

List of U.S. Army Research Institute Research and Technical Publications

**October 1, 2000 to September 30, 2001
With Author and Subject Index**

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

The means of dissemination of the results of ARI's research and development/studies and analysis program vary widely depending on the type of work, the subject matter, and the sponsor/proponent. Typically, major findings with immediate policy and procedural implications are briefed to sponsors and proponents in order to enable timely implementation. This is followed up with complete documentation in the form of research and technical publications such as the ones listed here. In many cases, these documents represent the actual item handed off to the sponsor/proponent; this is particularly true of the Research Product category. In other cases, results are published in order to provide a complete record of the work done, and for future reference by researchers doing work in the same or similar areas.

This annotated list for FY01 provides an idea of both the depth and scope of the ARI research effort, and is a valuable resource for anyone interested in military psychology from either a scientific or operational perspective.

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Introduction

The primary responsibility of the U.S. Army Research Institute for the Behavioral and Social Sciences (ARI) is to maximize soldier effectiveness. ARI accomplishes its mission through research and development in the acquisition, training, utilization, and retention of Army personnel. ARI research and products affect every Army mission with a human performance component.

As convenient references for qualified agencies and individuals and sponsors, ARI publishes lists of its technical and research publications. This issue of the publication list describes reports published during the period October 1, 2000, to September 30, 2001. It contains the abstract of each publication and the bibliographic information needed to identify a publication. The abstracts have been written, as far as possible, to describe the principal research findings in non-technical terms; however, technical language is used to communicate efficiently the details of research analysis. Author and subject indexing provide access to individual reports and topics.

ARI Publications

ARI publications are divided into separate, consecutively numbered categories appropriate to

their intended audience and function. During fiscal year 2001, the following types of research and technical reports were issued by ARI:

Research Note (RN). An interim or final report typically of limited interest outside of ARI. It is filed with the Defense Technical Information Center (DTIC) but is not printed. Research Notes usually fall into one of the following categories:

- An in-house report that is of limited interest outside of ARI but is considered worth submitting to DTIC to be part of the Department of Defense (DoD) archive of technical documentation.
- An interim contract report that is of limited interest outside of ARI but is considered worth submitting to DTIC to be part of the DoD archive of technical documentation.
- A final contract report that is of limited interest outside of ARI but must be submitted to DTIC in accordance with Department of the Army regulations to close a contract.
- Material related to a Research Report or

Technical Report (detailed tables, graphs, charts, sample forms, and sample training and testing materials) published as a Research Note to economize on printing and distribution.

Research Product (RP). A user-oriented report intended to aid Army personnel. Examples are handbooks, manuals, and guidebooks.

Research Report (RR). A report of completed research intended primarily for dissemination to military managers. Research Reports may deal with policy-related issues but typically do not include specific policy recommendations.

Special Report (S). A published report on a topic of special interest or in-house research intended primarily for dissemination to a select audience.

Study Report (SR). A published report briefly documenting studies and analyses.

Study Note (SN). A Study Note may contain or consist of technical text, computer code, diskettes or tapes with software, databases, codebooks or other documentation, raw data, data collection instruments, figures, tables, or any other products that do not concisely convey the import of a project but which must be archived for technical completeness.

Technical Report (TR). A report of completed research intended primarily for dissemination to researchers.

Research Reports and Technical Reports published by the U.S. Army Research Institute for the Behavioral and Social Sciences are intended for sponsors of research and development (R&D) tasks and for other research and military agencies. Any findings ready for implementation at the time of

publication are presented in the last part of the Executive Summary. Upon completion of a major phase of the task, formal recommendations for official action normally are conveyed to appropriate military agencies by briefing or memorandum.

ARI Distribution

Initial distribution of these publications was made directly by ARI. Research Reports, Technical Reports, Study Reports, and Research Products were distributed primarily to operational and research facilities and their sponsors in DoD, to other interested Government agencies, and to DTIC; copies of some reports were also sent to the Library of Congress for distribution to libraries participating in the Documents Expediting Project. Research Notes and Study Notes were deposited with DTIC but were not published.

These publications are NOT available from ARI. DoD agencies and contractors can purchase paper copies or microfiche from:

Defense Logistics Agency
Defense Technical Information Center
8725 John J. Kingman Road, Suite 0944
Ft. Belvoir, VA 22060-6218
(703) 767-9030 or DSN 284-9030

Other Government agencies and the general public can obtain unclassified reports from:

U.S. Department of Commerce
National Technical Information Service
5285 Port Royal Road
Springfield, VA 22161
(703) 487-4650

NOTE: When requesting copies of these reports, use the DTIC accession number (AD - - - - -) appearing in parentheses following the date of publication of each citation.

Technical Reports

TR 1106

Predicting Rifle and Pistol Marksmanship Performance With the Laser Marksmanship Training System. Smith, M.D. and Hagman, J.D. October 2000. (AD A384045)

To develop an LMTS-based tool for predicting small arms, live-fire marksmanship qualification performance, Idaho Reserve Component (RC) soldiers fired for qualification on LMTS and on the live-fire range with either the M16A2 rifle (N = 95) or M9 pistol (N = 81). A statistically significant relation between LMTS and live-fire qualification scores was found and validated for both rifle ($r = .55$) and pistol ($r = .47$) and then used to develop weapon-specific tools for RC trainers to use in predicting the probability of individual soldier, first-run, live-fire, rifle and pistol qualification based on scores fired on LMTS. Use of these prediction tools will enable RC marksmanship trainers to schedule LMTS-based training more efficiently by targeting only those soldiers in need of remediation (i.e., those predicted to be unlikely live-fire qualifiers), as well as to identify when enough training has been provided (i.e., when the predicted likelihood of live-fire qualification is good). These tools also provide the RC unit commander with a set of LMTS-based, empirically derived live-fire performance standards to support (a) implementation of a competency-based rifle, as well as pistol, sustainment training program of instruction using LMTS, and (b) use of LMTS-based qualification firing in place of live-fire qualification firing when outdoor range facilities are not readily available.

TR 1107

Applying Collaborative and e-Learning Tools to Military Distance Learning: A Research Framework. Bonk, C.J. and Wisher, R.A. October 2000. (AD A389681)

This report is a resource guide for those concerned with using collaborative and e-learning environments -- those that use the Internet -- in a military training setting. The report is intended for training developers and planners, instructional designers, and program evaluators. The report offers a broad examination of findings from the educational literature, where the preponderance of research on e-learning tools and collaborative learning (i.e., groups of learners who have a common goal) has been conducted. Reviewed first are the emergence of e-learning tools and

constructivism, the role of the instructor in such approaches, and the increasing importance of learner-centered approaches to instruction. Appropriate quantitative and qualitative research methodologies are then described. A summary of relevant findings on collaborative tools, individual differences, and learning communities is also provided. Suggestions are made for experiments that test the adaptability to military training environments of e-learning and collaborative learning methods emanating from education. Ten primary and 17 secondary experiments are devised that derive from current psychological principles in cognition, motivation, social factors, and individual differences as applied to Internet-enabled learning.

TR 1108 published in FY00.

TR 1109

An Annotated Bibliography of Recruiting Research Conducted in the U.S. Armed Services and in Foreign Services. Penney, L.M., Sutton, M.J., and Borman W.C. March 2001. (AD A389679)

This is an annotated bibliography of research conducted on military recruiting by the U.S. Army Research Institute for the Behavioral and Social Sciences (ARI), the other U.S. military services, and foreign military organizations. To provide a framework for the research summaries, they are organized around a model of military recruitment showing the important factors contributing to successful recruiting. The model contains the following factors: (1) personnel selection and assessment; (2) training and development; (3) recruiting management and organization; (4) recruiter performance; (5) marketing; (6) youth supply, characteristics, and influencers; (7) propensity; (8) enlistment decisions; and (9) delayed entry programs. One hundred fifty-one reports are summarized, describing recruiting research most relevant to the current U.S. military recruiting environment. It is hoped that the review provides a comprehensive yet concise picture of the research results generated by the U.S. Army, Navy, Marine Corps, Air Force, and foreign service recruiting research communities.

Technical Reports

TR 1110

Instructional Strategies for Training Teams in Virtual Environments. Lampton, D.R., McDonald, D.P., Rodriguez, M.E., Cotton, J.E., Morris, C.S., Parsons, J. and Martin, G. March 2001. (AD A389674)

This report describes the design and implementation of the Fully Immersive Team Training (FITT) research system, and the first experiment conducted with that system. FITT was developed to support research on the use of distributed Virtual Environments (VEs) for training dismounted infantry. The hardware and software functional requirements included: locomotion, object manipulation and aiming, communication among participants, design of avatars for participants and computer generated forces, data capture and playback, as well as a host of networking issues. The first experiment examined instructional strategies involving how and when to give guidance during team training with VEs. Ninety-four college students participated in the experiment. Two-person teams engaged in search missions in VEs depicting building interiors. Teams were given guidance either before (demonstration), during (coaching), or after (replay) the first practice mission, or not given any guidance at all (control group). Performance measures included: speed and accuracy of search, communications, and security procedures. Results indicated that the FITT interface worked well in enabling the participants to move in and interact with the VEs, and to act as a team. The feasibility of implementing and administering each of the instructional strategies in a VE training context was demonstrated.

TR 1111

Leadership Development: A Review of Industry Best Practices. Day, D.V. and Halpin, S.M. April 2001. (AD A391440)

A review of leadership development best practices in for-profit organizations was conducted. Practices discussed in this report include formal development programs, 360-degree feedback, executive coaching, job assignments, mentoring, networks, reflection, action learning and outdoor challenges. Additionally, five organizations that are popularly recognized for their leadership development practices are highlighted in this report. Highlights include information regarding

the organizational philosophy, values, and mission as well as information on how various leadership development practices are implemented and integrated. Best practice principles are drawn from this research and implications for their use within the U.S. Army are discussed.

TR 1112 and TR 1113 published in FY00.

TR 1114

Enhancing the Efficiency of Tank Gunnery Evaluation: A Strategy Revisited. Hagman, J.D. May 2001. (AD A391096)

Based on the analysis of gunnery scores fired by 171 M1A2 tank crews, an easy-to-use strategy was developed for predicting which crews will, and will not, first-run qualify on Tank Table VIII before all of the typically required ten engagements have been fired. Scores are added as each engagement is fired and the resulting sum is compared to tabular formatted cutoff scores established to support accurate qualification predictions. Adherence to this strategy will help Active Army armor unit commanders to maximize the efficiency of tank gunnery evaluation by reducing the number of first-run engagements fired, as well as the range time and operational tempo (OPTEMPO) resources spent in doing so, by roughly 20% without sacrificing the purpose and intent of the crew-level gunnery certification process.

TR 1115

Applying Digital Technologies to Evaluation: A Focus on Command and Control. Lickteig, C.W. and Quinkert, K.A. June 2001. (AD A392994)

The Army's growing reliance on digital technologies reinforces and extends concerns about training and evaluation, particularly in the area of command and control. Digital technology represents a new and powerful weapon for attacking evaluation requirements, but is a double-edged sword that poses challenge and opportunity. This report examines how digital technologies can help solve many evaluation challenges, including the ones they create. The Background chapter reviews basic issues confronting conventional command and control performance and evaluation. Two key issues considered are manually burdened methods and measures, and the limitations

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imposed by analog media. The Findings chapter examines how digital technologies might improve evaluations of command and control performance. This examination begins by identifying many of the new challenges introduced by digital command and control systems. Next, opportunities for overcoming evaluation challenges through the application of digital technologies are considered, including automated measures *of* versus *about* performance, more precise and comprehensive measures, and less burdened measurement methods. Finally, examples of digital measurement methods illustrate the potential for improving command and control evaluation through digital data integration, data mining, and data visualization. The report's conclusions identify some key research and development efforts required for applying digital technology to improve command and control performance and evaluation.

TR 1116

Assessing and Measuring Training Performance Effectiveness: 2000 Workshop. Hiller, J.H. and Wampler, R.L. (Eds.) August 2001. (AD A395940)

This report provides documentation of the papers and briefings presented to workshop participants. The goals of the workshop were to provide key Army leaders with:

- A review of current state-of-the-art methods for training performance measurement;
- Identification and clarification of measurement and assessment issues;
- Recommended solutions and identification of essential research and development.

Eighty-five individuals from government agencies (both military and civilian), academia, and contractors attended the workshop held in Newport News, VA on 6-7 September 2000.

TR 1117

Defining Digital Proficiency Measurement Targets for U.S. Army Units. Barnett, J.S., Meliza, L.L., and McCluskey, M.R. August 2001. (AD A396899)

The U.S. Army is exploring the advantages of networked computer systems to enhance battlefield situation awareness and command and control, a program known as digitization. The long-term goal of the present effort is to develop

measures of the skills needed to exploit the advantages of digitization. The initial challenge was to identify candidate digital skills, since there was no listing of digital skills available to use as a start point. This report focuses on the approach used to identify candidate digital skills. First, data from the Center for Army Lessons Learned (CALL) were analyzed to identify long-term, high-profile problems likely to be addressed by the effective use of digital systems. Next, digital procedures that units might employ to address these problems, and the cognitive capabilities soldiers would need to implement these solutions, were described. Through this process, twenty-two candidate skills were identified which could be used to identify measures of skill performance. The findings of this report will be used to help define performance standards and develop after action review aids.

TR 1118

Team Performance in Distributed Virtual Environments. Singer, M.J., Grant, S., Commarford, P.M., Kring, J.P., and Zavod, M. August 2001. (AD A396489)

The U.S. Army is using virtual simulations for mission planning, training, rehearsal, and concept development. Virtual environment (VE) technology can provide simulated real world activities for dismounted soldiers. One issue in the use of distributed simulations is whether team members learn, perform, and transfer their skills in distributed situations in the same ways as individuals in local situations. In this experiment, local and distributed teams completed a series of mission rehearsals in a VE over two days. Eighteen, two-person teams of college students performed synthetic tasks representative of tasks performed by police, emergency response, and military teams. All participants were trained to criterion in a VE before being assigned to a team. Biographical information and subjective self-report questionnaires were administered before, during, and after training and mission sessions. Local teams interacted face-to-face between mission rehearsal sessions, while distributed teams only interacted by phone during the after action review session following each mission. Local teams performed significantly better than distributed teams on several collective task measures over the repeated missions. Simulator

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sickness and presence during the mission
rehearsals were also investigated.

Research Reports

RR 1763

Refinement of Prototype Staff Training Methods for Future Forces. Deatz, R.C., Greene, K.A., Holden, W.T. Jr., Throne, M.H., and Lickteig, C.W. October 2000. (AD A383380)

This report documents the design, development, and implementation of refinements to a prototype staff training package for future forces. These training refinements were made to a prototype staff training package described in the report *Prototype Staff Training and Evaluation Methods for Future Forces*, Throne et al., 1999. The training refinements were implemented in a simulation-based experiment examining the impact of digital systems on Future Battle Command at the battalion and brigade level. This report focuses on the training support package designed to improve performance of staffs using advanced command, control, communications, computer, and intelligence (C⁴I) systems. Documentation is provided on the analysis, design and development of four staff training products developed under this effort: a Surrogate Command, Control, Communications, and Computers (SC⁴) System Demonstration, Digital Staff Drills, Team Training Sessions (TTSs) and TTSs Trainer Guide, and refinements to Tactical Decision-Making Exercises (TDXs). The formative evaluation is described for those products with survey results and project team observations reported by product type. Lessons learned on future staff training are documented and may help direct the Army's effort to develop command and staff training support packages (TSPs) for future forces.

RR 1764

Refinement of Prototype Staff Evaluation Methods for Future Forces: A Focus on Automated Measures. Throne, M.H., Holden, W.T. Jr., and Lickteig, C.W. November 2000. (AD A384027)

This report examines the use of digital information systems and automated measures of human performance to improve staff training and performance assessment. This work began with a review of research literature and technical documentation related to team performance and assessment, operations in digital environments, and automated performance data collection. A general design for staff performance assessment was formulated, based on findings of the literature review. An opportunity to implement

this design was provided by an Army Concept Experimentation Program (CEP), the Battle Command Reengineering (BCR) IV, which took place in April 2000. By participating in the BCR IV, researchers had the opportunity to conduct a trial implementation of the automated measures of performance assessment. Coordination between the U.S. Army Research Institute for the Behavioral and Social Sciences and the Mounted Maneuver Battlespace Lab (MMBL) at Fort Knox, Kentucky, enabled the two organizations to work together as a team to accomplish multiple goals. This report describes the development of prototype automated measures, the results of their use during the BCR IV, and lessons learned for future staff performance assessment efforts.

RR 1765

Special Forces 2000: A Report from the Field. Zazanis, M.M., Sanders, M.G., and Carpenter, T.D. January 2001. (AD B264775)

In 1999 the U.S. Army Special Forces Command (Airborne) (USASFC(A)) elected to survey their force to provide the command with updated information regarding career intentions, deployments, resources, and other critical issues in Special Forces (SF). Feedback was also obtained regarding the SF selection and training pipeline. Data were collected from 2,165 soldiers in the Spring of 2000, which represents a sample of about 40-50% of the population. Results provide critical feedback to SF commanders regarding key issues. Specific recommendations are provided.

RR 1766

Developing an Army Market Research Index in Support of Army Recruiting. Morath, R., Light, E., Gompper, N., Harris, J., and Zazanis, M. February 2001. (AD A389574)

A strong economy in recent years has increased the challenge that Army recruiters face in obtaining sufficient enlistees to meet force requirements. In order to continue to meet recruiting goals, the Army must understand youth perceptions and how youth make decisions about whether to join the Army. Generating appropriate market research for the Army requires first cataloguing the existing market research databases and identifying the critical questions that are not answered by current research. This effort identified existing databases that have information about youth and parent

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attitudes and developed a searchable electronic catalogue of these databases. For each of 64 databases identified, researchers acquired information such as the sample size, demographics of the subject population, the type of variables in the research, frequency of data collection, cost of obtaining the data, and point of contact information. An index was created that can be searched either using 17 relevant search categories or by a user-defined key word search. Recommendations for future research directions are discussed.

RR 1767

Training and Assessment of Decision-Making Skills in Virtual Environments. Pleban, R.J., Eakin, D.E., Salter, M.S., and Matthews, M.D. March 2001. (AD A389677)

This report describes a preliminary research effort to: 1) determine the effectiveness of using a virtual environment to train real world decision-making skills; 2) examine the feasibility of using a virtual environment as a test bed for developing situation awareness (SA) measurement instruments and; 3) empirically assess the role of SA in decision-making in simulated dismounted infantry environments. Seven experienced and seven inexperienced officers, role-playing a dismounted infantry platoon leader, individually conducted four urban operation scenarios (missions) in a virtual environment setting. Decision-making capability and SA were assessed for each mission. Objective decision-point accuracy improved significantly over missions. Level of experience did not impact the rate of learning. Experience did play a significant role in SA assessments. Selected SA measures also predicted a significant portion of the variance in objective decision-point scores. The research showed that real world decision-making skills could be trained using virtual environment technologies. To insure maximum benefit, virtual training must be combined with the appropriate field experience and mentoring. Conducting research in a controlled virtual environment setting permitted closer empirical scrutiny of the linkage between decision-making and SA in dismounted infantry operations and suggested new directions for further work in these areas.

RR 1768

The Virtual Sand Table: Intelligent Tutoring for Field Artillery Training. Wisher, R.A.,

Macpherson, D.H., Abramson, L.J., Thornton, D.M., and Dees, J.J. March 2001. (AD A388158)

This report examines the application of an intelligent tutoring system (ITS) for use in training a complex skill during the Field Artillery Captains Career Course. Based on a technology transfer agreement between the U.S. Army Training and Doctrine Command and the U.S. Army Research Institute for the Behavioral and Social Sciences, an ITS originally developed for the Navy was adapted for use in a sand table exercise. The exercise required students to deploy multiple launch rocket system assets during a reconnaissance and selection of position task. The task was conventionally taught using miniature replications of vehicles and launchers on a large table of sand. An ITS version of the exercise, called the Virtual Sand Table, replicated the training with the added advantage of informative feedback and computer-based coaching during the exercise. A comparison group (n=209) used the conventional sand table and the treatment group (n=105) used the Virtual Sand Table during a four-hour training exercise. Results, as measured by a hands-on performance test, indicated superior performance by the Virtual Sand Table treatment group, with an effect size of just over one standard deviation.

RR 1769

Analysis of the USAREC Recruiting Incentive, Partnership for Youth Success (PaYS) as Viewed by the Big-3 Companies of the Automotive Industry: Results, Conclusions and Recommendations. Elton, R.M., Benchhoff, D.L., and Bemis, A.H. March 2001. (AD A389686)

The Partnership for Youth Success (PaYS) is a new USAREC formulated recruiting incentive designed to appeal to high school seniors and graduates who would rather enter the workforce than attend college at the end of their initial term of Army service. The purpose of the present study was to present a briefing on the particulars of the PaYS program to officials of the "Big-3" automakers to determine the views of a homogeneous industry segment concerning the perceived strengths and weaknesses of the program as currently structured. This research was designed to offer all feedback gathered to the program's proponent for possible modification of the program to maximize its value as a recruiting incentive. An analysis of the feedback from the Human Resources

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Directors of Daimler-Chrysler, General Motors, and Ford as well as an official of the UAW indicated a uniform and consistent view that, while interested in employing former soldiers, the companies could not participate in the PaYS program as currently structured. Possible modifications of the program are provided as recommendations along with a possible protocol to be conducted on the target market by an appropriate survey agency to determine the extent of interest in the PaYS program as a significant recruiting incentive.

RR 1770

Measures of Platoon Leader Situation Awareness in Virtual Decision-Making Exercises. Strater, L.D., Endsley, M.R., Pleban, R.J., and Matthews, M.D. April 2001. (AD A390238)

This report documents an effort to investigate the situation awareness (SA) requirements for platoon leaders in a Military Operations on Urbanized Terrain (MOUT) environment. Subject matter experts with extensive infantry experience participated in a goal-directed task analysis to identify the SA requirements of platoon leaders at three levels: Level 1—perception, Level 2—comprehension, and Level 3—projection. From this analysis, objective and subjective SA measurement instruments were developed. Experienced and inexperienced officers engaged in four simulated missions in the Squad Synthetic Environment and responded to questions during halts in the simulation. Two instruments, the Situation Awareness Global Assessment Technique (SAGAT), a PC-based objective family of queries, and the Situation Awareness Behaviorally Anchored Rating Scale (SABARS), a subjective observer-rated instrument, both showed sensitivity to experience levels. The SAGAT scales also displayed sensitivity to the type of scenario and the point in the simulated mission at which the halt occurred. Officers with greater experience attended more to information about enemy locations and strengths, while less experienced officers attended more to information concerning friendly strengths. This has some intriguing implications for training new officers, but further investigation of these SA findings is necessary.

RR 1771

Commanders' Survey: Armor Captains'

Career Course (Distance Learning). Sanders, W.R. and Guyer, C.W. May 2001. (AD A390166)

The U.S. Army Research Institute for the Behavioral and Social Sciences (ARI) Armored Forces Research Unit (AFRU) at Fort Knox supports the U.S. Army Armor School (USAARMS) by conducting training research and development. The USAARMS has recently introduced a revised Armor Captains' Career Course (AC3) delivered primarily through Distance Learning (DL). In June 2000, the Director of the USAARMS requested that the AFRU provide Technical Advisory Service in the development and evaluation of a survey of both students and leaders involved with AC3 DL. This report describes the results of the survey developed to gather information regarding factors limiting participation in the AC3 DL course to include Reserve Component policies, monetary and non-monetary incentives, course impact on the student's other unit responsibilities, and factors contributing to student attrition. This report examines both course content and Reserve Component policies impacting distance learning time requirements and computer equipment support. Results of the survey were briefed to the Director of the USAARMS, and the Director of Training, National Guard Bureau in December 2000.

RR 1772

Assessing and Managing User-Produced Training Support Packages. Gossman, J.R., Graves, C.R., Mauzy, R.P., and Clagg, R.A. May 2001. (AD A390420)

This report describes the conduct and results of a project to examine assessment and management of user-produced training support packages (TSPs) for collective training exercises in live, virtual, constructive, and combined training environments for combat arms organizations at brigade and below at present and for the next five years. "User-produced" refers to TSPs that are developed by unit commanders and other unit trainers as well as institutional trainers who will be directly involved with executing the exercises they produce. The major research activities consisted of: data collection, data analysis, and development of products to fulfill the project objectives. A major focus of data collection was coordinating with the ongoing development of the Army Training Information Architecture which will establish a framework within which

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the products of the current project will fit. The project produced the following: a process for identifying core set exercises for combat arms units; the list of components and elements of a TSP for collective training exercises identified to a level sufficient to develop database specifications for them; recommendations for TSP assessment, approval, and distribution; and an identification of six types of users of TSPs along with their roles in exercise execution.

RR 1773

Cognitive Psychology Principles for Digital Systems Training. Sanders, W.R. June 2001. (AD A391035)

As the Army transitions to modern digital technology it faces a major challenge in designing computer-implemented training to support the acquisition, retention, and transfer of skills required to operate these systems. This report describes principles of cognitive psychology and related training techniques that can be incorporated into the design of computer-implemented training. While modern computers and the Internet offer technically advanced capabilities, the training potential of these systems comes from their ability to vary instructional methods and media systematically according to the cognitive demands of the tasks to be trained. The research described in this report builds on previous ARI skill retention research accomplished with the Army's Inter-Vehicular Information System (IVIS), where it was noted that a number of cognitive psychology principles might be applied to modify training to enhance skill retention. The products of this research are a set of cognitive psychology principles and related training techniques summarized in tabular form, and an outline for a training program structure. Examples of prototype training materials demonstrating the implementation of the cognitive training techniques are provided.

RR 1774

Six Myths about Digital Skills Training. Schaab, B.B. and Moses, F.L. July 2001. (AD A392922)

Soldiers entering the U.A. Army today encounter an array of weapons, equipment, and technologies that require information-age, digital skills. As these unique digital systems evolve, trainers are challenged to prepare soldiers to leverage these systems to meet complex, and sometimes

unanticipated, missions. In order to gain a better understanding of digital skill training, one group of soldiers was followed for almost a year as they experienced Advanced Individual Training, New Equipment Training, and unit training that covered one major hardware/software change and three software upgrades. Findings are based on observations, surveys, and performance on practical exercises. Results identify several misperceptions regarding the acquisition of digital skills and recommendations for modifying training to improve skill acquisition and transfer. For example, digital skills may not be highly perishable. Soldiers retain what they learned during Advanced Individual Training for at least three to four months, but many encounter difficulty in transferring what they have learned to a different problem setting. Training that engages the soldier by embedding the experience in a real-world context that requires active problem solving can enhance transfer.

RR 1775

Assessment of Initial Delivery of the Armor Captains' Career Course (Distance Learning). Sanders, W.R. and Burnside, B.L. August 2001. (AD A393635)

The U.S. Army Research Institute for the Behavioral and Social Sciences (ARI) Armored Forces Research Unit (AFRU) at Fort Knox supports the U.S. Army Armor School (USAARMS) by conducting training research and development. The USAARMS has recently introduced a revised Armor Captains' Career Course (AC3), formerly known as the Armor Officers' Advanced Course (AOAC), for Reserve Component (RC) officers, delivered primarily through Distance Learning (DL). In June 1999, the Director of the USAARMS requested that the ARI AFRU at Fort Knox provide Technical Advisory Service to assist in assessment of the new AC3 DL program. The request referred specifically to an assessment of the Internet-delivered Phase IA portion of the course. Results of the assessment provide evidence that the course is at least equally effective in presenting material previously taught in the AOAC RC program. The research also identified additional material that the AC3 DL program covers, which was not included in the AOAC RC program. This report provides training developers and Army leaders with a better understanding of the capabilities and challenges of training programs such as AC3 DL. It also provides course design,

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development, and implementation insights which may be generalizable to a broad range of Internet-delivered DL programs.

RR 1776

Decision-Centered MOUT Training for Small Unit Leaders. Phillips, J., McCloskey, M.J., McDermott, P.L., Wiggins, S.L., Battaglia, D.A., Thordsen, M.L., Klein, G. August 2001. (AD A394066)

This research effort applied principles of Naturalistic Decision Making to identify the cognitive challenges involved in platoon leader decision making in Military Operations in Urban Terrain (MOUT) building clearing missions. The findings informed the development of classroom, hardcopy, and multimedia training products to support Infantry Officer Basic Course students in MOUT decision making. A Cognitive Task Analysis of the building clearing task entailed a series of in-depth interviews with Army personnel experienced in MOUT. The analysis resulted in a detailed representation of eleven high-level decision requirements associated with the building-clearing task. Cognitive demands related to each requirement – critical decisions and judgments, sensory cues, other factors, and expert strategies – are included in the representation. Four products were developed based on the findings of the analysis: sixteen decision-centered training scenarios for MOUT environments; an interactive, multimedia tool (IMPACT) that supports instructors in training MOUT decision making skills; a classroom exercise that supports situation awareness appreciation and understanding; and a guide that provides supplemental information regarding the building clearing task from a platoon leader's perspective.

RR 1777

Training Critical Thinking Skills for Battle Command: ARI Workshop Proceedings. Riedel, S.L., Morath, R.A., and McGonigle, P.T. (Eds.). July 2001.

The ARI Workshop, Training Critical Thinking Skills for Battle Command, was held on 5-6 December 2001 at Ft. Leavenworth. The purpose of the Workshop was to (1) provide an overview of current research in critical thinking and training critical thinking (CT), (2) provide a forum for identifying and discussing issues related to training CT in the Army, and (3) develop recommendations for training and for future

directions for research and development in the area of CT training. Participants with a variety of expertise attended – military officers, instructors in CT and academic researchers in CT. The following papers were presented: *Critical Thinking in the 21st Century* by MG (Ret.) Lon Maggart; *Thinking Critically about Critical Thinking* by Diane Halpern; *A Framework for Critical Thinking Research and Training* by Susan Fischer; *A Three part theory of Critical Thinking: Dialogue, Mental Models and Reliability* by Marvin Cohen; *Critical Thinking in Teams* by Daniel Serfaty; and *A Simulation Tool for Critical Thinking Training* by Marvin Cohen. The Proceedings includes these papers, with the exception of the Serfaty paper. Workshop participants discussed a variety of issues related to training CT and their recommendations for training and future research are included in the Proceedings.

Research Products

RP 2001-01

Bradley Fighting Vehicle: Heat in the Driver's Compartment. Salter, M.S. and Eakin, D.E. January 2001. (AD A389671)

This paper reports some preliminary efforts to document heat issues in the M2A3 Bradley Fighting Vehicle. This research compared surface and ambient temperatures throughout the driver compartments of the M2A3 and its predecessor, the M2A2 ODS (Operation Desert Storm) vehicle. Reports by Bradley Fighting Vehicle personnel had suggested that the M2A2 ODS was hot, but that the M2A3 was hotter. Results of this study supported these reports. Surface temperature measurements indicated that radiant heat through engine-adjacent areas of the driver's compartment of the M2A3 produced extreme heat levels that were substantially hotter than the M2A2 ODS, although both models were found to have extremely high levels of heat in these areas. This study provided empirical evidence for a primary source of excessive heat within the M2A3 Bradley Fighting Vehicle driver's compartment. One of the possible engineering solutions to reduce heat in the driver's compartment suggested was implemented on a trial basis. Additional temperature readings on an insulated vehicle indicated that the insulation significantly reduced the heat coming from the engine area to the driver.

RP 2001-02

MOUT: Decision Making in Action. McDermott, P.L., Battaglia, D.A., Phillips, J., and Thordsen, M.L. April 2001. (AD A391474)

Military Operations in Urban Terrain (MOUT) create unique cognitive demands for small unit leaders. Years of experience are typically needed to master these demands. However, most platoon leaders tend to have limited experience in Army operations generally, and in MOUT specifically. Developed from in-depth interviews with veterans having MOUT combat experience, this report provides a comprehensive and detailed overview of the decisions platoon leaders must make during five stages of building clearing: secure perimeter, approach building, enter building, clear building and maintain security, and evacuate building. The report also discusses five general skills that are required throughout building clearing missions: think like the enemy, maintain situational awareness and the big picture, project into the future, apply rules of engagement, and lead subordinates.

RP 2001-03

Application of Cognitive Principles in Distributed Computer-Based Training. Deatz, R.C. and Campbell, C.H. July 2001. (AD A392929)

As the U.S. Army continues to develop more powerful and complex digital information systems, it is essential that both training needs and training opportunities are addressed to meet mission objectives. One way to address the training challenges of emerging digital systems is through the use of computer-based instruction (CBI), particularly because of the flexibility it offers in the way training can be delivered (e.g., embedded, distance learning, Internet). Another way is to improve learning by applying principles of cognitive psychology to the training design. This paper describes a research and development effort that incorporated a limited set of cognitive learning principles and techniques in the design of CBI for individual digital operator skills. To demonstrate the design features, four prototype training modules were developed for the Force XXI Battle Command Brigade and Below (FBCB2), the Army's vehicle-mounted digital system for distributing information to provide situational awareness. This paper describes how the selected instructional techniques and cognitive principles were used in distributed computer-based training. Pictures of screen layouts illustrate how the principles and techniques were instantiated in operator training for a digital system. Finally, this report provides a discussion of the lessons learned and issues for future research and development.

S47

Training Challenges for Digitization. Moses,
F.L. June 2001. (AD A395401)

This report outlines challenges about how best to train computer-based digital skills for future battlefield operations. It explains the foundation of Army needs, the state of current knowledge, suggests research to address the most pressing needs, and the potential benefits to the Army. Five training challenges for digitization are identified and discussed: (1) Determine task training requirements, (2) Training adaptability, (3) Prepare digitally-linked teams, (4) Assess skill levels of digital soldiers, and (5) Strategies for training on demand. The report's purpose is to communicate with training managers and leaders who have to make informed decisions about how to support training for the Objective Force and the future Army.

Study Reports

SR 2001-01

Training Analysis and Feedback Center of Excellence (TAAF-X). Anderson, L.B., Begley, I.J. II, Arntz, S.R., and Meliza, L.L. October 2000. (AD A384030)

This report describes a U. S. Army Research Institute (ARI) Simulator Systems Research Unit study conducted in response to a request from the U.S. Army Training and Doctrine Command (TRADOC) Army Training Modernization Directorate (ATMD). The goal of the project was to assess the feasibility of supporting the training analysis and feedback process for the U.S. Army's maneuver combat training centers (MCTCs) and selected homestation locations from a single centralized location, referred to as a Training Analysis and Feedback Center of Excellence (TAAF-X). The study refined ATMD's TAAF-X concept, identified potential implementation problems, described strategies for overcoming implementation problems, developed a TAAF-X Task database to use as an evaluation tool in analyzing the most efficient combination of strategies to overcome implementation problems, and estimated the overall feasibility of implementing the TAAF-X concept. Additionally we examined current programs under development and their potential impact on the TAAF-X concept.

SR 2001-02

Issues of Adaptive Automated Surveys in a Computer Network Environment. Entin, E.E., Kerrigan, C., Berbaum, M., Lancey, P., and McCallum, D. February 2001. (AD A389687)

Computer-based surveys administered over a computer network hold out a myriad of possibilities for tailoring surveys to particular groups or even to individual respondents, including adaptive automated surveys and new types of surveys never possible before. Computer-administered surveys allow survey items and instructions to be conveyed textually, graphically, and even in animation. Computer networks thus provide an ideal medium on which to conduct innovative, multimedia, dynamic surveys--surveys that can be sent instantaneously to a large number of recipients, regardless of whether the recipients are on-line at that time. They also allow the recipients to reply at a time that is convenient for them, without regard to whether the originator of the questionnaire is currently on-line and without having to look up an address or find a post box. The goals for this research included a review of the state of the art in current survey technology, an analysis of

which methods and procedures can be applied directly to computer network surveys, and hypothesized extrapolations of certain aspects of current survey technology that hold promise for the new medium of computer networks. Based on these findings, we delineated four sets of critical issues that must be investigated in order to conduct valid and reliable network surveys. We also conducted two pilot experiments to explore initial hypotheses about how effective network questionnaires should be formatted and how supporting help could be offered. These pilot experiments provided an opportunity to test and validate the experimental design and methodology that we developed. The appendix of this report discusses four areas in which empirical research is needed and outlines a program for conducting such research.

SR 2001-03

Effectiveness of Distance Learning for the Battle Staff NCO Course. Drenth, D.J., Kubisiak, U.C., and Borman, W.C. June 2001. (AD A393426)

This study compared graduates of a course taught through the Sergeants Major Academy by distance learning with graduates of the same course taught in residence, as usual. Unlike previous evaluations of distance learning, the measures used to compare groups were not students' immediate reactions to the course nor their end-of-course test scores but measures delayed until the graduates were on the job: (1) a written test of their job knowledge and (2) job performance ratings by their supervisors. Special care was taken to insure these measures were reliable and valid; the 42-item written test included only material covered in the course and the supervisors were motivated and trained on the technique of making accurate performance ratings. Knowledge test scores for a total of 172 NCOs and performance ratings for a total of 145 NCOs were collected from 8 sites. Results indicate that the different formats for the source, distance learning versus residence, had no reliable effect on either measures. NCOs received nearly the same knowledge test scores and supervisory ratings, on average, regardless of how the course was presented, supporting the conclusion that distance learning technology, as an alternative to residence-based training, does not involve a sacrifice of graduate quality.

SR 2001-04

Civilian Spouses of Soldiers: Comparison of the Results for Male and Female Spouses.

Study Reports

Marshall-Mies, J.C. September 2001. (AD A396481)

The 1995 Survey of Army Families III was conducted to examine the impacts of various Army programs on Army families, to identify new and emerging family issues, to assess progress in resolving Army Family Action Plan issues, and to track trends in the characteristics of Army families. A special analysis, summarized in this report, was designed to examine and compare these issues as they relate to civilian male and female spouses of Army soldiers. This report is based on 12,561 surveys, of which 1,757 were from male spouses and 10,804 were from female spouses. Although there were some differences between them (discussed in this report), civilian male and female spouses generally held similar attitudes and opinions in the 12 topical areas contained in the survey: Housing and Neighborhood, Family Relocation, Family Separations, Army Chaplains, Army and You, Your Background, Paid and Volunteer Work, Soldier Spouse's Background, MWR Programs and Installation Services, Children, and Army Way of Life. These findings will be useful for Army agencies and commands for developing plans, assessing policies, and evaluating program operations and outcomes.

SN 2001-01

The Effect of Reducing the Number of Tests in the Armed Services Vocational Aptitude Battery (ASVAB). Zeidner, J., Johnson, C., Vladimirovsky, Y., and Weldon, S. December 2000. (AD A385138)

The major goal of this research is to determine the effect on ASVAB classification efficiency of dropping the Numerical Operations (NO) and Coding Speed (CS) tests from the battery. If it could be shown that removing either or both of these tests would not significantly reduce the mean predicted performance (MPP) of the ASVAB classification or would not affect gender and racial fairness of the battery, then removing these tests would become defensible. Two data sets were used. The first set consisted of 150 job families containing 260,000 first-tour enlistees, and the second set (a subset of the first) consisted of 66 job families containing 83,000 observations. The criterion data were Skill Qualification Test (SQT) data from FY 1987-89. Findings indicate that a significant loss in MPP would be incurred by reducing the 9-test battery to a 7-test battery by removing NO and CS. The loss is 6.2 percent for the 150 job family data set and 8.1 percent for the 66 job family data set. The loss incurred from dropping NO is much less than from dropping CS, but the combined loss of dropping both tests is significantly greater than dropping either test alone. Dropping NO and CS would result in a greater loss of MPP for females than for the total sample. Dropping the two tests would not only increase gender unfairness of the battery, but would significantly reduce the accuracy of performance prediction for females. The pattern of loss for blacks is not as clear.

Research Notes

RN 2001-01

Contract for Manpower and Personnel Research and Studies II (COMPRS-II) Annual Report -- Year Two. Human Resources Research Organization. October 2000. (AD A382707)

This report documents and summarizes the activities of the first two years of a 5-year (1 base year and 4 option years) project to provide the U.S. Army Research Institute (ARI) non-personal, short- and medium-term scientific and technical support services in the solution of problems related to manpower and personnel. The program is referred to as the Contract for Manpower and Personnel Research and Studies II (COMPRS-II). HumRRO's primary responsibilities are to administer COMPRS-II for ARI under firm fixed-priced contracts by managing three inter-related tasks: (a) managing the COMPRS program in accordance with established operating procedures; (b) receiving and processing individual Statements of Tasks from ARI; and (c) managing, reporting progress on, and documenting the completion of delivery orders.

RN 2001-02

An Examination of the State of Workplace Learning at the End of the 20th Century. Schlechter, T.M. October 2000. (AD A382706)

This research note provides a snapshot of the state of workplace learning at the end of the 20th century. It also describes the training investment made by U.S. organizations, including the U.S. Army. This research note also reviews the links between workplace learning and a few central tenets of social cognition: (a) situated cognition, (b) regulatory behaviors, (c) efficacy, (d) shared mental model, and (e) transactive memory.

RN 2001-03

Development and Evaluation of a Program for Training Information Management in Distributed Organizations. Entin, E.B., Entin, E.E., and Hess, K. October 2000. (AD A383334)

A theory-based model of information management was created to develop a training program to train effective information management. The training program focused on the specific behaviors "prepare, filter, scan, read, and act" and helped information managers deal

more effectively with large amounts of information. Implicated ways in which the training paradigm could be improved and developed even further. The program fits in a niche that has been overlooked by researchers. The program focused exclusively on the process necessary to manage and integrate large amounts of information. This paper concludes that until automatic filtering systems improve dramatically enough to make the need for human filtering obsolete, a training program that focuses on specific behaviors such as Prep, Filter, Scan, Read, and Act can help people manage large amounts of information more effectively. Not only can people learn to better recognize and focus on important information, but they can learn to change behavior in such a way that they no longer contributes to other people's overload.

RN 2001-04

Army Culture. Winslow, D. November 2000. (AD A383899)

Methodological approach to the study of organizational culture gave rise to an economy of explanation which requires three levels of analysis: integration, differentiation, and fragmentation. Studies were classified as integrationist if they assumed or supported the idea of broad coherent patterns across the organization and/or placed an emphasis on a stable set of ideas, values, and norms characterizing the organization as a whole. Studies were classified as differentiated if they looked at specific groups or subcultures within the organization. Studies were classified as fragmented if they looked at the multiplicity of views (no consensus) and complexity focus (not clearly consistent or inconsistent). Army culture reflects the impulse or order (integration) the chaos (fragmentation) of warfare. The cross-pull between order and chaos is a key principle of army culture. Since the chaos of peace operations is qualitatively different from the chaos of war, the structuring of that chaos is bound to change.

RN 2001-05

A Review of Research on the Laser Marksmanship Training System. Smith, M.D. and Hagman, J.D. January 2001. (AD A388198)

This report reviews research on use of the Laser Marksmanship Training System (LMTS) to support small-arms marksmanship training and live-fire performance prediction. In general, the findings to date indicate that (a) an LMTS-

Research Notes

established rifle battlesight zero should not be used for record fire qualification without prior live-fire zero confirmation, (b) LMTS is capable of supporting effective initial entry, as well as sustainment, rifle marksmanship training although further research is needed to provide a definitive conclusion in regard to the latter, (c) LMTS-based performance can accurately predict the likelihood of both rifle and pistol live-fire qualification, and (d) these predictions provide an associated set of empirically derived, live-fire performance standards needed to support the implementation of competency-based small-arms training with LMTS as well as the use of LMTS for validating previous live-fire qualification performance when outdoor range facilities are not readily available or when mission requirements dictate.

RN 2001-06

Bradley Fighting Vehicle M2/M3 A3: Training and Soldier System Observations. Salter, M.S. January 2001. (AD A388153)

This paper reports some training and soldier systems observations about the newly introduced M2A3 Bradley Fighting Vehicle (BFV). Some cautions and lessons learned are included as they relate to the impact of the Bradley A3 on institutional and unit training, especially in the areas of digitization and device use.

RN 2001-07

The Effects of Battalion Staff Stabilization on Individual and Unit Performance: A Preliminary Investigation. Ardison, S.D., Bell, D.B., Tiggle, R.B., Milan, L.M., Bullis, R.C., Bourne, D.R. Jr., and Evans, W.E. February 2001. (AD A387969)

This research explored the feasibility and desirability of extending the time field-grade officers spend in battalions as either XO or S3 (and, thus, as part of a command team) from 12 to 24 months. A combination of surveys and interviews with brigade-, battalion-, and company-level leaders from seven "stabilized" battalions (i.e., XO, S3, CDR, and CSM serving together 24 months) and seven similar "non-stabilized" battalions was conducted. The relationships between extended tenure of battalion staff and measures of individual and unit performance, cohesion, communication, and command climate were investigated. Results showed that stabilization of battalion staff was not possible to maintain in a majority of the cases (six of the seven units). Although improvements in leadership skills and

abilities were associated with longer command team tenure, the results are those of a preliminary investigation and not intended for generalization to the Army at large.

RN 2001-08

Trends in Weapon Systems Performance at the National Training Center. Johnson, C.A. May 2001. (AD B267029)

This report documents improvements in the performance of weapon systems at the National Training Center (NTC) from 1985 to 1990. Data were obtained from the Battle Damage Assessments contained in the NTC Take-Home Packages and from the instrumentation center. Issues which had been identified by proponent schools during workshops on archived NTC data were examined. Findings address the utilization of the TOW weapon; range of tank engagements; and the synchronization of weapon systems.

RN 2001-09

Digital Skill Training Research: Preliminary Guidelines for Distributed Learning. Childs, J.M. June 2001. (AD A391742)

This task was aimed at the development of guidelines for distributed learning (DL). A matrix was generated to evaluate the effectiveness of various DL media for training representative knowledge/skill types. Of the approximately 200 DL studies initially reviewed, only 15 met predetermined selection criteria (empirical, learning outcome focus, conducted since 1996, applied training environments). Using a 3-point Likert scale, each study was rated according to the degree and direction of statistical difference reported between treatment (DL) and control group learning outcomes. Effect sizes were computed for those studies reporting standard deviations in learning outcomes. The majority of studies rated (77%) showed no significant difference in learning outcomes between DL-trained groups and their controls. Where differences were found, they favored DL-trained groups. Twelve factors are recommended as guidelines for designing, conducting, and evaluating effective DL.

Research Notes

RN 2001-10

Transfer of Training Revisited. Auffrey, A.L., Mirabella, A., and Siebold, G.L. July 2001. (AD A392933)

The research note contains a literature review of research on the transfer of training; it is intended for use by educational researchers and psychologists. The note includes information and comments on the relevance of transfer of training to what it labels as Army XXI environments, i.e., environments that might be found in the Army in the future and similar to those in what have been called the digital force and the objective force. The note presents different conceptualizations and measures of the construct of transfer of training, criticism of experimental findings in the area, a listing of the instructional and non-instructional sources of variation in the transfer of training, transfer enhancement through constructivist methods, additional thinking skills research, and the role of technology. Future research directions are suggested.

RN 2001-11

Mentor: Dialog Agent System for Mentoring and Conversational Role-playing. Murray, W.R., Sams, M., DeSmedt, W.H., and Loritz, D. August 2001. (AD A392955)

The goal of this SBIR program was to provide authorable, dialog-enabled agents for tutoring and performance support systems. Users interact with agents who carry out strategies and goals and can engage in mixed-initiative dialog via a natural language understanding and generation system. Non-programmers can author new domains and scenarios and create new dialog agents. The dialog system is authorable by non-computational linguists. The system has two types of agents, Mentor agents and Conversational agents. The Mentor agent is a simulated subject matter expert (SME) that provides troubleshooting and problem solving advice. Mentor engages in a dialogue with trainees, helping them solve problems by taking them through logical courses of action and asking and answering domain-specific questions. Conversational agents are used for role-playing scenarios. The only real difference between the two agents is that Conversational agents do not have specific problem solving strategies. Both Mentors and Conversational agents have domain specific knowledge and access to a common sense knowledge base. This report describes the

capabilities and limitations of results of this Phase II effort.

RN 2001-12

Reflections on the Structure of the Future Training System. Campbell, C.H. and Holden, W.T. Jr. August 2001. (AD A393431)

In redesigning itself for the future, the Army is grappling with a broad array of issues and challenges. Geopolitical changes, technological capabilities for both operational and training systems, and the demographics of the 21st century force must all be considered. Developments outside the mainstream of military transformation, such as the results of research into group and team behaviors and learning strategies, are also relevant. This paper addresses collective training needs and approaches for future brigade and below staffs. It makes the case for a training transformation, and presents descriptions of the objective training system and the research and policy development needed to construct that system. Three areas are considered: (1) issues and conditions that are driving the need for a training transformation; (2) a description of the objective training system that will enable the vision of the future brigade capabilities to become reality; and (3) recommendations for studies, research, development, and policy formulation needed to achieve the training transformation. This paper will serve as input to a research and development plan for U.S. Army Research Institute for the Behavioral and Social Sciences' Science and Technology Objective 02, Methods and Measures of Commander-Centric Training, by identifying key research issues and approaches for future training.

Index of ARI Publications

Abbreviations

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RP	Research Product	SR	Study Report
RR	Research Report	TR	Technical Report
S	Special Report		

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