81	70	48	50	58	-03	21	-04	31	20	19	25	29
MEAN	8.8	28.5	14.9	17.1	11.5	12.9	9.9	17.3	10.0	9.5	13.4	10.8	5.9	12.6	9.8	7.6	18.4	3.2			
STANDARD DEVIATION	3.0	8.3	3.7	6.0	3.8	3.2	3.8	4.9	3.7	3.5	3.6	4.2	2.2	3.8	2.7	4.2	3.2	1.8			

Decimal Omitted from Correlation Matrix.

APPENDIX E

INTERCORRELATIONS BETWEEN ALL PREDICTORS AND ALL CRITERION MEASURES

PHASE I

DRIVERS

	GNRMRA	GNRMRO	GNRUMA	GNRUMO	GNRUMS	DVRMRA	DVRMRO	DVRUMA	DVRUMO	DVRUMS	MEAN	SD	N
GNRMRO	.73										192.48	12.64	130
GNRUMA	.75	.64									399.34	43.10	130
GNRUMO	.70	.68	.96								297.53	39.03	130
GNRUMS	.66	.64	.96	1.00							37.77	11.97	130
DVRMRA	.30	.35	.45	.42	.41						209.47	22.15	130
DVRMRO	.13	.14	.10	.13	.11	.76					210.01	25.36	128
DVRUMA	.45	.50	.75	.77	.75	.68	.48				614.54	48.13	128
DVRUMO	.45	.50	.74	.78	.76	.63	.48	.98			513.35	46.65	128
DVRUMS	.43	.45	.72	.75	.74	.57	.47	.96	.97		82.98	16.40	128
DVRCRS	.13	.09	.21	.22	.23	.09	.08	.20	.22	.22	0.00	1.00	124
DVRCRT	.23	.15	.33	.31	.30	.15	.04	.25	.24	.26	0.00	1.00	101
DVRCOM	.20	.12	.29	.29	.29	.10	.01	.27	.28	.28		1.51	95

GUNNERS

	GNRMRA	GNRMRO	GNRUMA	GNRUMO	GNRUMS	DVRMRA	DVRMRO	DVRUMA	DVRUMO	DVRUMS	MEAN	SD	N
GNRMRO	.72										194.91	12.12	204
GNRUMA	.56	.61									401.56	40.37	203
GNRUMO	.48	.64	.95								295.97	35.45	205
GNRUMS	.42	.58	.94	.99							36.95	10.89	205
DVRMRA	.16	.30	.45	.39	.38						189.93	22.56	204
DVRMRO	.16	.08	.06	.02	.00	.67					192.00	24.89	196
DVRUMA	.18	.38	.74	.72	.72	.72	.41				587.88	49.07	196
DVRUMO	.18	.38	.70	.70	.70	.68	.45	.98			490.70	44.15	196
DVRUMS	.22	.34	.69	.68	.67	.61	.48	.95	.97		75.72	15.66	196
GNRHIT	.07	.07	.24	.20	.21	.12	.03	.22	.23	.23	3.19	1.85	205
GNRCRS	.07	.06	.24	.19	.20	.13	.04	.23	.23	.23	0.0	1.00	205
GNRCRT	.05	.19	.24	.25	.25	.27	.15	.31	.31	.27	0.0	1.00	180
GNRCOM	.08	.16	.32	.29	.30	.28	.15	.37	.37	.34		1.42	180

APPENDIX F

INTERCORRELATIONS BETWEEN ALL CRITERION MEASURES IN PHASE I AND PHASE II

APPENDIX F-I

DRIVING-VARIABLE ABBREVIATIONS

MEASURES FROM FT KNOX

KSTART - START TANK AND MOVE OUT

KBACK - BACK THROUGH BARRELS

KWATER - SHALLOW WATER CROSSING

KWALL - VERTICAL WALL DESCENT

KDITCH - DITCH CROSSING

KSPEED - HIGH SPEED RUN

KPARK - PARK TANK

KOVERALL - OVERALL DRIVING RATING

KDVRCRS - DRIVING COURSE SCORE

KDVRCRT - DRIVING SKILLS SCORE

KDVRCOM - DRIVING COMPOSITE SCORE

MEASURES FROM FOLLOWUP

FSTART - START TANK AND MOVE OUT

FBACK - BACK THROUGH BARRELS

FWATER - SHALLOW WATER CROSSING

FAVLB - ARMORED VEHICLE LAUNCHED BRIDGE CROSSING

FWALL - VERTICAL WALL DESCENT

FDITCH - DITCH CROSSING

FSPEED - HIGH SPEED RUN

FPARK - PARK TANK

FOVERALL - OVERALL DRIVING RATING

FDVRCRS - DRIVING COURSE SCORE

FDVRCRT - DRIVING SKILLS SCORE

FDVRCOM - DRIVING COMPOSITE SCORE

PREDICTOR FORMULA

DVRUMO - DRIVING PREDICTOR BASED ON UNIT-WEIGHTED MODEL AND ASVAB TESTS ONLY

DRIVER INTERCORRELATION KNOX AND FOLLOW-UP PERFORMANCE BY OBSTACLE

	KSTART	KBACK	KWATER	KWALL	KDITCH	KSPEED	KPARK	KOVERALL	KDVRCRS	KDVRCRT	KDVRCOM	FSTART	FBACK	FWATER	FAVLB	FWALL	FDITCH	FSPEED	FPARK	FOVERALL	FDVRCRS	FDVRCRT	FDVRCOM	DVRUMO
KSTART																								
KBACK	37																							
KWATER	-11	41																						
KWALL	29	28	25																					
KDITCH	42	18	09	65																				
KSPEED	38	20	14	80	59																			
KPARK	49	49	33	48	43	58																		
KOVERALL	50	62	19	52	42	40	63																	
KDVRCRS	59	69	38	72	63	57	77	91																
KDVRCRT	25	17	18	20	23	47	14	11	22															
KDVRCOM	63	55	28	59	59	70	62	68	81	75														
FSTART	08	13	14	06	14	02	09	09	14	31	27													
FBACK	-03	05	02	12	15	17	-12	02	03	34	17	62												
FWATER	-12	-03	54	07	-01	06	10	-04	06	15	16	15	-08											
FAVLB	-02	30	21	03	06	06	-03	12	14	30	26	71	72	05										
FWALL	06	34	36	-08	08	08	-17	07	20	38	47	65	37	39	59									
FDITCH	01	01	13	02	14	11	-14	01	02	37	20	72	77	-03	79	56								
FSPEED	-04	27	39	06	11	14	-06	13	17	35	27	65	71	22	85	77	81							
FPARK	05	-07	-07	-01	10	21	-10	05	01	34	18	40	59	05	60	46	68	63						
FOVERALL	-03	14	18	07	-10	27	04	13	10	23	21	38	59	20	57	52	51	62	63					
FDVRCRS	-07	29	07	-18	-16	01	-15	23	07	11	13	53	56	20	65	63	57	69	68	94				
FDVRCRT	13	02	14	41	13	29	03	04	15	36	31	-31	11	02	-04	-10	-12	-01	18	15	-01			
FDVRCOM	18	-01	-02	20	-01	08	-36	02	01	28	24	-02	33	23	27	32	19	33	52	64	63	77		
DVRUMO	16	15	27	45	21	44	21	16	32	29	37	19	38	20	46	11	37	40	44	49	37	37	49	
N	39	39	35	39	39	27	39	39	35	33	29	33	33	32	34	25	34	34	34	33	23	33	21	
$\bar{X}$	8.5	8.9	6.5	8.2	8.9	8.6	8.2	4.1	.01	.31	.17	7.0	7.1	5.4	7.6	7.1	7.6	7.3	7.0	4.2	--	--	--	
s	1.6	2.3	2.0	2.7	2.5	2.4	1.8	.66	1.3	1.1	1.9	1.6	1.5	1.8	1.8	2.2	1.8	1.9	1.9	.81	--	--	--	

APPENDIX F -II

GUNNERY-VARIABLE ABBREVIATIONS

MEASURES FROM FT KNOX

KE1R1 - ROUND ONE OF 1000m TELESCOPE ENGAGEMENT AGAINST STATIONARY TARGET

KE1R2 - ROUND TWO OF ABOVE ENGAGEMENT

KE2R1 - ROUND ONE OF 700m BATTLESIGHT ENGAGEMENT AGAINST MOVING TARGET

KE2R2 - ROUND TWO OF ABOVE ENGAGEMENT

KE3R1 - ROUND ONE OF 1400m PERISCOPE ENGAGEMENT AGAINST STATIONARY TARGET

KE3R2 - ROUND TWO OF ABOVE ENGAGEMENT

KE4R1 - ROUND ONE OF 700m TELESCOPE ENGAGEMENT AGAINST MOVING TARGET

KE4R2 - ROUND TWO OF ABOVE ENGAGEMENT

KHIT - TOTAL NUMBER OF HITS

KT6 - GUNNERY SCORE

KCRT - GUNNERY SKILLS SCORE

KCOM - GUNNERY COMPOSITE SCORE

MEASURES FROM FOLLOWUP

FE1R1 - ROUND ONE OF 1000m TELESCOPE ENGAGEMENT AGAINST STATIONARY TARGET

FE1R2 - ROUND TWO OF ABOVE ENGAGEMENT

FE2R1 - ROUND ONE OF 700m BATTLESIGHT ENGAGEMENT AGAINST MOVING TARGET

FE2R2 - ROUND TWO OF ABOVE ENGAGEMENTS

FE3R1 - ROUND ONE OF 1400m PERISCOPE ENGAGEMENT AGAINST STATIONARY TARGET

FE3R2 - ROUND TWO OF ABOVE ENGAGEMENT

FE4R1 - ROUND ONE OF 700m TELESCOPE ENGAGEMENT AGAINST MOVING TARGET

FE4R2 - ROUND TWO OF ABOVE ENGAGEMENT

FHIT - TOTAL NUMBER OF HITS

FT6 - GUNNERY SCORE

FCRT - GUNNERY SKILLS SCORE

FCOM - GUNNERY COMPOSITE SCORE

PREDICTOR FORMULA

GNRUMO - GUNNERY PREDICTOR BASED ON UNIT-WEIGHTED MODEL AND ASVAB TESTS ONLY

GUNNER INTERCORRELATION KNOX AND FOLLOW-UP PERFORMANCE BY TARGET

	K E1 R1	R2	E2 R1	R2	E3 R1	R2	E4 R1	R2	K HIT	T6	CRT	COM	FU E1 R1	R2	E2 R1	R2	E3 R1	R2	E4 R1	R2	FU HIT	T6	CRT	COM
K E1 R1																								
R2	25																							
K E2 R1	02	15																						
R2	12	06	42																					
K E3 R1	26	23	14	19																				
R2	04	03	-14	12	12																			
K E4 R1	11	06	16	16	07	-06																		
R2	16	-04	11	21	-06	07	26																	
K HIT	52	47	52	62	45	24	49	48																
K T6	57	41	56	55	51	14	56	40	98															
K CRT	01	-11	09	23	-03	01	-15	-11	-01	-02														
K COM	42	22	47	56	35	11	30	20	70	71	69													
F E1 R1	04	03	-02	00	03	12	-15	-03	-01	-02	-22	-16												
R2	16	-05	-23	-16	15	17	-18	-12	-09	-08	-16	-15	59											
F E2 R1	20	10	27	-02	-01	-03	18	-08	16	21	-08	14	04	10										
R2	02	-05	14	-03	01	02	07	-18	-01	04	-16	-07	15	-01	34									
F E3 R1	11	-06	-02	07	-11	04	02	02	02	01	-03	-03	20	32	-09	-08								
R2	20	-09	20	29	-11	13	14	14	23	23	-01	15	08	09	-08	-07	60							
F E4 R1	-05	-05	-05	03	01	11	00	-06	-02	-03	-13	-14	-03	05	14	18	17	-01						
R2	-04	-11	-03	-03	-02	08	07	-12	-06	-04	-09	-12	15	17	03	-01	00	-12	43					
F HIT	16	-07	06	03	-01	17	03	-12	05	08	-23	-10	58	61	39	40	54	37	51	44				
F T6	16	-05	05	01	02	15	-02	-13	04	06	-25	-13	62	61	42	33	53	27	50	41	97			
F CRT	24	02	-08	-01	07	13	-03	-02	07	08	37	31	09	14	-05	00	16	14	08	29	22	19		
F COM	25	-01	-02	00	04	18	-05	-09	06	07	07	10	45	47	24	23	44	25	41	47	77	77	77	
GNRUMO	23	20	10	23	19	07	04	-07	26	26	33	42	09	-06	-01	02	-04	-06	-01	13	01	04	24	17
N	81	81	81	81	81	81	81	81	81	81	78	78	64	64	64	64	64	64	64	64	64	64	61	61
$\bar{X}$	.37	.47	.42	.52	.15	.15	.49	.49	3.06	-.08	-.09	-.15	.52	.56	.37	.53	.39	.30	.53	.56	3.77	--	--	--
s	.49	.50	.50	.50	.36	.36	.50	.50	1.8	.99	.96	1.4	.50	.50	.49	.50	.49	.46	.50	.50	1.9	--	--	--

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