ARI Newsletter

Volume 15, Issue 2 www.ari.army.mil September 2005

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

Inside this issue:

New Screening Tool Boosts Recruiting

ARI's new Tier Two Attrition Screen (TTAS) has made it feasible for the Army to implement a new market-expansion pilot program for enlisting qualified non-high school diploma graduates (NHSDGs). With TTAS, the Army plans to expand its recruiting of nongraduate accessions. The goal of this program is to help the Army meet its FY05 and FY06 recruiting missions in an extremely challenging recruiting environment.

First-term enlisted attrition continues to be a persistent problem for the Army. Such attrition is disruptive, degrades unit performance, and wastes valuable training and recruiting resources. As the Army transforms to the Future Force, to include a temporary increase in size while simultaneously fighting the Global War on Terror, effective attrition management in conjunction with improved recruiting and retention programs will be a key requirement for Army effectiveness.

The Army, along with the other Services, places a premium on recruiting high school diploma graduates (HSDGs), because earning a high school diploma is predictive of an individual's potential for adapting to military life. The first-term attrition rate among HSDG's is about two-thirds the rate for non-high school diploma graduates (NHSDGs). Historically, approximately half of the NHSDG recruits fail to complete their initial term of enlistment. Although some NHSDGs do make very good Soldiers, collectively their high attrition is costly to the Army, reduces available manpower for deployment, and reduces the pool of potential Noncommissioned Officers for the Future Force.

With our nation at war, and an improving domestic economy, the Army is facing an extremely challenging recruiting environment. Unfortunately, the challenges of meeting its manpower requirements are likely to continue well into the future. Due to their relatively high first-term attrition rates, the Department of Defense limits the percentage of NHSDG that the Army can bring in for any given year to 10% of their enlisted accessions. However, NHSDG recruits are relatively plentiful in the youth market and many wish to serve in the military. At present, the Army is not fully capitalizing on this segment of the youth market; and, as mentioned earlier, some of these NHSDG would go on to become highly successful Soldiers.

ARI's New Tier Two Attrition Screen (TTAS)

Given the ongoing recruiting challenges and the tight recruiting budgets, the U.S. Army Accessions Command (USAAC) and ARI recognized the value of finding ways to expand the youth market and include NHSDG. To do this, ARI began work on an attrition screening method that could make recruiting from this market more viable by developing a new measure, or tool, for assessing attrition propensity among this high-risk NHSDG population. The goal here was to validate a tool to identify nongraduate

U.S. Army Research Institute for the Behavioral and Social Sciences
Website: www.ari.army.mil

Director: 703.602.7798 ● DSN 332.7798
E-mail: ARI_DIR@ari.army.mil

Technical Director:
703.602.7766 ● DSN 332.7766
E-mail: ARI_TECHDIR@ari.army.mil

Armored Forces Research Unit (Fort Knox)
502.624.2613 ● DSN 464.2613
E-mail: ARI_AFRU@ari.army.mil

Army Personnel Survey Office
703.602.7858 ● DSN 332.7858
E-mail: ARI_APSO@ari.army.mil

Army Trends Analysis Research Unit
703.602.7852 ● DSN 332.7852
E-mail: ARI_ATAG@ari.army.mil

Force Stabilization Research Unit (Boise)
208.334.9390 ● DSN: None
E-mail: ARI.FSRU@ari.army.mil

Fort Bragg Scientific Coordination Office
910.396.0874 ● DSN 236.0874
E-mail: ARI_BRAGG@ari.army.mil

Infantry Forces Research Unit (Fort Benning)
706.545.5589 ● DSN 835.5589
E-mail: ARI_IFRU@ari.army.mil

JFCOM Scientific Coordination Office (Suffolk)
757.203.3306 ● DSN 668.3306
E-mail: ARI_JFCOM@ari.army.mil

Leader Development Research Unit (Fort Leavenworth)
913.684.9753 ● DSN 552.9753
E-mail: ARI_LDRU@ari.army.mil

Occupational Analysis Office
703.602.7826 ● DSN 332.7826
E-mail: ARI_OAO@ari.army.mil

Plans and Programs Office
703.602.7975● DSN 332.7975
E-mail: ARI_PPO@ari.army.mil

Research and Advanced Concepts Office
703.602.7935 ● DSN 332.7935
E-mail: ARI_RACO@ari.army.mil

Management Support Office
703.602.8025 ● DSN 332.8025
E-mail: ARI_RSG@ari.army.mil

Rotary-Wing Aviation Research Unit (Fort Rucker)
334.255.9318 ● DSN 558.9318
E-mail: ARI_RUCKER@ari.army.mil

Selection and Assignment Research Unit
703.602.7763 ● DSN 332.7763
E-mail: ARI_SARU@ari.army.mil

Simulator Systems Research Unit (Orlando)
407.384.3981 ● DSN 970.3981
E-mail: ARI_SSRU@ari.army.mil

TRADOC Scientific Coordination Office
757.788.5623 ● DSN 680.5623
E-mail: ARI_TRADOC@ari.army.mil

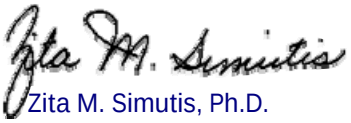
MESSAGE FROM THE DIRECTOR

The articles in this issue of the ARI Newsletter represent primary areas of our research program. The first article describes one of our top technical accomplishments in FY05 that is helping the Army meet its recruiting mission in an extremely challenging wartime environment. The Assessment of Individual Motivation (AIM) is part of a screening tool we developed to identify better recruiting candidates from the non-high-school degree graduate population. The Two-Tier Attrition Screen (TTAS) uses a body-mass index, scores from ASVAB composites, and AIM to identify non-grads who are most likely to adapt to Army life and are likely to have lower attrition rates. TTAS became operational in April 2005.

The next two articles are from our training research program. The first describes a research-based study to develop techniques to train Warrior Ethos in new recruits as they go through their initial entry training program. The second provides the results of experiments to maximize training of a new capability that Infantry Soldiers will have in the Land Warrior System. This new capability reduces exposure to enemy fire by allowing Soldiers to aim their weapons via a sight projected on a helmet mounted display. The research described in this article looks at how best to train Soldiers to take full advantage of this new technology.

The fourth article describes an ARI developed approach to training critical thinking skills that is being used in the Armor Captain's Career Course to train leaders who are deployed to Bosnia, Iraq, and Afghanistan; and, the final article in this issue discusses the results of the first stage of a project that is tracking the impact of the new Unit-Focused Stability manning system implemented in the 172nd Stryker Brigade Combat Team in Alaska. The goal of this research is to understand and track the impact of this new system on unit cohesion and readiness over a 3-year period.

I am very proud of the research and analyses our behavioral and social scientists conduct and the contributions that ARI continues to make to the U.S. Army. As the Army's primary behavioral and social science laboratory, our goal is to ensure that our Soldiers and their leaders are trained and ready to face today's challenges and are prepared to meet future challenges.



Zita M. Simutis, Ph.D.
Director and Chief Psychologist
of the United States Army

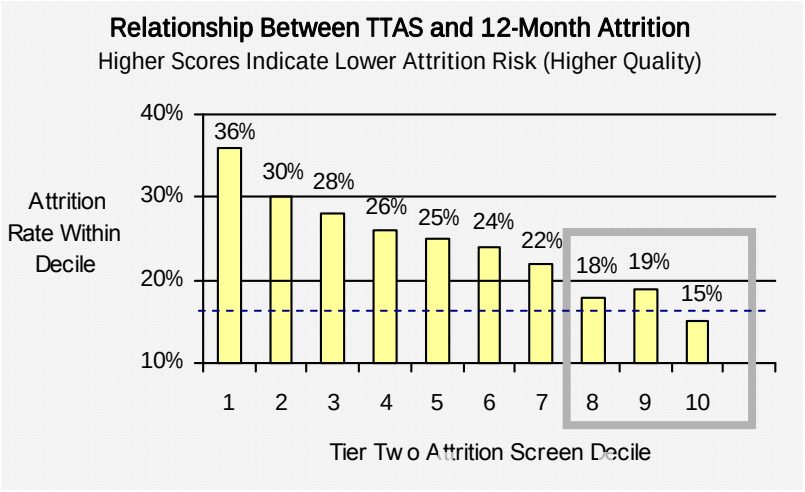
New Screening Tool Boosts Recruiting

recruits who would perform more like high school graduates – that is, they would be more likely to successfully adapt to military life and complete their first term of enlistment.

Our new NHSDG attrition-risk indicator is known as the Tier Two Attrition Screen (TTAS). TTAS uses a "whole person" assessment approach for evaluating NHSDG attrition risk by incorporating measures from the physical, cognitive, and motivational domains. Specifically, TTAS includes: (a) ARI's Assessment of Individual Motivation (AIM), a self-report, faking-resistant test of job-related motivational attributes; (b) a gender-specific Body Mass Index (BMI); and (c) selected subtest scores from the Armed Services Vocational Aptitude Battery (ASVAB). The ASVAB is used by the U.S. military services for selecting service members and assigning them to their military jobs. The BMI and ASVAB information is routinely collected during applicant processing and is readily available from automated personnel databases. AIM is administered as a special Army test at Military Entrance Processing Stations (MEPS) nationwide.

ARI developed TTAS using a longitudinal sample of 21,432 NHSDGs entering the Army between 2000 and 2003. Our research findings, presented at the 2004 Army Science Conference, showed that nongraduate recruits with higher TTAS scores (top 30%) had attrition rates comparable to those of high school diploma graduates.

The chart on the right shows the relationship between TTAS scores and 12-month attrition among 8,704 NHSDG recruits. *Lower* scores on TTAS are associated with *higher* attrition risk. For example, those recruits who scored in the lowest 10% on TTAS (i.e., decile 1) had the highest 12-month attrition rate (36%). As the chart shows, the observed attrition rate falls as one moves from decile 1 to decile 10 (where each decile represents the relative ranking on TTAS). Importantly, those scoring within the top 30% on TTAS (i.e, deciles 8 -10, shown within the shaded box) have an attrition rate which is comparable to that of high school graduates. For purposes of comparison, the overall high school graduate attrition rate (17.6% between 2000 and 2003) is indicated by the horizontal dotted line.



In sum, our findings indicate that TTAS is a valid index for identifying NHSDG recruits with a higher probability of completing their first term of enlistment and successfully adapting to Army life. This new assessment measure also provides valuable information that is not currently captured by traditional quality indicators such as education credential and the Armed Forces Qualification Test (AFQT) used by the services for recruiting.

2005 TTAS Implementation

A TTAS program was fully implemented in April 2005 and is projected to continue through September 2006. Under this program, high TTAS-scoring NHSDG recruits, who are projected to have lower attrition rates more comparable to high school graduates, will be given incentives that are normally restricted to graduates. These recruits must also meet other qualifications, such as scoring above average on the AFQT (i.e., within Test Category I-IIIA). The program to bring in these NHSDG will help the Army access additional recruits in FY05 and FY06. With the benefit of ARI's TTAS, the Army is now expanding the nongraduate market without sacrificing recruit quality. This measure is also providing more opportunities for recruiters to succeed in an extremely difficult recruiting environment.

The Army and ARI plans to track the future performance of TTAS accessions, and explore the possibility of expanding the TTAS concept to other groups (e.g., lower aptitude high school graduates) that currently have limited enlistment opportunities. When the recruiting market improves, the TTAS assessment measure could also be used to "screen out" Army applicants with the highest attrition risk.

For additional information contact Dr. Mark Young, Selection and Assignment Research Unit, Arlington, VA,ARI_SARU@ari.army.mil.

ARI SCIENTISTS WIN 2005 SMALL BUSINESS INNOVATION RESEARCH AWARD

Dr. Peter Legree from the Research and Advanced Concepts Office and Dr. Joseph Psotka from the Leadership Development Research Unit were honored at the 2005 Army Small Business Innovation Research (SBIR) Phase II Quality Awards Ceremony hosted by the Honorable Claude M. Bolton, Jr., Assistant Secretary of the Army for Acquisition, Logistics and Technology. The Quality Award is for their research management of Pearson Knowledge Technologies (PKT), the developer of products and services using automated text analysis for education and online collaborative learning. The company was 1 of 7 selected out of 240 eligible companies to earn this honor.

The Army's Quality Awards recognize SBIR Phase II research and development (R&D) that is bringing innovative technologies and products to market. Award winners are selected based on four criteria: *originality and innovation of research; relevance of the research to the Army mission; immediate commercialization potential of the research; and overall quality performance of the project*. SBIR is a government set-aside program designed to foster R&D in small businesses. Pearson Knowledge Technologies used its SBIR contract to develop software agents that monitor, moderate, and evaluate contributions in online discussion groups that are being used for Army officer education at the Command and General Staff College at Fort Leavenworth and in the Army War College distance learning program.

Pearson Knowledge Technologies bases their products and services on the only automated text analysis technology that evaluates the meaning of whole passages – their Knowledge Analysis Technologies™ (KAT) engine. This engine immediately measures writing and content in a way that simulates a skilled human grader and encourages better subject knowledge. Pearson Knowledge Technologies' writing and reading skills products, such as *Intelligent Essay Assessor* and *Summary Street*, use the KAT engine to help improve writing, reading and comprehension skills as well as build content knowledge for education and other markets.

ARI SCIENTISTS PARTICIPATE IN THE SOCIETY OF INDUSTRIAL & ORGANIZATIONAL PSYCHOLOGY 2005 Annual Meeting in Los Angeles, CA

Drs. Jay Goodwin and Stan Halpin chaired sessions, and Drs. Tonia Heffner, Scott Shadrick, and Michelle Zbylut presented papers. Others participating were Drs. Kelly Ervin, Susann Nourizadeh, Kim Owens, Joel Rodriguez, Jennifer Solberg, Jennifer Tucker, Len White, and Mark Young

Papers included:

Goodwin, G. F., Fallesen, J. J., Herman, J. L., & Shuffler, M. L. *Person-occupation fit in the Army: Impact on Career Decisions*; part of a Panel on Assessing Person Environment Fit for Selection.

Burke, C. S., Goodwin, G. F., Salas, E., Halpin, S. M. (2005, Apr). *Army leaders in teams: Knowns, unknowns, and a map for the future.* In D.V. Day & S. M. Halpin (Chairs), Leader Development Theory and Research in the United States Army.

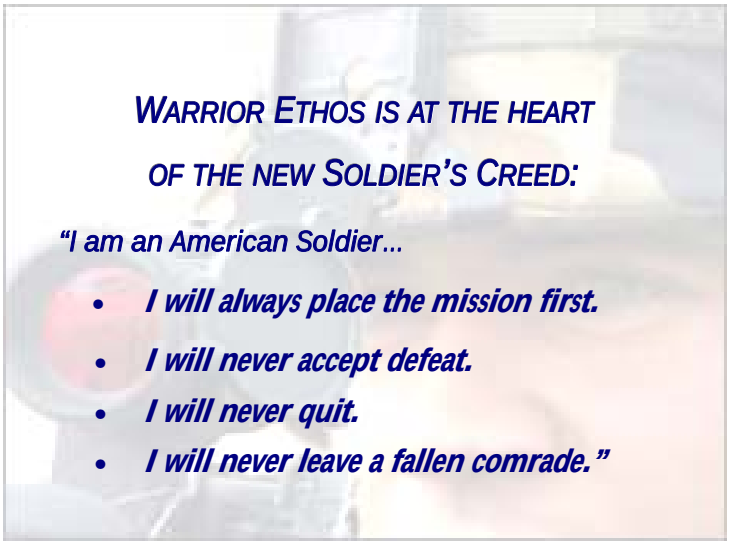
Goodwin, G. F. (2005, Apr). *Beyond the classroom: Training and Development in the 21st Century* (Chair)

Shadrick, S. (2005, Apr). *Technology integration in training and education.* In J. L. Kottke (Chair), The Evolution of Applying Technology to Teaching: Chalkboard to PowerPoint©.

Zbylut, M., Ward, J. N., & Mark, J. D. (2005, Apr). *Constructivism in training: A comparison of two interactive training tools*.

Van Iddekinge, C. H., Roth, P. L., Sager, C. E., & Heffner, T. S. (2005, Apr*). A construct-oriented investigation of a structured employment interview.* In U. Klehe & C. H. Van Iddekinge (Chairs), New Directions in Research on Structured Interview Validity.

Training Warrior Ethos



The emphasis on Warrior Ethos is to ensure that all Soldiers, regardless of branch or military occupational specialty, are successfully prepared to engage the enemy in close combat as part of a well-trained team. Warrior Ethos defines all American Soldiers and units, be they combat arms, combat support, or combat service support.

One of the goals of the Army Chief of Staff is to inculcate Warrior Ethos into all Soldiers and leaders. In support of this goal, ARI's Infantry Forces Research Unit at Fort Benning, is conducting research to determine the specific attributes and behaviors of Warrior Ethos and to develop new methods for training and assessing Warrior Ethos.

This article describes our initial work which is primarily focused on training Warrior Ethos in new recruits during Initial Entry Training (IET). The research is being conducted under the Army's Small Business Innovative Research (SBIR) program with The Wexford Group International.

The goals of the initial work are to:

- *Refine and operationalize the 2003 definition of Warrior Ethos*
- *Develop a method for inculcating Warrior Ethos into Army Soldiers*

Defining and Measuring Warrior Ethos Attributes

To accomplish these goals, a front-end analysis was conducted that included a review of relevant literature and theory, interviews with personnel with combat experience, and coordination with the Chief of Staff's Task Force Soldier and select personnel at the United States Military Academy.

Based on the results of the front-end analysis, seven attributes were identified that reflect the core psychological and behavioral elements of the four tenets of Warrior Ethos *(Mission First, Never Accept Defeat, Never Quit, Never Leave a Fallen Comrade).* These seven attributes are shown in Table 1.

Next, a framework was developed for measuring Warrior Ethos by linking the 7 attributes to the 31 individual Warrior tasks and 9 Warrior Battle Drills recently identified by the Warrior Task Site Selection Board. The Warrior Drills simulate stressful combat situations and provide Soldiers with opportunities to demonstrate Warrior Ethos. For each Warrior task and drill, we identified behaviors that both do and do not reflect the attributes of Warrior Ethos.

Table 1. Attributes of Warrior Ethos

ATTRIBUTE	BEHAVIORAL DEFINITION
Perseverance	Draws on sources of inner strength to endure adverse conditions and persist
Ability to set priorities	Prioritizes work based on an understanding that all tasks must be performed
Ability to make trade-offs	Makes trade-offs in the application of tactics, techniques, and procedures
Ability to adapt	Adapts, by smooth reaction, to changes in mission and unexpected, often unpleasant, surprise
Ability to accept responsibility for others	Assumes the workloads of Soldiers who fail to perform
Ability to accept dependence on others	Depends on comrades for assistance and personal security
Motivated by a higher calling	Understands the reason for fighting and believes that it is right

Training Warrior Ethos

Table 2 provides examples of behaviors that are consistent and inconsistent with Warrior Ethos for one of the Warrior Battle Drills - *React to Contact.*

Warrior Ethos Training

New Warrior Ethos training tools are being developed that will allow students to discover their own problem-solving strategies, resulting in more flexible Soldier behavior. Our approach does not attempt to train Warrior Ethos per se, but is focused on training behaviors that are consistent with particular attributes of Warrior Ethos. Soldiers are given the opportunity to learn a range of behaviors and strategies that are consistent with Warrior Ethos and are robust across a range of operational conditions.

The Soldier, for example, should not simply learn the rule, "*never accept defeat."* Rather, the Soldier should be given the opportunity to discover various strategies that enable him or her to succeed in the face of adversity and changing conditions.

Through this process, the Soldier discovers the knowledge, skills, and abilities that support and shape the emergence of a tenet of Warrior Ethos -- *never accept defeat.*

Initial Entry Training is currently a 9-week program that covers a wide range of skills and soldier fundamentals. The amount of information covered and the pressures within the course to prepare soldiers for their advanced training courses make it difficult to insert a new program of instruction (POI) for Warrior Ethos. Rather, our approach is to improve the training and assessment of Warrior Ethos by increasing Instructor and Soldier awareness of Warrior Ethos within the current training by modifying existing training exercises and warrior drills to provide opportunities for inculcating Warrior Ethos. Also, by using train-the-trainer procedures, instructors can learn different methods for recognizing and assessing appropriate Soldier behavior as well as how they can instill operational applications of Warrior Ethos.

Conclusions

The new Warrior Ethos training methods and assessment tools developed in this project will be tested during IET. Since "Soldierization" begins at the training center Reception Station, the trial interventions will focus on both the Reception Station and Basic Combat Training. This integrated approach for developing Warrior Ethos synchronizes with the Army's desire to develop Soldiers/ Warriors as soon as possible. This approach would also fit nicely with the pre-commissioning and post-commissioning training given to officers in the Phase I and II Basic Officer Leader Course (BOLC).

For additional information contact Dr. Scott Graham, Infantry Forces Research Unit, Fort Benning, GA at ARI_IFRU@ari.army.mil.

Table 2. Warrior Ethos Behaviors for *React to Contact*

Consistent Behavior	Inconsistent Behavior
Prioritizes tasks for mission accomplishment by immediately returning fire instead of telling others about the enemy.	Fails to prioritize tasks for mission accomplishment by not immediately returning fire.
Makes tactically smart trades between personal safety (moving to cover and concealment while shooting back)	Makes inappropriate trades in apparent personal safety by moving to cover and concealment, before shooting back.
Exhibits adaptability by smooth reaction to surprise with appropriate return of fire.	Fails to adapt to surprise conditions by delayed reaction and not immediately returning fire.
Acts with responsibility to fellow Soldiers by immediately opening fire to kill or suppress the enemy.	Fails to be responsible to fellow Soldiers by not immediately responding to either kill or suppress the enemy.
Depends on fellow Soldiers to provide covering fire after responding to enemy fires.	Shows over dependence on fellow Soldiers to return fire to survive the enemy contact.
Exhibits the Army Values of *Loyalty* to the unit and other Soldiers and *Personal Courage* by facing fear and danger.	Behavior does not exhibit loyalty and personal courage when facing fear and danger

Training for Reduced Exposure Firing with the Land Warrior System

A hush falls over the crowd as the carnival performer aims a rifle over his back and prepares to fire. Positioning a mirror in front of his face to see his weapon sight, he aims at an apple placed atop his assistant's head...

A U.S. Infantryman moves up to the corner of a building. Around the corner and up the street an armed gunman sits waiting for an unsuspecting target to cross the road. The Soldier, shoulder against the wall, reaches up to his helmet and flips a monocle sight down over an eye. Like the carnival performer, he can now see his target without having to look down the barrel of his rifle. He sticks only his rifle around the corner and scans the street with his sight, spotting the would-be ambusher. Still undetected behind the corner, the Soldier carefully aims his weapon and squeezes the trigger...

The vignettes above illustrate a powerful new capability that the Land Warrior (LW) System will provide Infantry Soldiers. With their weapon sight image projected onto a helmet mounted display (HMD), Soldiers will be able to observe, acquire, and engage targets while exposing only their weapon to the enemy. This reduced exposure capability differs from the direct view technique of firing using current technology.

This new technological capability raises some important research questions. Will the difficulty of achieving a stable firing position reduce Soldiers' marksmanship proficiency? This question was of interest because with reduced exposure firing, the Soldier can no longer use the pocket of the shoulder to stabilize the weapon and to absorb recoil. The Soldier must learn to stabilize the weapon with another part of the body. Other questions are raised as well. Are some positions better or easier to fire from than others? How much training is needed to make Soldiers effective when firing from these positions, and what kind of training is needed? These questions were investigated in a reduced exposure firing experiment conducted by ARI's Infantry Forces Research Unit with the LW version 1.0 System. This experiment was the first formal effort to examine the effects of reduced exposure firing and the type of training required to provide Soldiers with skills needed for successful use of this technique of fire.

Experiment – Three Days at the Range

Throughout a four-week data collection period, 17 Soldiers came to the range to go through a three-day sequence that began with equipment familiarization and the zeroing of each sight followed by practice scenarios and test scenarios. The Soldiers were 8 noncommissioned officers (NCOs), 7privates, and 2 Officer Candidate School students; 12 were Infantry, 5 were non-Infantry.

The main comparison of interest for this experiment was between *direct view firing* from traditional positions, in which the Soldier looks directly through the weapon-mounted sight, and *reduced exposure firing*, where the Soldier does not look directly into a weapon-mounted sight but rather can see the weapon sight image displayed in a HMD. As indicated in the vignette, reduced exposure firing gets its name because the Soldier can remain behind cover while using the weapon like a periscope to view and aim at targets.

For the *direct view firing* day conditions, the close combat optic (CCO) sight was used. The CCO is a unity power sight that allows the Soldier to aim with both eyes open, providing good peripheral vision. At night, the Thermal Weapon Sight (TWS) was used in the direct view mode; that is, Soldiers looked through the TWS eyepiece to view targets directly.

For the *reduced exposure firing,* both day and night firing involved a video/computer link from the weapon sight to the Soldier's HMD. The daytime conditions used a daylight video sight (DVS); the night conditions used the TWS with the image projected on the HMD. Both of these sights have wide (no to low power) and narrow (3 to 4 power) fields of view.

Soldier's experience with the sights varied. None of the Soldiers had prior experience with the DVS; only one had experience with the TWS. However, 11 of the 17 had experience with the CCO sight.

For both day and night sights, Soldiers participating in the experiment followed the same sequence of tasks. They boresighted and zeroed their weapons with the relevant sight. They also reconfirmed zero on each subsequent day. Soldiers went through a series of practice scenarios for firing from reduced exposure positions, both day and night. They fired from around a barricade and above a barricade, minimizing the exposure of their body to the enemy directly to their front. Figure 1, which is shown on the following page, illustrates these positions. Each Soldier could choose whether to fire from a foxhole or prone position. Soldiers did not execute practice scenarios with the direct view conditions prior to the test scenarios.

All firing was done at a Location of Miss and Hit (LOMAH) range, with stationary targets at 75, 175, and 300 meters. The LOMAH system detected the location of shots as they passed the plane of the target up to 2.5 meters above the

Training for Reduced Exposure Firing with the Land Warrior System

target and 1.5 meters on either side of it. This computerized system measured all shot information, including the windage and elevation deviations of each shot relative to the target center of mass, the order of the shot, and whether the shot was a hit or a miss.

Test Scenarios

After completing the practice scenarios, Soldiers executed a sequence of four test scenarios, as summarized in the following table. Each Soldier fired every scenario under every condition. Notice that for both day and night firing, the contrast of interest was between *direct view firing* and *reduced exposure firing*. As the table shows, the order of the scenarios was the same for all Soldiers, and progressed from the easiest to the most difficult scenario. In all scenarios, targets were presented at three distances (75, 175, and 300 meters).

Test Scenarios Fired by Every Soldier and the *Criterion Measures*

	Day Conditions		Night Conditions	
	Direct View With CCO: *Choice Of Firing Position*	Reduced Exposure With DVS: *Fired Above and Around a Barricade*	Direct View With TWS: *Choice Of Firing Position*	Reduced Exposure With TWS: *Fired Above and Around a Barricade*
Scenarios And Criterion Measures	TARGET ACQUISITION: Time to detect target and % targets detected			
	KNOWN DISTANCE: Round dispersion			
	FIELD FIRE WITH EXTENDED TARGET EXPOSURE TIMES: Probability of hit, round dispersion, and % targets detected			
	FIELD FIRE WITH STANDARD TARGET EXPOSURE TIMES: Probability of hit, round dispersion, and % targets detected			

The first scenario was Target Acquisition. Soldiers were instructed to acquire and then fire at timed, pop-up targets, but the accuracy of their fire was not assessed. Latency of target acquisition and percent of targets acquired were the only measures in this scenario. The sectors of fire were narrow, ranging from 1 to 4 degrees.

The second scenario was Known Distance. Soldiers were presented a single target at each distance. The targets remained up until all the rounds allocated for each distance were fired. The intent of this scenario was to determine round dispersion, independent of the requirement to detect targets. Once the target was detected, Soldiers could fire the allocated rounds at their own desired rate of fire.

The third scenario, Field Fire, tested the ability of Soldiers to acquire and hit stationary, single and double, pop-up targets. Targets remained up for different periods of time.

Figure 1. Reduced exposure positions firing above and around a barricade.

- In extended exposure, the duration of target presentation was longer (10 seconds for single targets, 20 seconds for double targets) than is typically the case in marksmanship scenarios. This was done because it was not known how long it would take Soldiers to acquire targets with the reduced exposure technique.
- In standard exposure, targets were up from 5 to 11 seconds, in accordance with a standard Field Fire scenario used in Basic Rifle Marksmanship training.

In both Field Fire timed conditions, the focus was on probability of hit, although round dispersion and percentage of targets detected were also measured.

Excursions

During the course of the experiment, we were able to explore two additional questions with excursions from the original research plan.

- The Scanning Excursion examined the ability of Soldiers to acquire targets during the day when they had to scan a wide sector of fire (45 degrees), which was 10 times the size of the limited sectors of fire in the main experiment. Four Soldiers used the CCO sight for direct view firing and the DVS narrow field of view for reduced exposure firing; only target detection was recorded.
- The Hasty Firing Excursion examined the Soldiers' ability to fire from hasty, non-defensive positions that would be typical of fighting in an urban environment. Soldiers fired only in daytime conditions with and without a sling to support the weapon.

Results

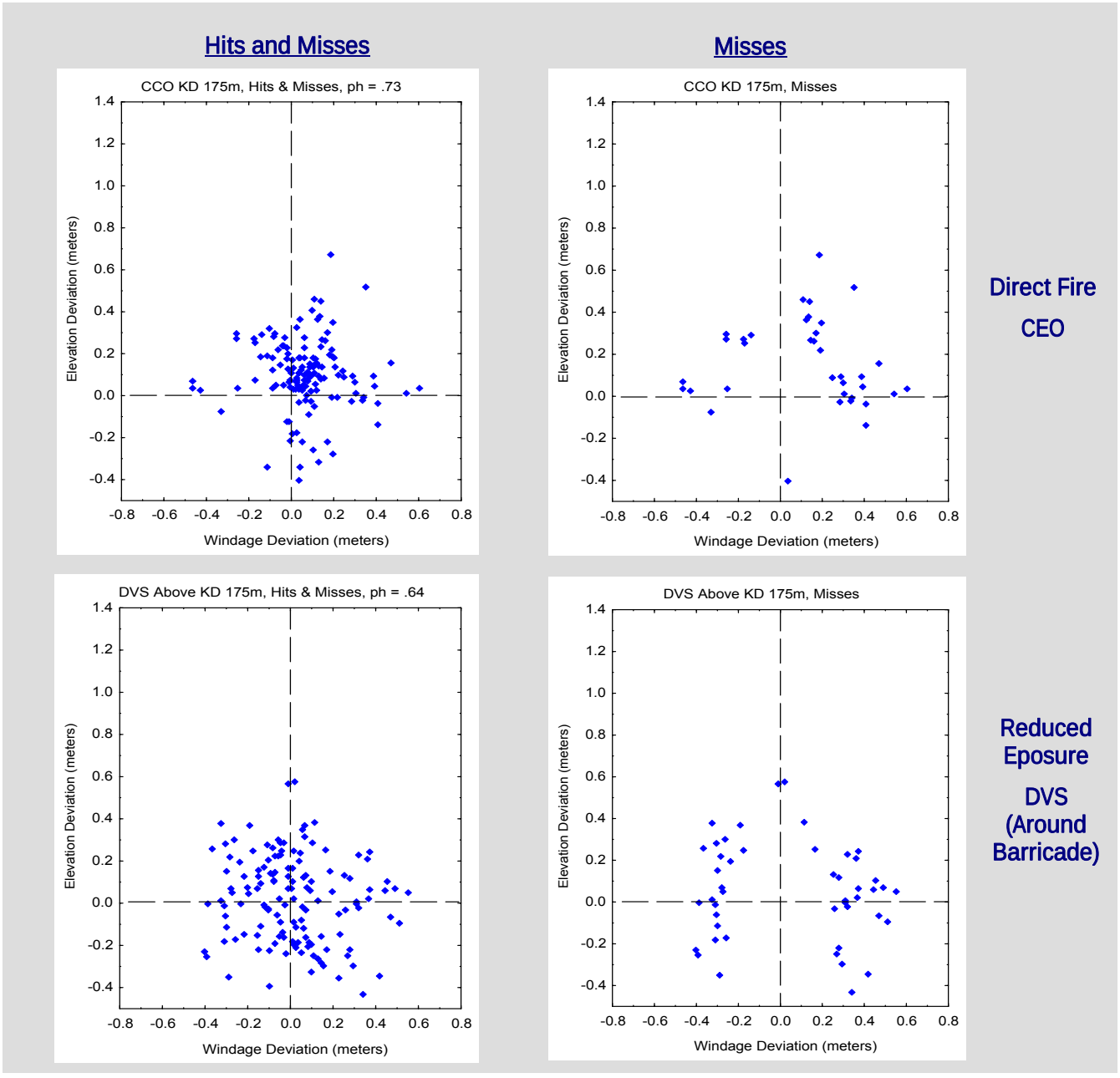
Target acquisition (time to detect target; % of targets detected). In the target acquisition scenario, there were no significant differences between direct view and reduced exposure firing. Soldiers quickly detected the vast majority of targets (98% during the day and 93% during the night). Most of the failed detections were at 300m, the farthest target distance.

Training for Reduced Exposure Firing with the Land Warrior System

Scanning Excursion: The difficulties in scanning a large sector of fire with a limited field of view were apparent in the scanning excursion. When using the CCO, Soldiers detected 90% of the targets, but when using the DVS with the narrow field of view, only 35% were detected. This was not surprising because Soldiers can use their peripheral vision with the CCO.

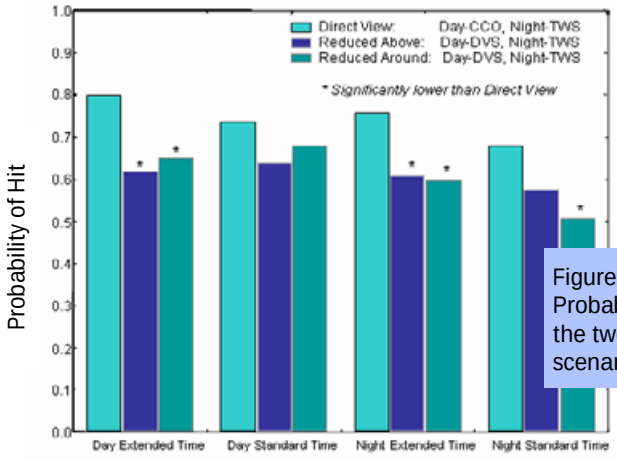
Known Distance (Round dispersion). Figure 2 illustrates the location of rounds at 175m in the daytime Known Distance scenario. The graph shows all shots as well as only the misses, allowing a visual comparison of dispersion patterns. In general, there was no difference in the dispersion patterns as a function of reduced exposure firing. Quantitative analyses of the shot dispersion data did show that dispersion increased as a function of target distance regardless of firing condition.

Figure 2. Shot locations in the Known Distance scenario at 175 meters. Target silhouette is outlined when only misses are displayed.



Training for Reduced Exposure Firing with the Land Warrior System

Field Fire (Probability of hit (ph). In both timed conditions of the Field Fire scenarios, the probability of hit was often lower for reduced exposure firing than for direct view firing. Significant differences occurred in three of the four scenarios, as indicated in Figure 3.



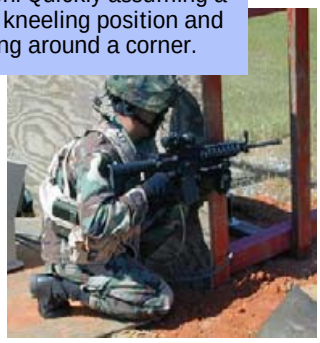
Target Exposure Time for Day and Night Firing

Figure 3. Probability of hit in the two Field Fire scenarios.

These differences reflected an average ph of .75 for direct view versus .58 for reduced exposure firing, a decrease of .17 in the ph. Conditions where no differences occurred reflected a decrease of .09 in the ph. Consistent with the round dispersion results, in all conditions, the ph declined as the distance to the target increased.

Hasty Firing Excursion: In the hasty firing excursion with the extended exposure Field Fire scenario, a single Soldier fired the DVS from a hasty kneeling, reduced exposure position (see Figure 4) and the CCO from a direct view prone position. When firing with the DVS, he missed all the first eight targets. At this point in the scenario, he shifted the butt of the weapon in the crook of his right arm to achieve a more stable position. He then hit 10 of the last 14 targets, a result comparable to the results achieved with the CCO direct view firing technique. These data clearly reinforced the importance of achieving a stable firing position with reduced exposure firing.

Figure 4. Hasty firing position: Quickly assuming a stable kneeling position and shooting around a corner.



The sling helped Soldiers establish a stable position faster, but did not increase the percentage of targets that were hit compared to firing with no sling. Two of the three Soldiers in this phase of the excursion had never used a sling.

Conclusions

The reduced exposure firing capability of the LW system provides Infantry Soldiers with important advantages on the battlefield. However, as with all new technology, maximum performance will not occur unless Soldiers are properly trained. The training procedure used in the experiment was clearly effective and when compared to some data from a previous reduced exposure night-fire exercise (with very limited pre-training), Soldiers' reduced exposure marksmanship performance in the current experiment was much better, with the probability of hit about 1.5 times higher.

Based on the experiment, the recommended training sequence is one that gradually increases the marksmanship skills that must be integrated and enhances Soldier confidence as training scenarios become more difficult. Soldiers first need to determine a stable position that works for them in a defensive position, considering such factors as their body size and whether they are left- or right-handed. This can be accomplished with dry-fire, target acquisition, scanning exercises. Then Soldiers should gain skill in hitting targets with known distance firing scenarios where target acquisition is not a factor. Next Soldiers must integrate their target acquisition and firing skills with timed, pop-up target scenarios. The last steps are training with hasty firing positions and against moving targets.

There remain three critical reduced exposure firing issues that need further research.

- What are the best training procedures for acquiring and engaging moving targets?
- What are the effects of the Soldier's sector of fire and field of view with the day and night sights?
- What are the best techniques to train Soldiers to quickly assume stable hasty firing positions that may be necessary during urban operations?

Marksmanship performance in this experiment with the reduced exposure fire technique was not always equivalent to the standard direct view firing technique. However, the relatively small reduction in lethality is more than offset by the increased survivability offered by the technology. By reducing the Soldier's exposure to the enemy by a factor of four, it allows Soldiers to conduct surveillance and deliver effective fire at much lower risk.

For additional information contact Dr. Jean Dyer, Infantry Forces Research Unit, Fort Benning, GA, ARI_IFRU@ari.army.mil.

Note. The experiment was supported by the Project Manager-Land Warrior, TRADOC Systems Manager-Soldier, Soldier Battle Lab, and G3, U.S. Army Infantry School.

New Advances for Training Deployed Soldiers

TLAC Multimedia Vignette-Based Training using the Virtual Tactical Operations

Over the past decade the U.S. Army has identified an emerging need to train and develop leaders who are more adaptive and capable of responding effectively to a wide range of military operations. To assist in meeting this need, ARI has a number of research and development efforts to look for innovative methods, techniques, and tools to train and develop adaptive performance. One of these is the Think Like a Commander (TLAC) project. This project uses a deliberate practice methodology to train leaders on critical cognitive skills. Over the past few years, a TLAC training program has been developed and implemented successfully in the classroom at Fort Knox, to train leaders in the Armor Captain's Career Course (ACCC). This training has also been provided via synchronous distance learning to officers in the Reserve Component (RC) ACCC. Initially, a majority of the RC students were completing the training from their homes or at their local armories; more recently, a large number of students in the course are taking it at their deployed locations in Bosnia, Iraq, or Afghanistan.

Our initial research goal in adapting the TLAC training to distance learning format was directly related to the ARI program of research to develop innovative methods and strategies to train and develop the Future Force, in particular to provide the scientific basis for effective embedded training (ET) technologies required for Future Combat Systems (FCS). When we found that we were largely providing training to deployed leaders and receiving extremely positive feedback from them, we turned our attention to the analysis of the training needs of deployed leaders. We examined those needs, evaluated various training methods, and discovered that the TLAC training approach already met many of the identified needs.

In this article, we will explain the key features of the TLAC approach, describe training needs identified for deployed Soldiers, and discuss the training approach planned for the Future Combat Systems (FCS). As these discussions will show, the TLAC methodology appears to be well-suited to help fill a training gap for deployed Soldiers.

Think Like a Commander: A Viable Approach for Distributed Training

As mentioned earlier, the TLAC methodology applies deliberate practice training concepts to train cognitive skills and allows students to model their thinking, understanding, plans, visualizations, and decisions after expert thinking patterns. The training method involves the presentation of cognitive drills to elicit and assess an individual's mental models and thought habits. These drills can be performed in an individual or group setting, a feature that provides a high degree of flexibility for the schoolhouse, the unit, and for self-development. The method has been used to significantly improve tactical thinking skills in brigade, battalion, and company commanders and assists in converting knowledge into behaviors that can be observed, measured, and coached.

RC students access TLAC materials using the Virtual Tactical Operations Center, a web-based collaborative tool. For these students, remote instructors at Fort Knox teach, coach, and mentor students on complex battle command skills in a collaborative, synchronous environment. Feedback on the distributed version has been uniformly positive, particularly from the deployed students. Some of the comments offered by students after completing the TLAC training are highlighted on the following page.

Given the number of Soldiers using TLAC while deployed, we felt it was important to investigate the training needs of these Soldiers and determine the extent to which TLAC was appropriate to meet those requirements.

What are the Primary Training Needs of Deployed Soldiers?

According to the Army principle – Train, Alert, Deploy – Soldiers are trained on fundamental warfighting skills and participate in realistic collective exercises to ingrain those skills prior to being alerted for a specific deployment. Once the Soldiers deploy, however, their training needs change. Our needs analyses with deployed Soldiers surfaced three primary needs or requirements.

First, training on deployments must focus on activities that are key requirements of the operation; for example, operating in a chemically contaminated environment or using newly fielded equipment. Both individual and collective training that is relevant to the environment and mission in which the unit is being deployed is also important (e.g., language, culture, terrain, weather). Significant

New Advances for Training Deployed Soldiers

Student Feedback from the Reserve Component Armor Captain's Career Course.

- "TLAC vignette has real world application to what we are doing right now in Iraq. TLAC makes you think and consider things that you might miss."
- "TLAC was a combat leader's reaction course for the mind."
- "TLAC makes you ask the hard question of WHY things are occurring."

training must be directed to mission-specific tactics, techniques, and procedures, and to responding appropriately to enemy tactics, (e.g., improvised explosive devices), in particular to emerging threat tactics that cannot be fully anticipated and that evolve as operations continue. Also, deployed Soldiers need training, practice, and rehearsals for impending missions. In short, the topics that are trained and practiced become focused on the specific requirements of the deployment.

A second, more subtle training requirement was observed through our experience with responses to TLAC vignettes at the ACCC. Both ARI researchers as well as the instructors at the course noticed a stark difference in the responses provided by captains who served in Bosnia compared to captains who served in Iraq. It was clear that each deployment entailed a different set of behavioral responses, a different mindset that was perhaps expressed most clearly in how these captains applied the rules of engagement. This observation was corroborated by comments of Soldiers who had served in both deployments. Perhaps TLAC would be a good method to prepare Soldiers ahead of time to better act and react within specific deployment environments and capitalize on, or train, the flexibility of the individual Soldier.

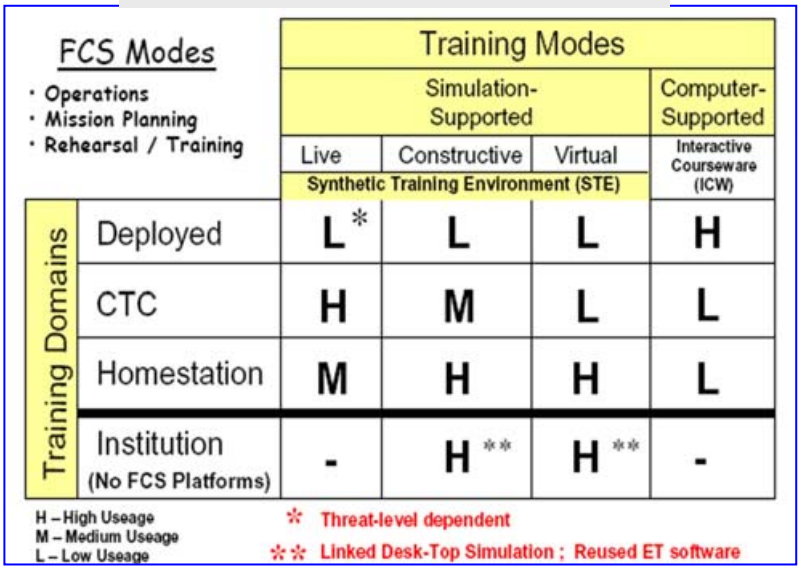
Finally, a third observation was that Soldiers may sometimes need practice on skills that are not necessarily being applied during a specific deployment; for example, Soldiers engaged in stability operations may have a need to maintain warfighting skills. Given operational requirements, it is not clear how feasible it is to devote resources that might otherwise be focused on actual mission requirements to such practice activities. Perhaps conducting exercises that require transitioning between conditions of higher and lower levels of conflict, however, would meet this need and would also be of immediate relevance to the current mission situation.

The methodology used by TLAC could easily be applied to meet each of these three needs for training deployed Soldiers and the training scenarios could easily be designed to incorporate changes in cultures and mission environments based on lessons learned during deployments. In addition to providing an appropriate methodology to meet the training needs identified by currently deployed Soldiers, TLAC can also fill training gaps identified as part of the planning and development for FCS.

Training Concepts for FCS

The FCS vision to provide Soldiers with opportunities to train wherever and whenever needed can be seen in Figure 1. The embedded training concept is the centerpiece of Future Force training. As shown, the two main modes of training will be "Simulation Supported" (exercises supported by a tactical simulation) and "Computer Supported" (interactive courseware). Much of the development work on FCS training systems revolves around incorporating a tactical simulation capability into FCS vehicles. As the figure indicates, however, simulation-supported exercises are generally intended to provide home station and Combat Training Center (CTC) training in fundamental warfighting skills, while interactive courseware is intended to be the main training method for deployed soldiers.

Figure 1. Embedded Training Usage Profile



New Advances for Training Deployed Soldiers

Simulation technologies have made major advances and often provide a high degree of realism, immersion, and fidelity; but to insure quality training, the simulator must also incorporate sound instructional principles and strategies. The key instructional principles that have emerged in ARI's research program can be seen in the box below.

Of these critical principles for effective training, tactical engagement simulations inherently provide only one of these components, the opportunity to practice the task to mastery under realistic conditions. Additional design work will need to be done to incorporate the other components of effective training within simulation exercises. Furthermore, the pace and complexity of the current exercises driven by tactical engagement simulations may actually interfere with many key training principles such as demonstration, measurement, feedback, immediate repetition, isolation of complex tasks, and focus on critical tasks that occur infrequently.

FCS Critical Principles of Training

Components identified in prior research

1. Identification of tasks,
2. Presentation of enabling knowledge,
3. Demonstration of how the task should be performed,
4. The opportunity for the trainee to perform the task,
5. Provision for feedback to the trainee concerning task performance, and
6. The opportunity to practice the task to mastery under increasingly difficult, but realistic conditions.

Newly identified components

7. An explicit description of elements that constitute correct performance of the task,
8. Performance measurement to assess whether the task is performed correctly,
9. Active effective coaching,
10. The opportunity for immediate repetition of poorly performed tasks, and
11. A focus on tasks that are difficult, critical, or constitute areas of individual or collective weakness.

In addition, the current constructive tactical simulations, largely force-on-force engagement events, have difficulty representing tactical elements that are emerging as important in the contemporary operating environment, e.g., caves, urban environments, civilians on the battlefield, bombs in the trunks of cars, and other asymmetric threats that are constantly changing. They are also difficult to modify quickly and provide little flexibility to respond to changing mission events and requirements.

Typical examples of interactive courseware, currently identified as the primary training mode during deployments, will not meet the training needs of deployed Soldiers. Existing [or current] Interactive courseware or interactive multimedia instruction (IMI), such as individual computer-based tutorials, can be useful for knowledge acquisition, but they do not incorporate the full set of training principles necessary for effective training. Such IMI are not adequate to develop and sustain the skills and performance levels of Soldiers and leaders; nor can they respond quickly to changing mission requirements.

Conclusions

The FCS training model emphasizes the importance of IMI for training deployed Soldiers, and yet in order to translate knowledge into action and actually conduct effective training, a form of IMI is required that incorporates the full set of training principles, that can be tailored to different deployment environments, and can respond quickly to changing mission requirements. The scientific approach, cognitive drills, and scenario-based exercises used in TLAC provide just this type of system with a more flexible form of IMI that can address very specific leader development needs, be easily tailorable, quickly updated, and is effective in turning knowledge into action. The TLAC method used in the ACCC blends a live instructor, a collaborative group, and individual vignette-based exercises to do an effective job of training cognitive leader skills in the classroom, in the unit, or for self-development whether in garrison or on deployment. The approach and the training principles that have emerged from ARI's FCS R&D program will also enable improvements in training overall and provide the scientific basis for fully leveraging simulator and computer technologies for more effective and efficient training now, and as future systems evolves.

For additional information contact Mr. Scott B. Shadrick, Armored Forces Research Unit, Fort Knox, KY, ARI_ARFU@ari.army.mil.

Unit-Focused Stability and Cohesion:

Year 1 Assessment

In October of 2002, the Army's Vice Chief of Staff created Task Force Stabilization (TFS) and charged it with the mission to develop a manning system that would minimize personnel turbulence in combat units. In response, TFS developed Unit-Focused Stability (UFS), a manning system where, unlike under the traditional Individual Replacement System (IRS) that swaps Soldiers in and out of units on an almost daily basis like spare parts, Soldiers assemble, train, and deploy together throughout the operational cycle of their unit.

Does Stability Promote Cohesion?

Although the increased stability under UFS is expected to foster cohesion over time and, in turn, enhance unit operational performance, the results of past longitudinal investigations into the relation between stability and cohesion have been inconclusive. Depending upon which report you read, cohesion has been found to increase, decrease, or follow either a U- or inverted U-shaped pattern over time.

Given this uncertainty over the temporal course of cohesion within a stabilized personnel environment, Human Resources Command has asked the U.S. Army Research Institute for the Behavioral and Social Sciences (ARI) to (a) assess the long-term relation between UFS and small-unit cohesion, (b) identify factors that enhance or detract from this relation, and (c) document lessons learned for improving future UFS implementation procedures. The test unit selected by the Army to support this assessment is Alaska's 172nd Stryker Brigade Combat Team (SBCT), the first unit to undergo the transition from the IRS to UFS.

What ARI Did

Year 1 of the planned multiyear longitudinal assessment is now over. During this first year, we developed paper-and-pencil surveys for examining the nature and extent of the relation between stability and cohesion. We also reviewed the literature to identify antececent variables (leader effectiveness, learning climate, job motivation, job satisfaction, morale, and personal/family well-being) thought to influence the development and maintenance of cohesion over time and added them to the surveys. Cohesion was measured on the three dimensions of horizontal, vertical, and organizational bonding and the affective (emotional) and instrumental (task-oriented) components of each (See Table 1). Successful horizontal cohesion, for instance, was defined as being associated with peer bonding and teamwork, vertical cohesion with caring and competent leaders, and organizational cohesion with unit members who feel good about their unit, identify with what it stands for, and work to achieve its goals in exchange for assistance in achieving personal goals.

Table 1. Dimensions of Cohesion and Their Components

Cohesion Dimension	Affective Component	Instrumental Component
Horizontal	Peer Bonding	Teamwork
Vertical	Leader Caring	Leader Competence
Organizational	Pride and Shared Values	Need/Goal Attainment

Survey items were grouped into 5-point, Likert-type scales *(1 = Strongly Disagree, 2 = Disagree, 3 = Neither Disagree nor Agree, 4 = Agree, and 5 = Strongly Agree)* designed to measure the different dimensions/components of cohesion and associated antecedent variables at different points in time. Surveys were administered to virtually all present-for-duty members of the 172nd SBCT once unit fill reached 90%. At the same time, we conducted face-to-face individual interviews with company- through brigade-level leaders and held separate focus group discussions with squad- and platoon-level leaders and their Soldiers. The results of the interviews were used to identify the perceived pros and cons (lessons learned) of initial UFS implementation.

What ARI Found

As shown on the following page in Table 2, cohesion levels on all dimensions were on the high end of the response scale, with a mean score for overall cohesion of 3.86 out of a possible 5. The mean scores for the individual dimensions ranged from 3.81 to 3.93. Reliable differences were found between vertical and organizational cohesion and between affective and instrumental cohesion. Higher vertical cohesion was presumably the result of confidence and trust n unit leaders which was particularly important during the early stages of unit development. In contrast, the higher scores for affective over instrumental cohesion

Unit-Focused Stability and Cohesion

supposedly resulted from Soldiers having the time to get to know one another, but not to train together on a collective basis because of the harsh Alaskan winter. These values will now serve as the baseline to assess future changes in cohesion as the unit trains and eventually deploys.

Although all correlations between cohesion and the six antecedent variables included in the survey were statistically significant ($p \leq .05$), leader effectiveness, learning climate, and morale were the best three predictors of overall cohesion (Table 3). In fact, these three variables accounted for nearly all of the total predicted variance in cohesion , with leader effectiveness alone accounting for 67% of this variance. Although correlation does not necessarily imply causation, the results of this first year's survey analyses suggest that efforts to enhance cohesion while Soldiers are stabilized under UFS would best be focused on improving leader effectiveness.

The interviews and focus group discussions consistently revealed three major concerns. The issue of most concern, especially among junior commissioned and noncommissioned officers (NCOs), was that UFS would negatively impact career progression. This concern surfaced in virtually every interview and worked its way into most of the NCO focus group sessions. The limited number of command positions within a brigade-sized unit was perceived to be the crux of the problem. Captains, in particular, were worried that they would not have the opportunity to command (a Branch qualification Requirement for promotion) or at best would have to accept a shortened command assignment because of the number of pre-command captains waiting in line and the relatively short time available for eligible captains to exercise command. Second, interviewees reported having to make career-impacting decisions on short notice based on information that, in retrospect, turned out to be incomplete or erroneous (e.g., that school attendance would be allowed under UFS). And finally, there were numerous comments that UFS ground rules were not applied uniformly across all ranks (e.g., majors were allowed to leave the SBCT but captains were not).

Despite these concerns, Soldiers widely believed that UFS would have a positive impact on unit cohesion because of the enhanced opportunity to train to higher levels in a personnel-stabilized environment. Married Soldiers expected a positive impact because of the predictability of assignment, fewer relocation moves, continuity of dependent schooling, and increased opportunities for spouse education. Single Soldiers, in contrast, had mixed views about the potential benefits of UFS. While some welcomed the opportunity for prolonged assignment, especially if they liked being in Alaska, others said that they joined the Army expressly to see the world and as a result viewed UFS as a negative policy change.

What Next?

During Year 2, we plan to extend our longitudinal assessment of UFS to (a) identify the impact of both external (unprogrammed losses/gains to the unit) and internal (duty position changes within the unit) personnel turbulence on platoon-level cohesion, and (b) continue collecting lessons learned. In addition, we will (c) assess the impact of cohesion on platoon-level collective performance (and vice versa) displayed during the 172nd SBCT's rotation to the Army's Joint Readiness Training Center (JRTC) at Fort Polk, LA. Stay tuned for more on this longitudinal project.

For additional information contact Dr. Joe Hagman, Force Stabilization Research Unit., Boise, ID, ARI_FSRU@ari.army.mil.

Table 2. Cohesion Scale Values

Scale	M	SD
Overall Cohesion	3.86	.69
Horizontal	3.86	.79
Vertical	3.93	.80
Organizational	3.81	.72
Affective	3.89	.72
Instrumental	3.81	.71

Table 3. The Predictive Model

Predictor Variable	R	R^2	R^2 Change
Leader Effectiveness	.816	.667	.667
Learning Climate	.857	.734	.067
Morale	.865	.748	.014
Personal Well-Being	.866	.751	.002
Job Satisfaction	.867	.752	.002
Job Motivation	.868	.753	.001

The ARI Newsletter and information about additional research products are available on the ARI website

www.ari.army.mil

DEPARTMENT OF THE ARMY
U.S. Army Research Institute
for the Behavioral and Social Sciences
2511 Jefferson Davis Highway
Arlington, Virginia 22202-5600