Technical Report 622

Target Acquisition and Analysis Training System: Comparison of Image Quality of Three Presentation Media

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The Army's Combat Vehicle Identification (CVI) Training Program (GTA 17-2-9) uses a 35mm slide system. Utilization of the Bessler Cue/See and Videotape as additional media on which to present CVI raised the issue of the extent to which these systems could affect image quality with a commensurate reduction of training effectiveness.

To evaluate the effects of image quality differences among the 35mm, Bessler, and videotape systems, 105 soldiers were pretested, trained on the (continued)

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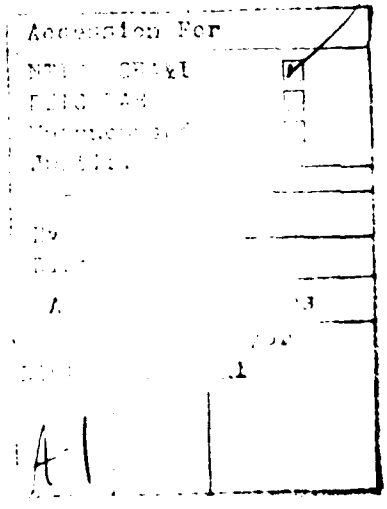
20. (continued)
three media, each of which used the CVI Training Program.

Performance was measured by the correct number of vehicle recognition and identification responses.

Comparisons of performance scores across the three media were not significantly different. It was concluded that the image quality of all three of the media was satisfactory for use with the CVI Training Program. No conclusions were drawn regarding the relative overall value of the three systems as training devices.



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Training and Simulation

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FOREWORD

The U.S. Army Research Institute for the Behavioral and Social Sciences (ARI), Fort Hood Field Unit, is developing a series of broad based long range target recognition and identification (R&I) training programs through its research program entitled Target Acquisition and Analysis Training Systems (TAATS). Both Training and Doctrine Command (TRADOC) and Forces Command (FORSCOM) have recognized the need for standardized R&I training and have requested that ARI conduct the research, development, and testing of appropriate programs.

This research was conducted to provide the Army proponent for Vehicle Recognition at the Combined Arms Center (CAC), Fort Leavenworth with information upon which to predicate future decisions for the use of alternate media for programs which will result from TAATS. Comparisons were made among the 35mm slide projector, 3/4" videotape and Bessler 8mm systems to determine whether image qualities of the two latter systems were sufficient to permit satisfactory training using the Army's Basic Combat Vehicle Identification (CVI) Training Program.

Results of this evaluation give TRADOC information which, in combination with cost estimates, provides the basis for determining whether the CVI Training Program can be used effectively with the Bessler and/or video training system(s).

EDGAR M. JOHNSON
Technical Director

TARGET ACQUISITION AND ANALYSIS TRAINING SYSTEM: COMPARISON OF IMAGE QUALITY OF THREE PRESENTATION MEDIA

EXECUTIVE SUMMARY

Requirement:

A series of Human Resources Needs (HRN) from both TRADOC and FORSCOM gave initial impetus to the establishment at the Ft. Hood Field Unit of ARI of a work unit called the Target Acquisition and Analysis Training System (TAATS). Within the framework of TAATS, two vehicle recognition training products have emerged that now comprise the Army's standardized training package. They are the Basic Combat Vehicle Indentification (CVI) Training Program (GTA 17-2-9) and the Basic Thermal Combat Vehicle Identification (TCVI) Training Program (GTA 17-2-10). The present research was done at the request of the Army's proponent for vehicle recognition, the Combined Arms Center, Ft. Leavenworth, Kansas. This report presents an evaluation of the effects of the quality of visual imagery as presented by the various media (35mm slide, 8mm Bessler, and 3/4" videotape) on recognition and identification soldier performance. Three modules extracted from the Basic CVI Program (GTA 17-2-9) were used as the test vehicle for this evaluation.

Procedure:

The 85th Army Reserve Division (Tng), Arlington Heights, Illinois provided 105 soldiers who were trained on the CVI program employing three different media modes: 35mm slides, videotape and 8mm movie film. Three modules from the Basic CVI Program were used. Pre- and post-test measures were taken on each medium and a second post-test additionally was taken using 35mm slides for soldiers trained with videotape and the 8mm film. Static images were used on the three media.

Findings:

To varying degrees the 8mm movie Bessler, 3/4" videotape, and 35mm slide systems have inherent characteristics which limit their image resolution capabilities. However, there were no significant differences in cognitive and performance measures among any of the three media. Rating scales were used to acquire subjective evaluations from six military/civilian trainers on the following: quality of image, training effectiveness, ease of use by a trainer, suitability for soldiers of differing abilities, and level of soldier interest. The videotape and 35mm slide systems (as total systems) received essentially the same highly positive ratings while the Bessler 8mm system was rated somewhat less positively.

Comparisons of performance before and after training clearly indicated that the training concepts embodied in the Basic CVI Training Program can be used with all three of these media.

Significant performance differences across all media were shown by soldiers differing in GT and ethnicity.

Satisfactory vehicle recognition/identification performance improvement was demonstrated when utilizing the Bessler, videotape and 35mm slide systems.

Conclusions:

The findings of this research led to the following general conclusions:

- The quality of images associated with each of the three media (35mm slide, Bessler and video) is satisfactory for use with the CVI Training Program.
- The Bessler system was less suitable for training during the test because of frequent equipment malfunctions.
- The learning of CVI skills by soldiers wearing glasses or contact lenses is not appreciably different from that of soldiers who do not wear glasses or contact lenses.
- Learning CVI skills is related to GT score and ethnic background.
- These findings have determined that the Army's CVI Training Program may be taught on all three of these systems without loss of training effectiveness due to lack of image quality.

Utilization:

These results will be used by TRADOC as input to decisions regarding the development, procurement, and distribution of CVI and other training programs and devices.

TARGET ACQUISITION & ANALYSIS TRAINING SYSTEM:
COMPARISON OF IMAGE QUALITY OF THREE PRESENTATION MEDIA

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INTRODUCTION

Background

The Target Acquisition and Analysis Training System (TAATS), a part of the research program at the ARI Field Unit, Ft. Hood, was designed to help create a coherent framework for development of training in the area of recognition and identification (R & I). A series of research and development (R & D) products have emerged to date from TAATS. They are: The Basic Combat Vehicle Identification (CVI) Training Program (GTA 17-2-9); The Advanced Combat Vehicle Identification (CVI) Training Program (Masking); The Basic Thermal Combat Vehicle Identification (TCVI) Training Program (GTA 17-2-10); The Basic Combat Vehicle Identification (CVI) Flash Card Program; and Combat Vehicle Training Program for the Remotely Piloted Vehicle.

Two of the training programs, the Basic Combat Vehicle Indentification (CVI) Training Program and the Basic Thermal Combat Vehicle Identification (TCVI) Training Program have been adopted and issued by the Army as standardized and official training for vehicle identification.

The medium selected for CVI and TCVI was the 35mm slide and the Kodak slide projector. The decision to use the slide and projector training medium was based on the fidelity of the image reproduction provided by the 35mm slide at extended viewing range compared with other media, portability, ease of use, group size in training and unit availability. Hence, the principal objective for selection of the 35mm slide projector for the CVI and TCVI was to increase the likelihood that a training media, consistent with The Table of Organization & Equipment (TOE's) at the battalion level of combat arms units, would be available to provide the training in an expeditious manner.

Military Problem

The Combined Arms Center (CAC), Ft. Leavenworth, Kansas, proponent for vehicle recognition, felt it was now important to consider the possibility of putting the CVI, TCVI and other planned programs on media other than 35mm slides which are available at installations such as TRADOC schools and possibly Corps or Army headquarters. If other media were suitable, the production and handling costs in both money and man hours could possibly be reduced. The Basic CVI program requires over 450 slides. Although the program is prepackaged by the Training and Audiovisual Support Center (TASC) into seven slide trays, the reproduction of the slides must be done carefully, and this does represent a probable cause for higher production costs. Reproduction of a videotape or 8mm film is perhaps easier, and may be subject to fewer potential sources for error.

At this point the major research question was to determine if training is adversely affected by projecting CVI vehicle images through the Bessler or the video playback equipment as compared with a 35mm slide projection system.

Physical image degradation which occurs when Bessler and videotape media are used, is a result of the limitations inherent within the production and reproduction equipment. More specifically, in the case of 3/4" U-Matic (cartridge) videotape system consisting of 3/4" tape, tape player and monitor (which is standard for industrial and Army training), horizontal color resolution in playback is limited to approximately 250 lines by the electronics in the tape player. Hence, this system has the greatest potential perceptual degradation.

Two illustrative studies have addressed the effects on image quality as seen on television monitors. Oatman (1965) found a significant difference between 300 and 400 levels of resolution but no difference among 400, 600, or 800 when target detection was the primary task. A study by Erickson and Hemingway (1970) found that a vehicle image required at least 10 scan lines per vehicle and an angular subtense of 14 minutes arc to ensure a high probability of identification. Direct vision performance was compared with performance on a TV monitor with the result that TV degradation "did not vary with image size but with lines per vehicle and background type". Both the Oatman and Erickson studies establish the fact that image quality on a TV system reduces performance and that an increase of scan lines above 250 is advisable in order to mitigate this effect.

Resolution limitation characteristics of 8mm movie film (Bessler) are the same as 35mm slide film with the added disadvantage of a smaller film format (image area). The 8mm film is approximately 1/16 the area of 35mm film and therefore has approximately 1/16 the number of lines of resolution available to it as does the 35mm film format. In a good quality 8mm system, horizontal lines of resolution can be over 350. The Bessler equipment, which uses 8mm film, projects the image through a series of mirrors and onto a specially coated plastic screen (rear projection). If the mirrors and screen are not clean additional image degradation can take place. For a description of the Bessler system see Appenix A.

The resolution characteristics of 35mm slide film are limited mainly by the resolving capabilities of the camera lens used when the pictures were taken, by the projection lens used, and by the type of surface the slides are projected upon. In a good quality 35mm system (camera lens, projection lens, and screen surface), the number of horizontal lines of resolution can be over 1000.

Purpose and Scope of This Technical Report

The main purpose of this report is to present the results of comparisons of recognition and identification performance of soldiers on three media (35mm slide projector, Bessler 8mm film and 3/4" videotape player) to measure the effect image quality has, if any, on that performance. Assessment measures of the potential loss of image sharpness or resolution are limited to cognitive measures of perception.

METHOD

General Description

Three modules of The CVI Training Program were used. The CVI program consists of 35mm slide images taken of 1/85 scale models using a terrain board to standardize background cues. The complete program has 30 vehicles; a module has five. Each module is divided into two training sections and a test section. Five views are shown (front, two oblique and two side) of each vehicle in each training section along with a monologue of significant identifying cues provided in a manual to the instructor. Soldiers make a written response to each image, friend (F) or threat (T) and the name of the vehicle. Presentation time is reduced in training section two to 15 seconds and to 8 seconds in the module test. For a detailed description of the CVI and the instructions used for training see Appendix B.

Three experimental groups, one group assigned to each of three training media, i.e., videotape, slides and 8mm film were pre-tested, trained and post-tested. A fourth, the control, was pre- and post-tested only. The 8mm film using the Bessler projection system required additional consideration.

The Bessler's most usual mode is as a self-paced training device; one individual at a time. However, for the purposes of this research, to control for length of stimulus presentation time, limitations were placed on the Bessler in the self-paced mode. Self-paced was restricted to one hour per module. Hence the major difference between the self-paced and the forced-paced experimental conditions was that the soldier advanced the slide during training on self-pace rather than the machine itself with forced-paced. An instructor observed the soldier's pace to be sure he completed all the training in the allotted time. Reports of the instructors indicated that the soldiers followed instructions and completed the self-paced training in one hour. In a second training mode, forced-pace, the Bessler was programmed to advance to a new static vehicle image every 30 seconds during training. During the module test there was a 15 second interval and the pre- and post-tests an 8 second interval. Hence the Bessler group was divided into two sub groups, one in a forced-choice mode and a second in a qusi self-paced mode. Although presentation mode has no bearing on the image quality, the major interest in this research, it was judged important to determine whether this procedure affected performance.

All groups were tested on Day 1 before the training using the module test for this device and given a post-test at the end of Day 2 after being trained on 3 modules over a two-day period. All groups were trained using the same three modules (Mods 3, 4, & 5) and received the same amount of training per day (two Mods on Day 1, one Mod on Day 2). In addition, all groups except the group trained on slides were administered a second post-training test using slides. Not giving the second test to the slide group was a deliberate omission. Design elegance would have been better served with it but administration of the same 4 minute test twice in 8 minutes was judged unncessary since a comparison of this data with the second test data from the videotape and 8mm groups would provide no interpretable numbers. If the two groups trained on video-tape and 8mm film, tested on their respective media

and then tested again on slides were compared with the third group trained on slides and given two slide tests in succession, the effects of media change (video to slide and Bessler to slide) could not be meaningfully separated from the possiblity that learning may have occurred between the first and second test measure. Moreover, the major purpose of the post post-test comparisions was to assess training transfer from one media to another and a slide to slide post post-test would not produce such a measure. Personnel were assigned to groups on the basis of GT scores, ethnicity, rank, and MOS, with the main objective being to maintain comparability on each of these characteristics for all groups. In this way groups were assembled to be as similar to each other as possible. Pre- and post-training test data were collected on a fourth group whose demographic composition was like that of Groups 1-3 but who received no training.

Although no instructor is required for the videotape and Bessler, monitors were available to assist with equipment operation and insure that instructions were followed.

Subjects

To conduct the research, 180 personnel were requested. On Day 1, 105 personnel were present, and it was their data that were considered for analysis. The data from 17 of these personnel in the training groups and 7 control group subjects were discarded because some training or post-training test results were missing. This left a total of 81 soldiers with complete test and training performance data. Some demographic data was not reported so that only 74 GT scores and 78 ethnic codes were available for analyses utilizing that information.

The personnel trained were drawn from the 1st and 3rd Brigades of the 85th Army Reserve Division (Tng) [One Station Unit Training (OSUT) 19E/19D] Arlington Heights, Illinois. Their median GT score was 104 (range from 66 to 144), median time in service was 6 years (range from 6 months to 27 years), median rank was E-5 (range from E-1 to E-8). Distribution by MOS is presented in Table 2-1.

TABLE 2-1

MOSs of Media Study Soldiers

MOS	n	Percent
11B - Infantryman	3	3.7
19D - Cavalry Scout	38	46.9
19E - Armor Crewman	10	12.3
71L - Administrative Specialist	2	2.5
76Y - Unit Supply Specialist	6	7.4
79D - Retention Specialist	3	3.7
Other	18	22.2

Note. Eleven MOSs had only one or two soldiers in each. One soldier failed to indicate an MOS.

Previous research within TAATS has pointed to the role of GT and ethnic background on target acquisition performance. It was, therefore, judged appropriate to verify that the distribution of cases for each of these factors was proportionate among the training media groups.

Table 2-2 presents the GT distribution and Table 2-3 the ethnic distribution by medium. Chi-Square tests for each distribution were done with no significant imbalance of subjects in either GT or ethnicity with medium type. Because the Chi-Square test is at times insensitive and the distribution for GT visually appears to be maldistributed, an analysis of variance (ANOVA) was also done with similar nonsignificant differences, [$F(2,71) = .41$, $p = .67$].

TABLE 2-2

GT Distribution in Each Medium

		<90	90-110	>110
Slides	n = 15	1 (07%)	8 (53%)	6 (40%)
Video	n = 17	2 (12%)	8 (47%)	7 (41%)
Bessler	n = 42	11 (26%)	13 (31%)	18 (43%)

n=74

Note. 7 GT scores not reported $x^2=4.61$, $p = .33$

TABLE 2-3

Ethnic Distribution in Each Medium

		White	Black	Hispanic
Slides	n = 15	7 (47%)	6 (40%)	2 (13%)
Video	n = 20	10 (50%)	8 (40%)	2 (10%)
Bessler	n = 43	22 (51%)	16 (37%)	5 (12%)

n=78

Note. 3 Ethnic codes not reported $x^2=.1$, $p = .99$.

The larger number of soldiers required for testing the Bessler system resulted from an effort to take into account the way soldiers normally interact with the system. See Table 2-4 for training group size. Of the total, five were females who were distributed among the three media to balance

any effect sex differences might have on performance. Although a control group of eleven was identified and pre-tested the first day, they failed to return the second for a post-test and therefore are not included in Table 2-4.

TABLE 2-4

Number of Soldiers in Each Training Group

Medium	n	Percent
Bessler	45	55.5
Self-Paced	18	
Forced-Pace	27	
Videotape	21	26.0
Slide	15	18.5

Procedure

The personnel reported in the morning on Day 1 and were assigned to one of the six pre-determined groups. An NCO from each group was placed in charge and given a master schedule of his group members. In addition, every soldier was given an individual schedule showing the time and room number where his training would be taking place. Due to limited classroom size, many groups had to be divided into smaller sub-groups and rotated into their respective classrooms.

Personnel were randomly seated at distances from the screen such that the image size subtended by their retinas was that expected at actual ranges of 1500, 3000, and 3500 meters using seven power (7x) binoculars. Personnel were assigned to the same seat for all training and testing thereafter.

Personnel in each group were administered a modified pre-training test and post-training test from the Basic CVI Training Program. Since only modules 3, 4 & 5 were used for training, only vehicles from those three modules were included in the testing.

After pre-testing on Day 1, personnel were trained on modules 3 and 4; on the morning of Day 2 all personnel were trained on module 5. In the afternoon of Day 2, everyone was post-tested using the same medium (videotape, Bessler, or slides) on which they had been pre-tested. In addition, all personnel except the group that trained on slides received an extra post-test (second post-test) on slides. Following the second post-testing, all personnel except those in the control group were given an evaluation sheet on which they indicated the medium they were trained on and asked to make ratings on several aspects of that medium.

Data Collection Instruments

During training and testing soldiers were required to make a written response on prepared answer sheets each time a vehicle image was projected.

They had first to make a recognition response - F for friend, T for threat or DK(?) for don't know. This was followed by an identification response in which the name or number of the vehicle was stated, or a DK(?) response if it could not be identified. For example, if a Soviet T-62 were projected the soldier should immediately write the letter T for threat and follow it with T-62. (See Appendix C for examples of the training and testing instruments).

An overall rating by six expert trainers of the relative merits of various aspects of the training on the three media was also done. See Appendix D for the instruments used.

Equipment

Equipment selection is a component of field research that is as careful considered as subject selection, i.e., its functioning should be representative of the average functioning of equipment available to Army unit. Equipment must work but must not be so deviant in its operation that performance measures taken on it may not be able to be repeated on equipment usually used in training. All of the equipment used was "off the shelf" of the 85th Division's Training and Audiovisual Support Center (TASC). No special calibrations were employed in this field test. The slides had been used in at least two previous studies.

Over 20 Besslers were tested to obtain the 10 necessary for the training. Five T.V. monitors and four video tape players were examined in order to secure one of each that had the screen size and pause capability needed. The videotape had been recently produced and was in good condition. The Bessler machines suffered from mechanical problems as well as image degradation due to dirt in the system. The screen used for 35mm slide projection was a sheet of white paper.

Data Analysis

Analyses are predicated on pre and post-test scores derived from the number of slides recognized and identified correctly. Analysis of Variance (ANOVA) is the statistical tool of choice. It is recognized that in some instances questions as to its appropriateness may arise due to cell disproportionality and heterogeneity of variance. Even where such deviations from the ANOVA model assumptions occur, the approach has been to formulate hypothesis, do significance tests and interpret the findings in light of conformity with hypotheses formulated and the consistency of the findings with data reported by other investigators. To the extent that statistical tests replicate findings reported elsewhere, inferences take on a greater measure of validity. Accordingly, replicability of a finding is the ultimate test of its validity. In like manner, where a statistical test is based on data that severely violate the assumptions of the model and no supporting data have been reported elsewhere, the most conservative approach is taken to conclusions.

Previous research (See references) with the two independent variables, recognition and identification, has reliably shown that the former is a relatively unstable measure of performance. This is due primarily to the 50/50 probability of being correct and the consistent disregard by soldiers of

the instructions which attempt to discourage guessing. For these reasons, where identification measures are available, they serve as the analytic figure ($\underline{F}$ or x^2). Where recognition is significant but identification is not, no special interpretation is made.

RESULTS

The major interest of this research was to determine whether performance may be adversely affected by reduced image quality resulting from projection of CVI vehicle images through media other than the 35mm system.

Media Comparison

Initially an ANOVA comparing the forced versus the quasi self-paced subgroups on the Bessler was done. No differences were anticipated in that observers noted the time required to complete a module of CVI training was an hour in both cases without prompting. As expected no significant differences for recognition or identification occurred, both F tests were < 1. The pace by pre- post-test interactions for recognition was nonsignificant [F (1,43) = 1.70, p = .20] as was the interaction for identification [F (1,43) = .28, p = .60]. Hence, these subgroups were subsequently treated as one group representing the Bessler System. See Table 3-1 for means and standard deviations.

TABLE 3-1

Pre - Post Performance Scores
for Forced- and Self-Paced Groups on the Bessler

	Self-Paced (n=18)				Forced-Pace (n=27)			
	Recognition		Identification		Recognition		Identification	
	M	SD	M	SD	M	SD	M	SD
Pre-Test Scores	12.39	4.93	0.17	0.51	13.63	6.34	0.22	0.58
Post-Test Scores	22.06	4.71	7.61	8.96	20.93	5.14	6.41	7.64

A mixed design ANOVA (within subjects for pre/post-test and between subjects for media) was used. A comparison was made using recognition and identification correct responses to each of the 30 slides across the three media systems - 35mm slide projector, 3/4" videotape player and the Bessler 8mm film - using the Basic CVI Training Program. Over all media no significant difference for recognition, F (2,78) = 2.59, p = .08, or identification, F (2,78) = 1.17, p = .32 was found. Pre- post-test changes for recognition or identification were not significantly different across the three media, both F tests were < 1.

An independent analysis of each of the three media attests to the robustness of the CVI Training Program concepts in that significant performance differences for recognition and identification did occur from pre-test to post-test for each medium. Table 3-2 presents the F tests along with the means and standard deviations.

TABLE 3-2

Comparison of Pre- Post-Test Performance Scores on Each of the Three Media (n=81)

	Slides (n=15)				Videotape (n=21)				Bessler (n=45)			
	Recognition		Identification		Recognition		Identification		Recognition		Identification	
	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD
Pre-Test Scores	10.13	8.04	0.20	0.77	12.29	6.20	0.67	1.24	13.13	5.79	0.20	0.55
Post-Test Scores	17.53	6.86	4.87	8.07	21.57	4.31	8.90	8.80	21.38	4.95	6.89	8.12
	$F(1,14)=61.96^{**}$		$F(1,14)=5.90^{*}$		$F(1,20)=68.29^{**}$		$F(1,20)=23.68^{**}$		$F(1,44)=84.20^{**}$		$F(1,44)=33.31^{**}$	

Note. Maximum Possible Score equals 30

*$p<.02$

**$p<.001$

Demographics

A series of mixed design ANOVAs using relevant demographic characteristics as between subjects variables were employed to assess pre- and post-test performance differences on the CVI Training Program.

The training groups were initially balanced based on GT scores provided by the 85th Division. Analysis of pre and post-test performance by GT scores produced a nonsignificant overall difference for recognition F (2,71) = .37, p = .70 but a larger effect for identification F (2,71) = 2.77, p = .07. See Table 3-3. The GT by test interaction was also non-significant F (2,71) = 2.85, p = .06.

In previous research (Heuckeroth, Smith & Shope, 1982; Smith, Shope, & Heuckeroth, 1982; and Shope, Smith & Heuckeroth, 1982), ethnicity was found to be significantly related to performance so was considered here. No significant overall difference among Black, Hispanic or White groups were found with recognition performance F (2,75)= .28, p = .77. However, identification did show a highly significant difference F (2,75) = 6.8, p = .001. See Table 3-4 for means and standard deviations.

TABLE 3-3

Performance by GT Score on Identification

	<90 (n=14)		90-110 (n=29)		>110 (n=31)	
	M	SD	M	SD	M	SD
Pre-Test	0.0	0.0	.41	1.02	.35	.75
Post-Test	2.57	3.67	7.84	9.09	8.68	8.73

n=74

Rank had no effect on performance differences for recognition, F (4,76) = .31, p = .88, or identification, F (4,76) = .60, p = .67.

Service time was grouped into three major categories for analysis: < 1 year, 1-5 years and > 5 years. A significant difference was noted for recognition, F (2,77) = 3.22, p = .05 but none for identification, F (2,77) = 1.90, p = .16.

Comparisons based on those who wear glasses with those who do not revealed no significant recognition, F (1,78) = .34, p = .56 or identification, F (1,78) = 1.77, p = .19 differences.

TABLE 3-4

Ethnic Performance on Recognition & Identification

	Recognition				Identification			
	M		SD		M		SD	
	Pre-Test	Post-Test	Pre-Test	Post-Test	Pre-Test	Post-Test	Pre-Test	Post-Test
Black (30)	12.07	20.30	5.42	4.24	.00	3.00	.00	4.57
Hispanic (9)	13.44	21.89	6.64	6.31	.44	8.44	.88	10.25
White (39)	12.23	20.69	7.15	5.83	.46	9.67	.91	8.64

n=78

Range Comparisons

Comparison of the three media at the 1500 meter range produced no significant differences for either recognition [F (2,56) = .18, p = .84] or identification [F (2,56) = 1.13, p = .33]. See Table 3-5 for means and standard deviations. No significant range by media interaction resulted with $F < 1$ with R & I.

TABLE 3-5

Performance at 1500 Meter Range with Three Media on Recognition and Identification

	Recognition						Identification					
	Slides (n=5)		Video (n=9)		Bessler (n=45)		Slides (n=5)		Video (n=9)		Bessler (n=45)	
	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD
Pre-Test	13.40	10.95	13.89	6.07	13.13	5.79	0.60	1.34	0.67	1.32	0.20	0.55
Post-Test	22.20	7.46	22.67	3.46	21.38	4.95	12.20	10.80	9.11	8.42	6.89	8.12

No range comparison beyond 1500 meters was possible with the Bessler because the smaller image size prohibited use of longer simulated ranges. However, range comparison with the video of 1500 and 2500 meters was done with a nonsignificant result for both R & I, the $F < 1$ in each case. See Table 3-6 for means and standard deviations.

TABLE 3-6

Performance on Video at 1500 Meters and 2500 Meters on Recognition and Identification

	Recognition				Identification			
	1500 Meters (n=9)		2500 Meters (n=8)		1500 Meters (n=9)		2500 Meters (n=8)	
	M	SD	M	SD	M	SD	M	SD
Pre-Test	13.89	6.07	12.5	6.00	.67	1.32	1.00	1.41
Post-Test	22.67	3.46	22.5	4.81	9.11	8.42	13.00	8.83

A comparison between slides and video at 3500 meters was not possible for identification in that no responses were made by the soldiers. A similar type of reaction at 2500 meters resulted with slides. All previous research (See References) reported no difficulty with identification out to the 3000 meter range with slide images and no significant performance differences between 2500 and 3000 meters. The slide images were reported as more difficult to see than in past research and may in part account for the lack of identification responses. On the other hand recognition responses were given at all of the ranges with no significant performance differences among ranges [F (2,30) = 2.52 p = .10] nor any significant performance range by media effects [F (2,30) = 1.10 p = .35]. See Table 3-7 for means and standard deviations.

TABLE 3-7

Comparison of Three Ranges by Type of Media on Recognition Performance

	1500 Meters				2500 Meters				3500 Meters			
	Slides (n=5)		Video (n=9)		Slides (n=6)		Video (n=8)		Slides (n=4)		Video (n=4)	
	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD
Pre-Test	13.40	10.95	13.89	6.07	7.33	6.09	12.50	6.00	10.25	6.85	8.25	6.65
Post-Test	22.20	7.46	22.67	3.46	15.33	5.72	22.50	4.81	15.00	6.06	17.25	2.63

Transfer of Training

The Basic CVI Training Program (GTA 17-2-9) is on 35mm slides and is the Army's standardized program. It is important to know whether training on one of the other media will transfer to slides. If, for example, the CVI Training Program were modified for use on the Bessler or videotape, some units may use that equipment for training. When a soldier goes to another unit, only slides might be available. A within subjects ANOVA compares performance on the video post-training test after completion of training on video with a second post-training test on slides. The result was a significant difference for recognition, F (1,20) = 12.04, p = .002, and identification, F (1,20) = 14.48, p = .001. See Table 3-8 for means and standard deviations.

TABLE 3-8

Comparison of Soldiers' Post-Test Scores in Video with Second Post-Test Scores Using Slides

	Recognition		Identification	
	M	SD	M	SD
Post-Test Video	21.57	4.31	8.90	8.79
Second Post-Test Slide	18.43	5.89	5.76	7.11

n=21

Since statistically significant differences were found, it appears that when training has been performed using the video system, subsequent testing immediately after training with slide system probably will result in a somewhat lower performance estimate.

A similar ANOVA for the Bessler was done with no significant findings for either recognition, F (1,44) = 3.73, p = .06 or identification, F (1,44) = 2.84, p = .10. See Table 3-9 for means and standard deviations.

TABLE 3-9

Comparison of Soldiers' Post-Test Scores in Bessler with Second Post-Test Scores Using Slides

	Recognition		Identification	
	M	SD	M	SD
Post-Test Bessler	21.38	4.95	6.89	8.12
Second Post-Test Slide	20.24	5.30	6.13	7.79

n=45

Control Group Performance

Although the design provided for a matched control group, the pattern of "no responses" by the control group did not permit numerical analysis. The "no response" suggests rather clearly that when evaluating training programs having a high degree of relevance to the soldier, few soldiers are sufficently motivated to accept the fact they will not be trained. It is conjectured this may be especially true with Reserve or National Guard units who gather for only a short time (2 days usually) and expect to receive some sort of training.

Expert Trainer Ratings

To provide another basis for analysis of the three media, six expert raters (two senior NCO's, three officers, and one civilian), four of whom were from other commands, observed the training and provided effectiveness ratings on five media related characteristics.

The sample size is small and no statistical tests were performed. Nevertheless, the views of these raters, all of whom are experienced in training and its development, training devices, and the military requirement for vehicle recognition, were judged to be of significant value to present their opinions in some detail. Ratings of the quality of the image show the Bessler as having a less suitable image while the slides and video were rated as "clear" or "very clear". However, no image was judged to be degraded from a training point of view. (See Table 3-10).

TABLE 3-10

Quality Of Image

	Very Clear	Clear	Marginal	Somewhat Degraded	Degraded
Slides	4 (67%)	2 (33%)	0	0	0
Bessler	1 (17%)	2 (33%)	3 (50%)	0	0
Videotape	6 (100%)	0	0	0	0

n=6

In the view of these raters, all three media were judged to be either "effective" or "very effective" in carrying the training burden. However, the Bessler was rated by only one report as "very effective" but by five as "effective" while the slide and video tape received a preponderance of "very effective" ratings- 4 out of 6. Nevertheless, all were judged to be useful for training. (See Table 3-11).

TABLE 3-11

Training Effectiveness

	Very Effective	Effective	Marginal	Somewhat Effective	Ineffective
Slides	4 (67%)	2 (33%)	0	0	0
Bessler	1 (17%)	5 (83%)	0	0	0
Videotape	4 (67%)	2 (33%)	0	0	0

n=6

Three of the raters categorized the Bessler as "marginal" or "somewhat difficult" to use by a trainer. One trainer found the videotape "somewhat difficult" but in general it was rated "easy" or "very easy". All raters responded to slides as "easy" or "very easy" to use. (See Table 3-12).

TABLE 3-12

Ease Of Use By Trainer

	Very Easy	Easy	Marginal	Somewhat Difficult	Very Difficult
Slides	2 (33%)	4 (67%)	0	0	0
Bessler	2 (33%)	1 (17%)	2 (33%)	1 (17%)	0
Videotape	3 (50%)	2 (33%)	0	1 (17%)	0

n=6

Raters were asked to compare the suitability of the media for soldiers of differing abilities. Two of the raters found each of the media only marginally suitable. The division of opinion resulted from the perceived importance of an instructor doing the training - Bessler and videotape do not require one. Slides do. (See Table 3-13).

TABLE 3-13

Suitability For Soldiers
Of Differing Abilities

	Highly Suitable	Suitable	Marginal	Unsuitable	Highly Unsuitable
Slides	2 (33%)	2 (33%)	2 (33%)	0	0
Bessler	1 (17%)	3 (50%)	2 (33%)	0	0
Videotape	1 (17%)	3 (50%)	2 (33%)	0	0

n=6

Level of interest shown by the soldiers was judged to be generally "very high" for videotape and slides, but raters felt the Bessler did not hold the interest as well due to the comparatively poor image and frequent mechanical problems. (See Table 3-14).

TABLE 3-14

Level Of Student Interest

	Very High	High	Moderate	Low	Very Low
Slides	4 (67%)	2 (33%)	0	0	0
Bessler	1 (17%)	5 (83%)	0	0	0
Videotape	3 (50%)	3 (50%)	0	0	0

n=6

To the question "What was liked best about each system", all six raters described the video image as having good clarity; three made the same judgement of the slides and one of the Bessler. Ease of use was most often attributed to the slides (5 out of 6) and was mentioned once each for video and Bessler. Standardization of presentation was identified three times as a useful attribute of the video but not at all for the Bessler. However, the use of a "live" instructor was cited by three raters with the slides as important. The Bessler was seen as a readily available device by two raters.

Least liked characteristics for the video were the bulk and weight of the equipment which made it difficult to use in the field and the lack of ease of operation. Slide images were noted as being unclear at longer simulated ranges and script deviation by the instructor a potentially distracting feature. The Bessler had poor images and technical difficulties.

Soldier Ratings

The soldiers were asked to evaluate the media upon which they were trained. The questionnaire used is at Appendix D along with the responses. Comments are media specific since the research design did not include any soldiers trained on all media. The subjective evaluation of how well the soldiers liked the media on which they were trained indicated that 90% were satisfied or completely satisfied with the video, 70% with Bessler and 67% with slides. See Appendix E for comments made by the soldiers.

DISCUSSION AND CONCLUSIONS

Discussion

Identification Performance

The performance levels achieved for identification in this and related research (see references) after two or more hours of training appear small. In this particular research after two hours of training, when post-test scores were examined in conjunction with GT scores, the mean number of vehicles identified out of a total of 15 were with GT <90 (16%), 2.36; GT 90-109, 5.34 (36%); and GT >110, 5.08 (34%). In part, these low scores were a result of the strict adherence to a requirement that the name or number of a vehicle was the only acceptable correct response. For example, the Jagdpanzer or ASU 85 are difficult to recall and to write. Research by Heuckeroth, et. al.(1983) show these among the vehicles with the lowest recall scores.

Another factor, the vehicle view, also tends to keep scores low. Half of the vehicle views are frontal. The remaining views are oblique. All previous research (see references) has found the front view significantly more difficult than the side and oblique views. The rationale for the front view comprising 50% of the final test is that the front view is the most difficult and will provide a conservative estimate of the soldiers' performance. A less cogent reason is that the front view of a vehicle is one of the most commonly seen on the battlefield. In fact, the front view is probably seen for a shorter proportion of the time than either an oblique or side.

It is useful to note that the image size is designed to be small to simulate accurately what is seen at longer ranges. The observation that "the image should have been larger" highlights the fact that almost all past training has concentrated on vehicles at close ranges where many details are visible. It is important to impress upon seasoned military trainers that at all present tank and TOW engagement ranges, most detail is lost. The CVI program was developed precisely for the purpose of meeting this training need. As most soldiers know, it is virtual suicide on the modern battlefield to wait until details are visible at ranges below 1500 meters to recognize or identify lethal weapon systems like those of a tank.

Recognition Performance

There is a strong tendency in some quarters to ignore the training problem in R & I by simply adopting the attitude that everything in front of The Forward Edge of the Battle Area (FEBA) is to be engaged. Lip service is often all that is given to the need to perhaps recognize first, i.e., determine if the target is friend or threat. Identification is seen as unneeded. However, all pre-test data show that the soldier recognizes only about 50% of the vehicles. Since there are only two choices (friend or threat) these scores are like flipping a coin which could mean on the battlefield that he kills one friendly tank for every enemy tank. This is a costly price to pay for lack of interest in R & I training.

Recognition as a performance measure has distinct limitations. The approach 99% of the soldiers took in responding was to ignore the "DK" or "?" alternatives provided for in the instructions. In effect, they operated as if there was a two alternative forced choice response condition. The scoring procedure took this factor into account and recognized that a 50/50 probability of guessing the correct response existed. For this reason, less meaning could be attributed to recognition differences than to identification differences. For example, there were no significant differences across GT levels with recognition. On the other hand, with identification, where chance guessing plays a smaller role, there were significant differences. Trainers should know this and be cautioned never to use only the recognition score for determination of level of knowledge of the soldier with the current final test instrument in the CVI program.

Self- vs Forced-Pace Performance

The failure to find a self-paced vs forced-pace difference is most easily explained by the experimental constraints placed on the self-paced condition in which the soldier is allowed a limited time to complete the training. This was necessary to control the length of stimulus presentation. Hence, the major characteristic of the self-paced learning situation, i.e., unlimited time, was changed and a modified self-paced condition resulted.

Transfer of Training

Results showed a lack of perfect transfer for video training when tested immediately on slides although much better transfer from Bessler to slides under similar test conditions id occur. These findings raise the often identified issue of how well this training, or any other of like type, transfers to the field or more especially combat.

A field test to measure how much transfer (60% or 70% or 90% or whatever) has been repeatedly suggested and is probably the most straightforward approach to the problem. However the importance of such testing is diluted by two factors. The first is cost. To conduct a test that would neet minimum design standards would entail a large number of vehicles from the CVI program. The cost of acquiring these would be prohibitive. The second is that much research on transfer of training has already been done, for the most part assessing the value of simulation devices and training as substitutes for the more costly training in the actual situation. Findings generally suggest that there is transfer but the degree of transfer is dependent on many factors. In few instances was it found that no transfer, or a negative transfer occurred. Therefore, in the budget estimates of many managers, the cost/benefit of such a test is moot.

Future Considerations

The poor test scores on R & I performance measures may be a result of the final test instrument used with the GTA 17-2-9 CVI Training Program. A redesigned instrument will be tested to provide the Army with a better index of the soldiers proficiency in the R & I area.

General Conclusions

The findings of this research led to the following general conclusions.

- The quality of images associated with each of the three media (Bessler, video and 35mm slide) is satisfacory for use with the CVI Training Program.
- The Bessler system was less suitable for training during the test because of frequent equipment malfunctions.
- The learning of CVI skills by soldiers wearing glasses or contact lenses is not appreciably different from that of soldiers who do not wear glasses or contact lenses.
- Learning CVI skills is related to GT scores and ethnic background.

REFERENCES

Erickson, A., Linton, M., & Hemingway, C. Image Identification on Television. Naval Weapons Center, NWCTP5025, September, 1970.

Heuckeroth, O.H., Smith, N.D., & Shope, G.L. Target Acquisition & Analysis Training System: Retention and The Effects of Retraining. U.S. Army Research Institute for the Behavioral & Social Sciences, In Review, 1983.

Oatman, L.C. Target Detection Using Black and White Television Study: The Effects of Resolution Degradation on Target Detection. U.S. Army Human Engineering Laboratories, Technical Memorandum 9-68, July, 1965.

Shope, G.L., Smith, N.D., & Heuckeroth, O.H. Evaluation of an Advanced Combat Vehicle Identification (CVI) Training Program (Masking); A New Approach to Target Acquisition & Analysis Training. U.S. Army Research Institute for the Bahvioral & Social Sciences, In Press, 1982.

Shope, G.L., Smith, N.D., & Heuckeroth, O.H. Target Acquisition & Analysis Training System: Verbal Proficiency, Motivation and Performance in The Basic CVI Training Program. U.S. Army Research Institute for the Behavioral & Social Sciences, In Review, 1983.

APPENDIX A

Description of the Bessler System

The Bessler Cue/See System is a self-contained audiovisual unit design for individual or group use presently being used in the Army Extension Training Program. The system employs a dual format in which visual image and audio signals are derived from separately driven cassettes. The visual images are recorded on a continuous loop, silent Super 8mm film loaded into a standard Super 8 film cartridge. Audio signals (narration and sound effects) and film advance cue signals are carried on magnetic tape in a standard compact cassette. Motion and still single frame images are used for this system.

APPENDIX B

Basic Combat Vehicle Identification (CVI) Training Program (Phase I)

This appendix is a copy of the Instructor's Guide from The Basic CVI Training Program (GTA-17-2-9) now in Army wide use. It is presented in this form so the reader may better understand not only the program composition but also the method of instructional presentation. There may be references to Appendices which are part of the complete package. When they are crucial to understanding of the instruction, they are attached at the end of this Appendix. It is recommended that the serious reader acquire a copy of The CVI Training Program for examination.

BASIC COMBAT VEHICLE IDENTIFICATION (CVI) TRAINING PROGRAM
(PHASE 1)

Introduction

This training program was developed to provide valid, efficient and economical training in combat vehicle recognition and identification at simulated tactical ranges of up to 4000 meters for all Army personnel whose duties encompass visual observation on the battlefield. The program is more than merely a "threat" program. In addition to vehicles employed by Warsaw Pact nations, the program includes US vehicles as well as vehicles of countries considered to be allied with the United States.

The following objectives guided the development of this program:

- o To develop a modular-type training program with each module being a complete and independent training block which could be administered in a short period of time.
- o To provide a training program which would involve a minimum of supportive materials and impose no undue demands on instructors.
- o To develop a program employing learning strategies which have proven successful in field studies of target recognition and identification.
- o To develop a training program and materials which emphasize those cues to vehicle identification that can actually be seen under typical field conditions at varying realistic combat ranges.

Training Program Design

The basic program, as described in this guide, consists of six training modules and one final test module. (See Table 1.) Each training module deals with a combination of five of the 30 different vehicles listed in Table 1. Each module is an independent training unit and can be used alone. The Final Test Module is administered after the trainee has completed all six training modules. It contains the 30 different vehicles included in the training modules.

Each training module includes an Instructor's Guide booklet and a carousel tray containing three sections of 35mm slides. The first two

Table B-1. Target Array

Training Module 1

T-62 Tank (USSR)
BTR-60P APC (USSR)
Leopard Tank (FRG)
M113 APC (USA)
Scorpion Tank (UK)

Training Module 2

BMD (USSR)
M60A1 Tank (USA)
AMX-13 Tank (Fr)
M109 SP Howitzer (USA)
ASU-85 (USSR)

Training Module 3

M48 Tank (USA)
MI [Abrams] (USA)
Saladin Scout Car (UK)
ZSU 23-4 ADA (USSR)
BTR-50 APC (USSR)

Training Module 4

AMX-30 Tank (Fr)
PT-76 Amphib Tank (USSR)
Scimitar Recon Vh (UK)
Marder APC (FRG)
T-72 Tank (USSR)

Training Module 5

Chieftain Tank (UK)
ZSU 57-2 ADA (USSR)
Jagdpanzer [JPZ 4-5]
Aslt Gun (FRG)
T54/55 Tank (USSR)

Training Module 6

Gepard [Flakpanzer]
ADA (FRG)
Centurion (UK)
SP-74 (USSR)
BRDM-2 (USSR)
BMP-1 (USSR)

Final Test - Module 7

All 30 of above vehicles

sections each consist of 25 slides showing the five HO scale (1:87) combat vehicles in each of five different views: Side Right (SR), Side Left (SL), Oblique Right (OR), Oblique Left (OL), and Front (F). The third section consists of 15 slides showing the front, one oblique, and one side view of each vehicle. The models are all camouflage painted, and were photographed on a terrain model to provide realism.

As discussed above, each training module is composed of three sections. Section A consists of 25 slide presentations, showing each vehicle in each of the five different views. Vehicles are presented in blocks of five, each block containing all five target vehicles. Views are randomized within each block of presentations. In Section A, each vehicle is shown once in each of its five views. However, the trainees will not be aware of the program's design as the slides are presented with no interruption between each block of five. During the presentation of each slide, the instructor will first ask the trainees to determine whether the vehicle shown is considered to be friendly or a threat, and indicate this by placing an "F" or "T" on their answer sheets. The instructor will also tell them to name the vehicle if they can. Either the numerical designation or the popular name of the vehicle can be used (e.g., M60, M1, Scorpion, Marder, T-62, etc.). If the trainees cannot make these determinations, they also indicate this on their answer sheets. (NOTE: Sample answer sheets are shown in Appendix B of this report). The instructor will then provide the information indicated above, and will also point out distinguishing characteristics or features of the vehicle which can be seen from the particular view shown. A list of these characteristics and features is provided for each slide in each module in the lesson plans in the appendixes. There is a separate appendix for each module. Finally, the instructor will answer any questions, and proceed directly to the next slide. The presentation time for each slide is manually controlled by the instructor to insure sufficient time for discussion. Therefore, this section is also referred to later in the Guide as the "Manual Presentation Sequence."

Section B consists of 25 slide presentations. The manner of presentation is the same as in Section A, except that the slides are in a different order and they are shown for only 15 seconds each. The changing of slides can be accomplished by means of an automatic timer on many types of projectors. Trainees will again be requested to indicate whether each vehicle shown is a friend or a threat, and to name the vehicle if they can. During the last few seconds of each presentation, the instructor will provide the correct answers and other information on the vehicle shown. Lists of the information to be provided are included in the lesson plans for each of the modules. Section B is also referred to later as the "Automated Presentation Sequence."

Section C is the test for the module. The test consists of 15 target presentations. Each vehicle is shown three times in a front, an oblique, and a side view. Each vehicle will be shown for only 8 seconds. No information will be provided the trainees during this test.

The initial module presentation to a group will require about 50 minutes. For subsequent modules, where the instructor does not have to explain the entire program, each module normally requires 35-40 minutes to complete. More time might be required if the trainees ask an unusually large number of questions. Part 1 of these instructions need not be repeated in their entirety once the trainees become familiar with the format of the program. To insure that the trainees remember the procedures, Part 2 of the instructions should be used each time a module is administered.

Each training module is packaged separately. The instructions and lesson plans for each module are included as separate removable appendixes in this looseleaf binder while the slides are packaged in separate carousel trays. Thus, six different units may be utilizing the six different modules at the same time.

Selection of Vehicles for the Training Program

The vehicles to be included in the array were selected by personnel from the Threat Center, 6th US Cavalry Brigade, III Corps, at Fort Hood, Texas. Of the 45 vehicles selected, only 21 were available in an HO scale and could be procured through commercial sources. (Nine other highly critical vehicles [T-72, T-62, ZSU 23-4, M1, BMD, BRDM-2, SP-74, BMP-1, and ASU-85] were handcrafted. Therefore, a total of 30 vehicles were employed in constructing the initial set of training modules. As soon as other vehicles become available, or can be handcrafted to produce other modules, they will be added to the program. As vehicles of a particular type become obsolete, the program is easily updated by replacing the slide with a new slide of a new vehicle.

Methodology for Development of Program Modules

Both type and size of vehicle were considered in the makeup of the modules. Since the training program stresses high lethality armor vehicles, the ratio of tanks to other types of vehicles is high. The tanks were distributed evenly throughout each of the six modules. Modules 1 through 5 contain two tanks and three other vehicles, while Module 6 contains one tank and four other vehicles. One "square-shaped" vehicle was placed in each module and one small vehicle was placed in each module. It should be noted that an attempt was made to organize the modules to achieve some balance between friendly and threat vehicles. The order of presentation of the six training modules is of no importance. Final Test Module 7 contains all 30 vehicles and is administered after trainees have received all six training modules.

The arrangement and coding of slides in the slide trays for each training module has resulted from careful tesing and analysis within the CVI program development process. Alteration or modification of these six training modules or rearrangement of the slides in this basic CVI program is prohibited.

Final Test Module Design and Administration

Upon completion of all six training modules the instructor may administer the Final Test Module (Module 7, Appendix H in GTA 17-2-9). The slide tray for this module contains 60 slides, 30 of the front view and 30 of an oblique view of the vehicles included in the previous training modules. The trainees must identify each vehicle as F (friend) or T (threat), and if they don't know, they should write "DK" or place a question mark (?) on their answer sheet.

In scoring the test the trainees start with a score of 120. One (1) point is deducted of each "don't know" response, and two (2) points for each wrong answer. Thus, the penalty for making a mistake is twice as great as the penalty for admitting lack of knowledge of the name or the friend/threat status of the vehicle. If a trainee should respond "don't know" for all vehicles, a zero (0) will be scored on the test (i.e., the trainee will lose a total of 60 points for the "don't know" responses in the Friend/Threat column and a total of 60 points for the "don't know" responses in the Vehicle Description column). However, if the trainee answers all items but answers them incorrectly, his score will be -120 instead of 0. The rationale for this scoring scheme is that it is far worse in a combat situation to mistakenly kill a friendly vehicle, or to allow an enemy vehicle to gain an unnecessary advantage because the gunner erroneously believes it is friendly, than to honestly not know whether the sighted vehicle is friend or foe. In the latter case the gunner will presumably either get help in identifying the vehicle as soon as possible and/or take cover while waiting for the vehicle to move to a position where he can identify it positively.

Each slide is exposed for 8 seconds in the Final Test. A sample answer sheet is included in Appendix B of this report. Appendix H in GTA 17-2-9 contains the trainee instructions and a listing of the slides in order of presentation if the trainees have previously completed the program and taken the Final Test.

Required Training Materials

A complete set of slides for each module is included in the kit. An instructor's detailed lesson plan for each module has also been prepared. These are enclosed as appendixes to this document. These materials are referred to as the "Instructor's Kit." The information provided in the lesson plans for each slide presentation was chosen to point out those identifying characteristics of each vehicle which are most likely to be visible from that particular view at tactical ranges.

Some "nice-to-know" information is also given in the lesson plans. For example, it is stated that the Soviet PT-76 can achieve a speed of 11 km/h in the water. This information is not necessary to identify the vehicle. However, it may be of use from a tactical standpoint, and usually serves to sustain and maintain the interest of the trainees.

The slides for each module have been numbered in the sequence in which they should be presented. For example, the slide numbered 1-1 would be the first slide presented in Module 1, the slide labeled 3-48 would the 48th slide presented in Module 3, etc. It is suggested the slides be sorted in the carousels for each module in the proper sequence to prevent loss or damage. A complete sequential listing of the 65 slides for each module can be found in the Target Array lists accompanying the Instructor's Lesson Plans for each of the modules.

Sample copies of trainee answer sheets are included in Appendix A and may be duplicated locally by the instructor. Finally, the sample set of instructions to trainees has been prepared and is included in each of the 7 modules (Appendixes B through H). This and all of the other materials described above (except the slides) are included in this looseleaf binder.

Other Instructional Support Requirements

This training can be conducted in almost any classroom which can be darkened for showing photographic slides. A viewing screen, either front or rear projection, can be used. However, rear projection is recommended as the projector will not obstruct the trainees' view. If a rear projection screen is not available, one can be assembled by using wooden framing and a screen material called "Polacoat." Polacoat, or a similar material, is usually available from the local Training Aids Service Office (TASO). In most circumstances, the viewing area need be no larger than 22" wide x 15" high.

If front projection is used a beaded screen should not be used as distortion results for observers who are not viewing the screen from directly in front. A piece of white posterboard makes an excellent substitute for a screen.

The projector and screen should be placed so that the image is slightly above the head level of the seated trainees. This will insure that no trainee's view is obstructed by a trainee in a closer row. Also, the projector should not be tilted. Tilting will result in distortion of the images.

If rear projection is employed, the slides should be placed in the carousel so that the side with the identifying number faces away from the projection screen.

A slide projector with a remote handswitch and automatic timer is recommended. Carousel projectors and carousels are usually available from local TASO's. The following stock numbers are provided to make it easier to requisition suitable equipment.

- Army Stock No. 6730-00-D00-8961
  Projector, 35mm Carousel Mdl 800
  w/zoom lens

- Army Stock No. 6730-00-P-54-6445
  Projector, 35mm Carousel Mdl 850H

Many trainees will not be able to spell correctly the names of all of the vehicles in this training program. Therefore, the first time a vehicle is shown in training, the trainees should be shown the name or numerical designation of the vehicle. A set of 8-1/2" x 11" cardboard cards are provided for this purpose for each of the training modules. The cards also show an acceptable abbreviation that the trainees may use in making their reponses. The use of the abbreviations will save writing time and reduce spelling errors. These abbreviations are shown in Table 2. The instructor (or an assistant) should show the correct card to the trainees each time a vehicle is described during Section A of the training. The cards should not be used in Section B or during the module test. If the cards become damaged or lost, any other convenient presentation method will do. For example, a chalkboard or hand printed replacement cards could be used.

Arrangement of Classroom and Projection Equipment

Depending upon the unit's missions and equipment, each instructor may wish to simulate different ranges and the use of different optical devices during training. Obviously, the greater distance between the trainee and the screen, the greater will be the simulated range. In order to simulate

Table B-2. Vehicle Abbreviation

Vehicle Code No.	Vehicle	Abbreviation
1	T-62	T-62
2	BTR-60P APC	BTR-60P
3	Leopard	Leo
4	M113 APC	M113
5	Scorpion	Scorp
6	Centurion	Cen
7	M60A1	M60A1
8	Gepard (Flakpanzer)	Gep
9	AMX-13	AMX-13
10	M109 SP	M109
11	M48	M48
12	M1 (Abrams)	M1
13	Saladin	Sala
14	ZSU 23-4	ZSU 23-4
15	BTR-50	BTR-50
16	AMX-30	AMX-30
17	PT-76	PT-76
18	Scimitar	Scim
19	Marder	Marder
20	T-72	T-72
21	Chieftain	Chief
22	ZSU 57-2	ZSU 57-2
23	Jagdpanzer (JPZ 4-5)	Jagd
24	T54/55	T54/55
25	Roland	Roland
26	BMD	BMD
27	SP-74	SP-74
28	BRDM-2	BRDM-2
29	BMP-1	BMP-1
30	ASU-85	AUS-85

a particular range with a particular optical device, the instructor must insure that the projected image of the vehicle is the same size as the image that the trainee would see in the field employing that optical device at that range. The materials available in this kit permit the instructor to simulate various optical devices at several tactical ranges. Table 3 shows the instructor what ranges and optics are simulated at various distances from the screen, assuming an image properly sized for a small classroom. Table 4 provides the same information for use with a large classroom, assuming an image that is twice as large.

To adjust the size of the projected images, use the plastic "Sizing Template" which is included in the instructor's materials for each of Modules 1 through 7 (Appendixes B through H). Next, locate the "Sizing Slide." This sizing slide is included as the first slide in each of the carousel slide trays for Modules 1 through 7. Have an aide hold the template against the center of the projection screen, and project the sizing slide onto the template. Adjust the size of the projected image by moving the projector or by adjusting the zoom lens (if you have one) until the projected rectangle matches exactly one of the rectangles on the template. The inner rectangle should be used for small classrooms and the outer rectangle for large classrooms. Instructors interested in the mathematics employed in deriving the tables are referred to the Technical Note at the end of this Appendix.

Ideally, each trainee should be seated exactly in front of the screen. Obviously, only one trainee can be seated exactly in front of the screen at any given range. However, some deviation from the center will have little effect on what the trainees see. But if a trainee is too far off center the vehicles will appear to be "stubbier" than they should.

It is also important to have all the trainees who are sitting in the same row the same distance from the projected images. To do this the rows are arranged so they form part of a circle. The following procedures will accomplish this objective.

1. Measure a distance of 4 feet directly in front of the screen and place a mark on the floor.

2. Then measure a distance of 7' to either side of the mark made in Step 1 (parallel to the screen), and place a mark at both points.

3. Using tape, or a piece of string and a piece of chalk, make a line from directly under the center of the screen through both of the marks made in Step 2 and extend the lines to the classroom walls. You will now have a "V" shaped area directly in front of the screen as you see in Figure 1.

4. Decide what ranges, which size image to use, and what optical device you wish to simulate. For example, assume you wish to simulate 7x50 binoculars at ranges of 1000 meters, 1500 meters, 2000 meters, 2500 meters, 3000 meters, and 3500 meters in a small classroom. Note in Table 3 that the eye-to-screen distance for 1000 meters at 7X in a small classroom is 5'5". This will be the distance for the first row of trainees.

Table B-3. Eye-to-Screen Viewing Distance* for Small Rooms

Simulated Range (meters)	Distance From Screen to Trainees' Eyes					
	no optic	6X optics	7X optics	8X optics	10X optics	13X optics
250	9'5"	---	---	---	---	---
500	18'10"	---	---	---	---	---
750	---	---	---	---	---	---
1000	---	6'3"	5'5"	---	---	---
1250	---	7'10"	6'9"	5'11"	---	---
1500	---	9'5"	8'1"	7'1"	5'8"	---
1750	---	11'0"	9'5"	8'3"	6'7"	5'1"
2000	---	12'7"	10'9"	9'5"	7'7"	5'10"
2250	---	14'2"	12'1"	10'7"	8'6"	6'6"
2500	---	15'9"	13'6"	11'9"	9'5"	7'3"
2750	---	17'3"	14'10"	13'0"	10'4"	8'0"
3000	---	18'10"	16'2"	14'2"	11'4"	8'8"
3250	---	---	17'6"	15'4"	12'3"	9'5"
3500	---	---	18'10"	16'6"	13'2"	10'2"
3750	---	---	---	17'8"	14'2"	10'11"
4000	---	---	---	18'10"	15'1"	11'7"

*Practical viewing distances are from 5 to 20 feet, so no other distances are given. Few people can be expected to consistently identify vehicles beyond 20 feet under these conditions.

Table B-4. Eye-to-Screen Viewing Distance* for Large Rooms

Simulated Range (meters)	Distance From Screen to Trainees' Eyes					
	no optic	6X optics	7X optics	8X optics	10X optics	13X optics
250	18'10"	---	---	---	---	---
500	37'9"	6'3"	5'5".	---	---	---
750	---	9'5"	8'1".	7'1"	5'8"	---
1000	---	12'7"	10'9"	9'5"	7'7"	5'10"
1250	---	15'9"	13'6"	11'9"	9'5"	7'4"
1500	---	18'10"	16'2"	14'2"	11'4"	8'8"
1750	---	22'0"	18'10"	16'6"	13'2"	10'2"
2000	---	25'2"	21'7"	18'10"	15'1"	11'7"
2250	---	28'3"	24'3"	21'3"	17'0"	13'1"
2500	---	31'5"	26'11"	23'7"	18'10"	14'6"
2750	---	34'7"	29'8"	25'11"	20'9"	15'11"
3000	---	37'9"	32'4"	28'3"	22'8"	17'5"
3250	---	---	35'0"	30'8"	24'5"	18'10"
3500	---	---	37'9"	33'9"	26'5"	20'4"
3750	---	---	---	35'4"	28'3"	21'9"
4000	---	---	---	37'9"	30'2"	23'2"

*Practical viewing distances are from 5 to 40 feet. Few people can be expected to consistently identify vehicles beyond 40 feet under these conditions.

5. Measure the distance 5'5" on a piece of string. Have an assistant hold the end of the string exactly under the center of the screen. Tie or hold the chalk at the 5'5" mark on the string, pull it taut, and draw an arc inside the V. Every point on this arc will be exactly 5'5" from the vehicle image on the screen.

6. Repeat the process described in Step 5 for the other ranges. Note that Table 3 shows that the eye-to-screen distance for 1500 meters is 8'1", for 2000 meters it is 10'9", for 2500 meters it is 13'6", for 3000 meters it is 16'2", and for 3500 meters it is 18'10"..

7. Arrange the trainee chairs so that the front edge of each chair is on one of the arcs. Since trainees tend to lean slightly forward, the eye-to-screen distances should be very close to those desired during training.

Figure 1 shows how as many as 38 trainees could be accommodated in a classroom that measures only 28 feet by 16 feet. Ideally, groups of this size should be trained in a larger classroom with the larger size images. This example is presented only to show that it is possible to train platoon-sized groups in a relatively small classroom if necessary. Normally, class size should not exceed 15-20 trainees in a small classroom. Every effort should be made to secure a large classroom for larger groups.

If a class consists of a smaller number of trainees, or if a large classroom is available, the seats nearest the lines drawn in Step 3 should not be used. These are indicated by an "X" in Figure 1. The images appear slightly distorted from these seats due to the angle at which they will be seen. Under no circumstances should trainee chairs be placed outside the "V" described in Step 3.

Depending upon class size, the ranges and the optical device to be simulated, the instructor may use fewer chairs in any row. Naturally, as much space as possible between chairs should be maintained to reduce opportunities for cheating. The use of regular chairs and clipboards increases seating flexibility.

It should be noted that only a limited number of ranges can be simulated at any one time with the arrangement shown in Figure 1. For example, it will not be possible to simulate a 7x50 binocular at both 1000 meters and 1250 meters at the same time. The distance between the arcs drawn would be only 16 inches (6'9" minus 5'5", see Table 3), which is about the length of the chair seat, so there would be no allowance for leg room.

Those trainees in the first row for Module 1 should be in a different row (at a different range) for Module 2, and in still a different row for Module 3, etc. This guarantees that all trainees get practice at several ranges, instead of having some trainees at close ranges all the time or at long ranges all the time.

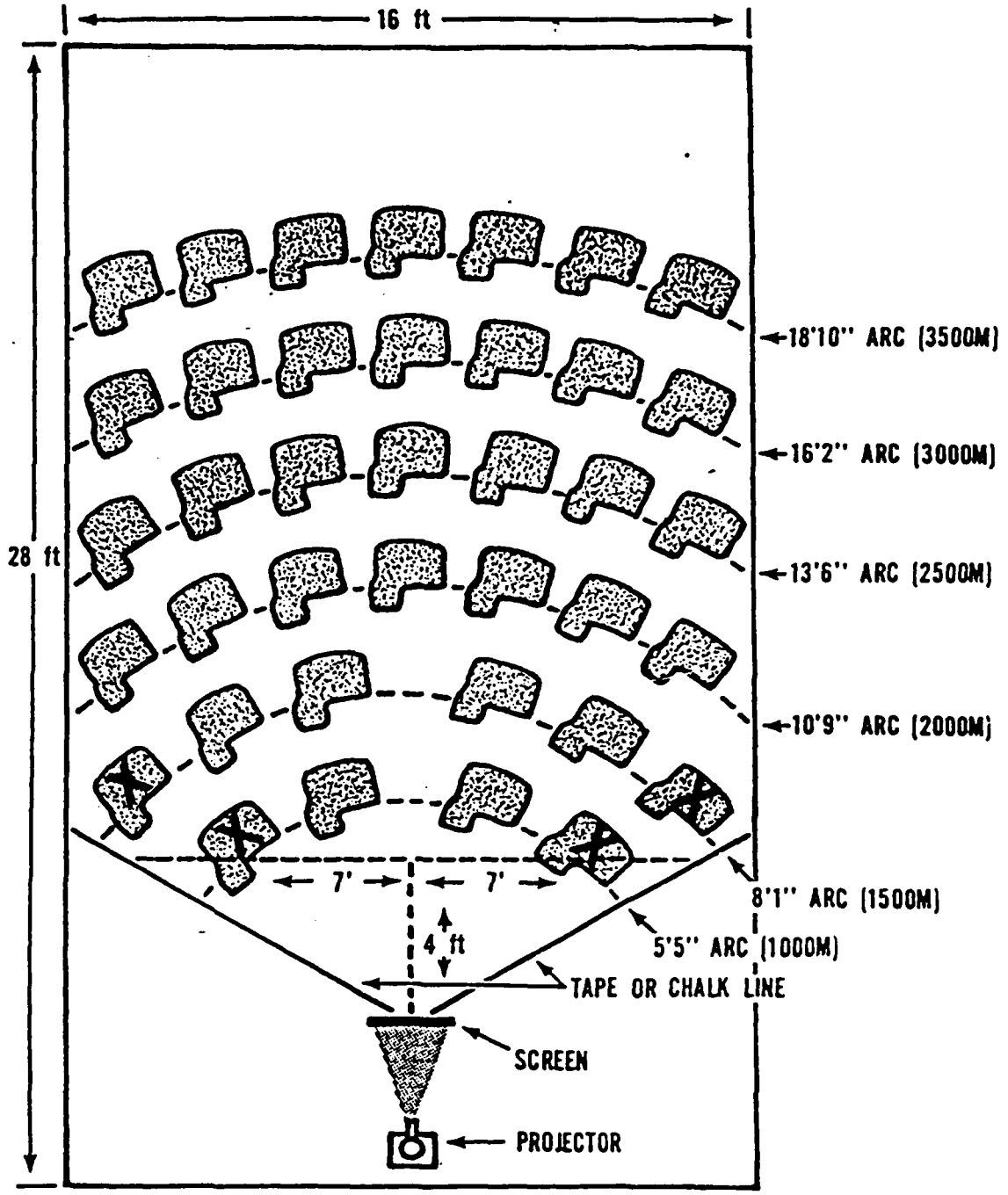

Figure 1. Classroom arrangement for simulating a 7X optic at ranges of 1000M, 1500M, 2000M, 2500M, 3000M, and 3500M in a small classroom.

Use of the Training Module Lesson Plans

The core of this Instructor's Guide and training program is the module lesson plan. There are six of these, one for each of the six training modules. They were not developed with the intent that the instructor should follow exactly every word that has been provided. However, the lesson plans should always serve as a basis and a guide in presenting the instructions.

Each of the six training modules may be used independently and interchangeably as a separate period of instruction.

Training Module Instructions

The two-part instructions are included in the front of each of the six training modules. Part 1 (reproduced below) is to be used with new trainees who have never participated in the program, or with trainees who have not participated for a long time and who may need their memories refreshed. Part 2 of the instructions should be read to each group of trainees just prior to each administration of each instructional module.

PART 1, INSTRUCTIONS TO THE TRAINEE

New weapon development is constantly increasing the ranges at which we can engage enemy targets. Ranges of 3000-4000 meters are now common. Yet, with all of the new weapons we have, the human eye still provides the best way of recognizing and identifying targets. As engagement ranges increase, vehicle identification becomes both more difficult and more important. In future wars, we can no longer expect friendly forces to be "here" and enemy forces to be "there." The battlefield is expected to be very fluid where friendly and enemy (or threat) forces intermix. We must be able to quickly and positively identify potential targets as friendly or threat, otherwise, we may kill friendly forces, or fail to kill a threat. Remember, a US vehicle is not the only friendly vehicle you will see. Our allies have them also. Their combat vehicles are different from ours, and sometimes look very much like those of nations we consider to be possible threats. A picture taken following a battle between Israeli and Arab forces illustrates this point. The picture showed an Arab tank knocked out by a finned projectile. The Arab Army was the only army using finned projectiles. They apparently had knocked out their own tank.

In all probability this happened because the Arabs were not sufficiently well trained in vehicle identification. Unfortunately, US

Army studies show that many US soldiers are also not adequately trained to identify vehicles at tactical ranges. The training you will be taking today is designed to help overcome this deficiency. You will be trained to recognize and identify armored vehicles using only those cues that you would actually be able to see at tactical ranges. At this time it is important to define the terms "Recognition" and "Identification." Recognition is being able to state whether the vehicle being shown is from a "friendly" or a "threat" nation. Identification is being able to label the vehicle being shown by either its most common or accepted name or its correct model number.

(NOTE: The instructor will have to vary the instructions in this next paragraph according to the number of students being trained, and the ranges and optical device being simulated.)

The image sizes of each vehicle you will see on the screen today are the same size you would see if you were looking through a ___ Power optical device (refer to Table 3 or 4 to select optical power and range) at specified ranges. Those of you in the front row are at a simulated range of approximately ___ meters; those of you in the second row are at a simulated range of ___ meters; and those of you in the third row are at a simulated range of ___ meters (etc., for additional rows).

All vehicles that you'll see have been photographed as if you were viewing the vehicle from slightly above, as though you were on a hilltop or in a low-flying helicopter.

Before I give you the instructions on the procedures that we will follow, I would like to emphasize that you will be tested ONLY on your ability to recognize and identify the various combat vehicles. Comments regarding vehicle weight, caliber of weapon, crew composition, and speed, are intended to relieve monotony and make the program more interesting to you. They do not help you recognize or identify the vehicles, and you will not be tested on them.

Are there any questions?

PART 2, INSTRUCTIONS TO THE TRAINEE

I would now like to review the procedures we'll follow.

The training program is composed of six modules or parts. Each module consists of five different combat vehicles and is independent of all other modules. At this time we will be looking at Module ___. You will see each vehicle in five different views:

1. Side Right
2. Side Left
3. Oblique Right
4. Oblique Left
5. Front

Each module, including this one, is divided into three sections:

1. Section A is a "Manual Presentation Sequence." By this, I mean I will control the presentation time of each slide. Each vehicle will be thoroughly discussed and you will get immediate feedback on whether you have correctly or incorrectly recognized or identified the vehicle being shown.

2. Section B is an "Automated Presentation Sequence." Each slide will be shown for 15 seconds and will then change automatically. I will provide comment the same as in Section A.

3. Section C is the test for the module. You will be tested only on your ability to recognize and identify each vehicle, nothing else. Each slide will be presented for 8 seconds and will then change automatically.

I will review each test slide with you after the answer sheets and work sheets have been collected.

If you'll look at the handout(Appendix A of this manual)in front of you, you will see that the first page requests information about your job, your MOS, your unit, and several other factors related to target identification capability. Please fill out the blanks on this information sheet at this time, and PLEASE PRINT. I'll be glad to answer any questions if you don't understand what is needed.

(Instructor: Allow time for trainees to complete the form.)

The second page is the work sheet for the Manual Presentation Sequence. Let's look at the example at the bottom of the page. These are five of the most common types of responses that you'll make. Each time I show a slide, I want you to indicate whether the vehicle is a friend or a threat by placing an "F" or a "T" in the blank by the trial number. If you don't know, just write "DK" for "don't know," or put a question mark (?) in the blank. Next, I want you to name the vehicle if you can. Either the numerical designation or the common name will do. For example, I wouldn't care whether you called the M-1 by that designation or whether you called it the Abrams. Again, if you don't know, simply write "DK" or place a question mark (?) in the column under "Vehicle Description." Notice in the example that it is alright to call a vehicle a friend or a threat, even if you don't know the name. However, do not guess. I'm scoring your test at the end of the module. You will lose more points for an incorrect answer than a "don't know" answer. Any questions on how to complete the answer sheets?

(Instructor: Answer any questions before going on.)

Alright, each time I show a slide I want you to fill in the blanks in the way I just described. After you have had time to record your answers, I'll tell you whether it is a friend or a threat, the name of the vehicle, and I will point out some features that will help you distinguish that particular vehicle. I will also answer any questions about the vehicle.

Now, look at the third page. Note that it is called "Section B: Automated Presentation Sequence." We will do the same things we did in Section A, except that I will not answer any questions at this time. Also, each slide will be shown for only 15 seconds.

Now, look at the last page. This is called "Section C: Module Test." During this portion each slide will be shown for only 8 seconds. I will not give you any information or answer any questions during this part. However, after I have collected your answer sheets, I will be glad to discuss any part of the training with you.

Before we begin, notice that in the upper right hand corner of each of the four sheets there are four blanks. Fill in today's date, which is _____. Just below the date is a blank for Module Number. Please write the number _____ in that space on all four sheets.

> (Instructor: Tell the trainees which Module Number to put in the blank. It is not necessary to start all trainees with Module 1.)

Just below the Module Number is a blank for the Optical Power of the binoculars or other simulated optical device you are using. Please write the number _____ in that space on all four sheets. Just below that is a blank for Range. You on the front row, write in the number ____ meters; you on the second row, write in the number ____ meters; and you on the third row, write in the number ____ meters(etc., for additional rows). Now write in your name and rank in the space provided. Please fill in all blanks on all four sheets.

> (Instructor: Allow time for trainees to fill in blanks.)

If there are no further questions, we'll begin the training. Get your pencils ready.

(Instructor:

1. The room lights should be lowered at this time. However, there must still be enough light for the trainees to see their answer sheets without difficulty, and for the instructor to see the lesson plan.

2. Many trainees have difficulty spelling the names of the vehicles. Therefore, the first time a vehicle is shown in Section A (Manual Presentation Sequence) the name or proper numerical designation should be shown to the trainees. The abbreviations should also be shown (see Table 2), and the trainees should be told they can use the abbreviations to save time in writing their answers. Cards with vehicle abbreviations have been provided for this purpose. However, any convenient presentation method will do. For example, if a chalkboard is available, the names, abbreviations or numerical designations can be written on the board. Be sure the writing is large enough to be seen at the lowered light level. At the end of Section A, these cues should be removed.

3. Just prior to the Module Test, read the instructions below.)

We are now ready for the Module Test, but first, I want to make a point. Be sure you use the actual name, the abbreviation, or the numerical designation when naming the vehicles. For example, if you labeled the US M60A1 tank only as a US tank, I would count it as a wrong answer. Use only those names I have shown you. Also, do not make wild guesses. You will lose 10 points for each incorrect answer. However, if you don't know the answer and write "DK" or put a question mark (?) in the blank, you will lose only 5 points. Alright, let's begin.

END OF TRAINEE INSTRUCTIONS

Optimum Use of This Program

It is recommended that no more than two hours of training be presented at any one training session. More time can result in eye fatigue and in the trainees becoming confused. Either will result in less efficient use of valuable training time. It is also recommended that the training be repeated periodically to refresh recognition/identification skills.

Factors Influencing Training

The performance of trainees on the Module Tests will be influenced by several factors. Among them are:

- o Trainees at a simulated range of 4000 meters will probably not perform as well as those at a simulated range of 2000 meters.
- o Variation in eyesight will affect performance and instructors should insure that trainees who normally wear glasses on the job wear them during training.
- o Trainees are working under ideal field conditions in the training. That is, the simulation approximates what would be seen on a very bright and extremely clear day. Such ideal conditions are not likely to exist on the battlefield. Therefore, trainees can be expected to be accurate at somewhat greater ranges in training than they would be on the battlefield.
- o Fundamental to any good performance is interest in learning. A trainee who isn't interested won't learn.

If the foregoing factors are taken into account, trainees in a small classroom who are within 20 feet of the projection screen should be expected to score 90% or more on the Module Tests. If the large size images are employed, the same result should be found for trainees who are within 40 feet of the screen. In developing this program it was found that approximately half the trainees within these distances scored 100%.

TECHNICAL NOTE

COMPUTATIONAL METHOD FOR TARGET SIZING AND VIEWING RANGE

The models employed in making the photographs for this training program were HO (1:87) scale. Therefore, when viewing one of these models from a distance of 1 meter, the size of the image on the retina of the eye will be the same as that of the full-scale vehicle when viewed from 87 meters. The sizing method described in this guide, employing the inner rectangle on the sizing template, was designed to make the projected image exactly the same size as the HO scale model vehicle. As a result, with the unaided eye, the projected image will be 1/87 the size of the real vehicle. Suppose that you wish to simulate a range of 500 meters for training. The projected image would have to be viewed at 500 - 87 = 5.7471 meters to appear the same size as the full-scale vehicle at 500 meters. To convert meters to feet we multiply by 3.2808. Therefore, 5.7471 x 3.2808 = 18.8552 feet. To convert decimal fractions of feet into inches, we multiply by 12. Hence, .8552 x 12 = 10.26 inches. In other words, rounded to the nearest inch, a soldier with no optical device would see the projected image from 18 feet, 10 inches as the same size as the full-scale vehicle at 500 meters. You can see from Table 3 on page 9 that this value has been entered opposite 500 meters.

The same general reasoning holds when simulating an optical device for this training program. For example, suppose that you wish to simulate a range of 2000 meters and a 7 Power optical device. With the device, the retinal image would appear the same size as that seen without the optic at 2000 - 7 = 285.7143 meters. However, the image being viewed is only 1/87th the size of the full-scale vehicle. Therefore, the projected image would appear to be the same size at 285.7143 - 87 = 3.2841 meters. Converting this to feet and inches in the same manner described above, this equals 10 feet, 9 inches. This value can also be seen in Table 3 opposite 2000 meters in the column for the 7 Power optic.

If the size of the projected image were doubled (i.e., if the outer rectangle is used), all of the viewing distances shown in Table 3 would also be doubled, which they are as seen in Table 4. A general equation for computing the viewing distance is shown below:

$$\text{Distance} = \frac{\text{Size of image}}{\text{Actual size}} \times \frac{(\text{Range in meters}) \times (3.2808)}{(\text{power of optic}) \times (87)}$$

Where:

Distance--the distance in feet between the projected image and the trainees' eyes.

Size of image--the size (length in mm) of the image projected on the screen.

Actual size--the true size (length in mm) of the HO vehicle being projected.

Range in meters--the full-scale range in meters which the instructor wishes to simulate.

Power of optic--the power of the optical device the instructor wishes to simulate, e.g., unaided eye = 1, 7 Power bincoulars = 7, etc.

It should be noted that the sizing procedure described in the guide with the inner rectangle is designed so that "Size of Image" and "Actual Size" are the same. Therefore, the first part of the equation (size of image - actual size) = 1. As a result, so long as the inner rectangle is employed, the equation reduces to:

$$\text{Distance in feet} = \frac{(\text{Range in meters}) \times (3.2808)}{(\text{power of optic}) \times (87)}$$

Using these equations, the instructor can compute the classroom viewing distance to simulate any full-scale distance or any optical device that is currently employed or may be employed in the future.

APPENDIX C

Module No. _____
Seat # _____

SOLDIER WORK SHEET

SOLDIER NAME _____ RANK _____

MODULES 1-6

Section A: Manual Presentation Sequence

Trial	Friend/ Threat	Vehicle Description	Trail	Friend/ Threat	Vehicle Description
1	_____	_____	14	_____	_____
2	_____	_____	15	_____	_____
3	_____	_____	16	_____	_____
4	_____	_____	17	_____	_____
5	_____	_____	18	_____	_____
6	_____	_____	19	_____	_____
7	_____	_____	20	_____	_____
8	_____	_____	21	_____	_____
9	_____	_____	22	_____	_____
10	_____	_____	23	_____	_____
11	_____	_____	24	_____	_____
12	_____	_____	25	_____	_____
13	_____	_____			

Module No._____
Seat # _____

SOLDIER WORK SHEET

SOLDIER NAME_____ RANK_____

MODULES 1-6

Section B: Automated Presentation Sequence

Trial	Friend/ Threat	Vehicle Description	Trial	Friend/ Threat	Vehicle Description
26	_____	_____	39	_____	_____
27	_____	_____	40	_____	_____
28	_____	_____	41	_____	_____
29	_____	_____	42	_____	_____
30	_____	_____	43	_____	_____
31	_____	_____	44	_____	_____
32	_____	_____	45	_____	_____
33	_____	_____	46	_____	_____
34	_____	_____	47	_____	_____
35	_____	_____	48	_____	_____
36	_____	_____	49	_____	_____
37	_____	_____	50	_____	_____
38	_____	_____			

Date: _____
Optical Power ____
Range _____

SOLDIER ANSWER SHEET (PAGE 1)

SOLDIER NAME _____ RANK _____

MODULE 7

Final Test

Trial	Friend/ Threat	Vehicle Description	Trial	Friend/ Threat	Vehicle Description
1	_____	_____	16	_____	_____
2	_____	_____	17	_____	_____
3	_____	_____	18	_____	_____
4	_____	_____	19	_____	_____
5	_____	_____	20	_____	_____
6	_____	_____	21	_____	_____
7	_____	_____	22	_____	_____
8	_____	_____	23	_____	_____
9	_____	_____	24	_____	_____
10	_____	_____	25	_____	_____
11	_____	_____	26	_____	_____
12	_____	_____	27	_____	_____
13	_____	_____	28	_____	_____
14	_____	_____	29	_____	_____
15	_____	_____	30	_____	_____

APPENDIX D

NAME_____
RANK_____
ORGANIZATION_____
DATE_____

1. I observed training/testing on the following media.

35mm Slides	Pre Test	Mod 1	Mod 2	Mod 3	Post Test
Bessler	Pre Test	Mod 1	Mod 2	Mod 3	Post Test
Video Tape	Pre Test	Mod 1	Mod 2	Mod 3	Post Test

2. Rate the media on the following characteristics:

Quality of Image	Very Clear	Clear	Marginal	Somewhat Degraded	Degraded
Slides					
Bessler					
Video tape					

Training Effectiveness	Very Effective	Effective	Marginal	Somewhat Effective	Ineffective
Slides					
Bessler					
Video tape					

Ease of Use by Trainer	Very Difficult	Somewhat Difficult	Marginal	Easy	Very Easy
Slides					
Bessler					
Video tape					

Suitability for Soldiers of Differing Abilities	Highly Unsuitable	Unsuitable	Marginal	Suitable	Highly Suitable
Slides					
Bessler					
Video tape					

Level of Student Interest	Very High	High	Moderate	Low	Very Low
Slides					
Bessler					
Video tape					

3. What did you like most about each of the media?

Video Tape

Slides

Bessler

What did you like least?

Video Tape

Slides

Bessler

4. Under what Training conditions would you use each of The Media?

Bessler

Video Tape

Slides

5. How similar did you feel the Training programs were?

	Very Similar	Somewhat Similar	Similar	Somewhat Dissimilar	Very Dissimilar
Video vs Slide	_____	_____	_____	_____	_____
Video vs Bessler	_____	_____	_____	_____	_____
Slide vs Bessler	_____	_____	_____	_____	_____

APPENDIX E

Soldier Comments on the Media

Video

Training

...sufficient for a refresher course...(E-6)
...was a good way to train...(E-7)
...the training gave the information in depth. It explained everything in detail...(E-7)

Image Range

...close up shots in first session would help...(E-7)
...at the range of 1500 meters the vehicles were easily identifiable...(E-7)

Image Quality

...if actual vehicles rather than models were used, it would have been better...(E-7)
...high resolution ...(E-7)
...was able to tell by sight most of the tanks shown...(E-3)
...vehicles were lifelike, and blend in with the landscape...(E-4)
...with the camouflaged vehicles the outline of vehicles was hard to distinguish...(E-5)

Other Comments

...good description, pleasing informational format...(E-7)
...I felt well informed...(E-3)
...the clues given during the tape were very helpful...(E-2)

Training

...the training was satisfactory...(E-5)
...good as review lesson technique but not sufficient as first time lesson for new students...(E-5)
...it was satisfactory...(E-2)
...a great improvement over previous instruction...(E-6)
...very good for learning...(E-6)
...I think that it is the best possible way...(E-4)
...Bessler is a good training method...(E-7)
...I liked the way they kept repeating the tanks...(E-2)
...the Bessler is a good training service...(E-6)
...a good system...(E-4)

Image Quality

...could not see clear...(E-6)
...the pictures were very hard to see...(E-3)
...the "picture quality" was not that good...(E-6)
...picture wasn't clear...(E-3)
...detail not too good...(E-7)
...it was clear...(E-3)
...pictures were not clear...(E-5)
...the images were slightly out of focus...shadows in the pictures...(E-7)
...some items were shaded out...9E-3)
...the vissin is deam...(E-2)
...the pictures were not always in focus...(E-4)
...some of them were too light...(E-7)
...the use of scale models does not lend itself to accurate ID, i.e., artificial light conditions. Background not in proportion...actual photos would be much more effective...(E-4)

Image Range

...good because the pictures represented what you would see at a distance...(E-3)
...too small of picture to pick out details...(E-6)
...pictures were too small on Bessler...(E-2)

Mechanical Problems

...the machine had quite a few malfunctions. The tape and pictures weren't always together...(E-4)
...machine worked poorly. Missed materiel...(E-7)
...the machine would malfunction...(E-6)
...audio did not correspond to visual, required to change Bessler...(E-8)

Bessler continued:

Narrative

...clear, good sound...(E-7)
...background info very helpful...(E-3)

Image Range

...models used were of fair quality - photos poor...was placed at 3500 meter range row...(E-5)
...I don't feel that you can effectively learn to identify vehicles by only looking at a tiny slide. one must see the vehicle larger and more closely to realize some of the details...(E-7)
...hard to pick out details...(E-5)
...too far away (3500 meters)...(E-4)
...they were hard to see from 3500m...(E-4)
...some of the slides were hard to see...(E-6)

Image Quality

...the slides looked good for the most part...(E-7)
...satisfactory visually, able to determine difference in vehicles...(E-6)
...the slide view showed clear pictures...(E-4)