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Research Report 1763

Refinement of Prototype Staff Training Methods for Future Forces

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Human Resources Research Organization

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14. ABSTRACT *(Maximum 200 words)*:

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 (C^4I) 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 (SC^4) 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.

15. SUBJECT TERMS

Battle Command Reengineering; Mounted Maneuver Battlespace Laboratory; C^4I; Staff Training; Demonstration; Team Training Sessions; Tactical Decision-Making Exercise; Vignettes; Trainer Guide

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Personnel Performance and Training Technology

FOREWORD

The Future Battlefield Conditions (FBC) Team of the Armored Forces Research Unit, U.S. Army Research Institute for the Behavioral and Social Sciences (ARI) has a Science and Technology Objective (STO) entitled "Force XXI Training Strategies." This STO is also reflected in the FBC work package (2228) FASTRAIN: Force XXI Training Methods and Strategies. Recent work under this work package has involved research and development concerning training for digital staffs. In order to continue this work, a contract entitled "Refinement of Methods for the Training and Assessment of Digital Staffs" was issued. The major purpose of this effort was to refine the prototype training and assessment techniques for future forces that had been developed during a prior research effort.

This report concerns refinement of training methods for future battle staffs equipped with digital command, control, communications, computers, and intelligence (C^4I) systems that had been developed during a previous research project. The report documents the design and development of three new prototype staff training products, including a surrogate Command, Control, Communications, and Computers (SC^4) System Demonstration, Digital Staff Drills, and Team Training Sessions (TTS). It also documents the refinement of previously developed Tactical Decision-Making Exercises (TDXs). The report examines implementation of the prototype products in a battalion-level Battle Command Reengineering (BCR) IV experiment, conducted by the Mounted Maneuver Battlespace Lab (MMBL) located at Fort Knox, Kentucky. Lessons learned from both the design and implementation of these methods of team training are also discussed.

At least two major audiences may be interested in this report. Researchers interested in the area of training for future forces will find an examination of a specific set of prototype team training sessions, fully developed during this project, that may be applicable to future staff training programs. Also, the report may be of interest to training developers, in that it describes an effort to implement digital staff training in a specific context (BCR IV). Thus this report may prove useful in future research and development efforts for training of future forces.

The prototype products developed under this effort are documented in a six-volume set of materials entitled *Training and Measurement Support Package, Battle Command Reengineering IV, Mounted Maneuver Battlespace Lab* (U.S. Army Research Institute for the Behavioral and Social Sciences, 2000), available from the MMBL. Evaluation findings from this effort are included in the MMBL's *Battle Lab Experiment Final Report (BLEFR) for Battle Command Reengineering, Phase IV* (in preparation).

The research reflected in this report was briefed to sponsors in a final In Progress Review, held at Armored Forces Research Unit, Fort Knox, Kentucky, on 13 July 2000.

ZITA M. SIMUTIS
Technical Director

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This report represents the efforts of a highly skilled and integrated team of research scientists, military experts, training developers, simulation technology experts, and administrative support personnel. Other than the authors, team members directly supporting the project included Mr. Neff Jenkins of Litton PRC and Mr. Mike Cobb of Human Resources Research Organization (HumRRO), who provided military subject matter expertise, and Ms. Kathleen Horn, who provided administrative support. Ms. Charlotte Campbell (HumRRO) was the Program Manager for this project. Her contributions went far beyond project supervision. She was involved in all project decisions, contributed her expertise as a Research Psychologist, and was a reviewer of this report.

Additionally, we had support and guidance from a variety of individuals and government organizations, including:

- Mounted Maneuver Battlespace Lab (MMBL), Fort Knox, Kentucky

  Colonel Richard Savage, Chief
  Major Joe Burns, Chief, Advanced Concepts Research
  Captain Dan Ray, Concept Integration Officer

- IITRI/AB Technologies

  Mr. Pat Ritter, Program Director for Research
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- Lockheed Martin-Marietta

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- Test and Evaluation Coordination Office (TECO), Fort Knox, Kentucky

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- 2nd Armored Cavalry Regiment, Fort Polk, Louisiana

REFINEMENT OF PROTOTYPE STAFF TRAINING METHODS FOR FUTURE FORCES

EXECUTIVE SUMMARY

Research Requirement:

The U.S. Army is currently developing and fielding information systems for the digital battlefield of the future. In support of this effort, the U.S. Army Research Institute for the Behavioral and Social Sciences (ARI), Armored Forces Research Unit, Future Battlefield Conditions Team is engaged in the design and development of prototype training. As a follow-on project to the initial *Prototype Staff Training and Evaluation Methods for Future Forces*, ARI's objective was to refine the staff training strategies for staff operations in the future digital tactical operations center at brigade and below. To accomplish this objective, the Project Team designed and developed three training products: Surrogate Command, Control, Communications, and Computers (SC^4) System Demonstration, Digital Staff Drills, and Team Training Sessions Trainer Guide. A fourth product, Tactical Decision-Making Exercises (TDXs) developed under the previous project, was also refined.

The prototype products were implemented during the Battle Command Reengineering (BCR) IV Concept Experimentation Program (CEP) experiment, led by the Mounted Maneuver Battlespace Lab (MMBL) team, at the Mounted Warfare Test Bed (MWTB) in Fort Knox, Kentucky. The ARI's purpose for participating in this experiment was to support the MMBL, gather feedback for improvements to the prototype training package, and support the Army's need to gain additional information on future staff training requirements.

Procedure:

The work conducted during the original project, *Prototype Staff Training and Evaluation Methods for Future Forces,* provided the foundation for the training design. In addition, the work on other ARI-developed structured training programs provided models for collective training support packages (TSPs). The Project Team also reviewed available literature regarding "soft-skills" (e.g., decision-making) training delivery methods. This review included study of the U.S. Army Training and Doctrine Command (TRADOC) Digital Learning Strategy (Department of the Army, 1998) and other training and education publications.

The analysis for each of the four training products began by adapting training methods derived from the literature and lessons learned from the original project to meet the unique requirements of the BCR environment. These requirements included the need for the staff to be prepared to conduct futuristic missions using unique equipment within a new staff organization. Based upon the analysis, the training products were designed and developed following established training development methods.

The complete prototype training program, with the new and refined products, was implemented during the BCR IV experiment from April 3 through April 21, 2000. The

experiment was conducted in the MMBL test bed at Fort Knox with the 2nd Armored Cavalry Regiment from Fort Polk participating.

The formative evaluation approach consisted of a formal aspect which included interviews and unit surveys administered at the end of the training week and BCR experiment. This was supplemented by an informal element of Project Team observations throughout the design, development, and implementation phases. The focus of the evaluations was on the implementation process and perceived benefits of the four new or revised training products.

Findings:

One finding from the implementation of the four training products during BCR IV is that a scenario-based structured training exercise is an effective and efficient training method. Though this finding is not new, it is one that was reinforced with the implementation of the Digital Staff Drills and the TDXs. A finding was made that a multi-media demonstration is a good method to present a concise overview of the key aspects of a complex digital command, control, communications, computers, and intelligence (C^4I) system, although it should be able to be displayed at the soldier's duty station. Another finding supports the concern that the full benefit of conducting team training sessions may be compromised when they are conducted in conjunction with learning to operate an advanced C^4I system and establishing a new staff structure in a compressed training schedule. Other findings regarding Team Training Sessions include: a) ensuring the training component is fully developed prior to developing a Team Training Sessions Trainer Guide, and b) training the Commander in advance of the unit to better customize the training for the unit members.

Utilization of Findings:

These findings provide insights into prototype staff training methods and products for future forces. The specific audience who may find the information contained in this report beneficial includes: a) training program designers, developers, and implementers; b) simulation system developers (hardware and software); and c) training unit and training site personnel.

The prototype staff training products and package were used to support the BCR IV and the findings were provided to the MMBL for inclusion in the *Battle Lab Experiment Final Report (BLEFR) for Battle Command Reengineering, Phase IV* (in preparation).

The complete prototype staff training package was provided to the MMBL for use in future BCR experiments, or for other related efforts, that includes the four training products discussed in this report. That six-volume set of materials is entitled *Training and Measurement Support Package, Battle Command Reengineering IV, Mounted Maneuver Battlespace Lab* (U.S. Army Research Institute for the Behavioral and Social Sciences, 2000).

This report documents this effort, including the lessons learned, that may help in the Army's development of TSPs for future staffs, including Brigade Combat Teams.

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REFINEMENT OF PROTOTYPE STAFF TRAINING METHODS FOR FUTURE FORCES

INTRODUCTION

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). Both the first and current projects were to provide training and evaluation support to the U.S. Army for the digital battlefield of the future. The success of the digital information systems is based on the provision of networked digital information systems to all soldiers in the areas of combat, combat support, and combat service support (Decker, 1996). As digital systems, referred to as Command, Control, Communications, Computers, and Intelligence (C^4I), evolve, there are changes in the complexity level of the skills the soldiers and leaders must possess.

The operation of a brigade or battalion staff is based upon information. Currently, the staff processes information by using several individuals to monitor and analyze data from a myriad of sources to form a common picture of the current battlefield situation. In the future, C^4I systems will provide much of that information more quickly, fuse it from multiple sources, and make it universally accessible. One by-product of the future C^4I systems may be the reduction in the number of staff needed to operate within this environment, though the amount of information and pace of operation will increase.

There is a tendency to think digital systems will provide most of the staff's situational awareness (SA). Endsley (1998) defines SA as "the perception of the elements in the environment within a volume of space and time, the comprehension of their meaning, and the projection of their status in the near future" (p. 97). Therefore, SA is not likely something that C^4I systems will directly provide, leaving commanders to rely on staff members to provide this level of information analysis. The difficulty then lies with training fewer staff members to effectively process, interpret, and use more information faster.

Both the current and original Project Team efforts were based on experimentation and observation. A trial implementation of the earlier work occurred during an Army experiment, Battle Command Reengineering (BCR) III. The experiment was led by the Mounted Maneuver Battlespace Lab (MMBL) team and took place in April 1999 at the Mounted Warfare Test Bed (MWTB) in Fort Knox, Kentucky. The current Project Team also conducted a trial implementation of the recent work during BCR IV in April 2000.

This report focuses on the Project Team's efforts to expand and refine a prototype staff training package. Expansion efforts included the design and development of a C^4I system demonstration, Digital Staff Drills, and a trainer guide for Team Training Sessions (TTSs). Refinement efforts included revising the Tactical Decision-Making Exercises (TDXs) that were designed during the first project.

A complimentary report documents the team's effort on the evaluation strategy, or staff performance assessment portion of the project, *Refinement of Prototype Staff Evaluation*

Methods for Future Forces: A Focus on Automated Measures (Throne, Holden, & Lickteig, in preparation).

The work reported here was performed by the U.S. Army Research Institute for the Behavioral and Social Sciences (ARI) staff and two contracted research and development organizations: Human Resources Research Organization and Litton PRC.

Organization of the Report

This report contains information regarding four innovative training products that were developed or refined during this project. The products are discussed in detail regarding their design, development, and implementation. There is also discussion of the products from a macro-perspective as to how they may influence current and future training needs for the Army. The organization of this report is presented in Table 1.

Table 1

Organization of the Report

Section	Description
Introduction	Summary of the first project's effort in addition to previous research and relevant literature on training designs
Training Products for BCR IV:	
SC^4 System Demonstration	Description of the analysis, design, development, and results of the formative evaluation for the SC^4 demonstration
Digital Staff Drills	Description of the analysis, design, development, and results of the formative evaluation for the drills
TTSs and TTSs Trainer Guide	Description of the analysis, design, development, and results of the formative evaluation for the TTSs and TTSs Trainer Guide
Refined TDXs	Description of the analysis, design, development, and results of the formative evaluation for the refined TDXs
Summary of the BCR IV Lessons Learned	Review of the current project's lessons learned
Directions for Future Research and Development	Description of the recommended future directions for command and staff training

Note. BCR = Battle Command Reengineering; SC^4 = Surrogate Command, Control, Communications, and Computers; TDX = tactical decision making exercise; TTS = Team Training Session.

Appendix A contains a list of the acronyms and abbreviations used in this report. Samples of training products developed for the Surrogate Command, Control, Communications, and Computer (SC^4) System Demonstration, Digital Staff Drills, and the TTSs and TTSs Trainer Guide are contained in Appendixes B, C, and D, respectively. In addition, the complete prototype staff training package developed during the previous and current project is available from the MMBL. This six-volume set of materials is entitled *Training and Measurement Support Package, Battle Command Reengineering IV, Mounted Maneuver Battlespace Lab* (U.S.

Army Research Institute for the Behavioral and Social Sciences, 2000). The Training and Measurement Support Package (TMSP) volumes and their contents are:

- *Volume 1. Overview and Front-End Analysis for Training and Measurement.* Documents all of the front-end analysis efforts and products from the previous and current project.
- *Volume 2. Initial Orientation and Train-Up.* Documents materials which include: the initial BCR IV briefing slides, the SC^4 System Demonstration, Training Plan Outlines (TPOs) for initial and advanced digital system training, copies of the performance assessments developed by the MMBL team, and the Digital Staff Drills.
- *Volume 3. Advanced Training.* Contains the staff training package materials for the scenario-based, structured training exercises developed as a prototype for use in BCR IV.
- *Volume 4. Team Training Sessions Trainer Guide.* Contains the revised TTSs descriptions, revised TPOs and support materials for conducting familiarization briefings, and execution materials for conducting the TTSs.
- *Volume 5. Measures.* Includes copies of all surveys and structured interview forms, descriptions and screen copies from the observer data collection instrument used in BCR III, and copies of surveys and specifications for the automated measures used in BCR IV.
- *Volume 6. Data Codebook.* Contains basic descriptions and analyses of the variables in the data sets resulting from the data collection in BCR IV.

Background

To better understand the requirement and purpose for the four training products discussed in this report, a summary of the previous project follows. This includes a brief discussion of the literature reviewed, the prototype staff training program, and lessons learned that were documented during the first project. As noted, more complete documentation is provided in the report entitled *Prototype Staff Training and Evaluation Methods for Future Forces* (Throne et al., 1999).

Training Literature

Based on the literature review for the first project, four key methods of effective training were identified and selected: use of advance organizing techniques, part-task training, deliberate practice, and context-based training (Throne et al., 1999). A description of these four methods follows with a brief note on how they were employed in the first project. These training methods were also used for the current project.

Advance Organizers

An advance organizer is a tool used to facilitate long-term recall and transfer of general concepts by organizing new material by relating it to known concepts and prior knowledge of the learner (Smith, Ford, & Kozlowski, 1997). When presented prior to the new training, the advance organizer serves as a bridge, helping the learners recall what they know about a topic

and transfer that knowledge to new topics. Cannon-Bowers, Rhodenizer, Salas, and Bowers (1998) define advance organizers as "...a category of activities such as outlines, text, aural descriptions, diagrams, and graphic organizers that provide the trainee with a structure for the information that will be provided in the practice environment" (p. 298).

An advance organizer used in the first project was a briefing that compared the training unit's current organization to what they could expect to see in BCR III. This briefing was provided to the unit at its home station and repeated during the initial orientation of the BCR experiment.

Part-Task Training

Another method of effective training is part-task training. Tasks are divided into smaller parts (subtasks) and are trained individually. This allows the learner to practice each subtask individually before practicing the task as a whole.

In BCR III, the part-task training method is used throughout the prototype staff training program by first teaching parts of tasks during the individual SC^4 system training. Gradually, the tasks are grouped into more complete sets as more complex elements are added. This process continues until the learner is practicing the whole task as it would be performed in collective tactical exercises.

Deliberate Practice

While part-task training is valuable to the learner's retention of the training, deliberate practice is important because it is the means by which training is reinforced. Deliberate practice incorporates the concept of part-task training described above, with observer guidance and feedback while practicing, until the criterion is reached. Although essential, practice alone does not assure a task will be performed well.

Deliberate practice was incorporated in the C^4I system training during BCR III by providing structured practice exercises to reinforce the training received after each segment of C^4I system training.

Context-Based Training

Each of the previously described training techniques contributes to performance improvement; however, their influence will be even stronger if training is provided in a job-related context. According to Means, Salas, Crandall, and Jacobs (1993), training should be conducted "...within a meaningful (but not necessarily whole) task context..." (p. 316). By allowing learners to practice interacting with a system without any guidance or context, they will not develop an acceptable understanding of the material (Cannon-Bowers, Salas, & Converse, 1992). Therefore, specific instructional guidance should be provided, and training should relate to the job context, to ensure accurate understanding among team members (Throne et al., 1999).

Context-based training was used in BCR III for the task training that provided practice opportunities for system operational skills in a mission scenario using small groups. It was also

used in the subsequent collective tactical exercises focused on using those C^4I system skills to accomplish collective battle staff tasks.

Prototype Staff Training Program

An overview of the complete prototype staff training program developed for BCR III is shown in Figure 1. Again, the key training methods included in this program were: a) advance organizer, b) part-task training, c), deliberate practice, and d) context-based training. The content of this program addressed three major training needs: system operations, tactical skills, and team process skills, as discussed in Throne et al. (1999). The three staff training needs might be categorized as: knowing how to "push the buttons" of the SC^4 system, found in the Levels 1 through 3, individual skills; applying "button pushing" to accomplish small parts of their jobs in a tactical setting, Level 4, small group skills; processing the information provided by the system and other team members during a tactical mission exercise, Level 5, team decision-making skills.

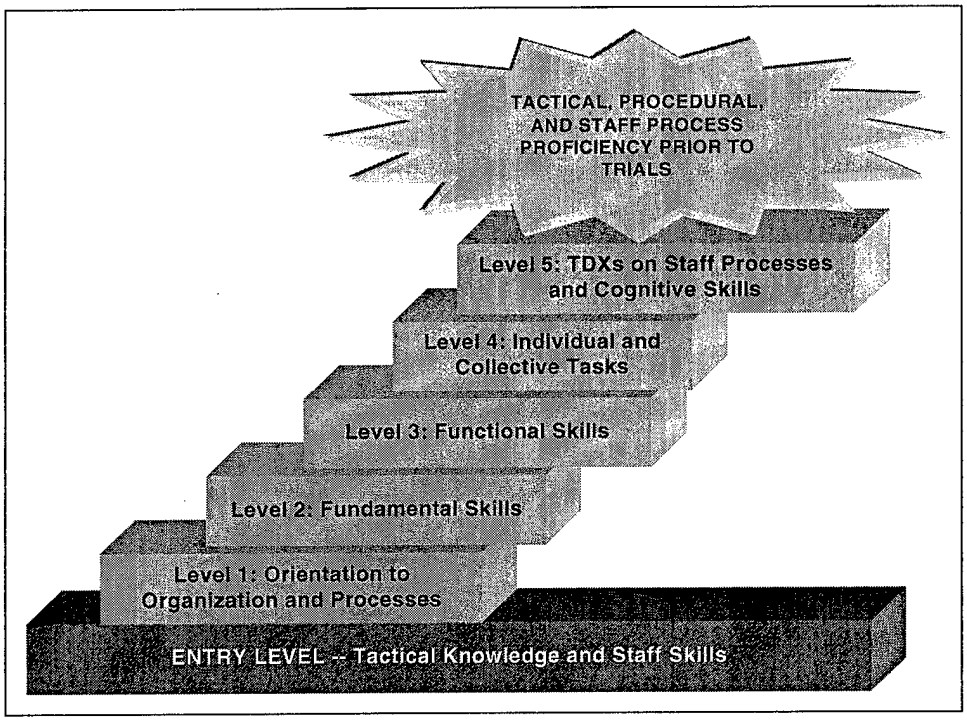


Figure 1. Training levels for first project and Battle Command Reengineering III.

The formative evaluation for the prototype staff training program took two forms: informal and formal. The informal evaluation included iterative design and development reviews by the previous project's team members and subject matter experts (SMEs). The formal evaluation consisted of a series of surveys and interviews with the training participants, MMBL staff members, and military Observer/Controllers (O/Cs).

Selected Lessons Learned from Battle Command Reengineering III

The first project's team used the results of the evaluation to generate lessons learned (Throne et al., 1999). Some of those lessons learned were applied to the product development

and refinements described in this report. Table 2 relates lessons learned to the training products developed and refined during the current project.

Table 2

Battle Command Reengineering (BCR) III Selected Lessons Learned Applicable to Current Project

Lessons Learned from BCR III	Current Project Products
Provide the training audience a general understanding of C^4I system capabilities and train-up expectations during the initial orientation	SC^4 System Demonstration
Provide more practice exercises to help bridge the individual and collective training gap between the functions and task training found in Levels 3 and 4	Digital Staff Drills
Create a trainer guide for the TTSs	TTSs and TTSs Trainer Guide
Increase the pace of training during the TDXs	Revised TDXs

Note. C^4I = command, control, communications, computers, and intelligence; SC^4 = Surrogate Command, Control, Communications, and Computers; TDX = tactical decision making exercise; TTS = Team Training Session.

TRAINING PRODUCTS FOR BATTLE COMMAND REENGINEERING IV

This section of the report begins with a description of the BCR IV training environment, followed by a general overview of the training products, and discussion of the evaluation strategy. That is followed by a description of the analysis, design, development, implementation, results, and discussion for each product. Those products are:

- SC^4 System Demonstration
- Digital Staff Drills
- TTSs and TTSs Trainer Guide
- Refined TDXs

Training Environment for Battle Command Reengineering IV

Descriptions of the BCR IV participants; the unit's organization, particularly staff roles; and the equipment used are provided below. This training environment was challenging in that it required the unit to acquire new roles in a new organization as well as new digital equipment skills, during a one-week training period.

Participants

The unit participating in the experiment was an active Army cavalry squadron staff with its subordinate company commanders. One company brought drivers and gunners to man several

Future Combat Vehicle simulators. As shown in Figure 2, the squadron staff, which operated in a virtual simulation, included the commander and 13 staff officers and non-commissioned officers (NCOs). The commander and staff were reconfigured into two battle command vehicles (BCVs) and two staff operations vehicles (SOVs), or nodes. The battle command reengineering aspect of the BCR IV experiment was focused on this group of 14 soldiers referred to as the primary training audience in this report. The node functions and job responsibilities for each staff member were left to the discretion of the squadron commander, who was allowed to reorganize the staff as he gained experience operating a C^4I system. The extended training audience included company commanders, deputy company commanders, scout platoon leader, scout platoon sergeants, and combat vehicle personnel.

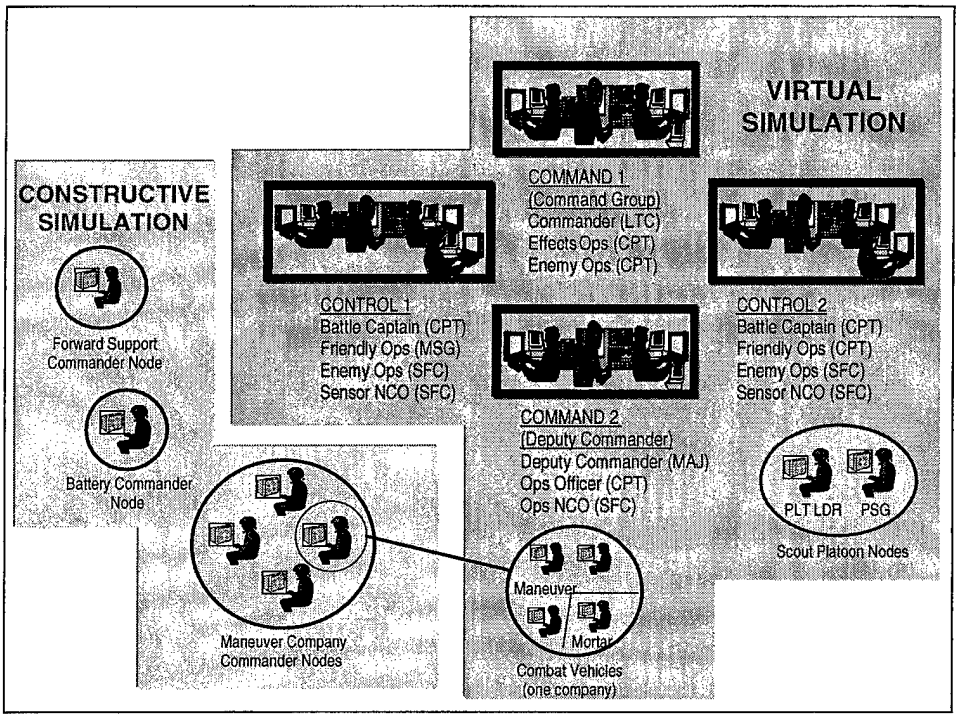


Figure 2. Battle Command Reengineering IV unit and staff structure.

Materials

The BCR IV used emulation as well as constructive and virtual simulators. Figure 3 shows the layout of the SC^4 system in the BCVs and SOVs. The primary user interface, and a key SC^4 component, was the Plan View Display (PVD) which is depicted in Figure 4. The overall SC^4 system included the following capabilities:

- Command and Control PVD, represented by the Modular Semi-Automated Forces (ModSAF) two-dimensional PVD. On the PVD, the commander and the staff are able to view movements of all of their own systems, as well as any opposing forces (OPFOR) units detected by satellite or other sensors. Overlays can be drawn on the PVD, users can add labels or other notes, and there are tools that show past events and project future movements.

- Stealth display, providing a 3-dimensional representation of the battlefield with all of the systems that are visible on the PVD (i.e., friendly and detected OPFOR).
- Video teleconference (VTC) capability linking the commander and the staff.
- Collaborative Whiteboard capability, to allow the commander to present his intent and guidance to the staff visually and quickly. Users who are part of the Whiteboard session can show snapshots from their PVDs, draw in different colors on those images, add clipart-style labels and icons, and type words onto the Whiteboard.
- Large screen display, providing a three-dimensional representation of the battlefield with all of the systems that are visible on the PVD, Stealth, Whiteboard, or Unmanned Aerial Vehicle (UAV) screens.
- Digitized modified combined obstacle overlay (MCOO), produced automatically for the large screen display, rather than as a manually produced intelligence overlay.
- Satellite imagery, acting as the electro-optic satellite sensor to deliver a direct downlink imagery feed.

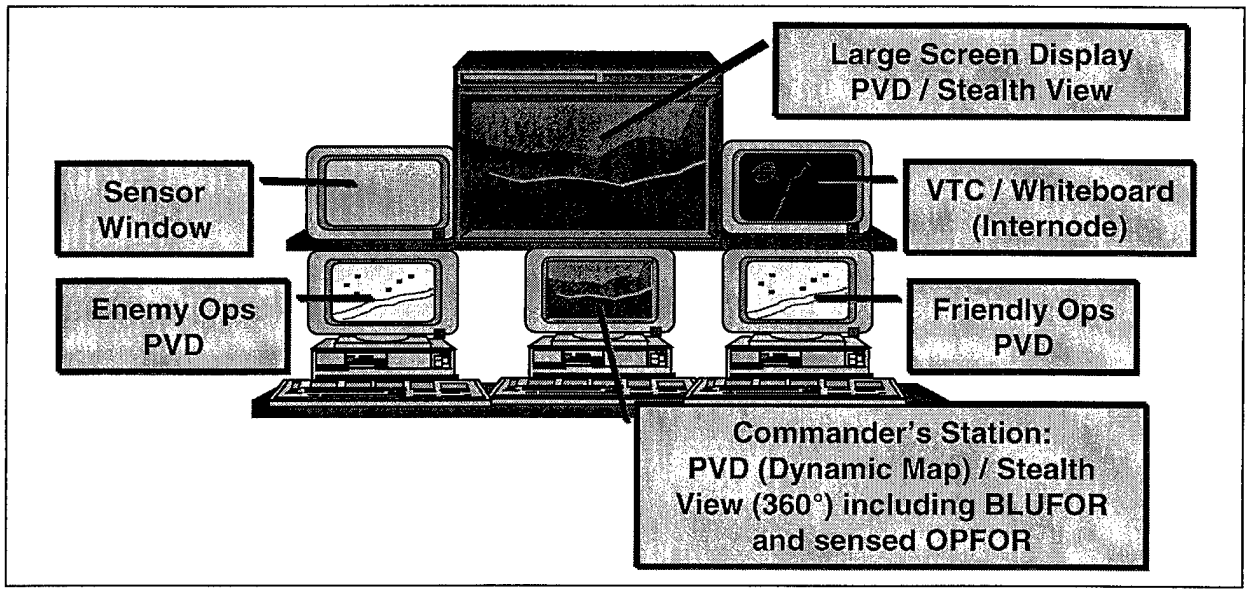


Figure 3. Surrogate Command, Control, Communications, and Computers system setup.

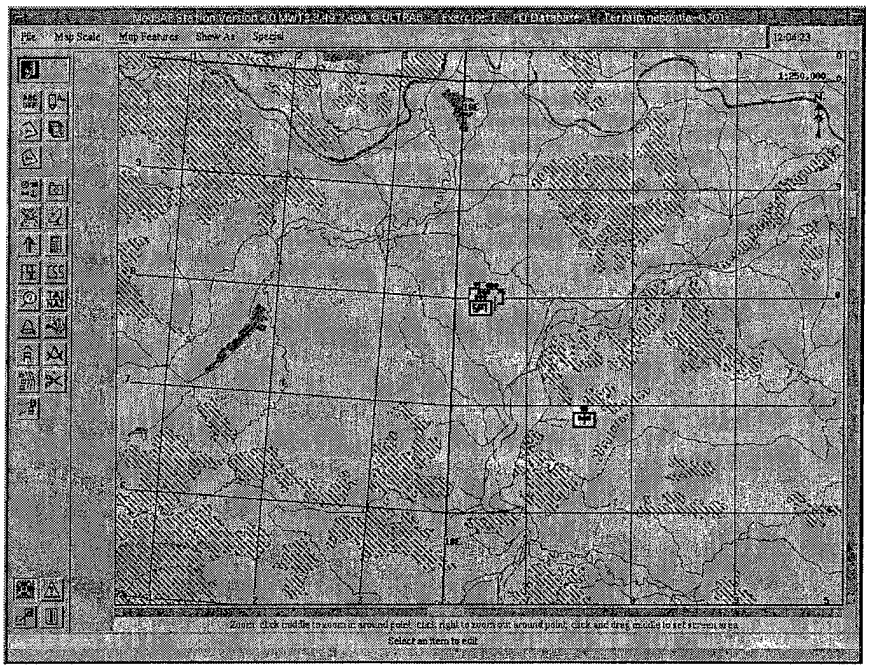


Figure 4. Sample Plan View Display screen.

Vehicles and weapon systems were represented in either constructive or virtual simulation. Constructive simulation (ModSAF) was used to generate and control the OPFOR, friendly forces below the company level, and unmanned vehicles replicating both aerial and ground sensors (referred to as UAVs and Unmanned Ground Vehicles (UGVs), respectively). Constructive simulation workstations were used by the mortar battery commander, forward support company commander, four maneuver company commanders, and six deputy company commanders. The remainder of the extended training audience was in virtual simulation.

In the virtual environment, simulators were used to represent several vehicles. These included the battalion commander and deputy commander vehicles which were represented by the Advanced Research Projects Agency (ARPA) Reconfigurable Simulator Initiative (ARSI) simulator and an ARSI mockup, respectively; and BCVs and SOVs which were represented by command and control vehicle (C^2V) mockups. Scout vehicles and the manned platoon vehicles of one maneuver company were represented by Future Combat Vehicle mockups. The virtual and constructive environments were linked by means of distributed interactive simulation (DIS) to form the seamless battlefield environment for the participants.

The BCR IV experiment missions were based on tactical operations that an Army battalion, equipped with an advanced digital C^4I system, might be expected to conduct in the year 2010 and beyond. The virtual terrain chosen for the experiment was northeastern Bosnia-Herzegovina, centered around the city of Tuzla. This terrain is extremely mountainous with limited ground mobility corridors.

Finally, the timeline for BCR IV, as shown in Figure 5, provided only one week to train primary and extended training audiences. During this one week of training, participants were required to learn: how to operate the SC^4 system, a new staff organization, new roles and

functions, new orders of battle and weapon system capabilities, and to operate in relatively new terrain. This training environment is important to note since it impacted the design of the training products. There was a great deal of information to be covered in a compressed time frame.

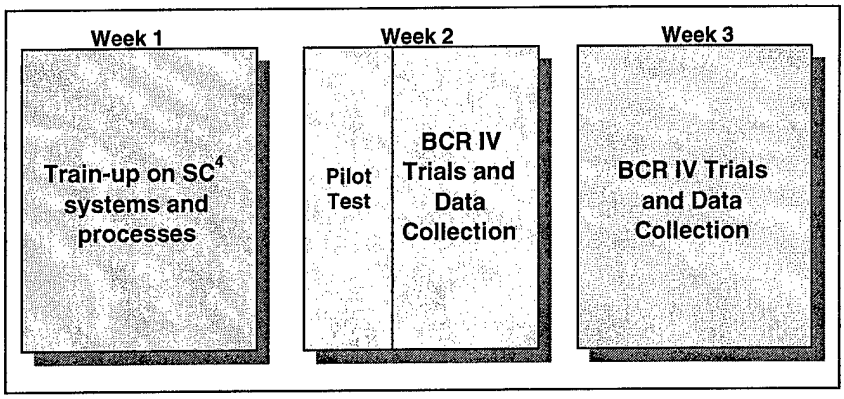


Figure 5. Staff training schedule for Battle Command Reengineering (BCR) IV.

Overview of the Training Products

Prior to discussing the current project's products (new and refined), it is important to understand how they fit within the prototype staff training program described in the background section. The revised training level hierarchy, Figure 6, shows where each new training product fits in the overall training strategy. The SC^4 System Demonstration was incorporated in Level 1, Initial Orientation. The Digital Staff Drills are a bridge between functional and task training, and therefore, were inserted after Level 3, creating the new level in the hierarchy. Additionally, as the figure indicates, TTS exercises are introduced in Level 5 Task Training and are part of the Level 6, Revised TDXs, as well.

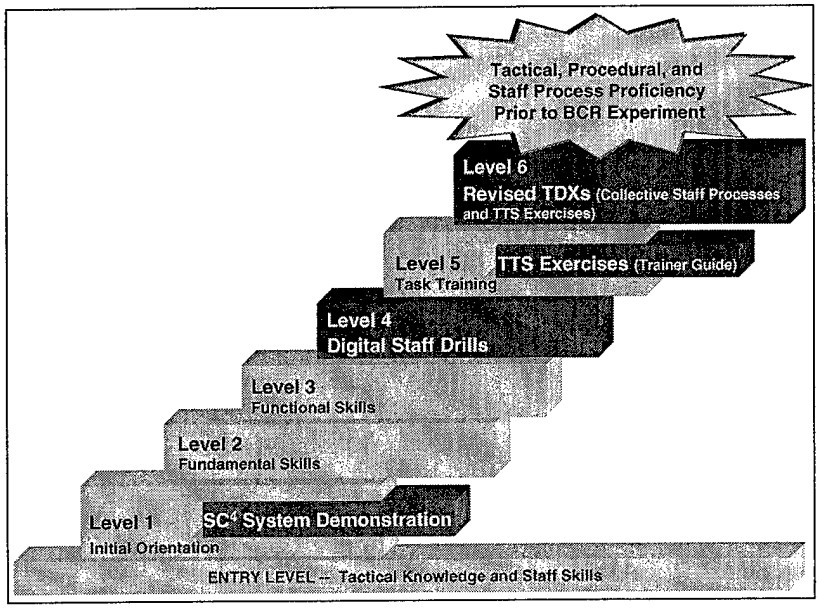


Figure 6. Revised training levels for current project and Battle Command Reengineering IV.

The training development approach used during this project is based on the Army's Systems Approach to Training (SAT) as documented in Department of the Army (1999). The process begins with a front-end analysis, followed by design and development phases. Throughout the process, products are reviewed, evaluated, and revised as necessary. It should be noted that SAT is not a lock-step process and often the lines between analysis, design, and development can overlap. This report attempts to categorize the efforts based on SAT, but concedes that some efforts overlap more than one phase.

All of the training materials developed for the four products are documented in Volumes 2, 3, and 4 (U.S. Army Research Institute for the Behavioral and Social Sciences, 2000). Key aspects and examples of selected materials are provided within the body of this report. Extended examples of some materials are provided in the appendixes, as indicated in the text.

The Project Team, as part of its overall analysis, identified the primary training attributes for each level of training. Table 3 shows the matrix that was used to define the levels. The left column identifies attributes of training that are primary training characteristics. The matrix provided a simple way to highlight the distinctions between the training levels.

Table 3

Training Level and Attribute Matrix

Attributes	Level 1 Initial Orientation	Level 2 Fundamental Skills	Level 3 Functional Skills	Level 4 Digital Staff Drills	Level 5 Task Training and TTSs	Level 6 TDXs (with TTSs)
Training Focus	System	System	System	System	Staff Processes	Staff Processes
Audience	Individual	Individual	Individual	Small Group	Small Group	Collective
Context-Based	Very Limited	Very Limited	Limited	Moderate	High (Scenario-based)	Very High (Mission-based)
Topic	SC^4 System Capabilities	Basic SC^4 Skills	Advanced SC^4 Skills	System Skills Practice	Abbreviated MDMP	Collective Tasks and Team Training
Method	Demonstration	Training	Training	Exercise	Exercise	Exercise
Reinforce Training	None	Individual Practice and Performance Assessment by RA	Individual Practice and Performance Assessment by RA	Small Group Practice an Performance Assessment by RA	Small Group Practice	Collective Practice
Led By	Training Director	RA	RA	RA	Training Director	Training Director

Note. MDMP = military decision-making process; RA = research assistant; SC^4 = Surrogate Command, Control, Communications, and Computers; TDX = Tactical Decision-Making Exercise; TTS = Team Training Session.

The training level and attribute matrix was used to develop the definitions for the six distinct, progressive training stages. Brief descriptions are as follows:

- Level 1, Initial Orientation. An advance organizer containing an introduction, orientation, and system demonstration for the BCR Experiment.
- Level 2, Fundamental Skills. Individual training focused on basic SC^4 system tools conducted in a very limited contextual setting. The training is led by a Research Assistant (RA), with time allotted for deliberate practice followed by a go/no go performance assessment by the RA.
- Level 3, Functional Skills. Individual training, in a limited contextual setting, focused on more advanced SC^4 system tools that are grouped by functional usage. The training is led by an RA, with time allotted for deliberate practice followed by a go/no go performance assessment by the RA.
- Level 4, Digital Staff Drills. Staff drills in the form of vignettes for practicing selected SC^4 system tools in a moderately difficult tactical context. The exercises are led by an RA followed by a go/no go performance assessment by the RA.
- Level 5, Task Training and TTS. Staff and team exercises focused on combining newly acquired SC^4 system skills with staff processes in a highly contextual, scenario-based setting. The exercises are led by the Training Director. Two TTSs are introduced that focus on identifying team roles and functions in addition to information management issues.
- Level 6, TDXs (with TTSs). Collective structured training exercises that provide practice using SC^4 system skills and staff processes in a mission-based setting. The TDXs are tactical exercises that are led by the Training Director and contain three embedded TTSs focusing on improving teamwork, SA, and decision-making.

Formative Evaluation Strategy

The formative evaluation was established as a twofold process: informal and formal. Informal formative evaluation consisted of repeated reviews of the training products throughout the design and development phases and is consistent with the SAT and structured training approaches. The reviews, process walkthroughs, and trials were conducted by an internal network of SMEs and training professionals. They were supplemented by input provided by ARI and MMBL staff.

The formal evaluation consisted of surveys that training participants completed at the end of the training week and at the end of the experiment. The surveys contained separate sections for each of the training products: SC^4 System Demonstration, Digital Staff Drills, TTSs, and TDXs. In each section, participants were asked to rate each item on a scale of 1 (Strongly Disagree) to 5 (Strongly Agree). Additionally, for each section, participants were provided with space to comment on what could be added, dropped, or changed to improve that particular product.

The survey administered at the end of the experiment was similar to the one presented at the end of the training week to allow participants a chance to rate the training again after completion

of the experiment. This gave the Project Team the opportunity to discover whether participants had changed their minds about how well the training week prepared them for the experiment, after they had finished with the experiment. A major difference between the two surveys was that the survey presented at the end of the training week was paper-based, while the survey presented at the end of the experiment was computer-based at the staff member's duty station. This difference was due to the lack of time available to pretest computer-based administration of the first survey. Notably, the MMBL staff anticipates that all participant surveys in future BCR experiments will be computer-based.

The survey results examined in this report address only the results from the end of experiment survey, since there were no significant differences between the two training surveys. Although, surveys were administered to the entire training audience, the results being reported only include the 14 members of the primary training audience who were the focus of the staff training products. The results from all training audience members who completed the surveys can be found in *Volume 6: Data Codebook* (U.S. Army Research Institute for the Behavioral and Social Sciences, 2000).

Training Product Information

This section addresses each of the four training products developed and implemented: SC^4 System Demonstration, Digital Staff Drills, TTSs and TTSs Trainer Guide, and refined TDXs. Each product section will contain information regarding product development, implementation, and results. Within the separate discussion sections, the specific lessons learned for each product are presented. Those lessons learned are consolidated in the "Summary of Battle Command Reengineering IV Training Lessons Learned" section.

SC^4 System Demonstration

The training product referred to as the SC^4 System Demonstration was designed and developed as part of the initial orientation program. Overall, this orientation was to provide the training audience with introductory information prior to the BCR train-up and experiments. The SC^4 System Demonstration is an overview of key SC^4 system capabilities within a scenario-based context.

Method

The Method section will cover the analysis, design, development, and implementation of the SC^4 System Demonstration. Results and discussion follow that section.

Analysis. For this project, the Demonstration was a preview that showed how the SC^4 system might be used during mission exercises. Prior to the start of training, a demonstration helps the training audience understand how the training program will be conducted (Koger et al., 1998). As a means to present a preview, research has suggested that demonstration videotapes (or similar multimedia presentation) could provide a standard of performance and familiarity with the training situation (Shlechter & Anthony, 1996).

The advance organizer training method discussed earlier recommends the training audience be provided a framework, such as key system aspects, for the information being addressed in the training, (Cannon-Bowers, Rhodenizer, et al., 1998). Additionally, the training should be conducted within a meaningful task context (Means et al., 1993). By including a demonstration of the SC^4 system, the training audience could develop a general understanding of how key aspects of the SC^4 system would be utilized during mission exercises similar to what they would experience during the BCR experiment.

In addition to the literature, a primary basis for initiating the design and development of the SC^4 System Demonstration was found in the lessons learned from BCR III, Initial Orientation. One of the lessons learned was that participant soldiers thought the amount of time allocated to the Initial Orientation was excessive, and that more time should be spent on SC^4 system practice. The RAs indicated that information on operating the SC^4 system should be included into the information provided to the unit before it arrived at the training site (Throne et al., 1999). The relevant lessons learned from BCR III include:

- Establish the end-state or unit performance expectations for using the SC^4 system.
- Reduce the length of time for orientation.
- Include all training participants (primary and extended training audience).

In order to reduce the amount of time the training audience spent in the initial orientation, the demonstration would have to reach the maximum number of people, in a compressed time frame, and still hit some essential aspects of the SC^4 system capabilities. The approach selected was to run the demonstration in a classroom setting, projecting the system screens on a wall so that the entire training audience can see the screen displays. This would allow all members of the training audience to receive the same demonstration, and greatly reduce the technical and trainer coordination effort required to execute the demonstration.

Design of the SC^4 System Demonstration. Basic structural and content parameters were established by the Project Team as a design framework before actual design of the demonstration began. These parameters addressed training objectives and environment, including the overall training schedule. First, the demonstration could be no more than 60 minutes: up to 15 minutes could be used for an introduction; the actual demonstration should last for 30 minutes or less; and 15 minutes should be allocated for a review and answering questions. Second, the demonstration would be focused on key aspects of the SC^4 system so that both the primary and extended training audience would gain an understanding of the more common tasks they would need to learn during their training. Table 4 describes the key aspects of the SC^4 system upon which the Project Team decided to base the demonstration. Third, MMBL active duty personnel versus civilian contractors would be the demonstrators. Fourth, the demonstration would have a tactical context to mirror conditions similar to those the experimental unit could experience during BCR IV. Finally, the demonstration, while showing specific SC^4 capabilities, had to be flexible enough to allow the introduction of new software that might be developed up to the time the BCR Experiment began.

There were several limitations related to the SC^4 system itself that had to be considered in the design of the demonstration. The operating system has no capability to record the actions of an operator manipulating SC^4 tools. However, the Project Team could capture individual screen dumps which could then be linked together to show the series of actions required to manipulate the tool and obtain the desired result. Another limitation was the operating system could not remotely display or "emulate" an SC^4 system operator's manipulation on another SC^4 system. However, another monitor could be attached to an SC^4 display so that someone else in close proximity to the operator could view the display.

Table 4

Key Aspects of SC^4 System Addressed in Demonstration

Key Aspect	Description
Information Fusion	The ability of the SC^4 system to take information from multiple sources, process and aggregate the information, and display it pictorially (refer to Figure 4). The specific capabilities to be shown were SITREPs, SPOTREPs, Unit Status Reports, and Battle Damage Assessment.
Collaborative Planning	The capability of the SC^4 system that allows two or more soldiers to conduct collaborative planning on an electronic file from geographically dispersed locations. The specific capabilities of the SunForum Whiteboard and the PVD Conference Tool were to be demonstrated in terms of creating a tactical operations order.
Electronic Reference "Footlocker"	The capability of soldiers to use web-browser technology to find, review, download, and/or print reference (and eventually training) information without having to actually maintain a paper copy at their duty workstation.
Situation Awareness	The ability of the SC^4 system to enhance situational awareness through automatic display of friendly unit and vehicle locations and status, and OPFOR unit or vehicle locations. All friendly location and status data is updated every 30 seconds. The OPFOR location and status data is updated every 30 - 90 seconds.

Note. OPFOR = opposing forces; PVD = Plan View Display; SC^4 = Surrogate Command, Control, Communications, and Computers; SITREP = situation reports; SPOTREP = spot reports.

Development of the SC^4 System Demonstration. The first step in the development process was to create a list of events that would generate the visual cues to illustrate the key aspects of the system. As the event list was being generated, consideration was given to the tactical situation and timeline which would provide a context for the events. The Project Team decided upon a scenario in which the experimental unit would be in dispersal areas around an airfield. Presentation formatting options and tradeoffs were also analyzed. For example, to avoid cluttering the SC^4 screen displays with unnecessary vegetation and contour lines, the terrain selected was relatively free of vegetation and flat.

To provide the stimulus for the demonstration, a ModSAF exercise was created by the Project Team in conjunction with MWTB personnel. A series of trial runs, following the event list, was conducted to ascertain if the visual cues were being generated. The initial trial run required approximately 85 minutes. Significant periods of time in which the visual display to the audience would change only slightly or not at all were eliminated. The result was a demonstration that was approximately 23 minutes in length. This was well within the window of 30 minutes for the actual demonstration which had been established during the design phase.

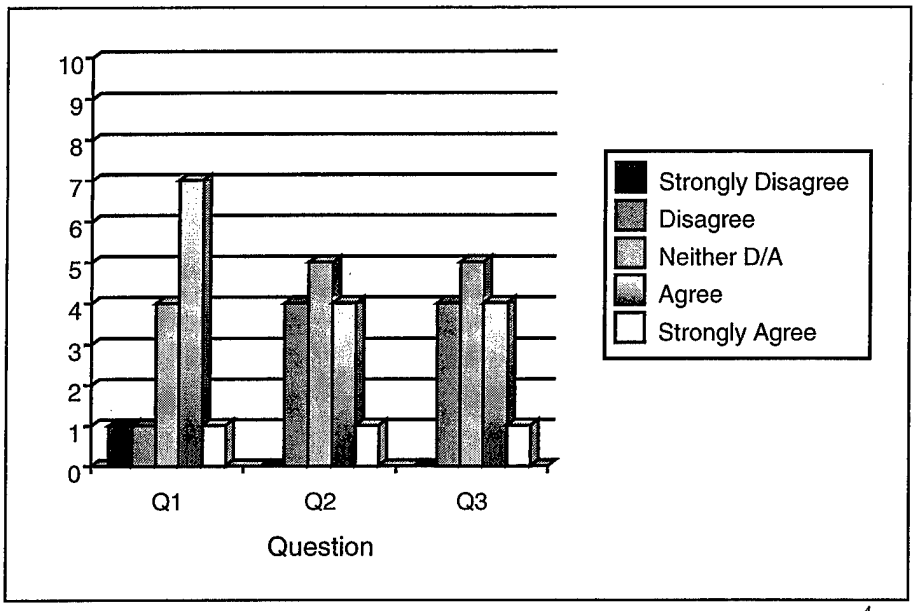
As the development progressed, the Project Team also identified the need for ancillary visual displays to support portions of the narration. A series of overhead slides based on SC^4 displays was created to augment the projected SC^4 image (for samples, see Appendix B). The overhead slides were projected on the wall alongside the SC^4 image so that the demonstration audience could view the two displays as the scripted narration was delivered.

Implementation. The demonstration was presented to the training audience on Training Day 1, after an initial orientation which included an introduction to the BCR Concept Experimentation Program (CEP) and the training facility. The demonstration was presented in a classroom setting and began with introductory comments addressing the purpose and objectives of the demonstration. The SC^4 screen displays were projected on the wall with the scripted narration provided by a soldier assigned to the MMBL. The workstation used to demonstrate the capabilities of the SC^4 system was operated by a member of the Project Team. Another Project Team member operated a remote SC^4 workstation so that the interactive Whiteboard capabilities of the system could be demonstrated. The actual demonstration, including questions from the training audience, took approximately 45 minutes.

Results

The survey results reported in this section focus on the 14 primary training audience members: the squadron commander and his staff located in the four nodes (depicted in Figure 2). The frequency ratings for their responses are presented in Figure 7. Overall, the respondents provided mixed ratings about the demonstration. The primary training audience tended to agree that the demonstration was a useful introduction to some of the SC^4 capabilities they used during the experiment as indicated by ratings on Questions 1 (Q1). However, only a minority agreed that the demonstration helped prepare them for the experiment (Q2) or that it was a worthwhile use of training time (Q3). An interpretation of these ratings is provided in the Discussion section.

From the survey comments, it appeared that some of the participants thought the demonstration was fine and provided them a general idea of what they needed to know. For example, the commander said "It was a good one over look at the system." Others said they would have preferred a more intensive demonstration (e.g., "do a hands on demo," "allow some participants in the demo"). Finally, some of the people who did not think the demonstration was a worthwhile use of training time commented that they would have preferred to move directly into hands-on training and skipped the demonstration entirely. Examples of comments included: "Let the soldiers play with the system for a while" and "Let us get in and start learning the system."



Note. N = 14. Q1 = The demonstration was a useful introduction to some key SC^4 tools and capabilities that I used during the experiment. Q2 = The demonstration helped prepare me for some of the things I did later during the experiment. Q3 = The demonstration was a worthwhile use of training time.

Figure 7. Participant ratings of SC^4 System Demonstration results.

Discussion

The demonstration, at least partially, met the objective of providing a concise overview of key aspects of a complex system which had been missing from previous BCR training efforts. However, participant comments and suggestions, along with Project Team observations, for demonstration improvement are provided.

From a training delivery perspective, the MWTB classroom setting for the demonstration was less than ideal. The MWTB is housed in a temporary metal frame building with an open floor plan that can accommodate rapid changes in configuration. The lighting system in the spaces that were used for the demonstration is an industrial design that provided little flexibility in adjusting intensity without turning off individual lights. The ambient noise level in the MWTB is high due to the concrete floor, metal walls and roofing, and the continuous air handler noise necessary to keep the large numbers of computers cool. Perhaps a better approach would be to design a demonstration that could be delivered and viewed at a soldier's duty workstation. This would improve aural and visual delivery. In addition, the training audience can benefit from watching how the system is manipulated in addition to viewing the results of the manipulations on the screen displays. An exportable, outside of the MWTB, version could also be developed and made part of a unit's advance preparation before arriving at the BCR site.

From a training requirement perspective, the focus needs to remain on demonstrating key aspects of the digital C^4I system. Not all capabilities of such a system can or should be included in a demonstration. Finding the right balance between the full capabilities of the system and the ability of an audience to comprehend what is being demonstrated needs to be carefully worked out to maintain interest in the system. In structuring the demonstration, a main consideration is

to determine whether to include all echelons of unit leadership in the audience or to tailor a demonstration to each level. While it may take greater resources to create tailored demonstrations, the payback in improved understanding and training performance may be worth the investment.

Digital Staff Drills

The Digital Staff Drills were designed to bridge individual SC^4 systems training (Levels 1 - 3) and small group staff process training (Level 5). The Digital Staff Drills provide an opportunity to practice and assess staff skills at a group level by focusing on key procedures required to successfully operate the SC^4 system during tactical operations. Each drill is set within a short, simulation-based tactical vignette that provides the context and cues needed to stimulate performance of a specific aspect of the SC^4 system.

Method

The Method section will cover the analysis, design, development, and implementation of the Digital Staff Drills. Results and discussions follow that section.

Analysis. A review of training literature indicated that scenario-based training benefits the training audience by providing cues similar to those which will be experienced in the actual environment (Cannon-Bowers, Burns, Salas, & Pruitt, 1998). An important component of scenario-based training is the need to provide feedback during and immediately following the training. Deliberate practice is a training technique applicable to drills with regard to the repetitive tasks and immediate feedback from the RA.

Another aspect of the analysis was a review of the lessons learned from the BCR III experiment. The lessons learned, reported in Throne et al. (1999), were based upon participant comments and observation by SMEs. A recurring comment and observation was the need to include more practice time with the guidance and feedback from knowledgeable RAs. The relevant lessons learned from BCR III include:

- Provide additional practice for SC^4 system skills.
- Conduct some type of assessment of SC^4 system skills.
- Provide system checklists and/or job aids.

The final step in the analysis was to determine the key SC^4 system procedures required during tactical operations. It should be noted the selection of tools to cover during the drills was based on the results of tool usage measures developed for BCR III which showed which tools were most likely to be used. Using the first project team's observations in combination with data from the BCR III regarding SC^4 system usage, several candidate tasks and functions were identified, as indicated in Table 5.

Table 5

Candidate Staff Tasks and Functions

Candidate Staff Tasks and Functions	
Conduct intranode whiteboard conference	Create a tactical overlay
Conduct internode whiteboard conference	Submit reports
Conduct mission analysis	Produce and order
Refine (analyze) course of action	Target enemy forces
Develop a course of action	Manage electronic files
Develop a reconnaissance and surveillance plan	Select battle position
Conduct CSS operations	Execute surveillance
Engage enemy forces	

Note. CSS = combat service support.

After reviewing the candidate staff tasks and functions list, Whiteboard conferencing was selected as the most critical task. This decision was based on the results of BCR III when the training unit took approximately four hours to conduct the first battalion-level Whiteboard conference (Throne et al., 1999). The Project Team, therefore, first developed a Digital Staff Drill based on conducting Whiteboard conferences. Then, as time and resources permitted, the Project Team would develop additional Digital Staff Drills that focused on:

- *Selecting Battle Positions* to cover SC^4 system tools for creating and distributing operations orders and overlays.
- *Targeting* to cover SC^4 system tools for battle tracking and battle damage assessment.
- *Combat Service Support* to cover SC^4 system tools for logistic estimates, unit status, and route planning.

The training audience targeted for the Digital Staff Drills was the squadron commander and primary staff members with company commanders providing supporting roles. The training time allocated for these drills was four hours during the morning of Day 3, after the squadron had completed Functions Training (Level 3) and before starting Task Training (Level 5).

Due to resource constraints, two Digital Staff Drills, Conduct a Whiteboard Conference and Select Battle Position, were developed during this project. The following section covers the design of these two Digital Staff Drills.

Design of the Digital Staff Drills. There were two goals established for the drills. The first was to provide additional practice using the SC^4 system, and the second was to provide an assessment feature to ensure system proficiency prior to moving on to the next level of training. The foundation for the design of the Digital Staff Drills originates in ARI research exploring the use of vignettes for assessing tactical command and control skills (e.g., Lickteig, 1991; Lickteig & Emery, 1994). The use of vignettes was well established with the *Force XXI Training Program: Combined Arms Operations at Brigade Level, Realistically Achieved Through Simulation* (COBRAS), which developed a series of 24 vignettes for brigade staffs. The process

established by Campbell, Ford, Campbell, & Quinkert (1998), addresses how to: a) focus training on key objectives and performance considerations for a small group, b) "slice" a single event from a larger scenario, and c) keep user preparation time and materials to a minimum.

The design limited each Digital Staff Drill to approximately 60 minutes. There was an introduction or set-up period, an execution segment of approximately 30 minutes that included four separate events, and a period for reviewing performance. The performance evaluation centered only on SC^4 system operational procedures, not tactical proficiency.

For adequate practice and assessment opportunities, the Digital Staff Drills were designed to provide an opportunity for each primary staff member to demonstrate proficiency with selected staff tasks. Referring to the top part of Figure 8, the first three events of a drill are listed in the center. The circles around each node indicate that the staff works together on the tasks within each node. The fourth event of a drill, pairs two nodes, as indicated in the bottom part of the figure, to work together similar to how they will collaborate during the TDXs and experiment. As mentioned earlier, company commanders were included in the drills to raise the tactical training context as supporting roles.

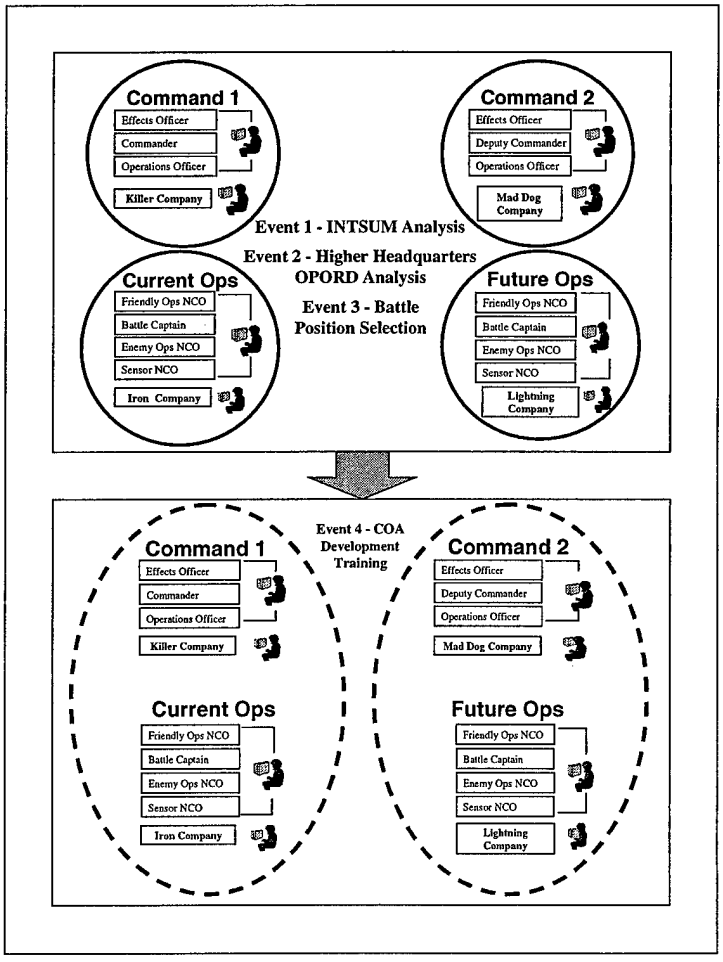


Figure 8. Node groupings by event for Conduct a Whiteboard Conference Drill.

Development of Digital Staff Drills. To establish a tactical context for the Digital Staff Drills training, the Project Team adopted a modified version of the scenario that was used during the demonstration. That is, the training unit had arrived at an airfield and was located in dispersed assembly areas. The OPFOR was moving to encircle the unit and attack it from four separate directions. The terrain selected for the drills had well defined mobility corridors that were separated by mountain ridges. This allowed the four command and control nodes and their associated company commanders to train simultaneously without interfering with one another.

To guide development, an event list was created for each drill to provide the structure around the cues required to stimulate the staff member performance. The events are listed in Table 6.

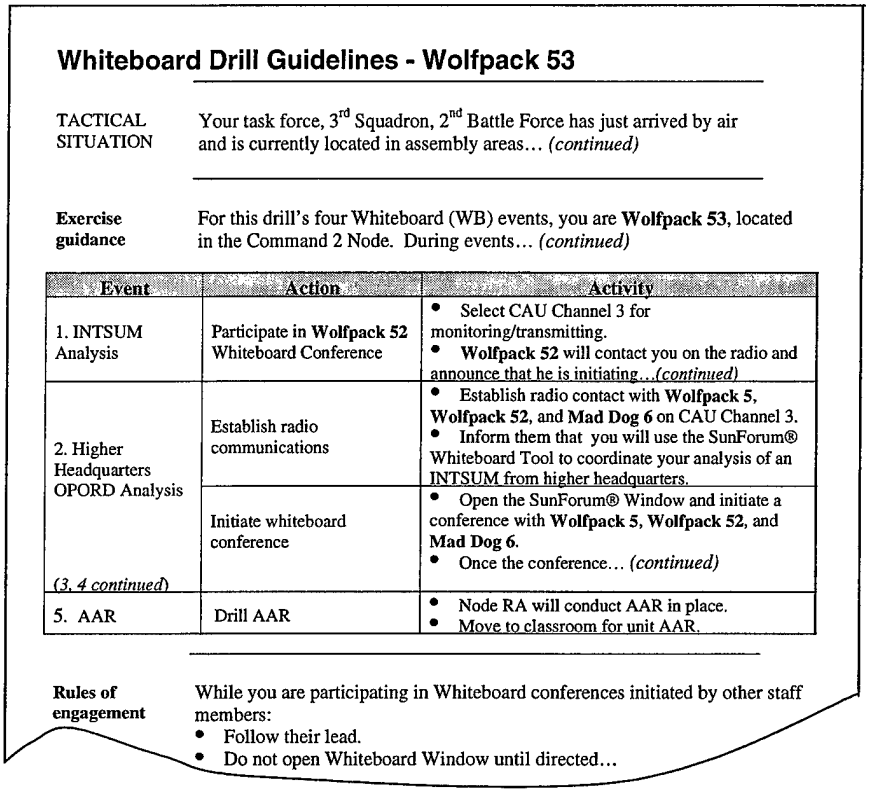
Table 6

Drill Events

Digital Staff Drill 1: Conduct a Whiteboard Conference		
Event 1	INTSUM Analysis	Enemy Operations Officer receives INTSUM from HHQ, initiates a Whiteboard conference within node to discuss INTSUM and designate NAI.
Event 2	HHQ OPORD Analysis	Friendly Operations Officer receives OPORD from HHQ, initiates a Whiteboard conference within node to discuss OPORD specified and implied tasks.
Event 3	BP Selection	Battle Captain initiates a Whiteboard conference within node and a company commander to select three platoon Battle Positions.
Event 4	Course of Action Development	Both command nodes initiate a Whiteboard conference with a control node and two company commanders to designate company areas of operations from a change of mission.
Digital Staff Drill 2: Select Battle Position		
Event 1	Commander's Planning Guidance	Node OICs receive commander's planning guidance via Netscape® e-mail message, sends reply.
Event 2	Staff Estimate Update	Staff use Netscape® browser to research the threat capabilities manual.
Event 3	BP Selection	Staff open a PVD overlay file, drawing Battle Positions, save and send overlay to Node OIC.
Event 4	BP Analysis, PVD Conference	Node OIC opens a PVD conference with node staff, discusses solution and sends file to HHQ.

Note. BP = Battle Position; HHQ = higher headquarters; INTSUM = intelligence summary; NAI = named area of interest; OIC = officer-in-charge; OPORD = operations order; PVD = Plan View Display.

A separate drill "guideline" was developed for each staff member and company commander participating in the instruction. The guidelines were individualized and provided specific, step-by-step performance instruction based on the individual's role during each event in the drill. An abbreviated sample from the Conducting a Whiteboard Conference Digital Staff Drill is shown in Figure 9. An example of a complete Whiteboard Drill Guideline can be found in Appendix C.



Whiteboard Drill Guidelines - Wolfpack 53

TACTICAL SITUATION: Your task force, 3rd Squadron, 2nd Battle Force has just arrived by air and is currently located in assembly areas... *(continued)*

Exercise guidance: For this drill's four Whiteboard (WB) events, you are **Wolfpack 53**, located in the Command 2 Node. During events... *(continued)*

Event	Action	Activity
1. INTSUM Analysis	Participate in **Wolfpack 52** Whiteboard Conference	• Select CAU Channel 3 for monitoring/transmitting. • **Wolfpack 52** will contact you on the radio and announce that he is initiating...*(continued)*
2. Higher Headquarters OPORD Analysis	Establish radio communications	• Establish radio contact with **Wolfpack 5, Wolfpack 52**, and **Mad Dog 6** on CAU Channel 3. • Inform them that you will use the SunForum® Whiteboard Tool to coordinate your analysis of an INTSUM from higher headquarters.
(3, 4 continued)	Initiate whiteboard conference	• Open the SunForum® Window and initiate a conference with **Wolfpack 5, Wolfpack 52**, and **Mad Dog 6.** • Once the conference... *(continued)*
5. AAR	Drill AAR	• Node RA will conduct AAR in place. • Move to classroom for unit AAR.

Rules of engagement: While you are participating in Whiteboard conferences initiated by other staff members:
- Follow their lead.
- Do not open Whiteboard Window until directed...

Figure 9. Example of the drill guidelines for Conduct a Whiteboard Conference Digital Staff Drill.

An interesting feature of the Conduct a Whiteboard Conference guidelines is the concept of rotating the "initiator" or "lead" role for participants in a conference. Each event cued a different node member to initiate, or lead, a conference which ensured that each squadron primary staff member had the chance to practice the procedure. This feature was described in detail during the pre-drill briefing to provide the information regarding what will happen during the drill, the objectives of the drill, and the expectations of their performance.

In addition to the guidelines, staff members were also provided a job aid (see Figure 10) for each drill. The aid provided the operational steps required to perform the critical SC^4 System's tasks applicable to the drills. Though the job aids were intended to support training, by posting a copy in each node, they could also provide a quick reference for the staff during the BCR experiment missions.

SunForum Whiteboard Job Aid

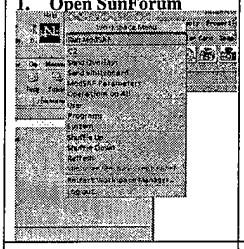
Action - Icon	Description
1. Open SunForum 	• Cursor in desktop open area • Click right mouse button. • Using the left mouse button, click on **C2** heading • Click on **SunForum** heading • Use left mouse button for all subsequent actions.
2. Find Addresses  **Address Book**	• When SunForum window has opened • Click **Address Book** • Click on individual address
3. Call Participants	• Click the **Call** button • Select and call additional participants until everyone…

Figure 10. Example of job aid for Conduct a Whiteboard Conference Digital Staff Drill

A contributor to the successful implementation of the Digital Staff Drill was the skill of the RAs. Though the drills do not require constant input from the RA as do the Fundamental and Functions training (Levels 2 and 3, respectively), the RAs monitor the actions of the training audience to provide guidance, feedback, and additional training should someone have difficulty with a particular procedure. Each RA was given an event guide (see Figure 11) which provides a "script" of the actions received by each participant (as provided in the guidelines). The event guide also covered the sequence of actions of the staff members, the company commanders, and other personnel in the White Cell who support the drill. By following the event guide, the RA could ensure that the drill was unfolding in sequence with the individual staff member's drill guidelines, and that the supporting personnel were providing the correct cues when needed.

3.3 Event Guide, Continued

Whiteboard Conference Event 3: Battle Position Selection

Trainer Notes/Events/Briefings	Node Participants	Company Commander	White Cell	Done (✓)
Note: The RA notifies the Training Director that the node is prepared to continue with Event 2. *Note: The Training Director directs the White Cell to send the Higher Headquarters OPORD Whiteboard file to the Friendly Ops station in the nodes that are ready.*			White Cell sends the Higher Headquarters OPORD Whiteboard file to the Friendly Ops in each node.	
Note: RA monitors Friendly Ops and assists as necessary.	Friendly Ops initiates whiteboard conference with the node OIC,	Company commander enters whiteboard…		

Figure 11. Example of the event guide for Conduct a Whiteboard Conference Digital Staff Drill.

A function for the RAs would be to assess the SC^4 System critical task proficiency of the participants. To assist in developing this assessment, an after action review (AAR) checklist (see

Figure 12) was developed for use by the RA. It was keyed to the drill events and provided space for the RA to indicate whether each individual staff member was proficient or needed additional training. At the conclusion of the drill, the RA would conduct an informal review with the node staff members and provide them feedback on their performance.

Conduct a WhiteBoard Conference Drill
After Action Review Checklist

ACTION	Enemy Ops		Friendly Ops		Co Cdr(s)		Node OIC	
	S	I	S	I	S	I	S	I
INITIATE WHITEBOARD CONFERENCE								
Solaris® Operating System								
SunForum® Window								
Address Book								
CONDUCTING WHITEBOARD CONFERENCE								
Call participants								
Open Whiteboard Window								
Open Whiteboard File								

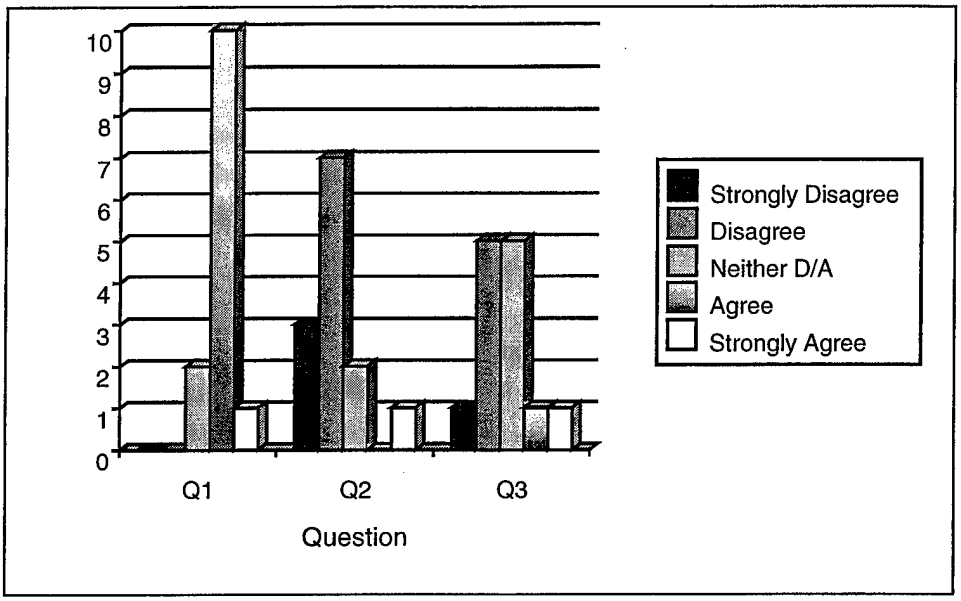
Figure 12. Example of an after action review checklist for the Conduct a Whiteboard Conference Digital Staff Drill.

Implementation. The two developed Digital Staff Drills, Conduct a Whiteboard Conference and Select Battle Position, were successfully implemented during the morning of Training Week, Day 3. No significant problems were noted by the Project Team. Each of the two drills took about 75 minutes to accomplish.

Results

The squadron commander and the 13 primary staff members were asked questions about the drills in the survey administered at the conclusion of the training week and at the end of the experiment. Unfortunately, one staff member neglected to complete or turn in a survey, therefore the results are being reported for 13 respondents. Overall, the survey results indicated a favorable response regarding the usefulness of the drills.

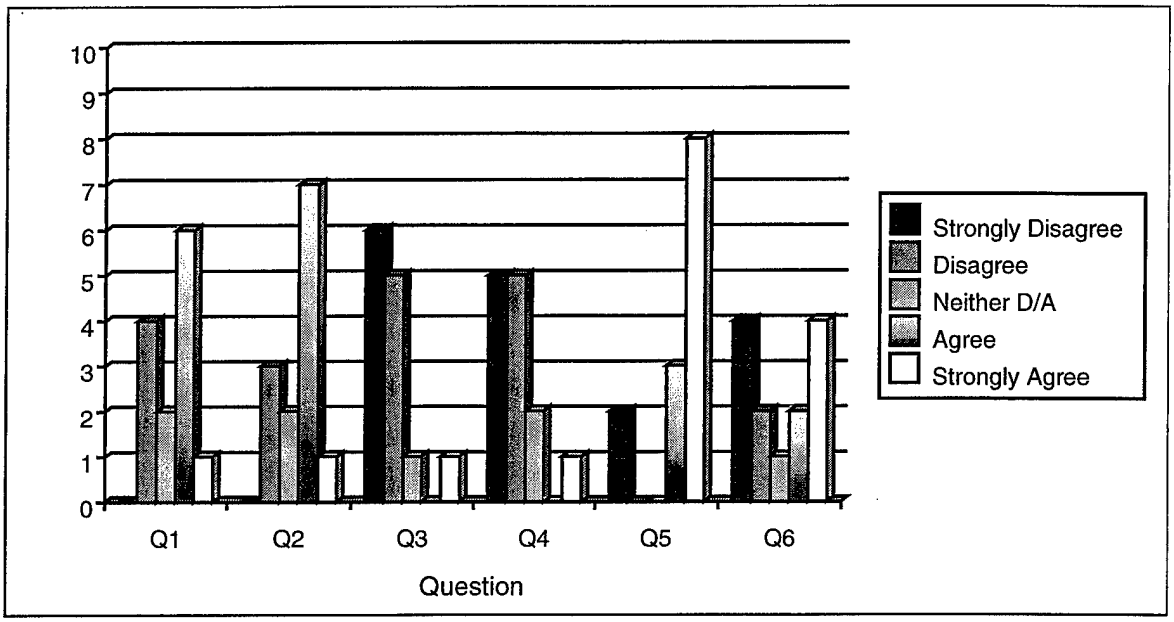
Conduct a Whiteboard Conference Digital Staff Drill. As seen in Figure 13, a majority of the respondents felt the drill was helpful. Several comments centered on the desire to have more repetitions of the procedures and to provide a reference guide (or more training) to the RAs so they could better field questions. The survey results also indicated that the job aid was not used during the actual BCR experiment. It is interesting to note that there were numerous comments for BCR III that a job aid was needed, however, these results might seem to indicate otherwise. There were two comments received that the job aid needed improvement, but no specific suggestions were provided.



Note. N = 13. Q1 = This drill was useful in helping me initiate Whiteboard conferences during the experiment. Q2 = I referred to the job aid on initiating Whiteboard conferences at least once during the experiment. Q3 = Because of the job aid, I already knew how to initiate a Whiteboard conference by the time the experiment began.

Figure 13. Participant ratings of Conduct a Whiteboard Conference Digital Staff Drill.

Select Battle Position Digital Staff Drill. The results were a little less favorable overall with this drill, though still positive (see Figure 14). Over half of the participants felt that this drill was useful in helping them edit and send overlays during the experiment. Although most of the respondents denied referring to the job aids during the experiment, they may have used them earlier in the training. Most of the participants used the Netscape® browser at least once during the experiment, while only six initiated PVD conferences. Participant comments noted a need for more practice with the PVD conference feature, more help for the RAs to be able to respond better to questions, and the need for a more realistic tactical requirement: "Draw phase lines instead of battle positions."



Note. N = 13. Q1 = This drill was useful in helping me edit overlays during the experiment. Q2 = This drill was useful in helping me send overlays during the experiment. Q3 = I referred to the job aid on using the Netscape® browser at least once during the experiment. Q4 = I referred to the job aid on initiating PVD conferences at least once during the experiment. Q5 = I used the Netscape® browser during the experiment.[1] Q6 = I initiated PVD conferences during the experiment.

Figure 14. Participant ratings of Select Battle Position Digital Staff Drill.

Discussion

The drills, as designed, developed, and implemented, were at least partially successful in providing additional training to the commander and the primary staff members in operating the SC^4 system. Undoubtedly, a key "result" was that few serious problems with Whiteboard conferencing occurred, in contrast to BCR III. These results suggest that scenario-based training is a better method for training on C^4I systems that the lecture and demonstration method employed during some previous BCRs.

Developing structured scenario-based training, however, is costly in terms of the resources required to put it together. It may have limited applicability when C^4I systems are continually being modified or reconfigured. In the BCR environment, for example, a change to the specific software program used to conduct Whiteboard conferences may require, at a minimum, the staff member drill guidelines and job aid be redone or completely discarded which would require that the training development cycle be reinitiated.

Moving from individual to staff collaborative training adds complexity which may detract from the overall objective of providing increased training opportunities and assessing performance. Extending training beyond the primary audience creates other requirements for cues and interdependencies that may not be needed for the primary training audience. The

[1] Questions 5 and 6 were recoded for Figure 14. On the surveys, the questions appeared as not using the Netscape® browser and not initiating PVD conferences. Since disagreement would actually be positive for these two questions, they were recoded so that agreement would be positive and the results presented in the figure would be consistent.

problem with the addition of cues is that they may interfere with or muddy the execution of the primary tasks of the drill. For example, including a requirement for a drill to train a vehicle gunner while simultaneously training a battalion intelligence officer means much more than just adding a couple of more targets to the scenario. The cues that the intelligence officer would need to be adequately trained (e.g., robotic scouts and unmanned aerial scout vehicles) would be inconsequential to the gunner.

Finally, there is still a lingering question regarding the usefulness of job aids. Many responses were received from BCR III that job aids were needed. It was clear from BCR IV, however, that the job aids usage was low. There are a few possible reasons for the low usage. First, as indicated by the commander, the job aids might have been more helpful had they been used as "training" aids when those tasks were first introduced. Second, the job aids may have covered tasks that were so well practiced during training that the need to refer back to process steps was eliminated. A solution for these concerns could be to develop separate training aids and job aids. The training aids would focus on commonly used functions and would be used when the system functions are first introduced and practiced. The job aids would focus on important system functions that are used less frequently during a collective mission exercise. Notably, the more such aids are made available on-line, the more they may be accessible on demand.

Team Training Sessions and Team Training Sessions Trainer Guide

This section of the report covers two related efforts, the revision to the TTSs and development of a trainer guide for the TTSs. The TTSs were developed during the first project to provide brigade- and battalion-level staffs the opportunity to develop and practice teamwork and decision-making skills. They are a series of five exercises, with associated short briefings to describe their benefits and processes, that are used in conjunction with a brigade or battalion tactical training event. The Trainer Guide provides the information required to conduct and implement the training sessions.

The TTSs are: a) Roles and Functions, b) Information Management, c) Pre-Execution Brief, d) Situation Update, and e) Team Decision-Making Debrief. Although each TTS can be used independently, as a complete set they may provide an integrated approach to improving teamwork and decision-making skills. It should be noted that the TTSs were intended to be exercises a commander will want to adopt and use during any tactical training event that includes the staff, not just the BCRs.

Method

The Method section will cover the analysis, design, development, and implementation of the TTSs and TTSs Trainer Guide. Results and discussion follow that section

Analysis. The training aspects incorporated in the TTSs, not only included context-based training discussed in the background section, but decision-making, teamwork skills, SA, and information management (Throne et al., 1999). The cognitive and collaborative nature of this training, sometimes called "soft-skills," is quite different than psychomotor training, or "hard

skills" and it may demand different methods of delivering training. Therefore, the Project Team reviewed current literature for delivery methods of "soft-skills" training.

When dealing with "soft-skills" training, there is a need to both educate and train. Educating increases intellectual awareness of a subject; while training increases proficiency in the execution of a given task. Therefore, it is best to educate briefly, then train at length (Georges, 1996). First, learners are educated about what they are being asked to achieve and the cognitive and collaborative skills they will have to execute in order to obtain those results. Then they must practice, with expert guidance, until they become proficient (Georges, 1996).

A popular approach to soft-skills training combines two aspects of training discussed earlier: part-task, deliberate practice, and context-based training (Georges, 1988; Whitmore & Fry, 1974). They state that the systematic breakdown of tasks is important in soft-skills training to effectively complete the task from start to completion. Then the learner should practice the steps of the task, and perform or roleplay the task in a "real" situation. By interacting with one another in roleplaying situations, the learners may become more aware of each other's roles, knowledge, skills, abilities, and preferences (Cannon-Bowers, Tannebaum, Salas, & Volpe, 1995).

Initially, the Project Team focused on the design and development of the TTSs Trainer Guide. When the lessons learned from the BCR III were reviewed, there were several comments suggesting improvements which prompted consideration of revising the TTSs. The relevant lessons learned from BCR III include:

- Revise the Information Management training session content.
- Revise the titles of some training sessions to reflect current military terminology.
- Develop a strategy to increase unit leader acceptance of TTSs.
- Provide a trainer outside the unit to implement the TTSs

Also, the TTS materials from the previous project were closely examined. This effort resulted in a concern that the sessions, as originally developed, lacked clear training objectives and a documented method of how they should be implemented. This concern was supported by comments received from BCR III indicating the staff felt they did not have a good grasp of the expectations of the training. The Project Team, therefore, determined that designing and developing a trainer guide for TTSs that were not well defined was premature. The Project Team decided to clearly define and develop the TTSs, before designing and developing the trainer materials.

Design of TTSs and TTSs Trainer Guide. The first of two underlying assumptions, which were established prior to the start of the design phase, was to retain the basic design features of the TTSs established during the previous project. However, ARI concurred that work was required to improve methods and training procedures, and to determine clear objectives for each session. Table 7 documents the training objectives for the TTSs.

Table 7

Team Training Sessions Training Objectives

Team Training Sessions		Objectives
Roles and Functions	→	Understand your own and other's roles, functions, and tasks.
Information Management	→	Establish unit standing operating procedures for file naming conventions, retention, and deletion.
Pre-Execution Brief (Pre-Action Analysis)	→	Identify potential problems that could negatively impact the mission (not previously addressed in planning) and their solutions.
Situation Update (Commander's Timeout)	→	Share a common understanding of the current situation, mission, and commander's intent.
Team Decision-Making Debrief	→	Identify improvements to the decision-making process.

Note. The titles in parentheses were Team Training Session names used during Battle Command Reengineering III.

Refinement of the TTSs focused upon two lessons learned from their implementation during BCR III: obtain the commander's buy-in to use the TTSs and develop clear step-by-step procedures for conducting the sessions. Therefore, a front-end analysis was needed that would describe the purpose, benefits, and procedural description of the TTSs. Interviews would be conducted with SMEs having battalion staff training experience to determine the type of information that a commander would likely want to know. Then procedures for conducting each TTSs were established through a series of round table discussions with Project Team members and ARI's contract representatives.

The second underlying assumption for the design phase was to have the TTSs Trainer Guide be generic in nature, so that it could be adaptable for a variety of training environments. There was, however, an opportunity to conduct a trial of the Trainer Guide during BCR IV which required a BCR IV specific Trainer Guide to be developed. Therefore, a dual-track design was adopted for the trainer materials: one set of materials framed with generic team concepts and processes; another set of materials that were specifically applicable to BCR IV. This dual track resulted in the BCR IV materials becoming a formative evaluation vehicle for the generic Trainer Guide.

The design also addressed required trainer characteristics and qualifications. The trainer for the TTSs should be of equal or higher rank to the battalion or squadron commander, be familiar with the current operating environment, and have brigade- or battalion-level training experience.

Development of the TTSs and TTSs Trainer Guide. As with the design phase, the development phase followed a similar dual-track process: a generic TTSs Trainer Guide and one that was specifically focused on BCR IV. It was decided to first develop the Roles and Functions TTS. This would include determining the process for delivering the Roles and Functions exercise in addition to developing the TTSs Trainer Guide support materials.

Project Team brainstorming sessions were conducted to "walk through" the process of how each TTS would be implemented. These brainstorming sessions included three Army SMEs, a psychologist, and two training developers. The inclusion of the SMEs was critical to ensure the procedures developed for conducting the TTSs were appropriate and acceptable to a commander and unit. Weekly process reviews were conducted throughout the development process. As a summary, Table 8 provides a brief description of the implementation method that was developed for each TTS. A complete description of each TTS can be found in Volume 4 of the *Training and Measurement Support Package, Battle Command Reengineering IV, Mounted Maneuver Battlespace Lab* (U.S. Army Research Institute for the Behavioral and Social Sciences, 2000).

Table 8

Summary of Team Training Sessions (TTSs) Implementation Procedures

TTS	Implementation Procedures
Roles and Functions	• Write down who they report to, who reports to them, and the tasks within their area of responsibility using the Roles and Functions worksheet. • Identify, on the worksheet, from whom they receive task related information. • Identify, on the worksheet, to whom they provide task related information. • Brief key aspects of the information on the worksheet to other staff members. • Discuss solutions to conflicting information or product flows.
Information Management	• Receive a briefing on an Information Management exercise scenario. • Identify the problem identified in the exercise scenario and discuss how to prevent it from happening. • Develop standing operating procedures to address the problem described within the scenario.
Pre-Execution Brief	• Review roles and primary tasks for executing the upcoming mission. • Identify potential problems which could occur (since planning phase). • Determine solutions for key problems. • Brief task responsibilities, potential problems, and solutions to staff.
Situation Update	Staff Huddle, Variation 1 (exercise is stopped or paused): • Prepare answers to questions regarding current battle situation, current information needs, and expectations for the near future. • Brief their answers to the questions. • Receive feedback from commander regarding any misunderstandings. Commander's Timeout, Variation 2 (exercise continues): • Receive commander's assessment of current battle situation. • Receive commander's expectations of the near future situation.
Team Decision-Making Debrief	• Identify a key decision they made during the exercise. • Discuss aspects of decision; what resources were needed, were resources available, to whom decision was conveyed, feedback received. • Analyze several decisions with regard to process and impacts on team.

Each TTS entailed a familiarization briefing and an exercise. Each briefing was to be conducted once per training event so the unit members understand the objective and process for each TTS. The exercise portion of the first two TTSs (Roles and Functions, Information Management) were also designed to be conducted before mission receipt and focus on more general staff process issues. The last three TTS exercises were embedded within tactical training exercises. Therefore, the TTS exercises are repeated with each new tactical exercise similar to

conducting troop leading procedures or an AAR. Because the "embedded" TTSs are part of and dependent upon a tactical exercise setting, there was little benefit in trying to create "practice" opportunities in a classroom. Therefore, the first tactical exercise during a training event becomes the "practice" exercise. Figure 15 shows how the TTSs are designed to fit into a tactical training event.

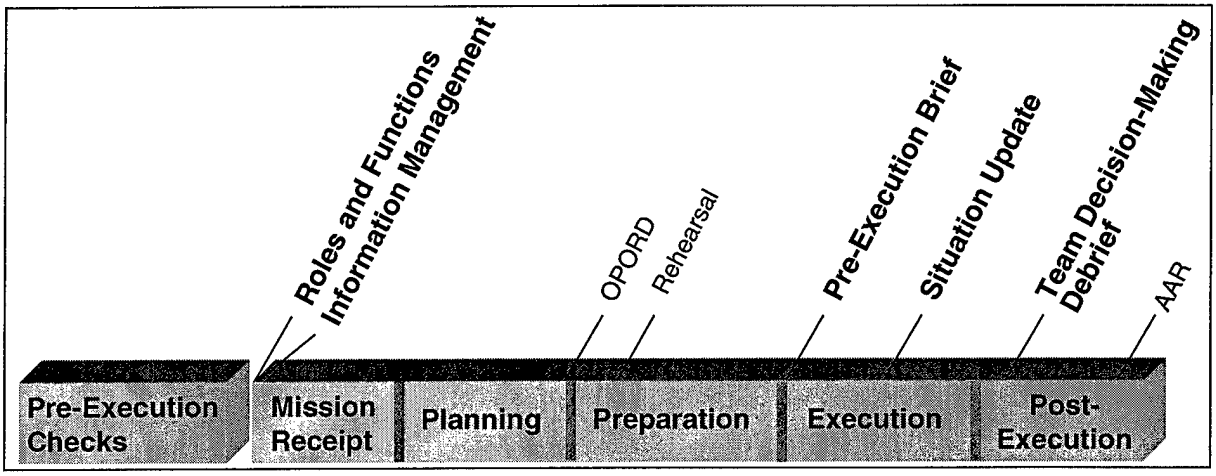


Figure 15. Team Training Sessions' sequence during a tactical training event.

As the TTSs were being developed, the TTSs Trainer Guide was being developed. A brief description of each section in the Trainer Guide is provided in Table 9. Samples of selected materials from the Trainer Guide sections can be found in Appendix D. The sample materials include: Overview, Commander's Read-Ahead, TPO and exercise worksheet for Roles and Functions, and the Team Decision-Making Debrief execution guidelines and worksheet.

Full support by the commander may be important to the successful implementation of the TTSs. Therefore, the "pull-out" Commander's Read-Ahead section was created to address this concern. This section was provided to the commander in advance of the train-up week. Providing a clear rationale and description of the TTSs to the commander ahead of time, may prepare him to work with the trainer to develop the specific implementation details.

The TTSs section contains TPOs that are the framework from which a training plan can be developed by the trainer. The design of the TPOs was similar to the TPOs designed in the first project. Notably, for the BCR-specific guide, a full training plan was developed by the Project Team from the TPO. Other materials provided in the following subsections include briefing slides, worksheets, and procedures for conducting the exercises for the Roles and Functions and the Information Management TTSs.

The section entitled Conducting TTS During Mission Exercises contains the execution materials for the three TTSs that occur during tactical training exercises: Pre-Execution Brief, Situation Update, and Team Decision-Making Debrief. As these TTSs are repeated with each tactical exercise, the same guidelines, slides, and worksheets are used repeatedly.

Table 9

Team Training Sessions (TTSs) Trainer Guide Sections

TTSs Trainer Guide Sections	Description
Overview	Introduces the TTSs by providing information regarding TTS design, TTSs Trainer Guide Design, Trainer prerequisites and responsibilities, and training audience.
Commander's Read-Ahead	Designed as a separate "pull-out" section that describes what the TTSs are, their benefits and process, commander's role, and an additional background section regarding the research behind the development of the TTSs.
TTSs	Five TTS sections which provide an overview, a Training Plan Outline for the familiarization briefing, briefing slides, and exercise materials (for Roles and Functions/Information Management) such as execution guidelines, overhead slides, worksheets.
Conducting TTSs During Mission Exercises	Provides easy access to the materials needed for conducting the three embedded TTS exercises (Pre-Execution Brief, Situation Update, Team Decision-Making Debrief) such as execution guidelines, overhead slides, worksheets.

Implementation. Roles and Functions and Information Management were implemented on Training Day 4 at the start of Level 4, Task Training. The trainer conducted the briefings using the TTSs Trainer Guide. This individual was a military person with battalion level command and training experience, as recommended by the guide's trainer prerequisites. Generally, the TTS exercises were conducted as designed, although specific implementation procedures were altered by the participating unit. Results from the implementation are discussed in the following section.

The remaining three TTSs that are part of tactical training exercises (Pre-Execution Brief, Situation Update, and Team Decision-Making Debrief) were not implemented during the BCR IV. The commander, after reviewing the training materials for those three sessions, indicated he already used similar techniques, or exercises, as part of his staff development activities. The Project Team decided to observe the unit's method.

Results

This section discusses the data collected after implementation of the TTSs Trainer Guide and training sessions during BCR IV. First, the TTSs Trainer Guide was assessed by combining interview comments from the trainer with the Project Team observations. No TTSs Trainer Guide surveys were administered since there was only one trainer using the guide. Second, the results from participant surveys and Project Team observations are presented for the Roles and Functions and Information Management sessions. Since there were no notable differences between the surveys at the end of the train-up week and end of experiment, only the data from the end of the experiment survey are discussed. The remaining three TTSs: Pre-Execution

Brief, Situation Update, and Team Decision-Making Debrief are covered under one heading since they were not implemented during BCR IV.

TTSs Trainer Guide. The TTSs Trainer Guide was used by the trainer designated to deliver the TTSs familiarization briefs and exercises. In addition to using the materials during BCR IV, the trainer also was a reviewer during the Trainer Guide development phase and provided feedback which resulted in revisions to the materials and implementation processes.

Overall, the TTSs Trainer Guide received favorable comments from the trainer regarding the organization of the materials, completeness, and clarity. Particularly, the trainer felt the addition of the Commander's Read-Ahead was a good idea, especially when dealing with new training concepts. The trainer reported the Overview section provided complete and appropriate information in a concise manner. Dividing the sections by training session allowed the trainer to access more easily all necessary materials when preparing to deliver each training session. Also, positive comments were made regarding the clear wording on the slides, with the "extra" details provided in the TPO.

Only minor changes and enhancements to the TTSs Trainer Guide were recommended by the trainer:

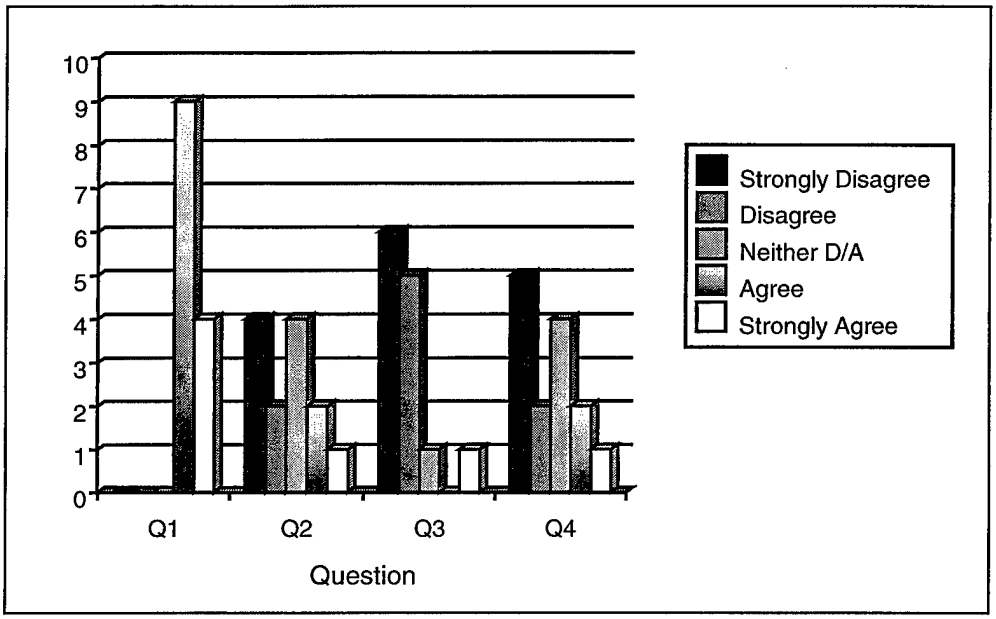
- Provide the Commander's Read-Ahead as a "pull out" annex. This would expedite delivery and reduce redundancy since, as an executive summary, it duplicates much of the information provided in the overview section.
- Revise the order of information in the overview by presenting the training schedule first, then how the guide is designed.
- Clearly define who exactly the intended training audience should include in the overview or in each training session section.

Roles and Functions. In general, the implementation procedures for the Roles and Functions exercise were followed during BCR IV. However, the unit did not exactly follow the implementation process as designed. The first process or procedural change requested by the participants was to delay the timing of the Roles and Functions exercise. The primary training audience found it difficult to determine roles and functions for individuals prior to gaining some experience with the SC^4 system in a mission exercise. This resulted in the staff opting to conduct a second iteration of the Roles and Functions after the first collective training exercise.

The implementation design requested that the staff members first complete a Roles and Functions Worksheet (found in Appendix D) requesting information such as: staff member's job title, supervisory control, individual tasks (with many draft examples provided based on BCR III), and how information flows between staff members. The staff members were to brief, in turn, their worksheet information to the entire staff, and then discuss any problems or questions raised by other staff members. Another change to the process was the commander first clustered with the node OICs, using blank worksheets to identify the task assignment for each node. The node OICs then met with their respective node personnel to discuss individual roles, having everyone complete the worksheet at that point. Finally, the staff met as a whole group and each individual discussed his roles with the rest of the staff in a round-table format rather than

successive briefs. Starting with Control nodes, each member of the node discussed to whom they reported, if someone reported to them, their key tasks, from whom they received task related information or products, and to whom they provided task information or products.

Only the 14 primary staff members who participated in the Roles and Functions exercise completed the survey items for this training session. Their frequency ratings for the survey items are provided in Figure 16. Unfortunately, one of the participants did not complete the survey. Therefore, the ratings in the figure are based on responses from 13 of the primary staff members. As can be seen from the figure, all participants agreed that the Roles and Functions exercise was useful. However, they did not necessarily agree with using the Exercise Worksheet to draw the diagram mapping out their roles and functions.



Note. N = 13. Q1 = Identifying what each staff member is suppose to do is a useful exercise. Q2 = Drawing the diagram was useful in helping me identify what I was supposed to do during the experiment. Q3 = I referred to my diagram during the experiment. Q4 = Because of the diagram, I already knew everyone's roles and functions by the time the experiment began.

Figure 16. Participant ratings of Roles and Functions session.

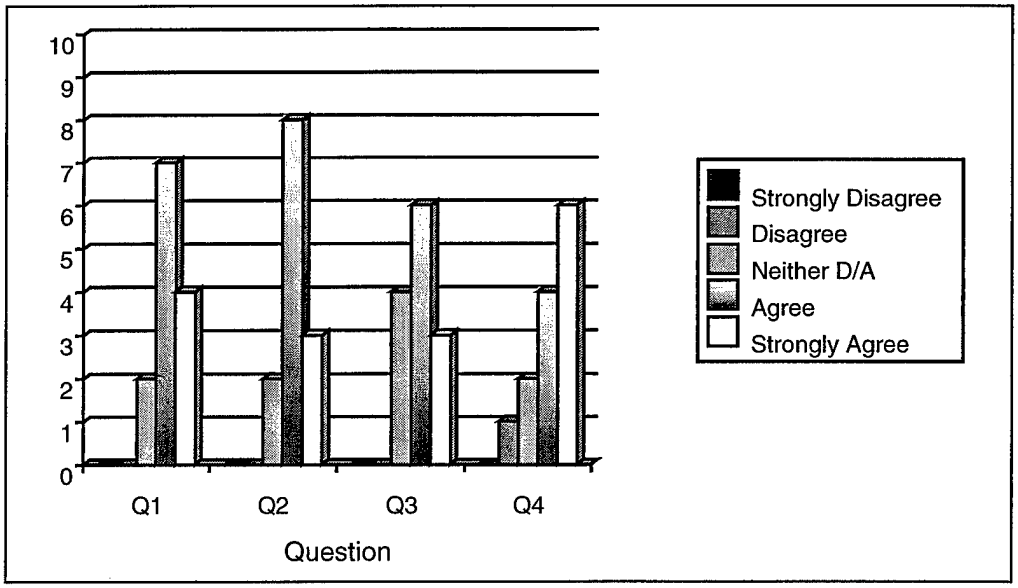
Three of the participants commented that the staff preferred their way of conducting the exercise over the method proposed by the Project Team. Other comments referred to the timing of the Roles and Functions exercise. For example, one node OIC commented that the "Staff needs time to actually execute in order to identify tasks and responsibilities. The staff exercise should be held off for a day or two." Another node OIC commented that the "...roles and functions with no experience is meaningless."

In order to evaluate this exercise better, the primary staff members were asked to complete the Roles and Functions diagram again at the end of the experiment. The Project Team's review of these final worksheets disclosed that there was still confusion regarding supervisory and reporting roles and relationships. An example is that several staff members indicated they had

direct supervisory control over the Sensor NCOs, while the Sensor NCOs indicated they were supervised by someone else altogether. Therefore, even though some of the staff did not think completing the diagram worksheet was helpful, some kind of guidance appears to be needed for at least some of the staff members. Overall, the results suggest that the Roles and Functions exercise would be a worthwhile use of training time. However, participant comments indicated the need for modification, especially to methods for defining roles and timing of the exercise.

Information Management. The Information Management session was intended to give the staff members an opportunity to develop a standing operating procedure (SOP) for naming overlays. With the SC^4 system, as with most digital systems, it is important to have unique file names so that one file will not inadvertently replace or write over another. In this session, a file naming problem scenario was presented to the unit by the trainer. Then the primary staff members were given a chance to come up with a workable solution. Instead of discussing strategies as a group (as designed), the deputy commander briefed the staff with the SOP that they would use.

Although all the participants were included in the Information Management briefing, only the 14 primary staff members were asked to complete the survey items regarding the Information Management session since they were the only ones who actually distributed overlays to others. Of the 14 primary staff members, only 13 completed the survey. Figure 17 provides their frequency ratings for the Information Management exercise.



Note. N = 13. Q1 = Developing SOPs for naming overlays is a useful exercise. Q2 = Understanding the file-naming conventions of the SC^4 system was useful during the experiment. Q3 = I used the SOPs we developed during this exercise when naming and/or saving overlays in the experiment. Q4 = I named and/or saved overlays during the experiment.[2]

Figure 17. Participant ratings of Information Management session.

[2] Question 4 was re-coded for Figure 17. On the surveys, the question appeared as not naming and/or saving overlays. Since disagreement would actually be positive for this question, it was re-coded so that agreement would be positive and the results presented in the figure would be consistent.

As indicated in Figure 17, the majority of the participants felt that the Information Management was a useful exercise and that it was important to understand the SC^4 system's file-naming conventions. The majority of the staff members agreed that they used the SOPs for naming and saving files, and that they did have to name and/or save overlays throughout the course of the experiment. Most respondents reported they used the SOPs developed, but it seemed from the survey comments that some of the staff did not initially hear or understand this solution and were not aware of it throughout the experiment. As one of the participants asked on the end of experiment survey, "What is the file naming convention of SC^4 system?"

TTSs During Mission Exercises. The Pre-Execution Brief, Situation Update, and Team Decision-Making Debrief were designed to be conducted as part of a tactical training exercise. However, these TTSs were not implemented during BCR IV. After the commander received the Commander's Read-Ahead and had a chance to review it, he met with members of the Project Team to clarify his training approach. The commander explained that he routinely conducted similar training as part of his usual staff development activities. Therefore, the Project Team decided to observe these types of staff activities during the BCR, rather than impose other versions, and the staff never received the familiarization briefings for these TTS exercises. As one staff member commented, "...since we are an experienced team, we used our own format rather than the one recommended by the exercise. Content is the key, not format."

Discussion

The survey results and comments from the staff reported above are combined with observations by the Project Team to provide an evaluation summary of TTS training in the BCR environment. Though the TTSs were not fully implemented, there were lessons learned that may be useful to future efforts to provide this type of training.

The initial focus was to design and develop a trainer guide for the TTSs. However, it became evident very quickly that the training must be well-developed before progress can be made to develop a trainer guide. To successfully implement this type of training, several points should be noted. First, the commander has to understand and embrace the training prior to implementation. Second, the implementation of the TTSs must be clearly outlined in an easy to use format. And third, the implementation of the TTSs must be easily adaptable to the training environment and staff organization. The TTS Trainer Guide is essential to address these points. The "generic" Trainer Guide was designed to provide the framework from which specific training plans, slides, and worksheets can be developed to fit different training environments easily.

The survey results, comments, and Project Team observations indicate that the Roles and Functions TTS is a beneficial exercise. Though the TTS exercise process was altered from the original design, the overall purpose of the exercise is solid and was supported by the participants. The staff maintained the concept of identifying and communicating each person's role and functions, but tailored the process to fit their organization. That process could be used as a model for revisions to the exercise. It was clear that the placement of the Roles and Functions exercise should be later in the training week. The commander and staff clearly indicated it was essential to gain mission-related experience in their new environment, before attempting to determine each person's roles and functions. Other recommended changes include: a) allow the

commander and senior staff members to determine general tasks, b) have the senior staff members discuss specific tasks with individuals in the their domain, and c) allow the individual staff members to discuss their roles and functions in a round-table group format.

The Information Management TTS appeared to be a beneficial exercise, but also needs modification. This session was received better by the unit during BCR IV than BCR III. This was probably due to focusing on specific information management issues, instead of rehashing general information management principles that the staff members may have received numerous times throughout their career. Key information management problems for the particular training environment should be been identified and addressed in the exercise design, such as file naming conventions. Also, though potential solutions to information management problems should be prepared, the staff needs ample time to create their own solutions and develop unit SOPs. The session is positioned well, after the Roles and Functions, but it should also be moved to a later time slot to allow the staff to gain some experience operating within the new mission environment. This will prepare the staff to better develop appropriate SOPs to deal with information management problems they identify.

In general, the BCR is a difficult training environment to develop "new" teamwork skills, due to the training time constraints, new systems, and new staff structure. The BCR experiments focus primarily on gathering feedback about SC^4 system and future warfare system capabilities, in addition to focusing on staff performance using the new organizational environment. Trying to incorporate staff process training on top of SC^4 system training and a new organizational structure may be a step too far, particularly considering the one week train-up window.

Still, the Project Team concludes that this type of training has benefit for use in the BCR. It is recommended the commander receive the training in advance of the unit and become an integral part of the TTSs. Finally, as indicated by respondent ratings and comments, the training audience should be an essential factor in the design and refinement of the training they are to receive.

Refined Tactical Decision-Making Exercises

The TDXs were designed to provide a battalion or squadron battle staff the opportunity to combine teamwork and decision-making skills with collective battle staff tasks using the full capabilities of the SC^4 system. The exercises provided the opportunity to practice new skills in a tactical scenario similar to the type of mission used during the pilot and trials of the experiment.

Methods

The Method section will cover the analysis, design, development, and implementation of the refined TDXs. Results and discussion follow that section.

Analysis. The TDXs, developed during the first project, were designed to provide context-based training in the BCR environment. Other training aspects included in the TDXs were decision-making, teamwork skills, SA, and information management (Throne et al., 1999).

Though TDXs were favorably received by the staff members during BCR III, there were several comments received which indicated the need for some revision. The most prevalent concern was that the pace of the TDXs was too slow. By reducing the time for the TDXs, there would be more opportunity for SC^4 system practice (e.g., Digital Staff Drills). The relevant lessons learned from BCR III include:

- Reduce the training time allocated for the TDXs.
- Increase the level of OPFOR activity early in the TDX sequence.
- Increase the amount of Combat Service Support functions.

An additional requirement for refining the TDXs was to convert them to a new terrain database for BCR IV, based on a decision by the MMBL to expand the size of the tactical maneuver area available for experimentation.

Design of the Refined TDXs. The TDX analysis for BCR III led to the delineation of four distinct segments that required the participants to practice a wide range of staff processes and SC^4 functions. The four segments outlined were: a) Mission Analysis and Wargaming; b) Mission Rehearsal; c) Execution of a Squadron Branch; and d) Execution of a Brigade Sequel. Each of these segments were developed into TDXs. Based on the BCR III participant comments, the last two TDXs provided unique opportunities and sufficient cues and, therefore, should remain intact. Since additional BCR IV train-up time was required to address communication and coordination functions, the Mission Analysis TDX and the Rehearsal TDX were combined into one TDX.

Development of the Refined TDXs. The overall training objectives, tasks, conditions, and events for the new TDXs remained the same, but the execution time was reduced from 12 hours to 8 hours to force the battalion staff to work at a faster pace. Additionally, the revised TDS provided more activity for the subordinate company commanders and other non-staff personnel.

The intent, outside of reducing the time allocated for the TDXs by a half day, was to run the TDXs during BCR IV in the same fashion they were conducted for BCR III. Some additional refinements included increasing the unit's need to deal with shortages in ammunition and fuel, and non-operational key combat systems (e.g., fighting vehicles, mortar systems). Additionally, OPFOR activity was programmed to begin earlier, and non-combatants were introduced as an operational consideration into the training unit's area of operation, as would occur during the BCR trials.

Descriptions of the refined TDXs are provided in Table 10. The three TDXs shared a common tactical scenario and were projected to last 4 - 8 hours each. The TDX events, as documented in Volume 3 (U.S. Army Research Institute for the Behavioral and Social Sciences, 2000), paralleled situations contained in the BCR trials. They were designed to assist the squadron participants in planning, preparing, and executing common battle staff collective tasks in the uncommon BCR environment.

Table 10

Tactical Decision-Making Exercise (TDX) Descriptions

TDX	Description
Mission Analysis and Rehearsal	Provided the battle staff decision-making practice using SC^4 tools under experiment-like conditions and practice conducting a virtual rehearsal. The exercise limited current operation requirements so that the battle staff focus would be on developing techniques and procedures for their decision-making process for the BCR.
Execution of a Battalion or Squadron Branch	Provided the Squadron Cdr, staff, and subordinate commanders practice in modifying and executing a branch to their defensive plan using SC^4 tools under experiment-like conditions.
Execution of a Battalion or Squadron Sequel	Provided the battle staff practice with planning a future operation while executing a current mission.

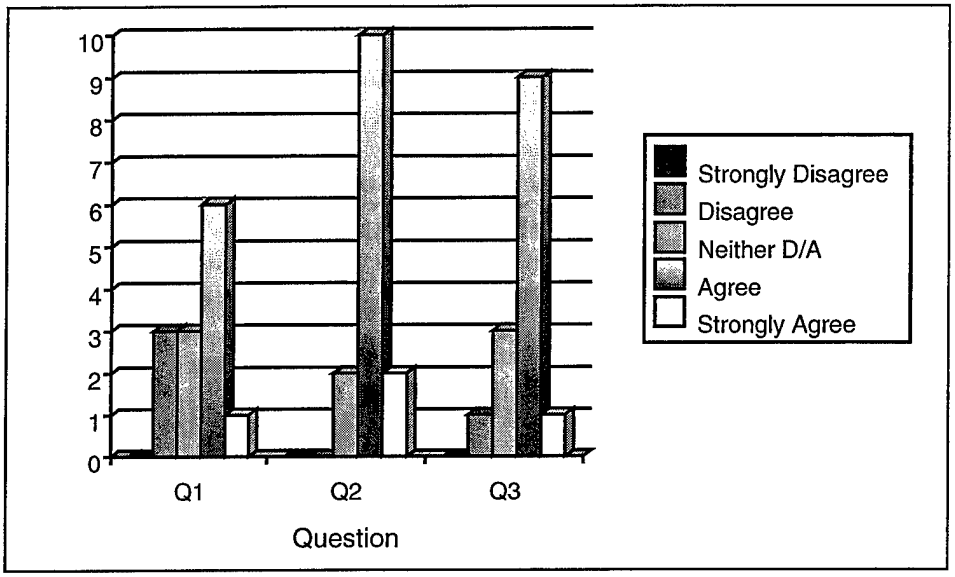
Note. BCR = Battle Command Reengineering. SC^4 = Surrogate Command, Control, Communications, and Computers.

Implementation. Originally scheduled to end on Day 5, the TDXs were conducted on Days 4 - 6 of the BCR IV training week. The extension of the training week was caused by numerous factors, including technical difficulties. All other aspects of the TDX implementation went according to the refined design.

Results

Both the primary and extended training audiences completed the TDX survey. However, since the focus of this report is on the 14 primary training audience members, only their results are presented in the body of the report. One staff member did not complete the survey, therefore, the results are based on 13 respondents. Figure 18 contains the frequency ratings for each of the TDX survey rating items.

Comments from the training audience generally indicated a desire for more and shorter tactical missions that involve the whole squadron in combat while the staff plans future tactical operations. From the Project Team's perspective, the TDXs provided good practice, and the supporting TDX materials, such as orders and overlays, provided a solid basis for planning, preparing, and executing the TDXs. At the completion of the TDXs, the training audience appeared reasonably ready to perform whatever mission they were assigned during the BCR IV experiment.



Note. N = 13. Q1 = The TDXs were representative of what happened during the experiment. Q2 = The TDXs gave me a good chance to practice using the SC^4 system. Q3 = The OPORD and associated tactical materials gave me enough information for planning.

Figure 18. Participant ratings of Tactical Decision-Making Exercises (TDXs).

Discussion

The TDXs appeared to help prepare the staff and the unit to participate in the BCR IV experiment, based upon participant comments and ratings. The fact that the TDXs mirrored the tasks and conditions for the upcoming BCR trials contributed to this success. This reinforces a finding from previous projects, such as the Fort Knox Armor Center's impact analysis for the Virtual Training Program (VTP), that simulation-based structured exercises are an effective and efficient training method (Davidson, 2000).

Notably, collective training for unit staffs equipped with digital C^4I systems requires an integrated training package. This package must address not only the staff, but also the multi-echelon training audience, supporting intelligence systems, and a multi-faceted control cell to provide all of the scripted exercise cues that the unit and staff would expect to receive.

As the scope of the BCR experiments begins to include other factors not directly related to battle command reengineering and additional personnel are added to the training audience, there is a propensity for a staff training exercise to turn into a command arms exercise. However, the staff training focus, explicit in the TDX design, needs to be maintained to prepare the staff for meaningful BCR trials.

BATTLE COMMAND REENGINEERING IV TRAINING LESSONS LEARNED

As with any research and development effort, an important product is the documentation of overall project lessons learned. A consolidated summary of the lessons learned during BCR IV is presented by product type. A brief description of the benefit or advantage to implementing each lesson is also provided. A full discussion of each lesson learned can be found in the preceding Training Products section.

SC^4 System Demonstration

The SC^4 System Demonstration was developed, as part of the initial orientation program, to provide the training audience with an overview of key SC^4 system capabilities and unit performance expectations in a scenario-based context. The demonstration was presented to the training audience in one group, displaying the key system capabilities on a wall in the MWTB with a narrator describing the visuals and scenario. Table 11 summarizes the lessons learned.

Table 11

Summary of SC^4 System Demonstration Lessons Learned

Lesson Learned	Advantage to Implementing
Conduct the demonstration at a soldier's duty position	Provides the opportunity for the training audience to not only see the SC^4 system screens as they will be viewed during training, but watch how the system is manipulated. It also reduces the difficulties with ambient noise, inflexible lighting, and system display details in a large viewing area.
Develop the demonstration in an exportable format	Provides an opportunity for the staff to gain an understanding of the training environment in advance of the training week. The better prepared the unit is prior to training, the more likely training will be improved.
Use key system aspects for demonstration content	Limits the training to key points of the system capabilities, without the burden of too much detail. The purpose of a demonstration is to provide a general overview of unit performance expectations. With a complex system, there is the potential to provide too many details.
Tailor the demonstration to different duty positions	Limits the amount of information each person receives, yet narrows it to appropriate topics. Several key system capabilities of interest to the staff did not apply to the majority of the extended training audience. Tailoring the demonstration provides time to preview particular functions with the appropriate training audience members.

Digital Staff Drills

The Digital Staff Drills are designed to provide practice and assessment opportunities for SC^4 system skills by focusing on selected critical procedures required to conduct tactical operations. Each of the two drills developed, Conduct a Whiteboard Conference and Select Battle Position, focused on a different aspect of the SC^4 system. Table 12 summarizes the lessons learned.

Table 12

Summary of Digital Staff Drills Lessons Learned

Lesson Learned	Advantage to Implementing
Utilize scenario-based training, whenever applicable	Provides the opportunity to practice new system skills as they will be used in a mission setting. The drills reduced or eliminated the problems noted in previous BCRs with staff executing the tasks covered in the drills. The training needs to be updated, though, each time digital C^4I systems are modified.
Maintain the training focus on the primary training audience	Keeps the emphasis of the training on the staff, who is the primary focus of the BCRs. As the audience is expanded, the focus on the primary training audience is lost.
"Embed" training and job aids	Training aids can address the more critical, often-used system tasks until the training audience has gained proficiency. Job aids can be developed to provide a reference for less used system functions. Embedded aids ensure help is available, as needed.

Note. BCR = Battle Command Reengineering; C^4I = command, control, communications, computers, and intelligence.

Team Training Sessions and Team Training Sessions Trainer Guide

The TTSs were developed to provide brigade- and battalion-level staffs the opportunity to develop and practice teamwork and decision-making skills. They are a series of five exercises with associated short briefings and are: a) Roles and Functions, b) Information Management, c) Pre-Execution Brief, d) Situation Update, and e) Team Decision-Making Debrief. The TTSs Trainer Guide provides the information required to conduct and implement the training sessions. Table 13 summarizes the lessons learned.

Table 13

Summary of Team Training Sessions (TTSs) and Trainer Guide Lessons Learned

Lesson Learned	Advantage to Implementing
Ensure training is well-developed before developing a trainer guide	Ensures the training content has been fully developed so that the implementation process and required materials can be identified in the trainer guide.
The trainer guide is essential to successfully conduct TTSs	Provides the essential information to gain the commander's support for conducting the TTSs, clearly outlines steps to implement the TTSs exercises, and provides a framework to adapt the TTSs to the training environment.
Modify timing and implementation process of Roles and Functions TTS	Ensures the unit members have enough experience with the system to conduct this TTS and simplify the process.

(table continues)

Table 13 (Continued)

Lesson Learned	Advantage to Implementing
Focus Information Management TTS on specific information issues.	Provides the staff with specific information and a "draft" process by which unit SOPs can be developed that are appropriate to the training environment.
Conduct team (staff) training "outside" the BCR environment.	Provides the opportunity to focus solely on staff process skills. Trying to develop "new" teamwork skills while learning a new and different system and organizational structure may be a step too far.
Train commander in advance of staff members.	Ensures that the commander has a complete understanding of the team training process and desired outcomes, and includes his input into the training implementation plan.

Note. BCR = Battle Command Reengineering; SOP = standing operating procedure.

Refined Tactical Decision-Making Exercises

The TDXs were designed to provide a battalion or squadron battle staff the opportunity to combine teamwork and decision-making skills with collective battle staff tasks using the full capabilities of the SC^4 system. The exercises provided the opportunity to practice new skills in a tactical scenario similar to the type of mission used during the pilot and trials of the experiment. Table 14 summarizes the lessons learned.

Table 14

Summary of Refined Tactical Decision-Making Exercises (TDXs) Lessons Learned

Lesson Learned	Advantage to Implementing
Utilize scenario-based training	Prepares the staff to be better able to conduct mission exercises during the experiment by practicing command and control in a similar mission context.
Collective training requires an integrated training package	Provides all components of an integrated training package to address multi-echelon training and a multi-faceted control cell to provide expected cues.
Maintain staff training focus for TDXs	Ensures the original intent of the TDXs is maintained, to provide a staff the opportunity to practice teamwork and decision-making skills while using the SC^4 system. As the scope of the BCRs expands, there will likely be a tendency to turn TDXs in to CFXs.

Note. BCR = Battle Command Reengineering; CFX = command field exercise; SC^4 = Surrogate Command, Control, Communications, and Computers.

DIRECTIONS FOR FUTURE RESEARCH AND DEVELOPMENT

The Army has a need for a command and staff TSP that would fully integrate digitization into normal staff training. While this project's training products were designed to support BCR experimentation with battle command and staffs projected to be fielded in 2012 and beyond, some of the digital C^4I capabilities that were showcased during the BCR may become available

to digital staffs much sooner than that. The Interim Brigade Combat Teams, scheduled to be fielded in early 2001, will be confronted with some of the same challenges presented in the BCR: new equipment, new organization, new digital C^4I systems, and a compressed training schedule. As a result the need for command and staff training for future forces is underscored.

Some future directions recommended for developing command and staff training to match future force requirements are summarized in Table 15. These directions are based on lessons learned during this effort and related work on command and staff training. A detailed discussion of each follows the table.

Table 15

Future Directions for Command and Staff Training

Future Directions	Rationale
Incorporate instructional principles	Advance organizers, part-task training, deliberate practice, and context-based training provide a means to create training that relates new situations to old, breaks up complex tasks, provides feedback with practice, and does this within a "real" situation.
Address multi-echelon and multi-functional training	Supports multi-echelon training in various organizations, current and future digital systems, and duty positions within a staff.
Form integrated training development team	Future digital C^4I systems will require integrated teams of experts to develop training that addresses the needs of the multi-echelon units and multi-functional soldier.
Use structured training	Structured training focuses training on selected objectives and tasks in a controlled environment that "sets" the conditions for training.
Include team training	Provides a model from which training could be constructed that focuses on improved staff performance. This can be beneficial with a need to quickly integrate new staff deployed on a contingency mission.
Use embedded training technologies	Benefits of embedded training have been well established by the military. It has been focused primarily on combat vehicle crews. There is a need to expand that training to the staff.
Tailor training feedback	Not all staffs require the same type of training or feedback. Need to explore new ways to tailor immediate feedback.
Provide tool for flexible training	Commander and staff need tools to shape training to their needs.

Note. C^4I = command, control, communications, computers and intelligence; TSP = training support package.

The four instructional principles used to develop the prototype future staff training package might guide development of a command and staff TSP. *Advance organizers* provide a bridge for soldiers to transition easily from familiar organizations, equipment, doctrine, and tactics into the new and unfamiliar. *Part-task training* simplifies the challenge of learning about complex systems and intricate procedures by allowing soldiers to master smaller parts of the whole incrementally until finally the soldier, crew, small group, or unit demonstrates mastery of the whole. *Deliberate practice* provides guidance and feedback to soldiers to assure them that they

are meeting the required performance standards as they progress through their training. *Context-based training* builds soldier confidence in themselves, their leaders, and their weapons and equipment by replicating the combat conditions in which they will be expected to fight.

A command and staff TSP should support multi-echelon training and training for soldiers who perform multiple mission roles. However, unless carefully designed, the cues required to initiate this type of training could overlap each other and become training distracters. It should be comprehensive and yet flexible enough to accommodate the various staff organizations, and current and projected digital C^4I systems that will be an integral component of the Future Combat Systems (FCS). It should support scenarios and conditions like those likely to be encountered during contingency operations where the staff could find itself operating in an unfamiliar environment with combined and joint forces.

Any training for staffs that are equipped with future digital C^4I systems, such as those represented by the SC^4 system used during this project, will require an integrated team of C^4I system experts, tactical operation experts, and training and evaluation experts. Any changes to either the hardware configuration of the C^4I System or to software residing on the system could reduce the value of training that had previously developed, or cause a new training design and development effort to be undertaken.

Commanders and staffs should be able to arrive at the training site after having completed the necessary troop leading procedures to familiar their soldiers with their mission, and begin to train immediately. Incorporating structured training into the TSP provides this capability. Structured training is focused on specific training objectives and selected critical tasks, provides standardized training exercise control to ensure practice of the critical tasks, provides standardized feedback to guide and reinforce task performance, and provides all supporting training materials in the form of the TSP itself (Campbell, Campbell, Sanders, Flynn, & Myers, 1995).

Team skills training should be an integral part of the command and staff TSP. Future commanders may find that their staff is augmented by personnel who have not previously trained with the unit prior to its deployment on a mission. Commanders need to be able to integrate these personnel into their staff rapidly, with little disruption to the staff's effectiveness and efficiency. Training constructed around the Military Decision-Making Process (Department of the Army, 1997) may not develop the adaptability, shared SA, communications, coordination, performance monitoring and feedback, and decision-making skills that are required for effective staff performance in a short period of time. The TTSs developed as part of this project provide prototype examples for such training.

A method for increasing realism or providing a way for commanders and staffs to train separately from their subordinate units under field conditions during breaks in training may be to develop embedded training capabilities. Embedded training could take many forms, from an automated tutor coaching a soldier through a task, to a full mission rehearsal capability involving every soldier in the unit. With embedded training, soldiers and staffs can train close to the operational environment in which they will fight. Most of the focus on current embedded training has involved combat vehicle crews.

Performance feedback should be immediate and objective without interfering with the actual functioning of the staff, and does not require extensive SMEs to observe. The commander and the staff being trained should also have the tools to tailor the feedback they receive based on their training needs. Not all staffs will need the same type of training and do not need a fixed set of performance assessments. Extensive research and development is still required to embed staff training into digital C^4I systems. If staff training can be successfully embedded, then automated feedback of staff performance will become critical (see Throne, Holden, & Lickteig, in preparation).

Finally, the training audience, the commander and staff, must be given the tools to shape their training. A command and staff TSP should provide that flexibility without creating an unmanageable administrative burden on the unit. There is a current ARI research project that provides commanders the tools to create their own individualized structured exercises for the Close Combat Tactical Trainer off-site, and then proceed to the training facility and execute the training (Gossman et al., 1999). Such tools will be needed for future commanders and staff to develop and execute their own embedded training exercises.

SUMMARY

The issue of how the operating environment of commanders and staffs will change in the future is fundamental to staff training requirements. Effective training for future commanders and staffs cannot be developed without some idea of what future commanders and staffs will have to do, and how that differs from what they do today. The ARI has already conducted several studies of what the soldiers of the 21st century will confront, and how those soldiers need to be selected and trained as summarized by Ford, Campbell, Campbell, Knapp, and Walker (in preparation).

Training developers must be prepared to meet the changing collective task demands and training requirements that will confront future soldiers and leaders. It is anticipated that the future Army will include lighter and more mobile forces fielded in brigade sets. This future training environment may rely heavily on technology to provide distributed and embedded training approaches to meet collective and unit-based training requirements, including command and staff training. According to Witmer and Knerr (1996), there are few instances of successful implementation of embedded training in Army systems. Currently, most embedded training is limited to individual tutorials that do not allow direct interaction with others or the use of equipment and software used on the job. However, the design of synchronous embedded training for a collective audience is a challenge that will require innovative and highly integrated training approaches.

In addition, FCS brigades will likely be composed of multi-functional soldiers and leaders who perform multiple tasks, in contrast to the current orientation on job specialization. Staff personnel, in particular, may need to be multi-functional, as evidenced by the MMBL's work on Battle Command Reengineering. It follows that the Army will need to identify principles and derive rules for optimally assigning multiple tasks to soldiers.

In conclusion, the Army's projections for future operational conditions entail severe training challenges, particularly at the command and staff level. The prototype methods and products

documented in this report may help direct the Army's effort to train the commanders and staffs of future forces.

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APPENDIX A

LIST OF ACRONYMS

1SG ..... first sergeant

AAR ..... after action review
ARI ..... U.S. Army Research Institute for the Behavioral and Social Sciences
ARPA ..... Advanced Research Projects Agency
ARSI ..... Reconfigurable Simulator Initiative

BCR ..... Battle Command Reengineering
BCV ..... battle command vehicle
BLEFR ..... Battle Lab Experiment Final Report
BLUFOR ..... blue forces
BP ..... Battle Position

C^2V ..... command and control vehicle
C^4I ..... command, control, communications, computer and intelligence
CAU ..... crewman's access unit
Cdr ..... commander
CEP ..... Concept Experimentation Program
CFX ..... command field exercise
COBRAS ..... Combined Arms Operations at Brigade Level Realistically Achieved Through Simulation
Co Cdr ..... company commander
CSS ..... combat service support

DIS ..... distributed interactive simulation

FASTRAIN ... Force XXI Training Methods and Strategies
FBC ..... Future Battlefield Conditions
FCS ..... Future Combat Systems

HHQ ..... higher headquarters
HumRRO ..... Human Resources Research Organization

INTSUM ..... intelligence summary

MCOO ..... modified combined obstacle overlay
MDMP ..... military decision-making process
MLRS ..... Multiple Launch Rocket System
MMBL ..... Mounted Maneuver Battlespace Lab
ModSAF ..... Modular Semi-Automated Forces
MSR ..... main supply route
MWTB ..... Mounted Warfare Test Bed

NAI..... named area of interest
NCO ..... non-commissioned officer

O/C..... observer/controller
OIC..... officer-in-charge
OPFOR..... opposing forces
OPORD..... operations order

PVD..... plan view display

RA..... research assistant

SA ..... situational awareness
SAT..... Systems Approach to Training
SC^4 ..... surrogate command, control, communications, and computers
SITREP ..... situation report
SME ..... subject matter expert
SPE..... Structured Practice Exercise
SPOTREP ..... spot report
SOP ..... standing operating procedure
SOV..... staff operations vehicle
STO ..... Science and Technology Objective

TDG ..... Tactical Decision Game
TDX ..... Tactical Decision-Making Exercise
TECO ..... Test and Evaluation Coordination Office
TMSP ..... Training and Measurement Support Package
TPO ..... Training Plan Outline
TRADOC ..... U.S. Army Training and Doctrine Command
TSP..... training support package
TTS ..... Team Training Session

UAV..... Unmanned Aerial Vehicle
UGV..... Unmanned Ground Vehicle

VTC..... video teleconference
VTP..... Virtual Training Program

WB ..... Whiteboard

APPENDIX B

SAMPLE MATERIALS OF THE SC^4 SYSTEM DEMONSTRATION

This appendix provides sample materials of the Surrogate Command, Control, Communications, and Computer (SC^4) System Demonstration which is conducted during the Level 1, Initial Orientation training. It provides the reader with brief samples of selected training materials mentioned in the report that were designed and developed to conduct the demonstration. A complete set of materials can be found in Volume 2 (U.S. Army Research Institute for the Behavioral and Social Sciences, 2000).

The table of contents below provides a list of the demonstration materials provided in this appendix. The first column in the table provides the title for each product. The second column states whether this appendix contains a partial or a complete sample of the product and the last column identifies the page number.

Battle Command Reengineering IV SC^4 System Demonstration Script

The demonstration was delivered by using a combination of a projected screen display of a pre-recorded exercise using the SC^4 system, narrative descriptions of the events depicted in the pre-recorded exercise, and overhead projection slides. The Training Director uses the narration (script), sample below, to provide the training audience with a description of key aspects of the SC^4 capabilities depicted on the screen display. The script also provides the training audience a contextual setting for the system capabilities, similar to the type of mission the staff may be conducting during the Battle Command Reengineering (BCR) experiment.

BCR IV SC^4 System Demonstration

Title Slide

Now that I've updated you on the BCR IV experiment, I'm going to demonstrate some of the key aspects of the SC ^{4} system that you will be using during the experiment.

Demonstration Objective Slide

The objective of the demonstration is to provide a quick overview of how the system could be used in an operational setting. We will show you a way to perform certain functions, but there may be other ways to do the same thing. Your training will help you discover what is the best way for you.

Key Aspects Slide

Key aspects of the system that you will see during the demonstration are as shown on this slide. *[Laze to slide as needed]*

In terms of Information Fusion which describes the ability of the SC^4 System to process and display information from a variety of sources, we will show you how to obtain SITREPs and SPOTREPs, as well as a technique for determining unit status and a way to obtain battle damage reports. For collaborative planning on a common relevant picture among commanders and staff, we will show you a SunForum Whiteboard conference, and a PVD Whiteboard conference. We will show you how to the use the electronic reference library to look at the threat manual. And, capabilities of the SC^4 system to provide you with Situational Awareness.

The tactical situation portrayed during this demonstration actually took about an hour to unfold. In the interest of saving time, the action has been compressed to about 30 minutes. For demonstration purposes, some artificiality has been introduced in terms of the tactical disposition of the squadron and OPFOR engagements. Your unit might react differently to the situation depicted during this demonstration.

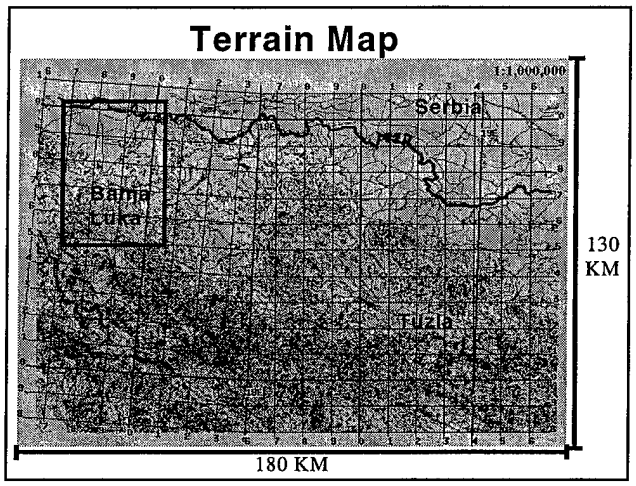
Terrain Map Vugraph Slide

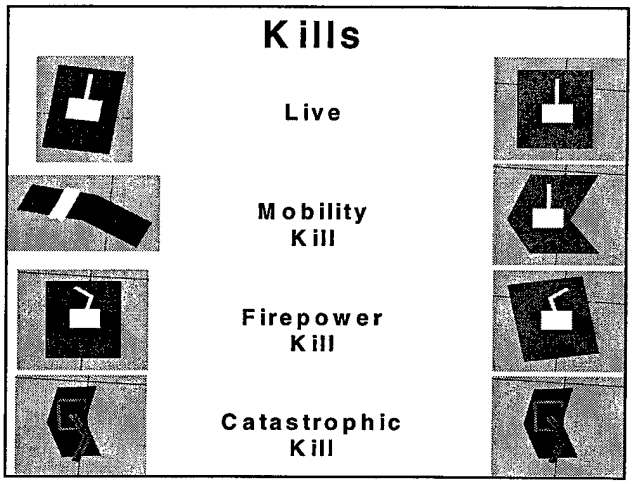
The demonstration is being staged around the Banja Luka Airfield in Northeastern Bosnia. Many of you have had chance to serve in Bosnia and are already familiar with the terrain. The Vugraph slide shows the location of the demonstration on the terrain. *[Laze to map scale on map and PVD]* **Note the map scale indicated in the upper right hand corner here and on the PVD which gives you an idea of the amount of terrain you are looking at.**

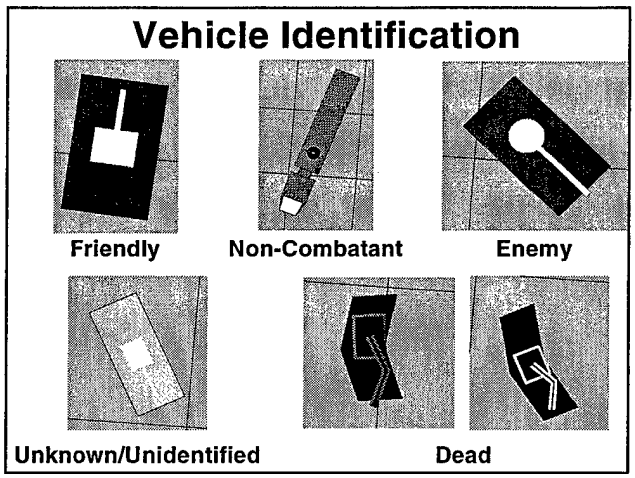
Let me set the stage for the demonstration. The 3rd Squadron, having just deplaned, is in local dispersal sites around the Banja Luka airfield in order to rig equipment, battle sight weapons, and finish vehicle combat loading of ammunition and fuel. Iron Troop is located to the northwest of the airstrip; Killer Troop is to the northeast; Lightning Troop is located to the southwest of the airstrip; with Mad Dog Troop located to the southeast. A Multiple Launch Rocket System (MLRS) battery is positioned.

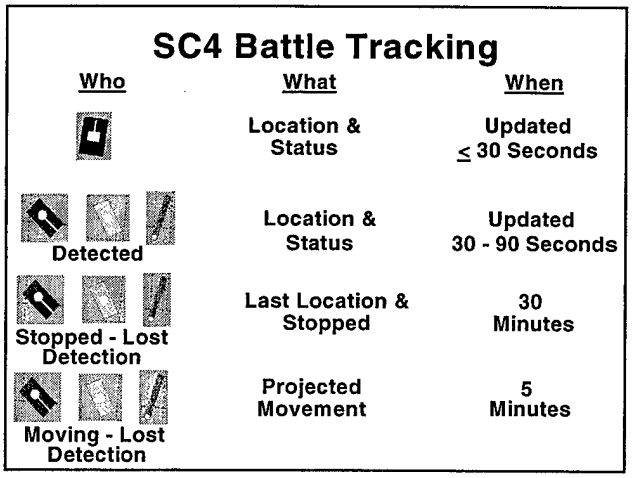
SC^4 System Demonstration Overhead Projection Slides

In addition to the projected SC^4 system screen display, the demonstration overhead slides provide a reference of the way in which information is displayed on the SC^4 system. The demonstration narration provides cues to when to display and discuss these overhead slides.



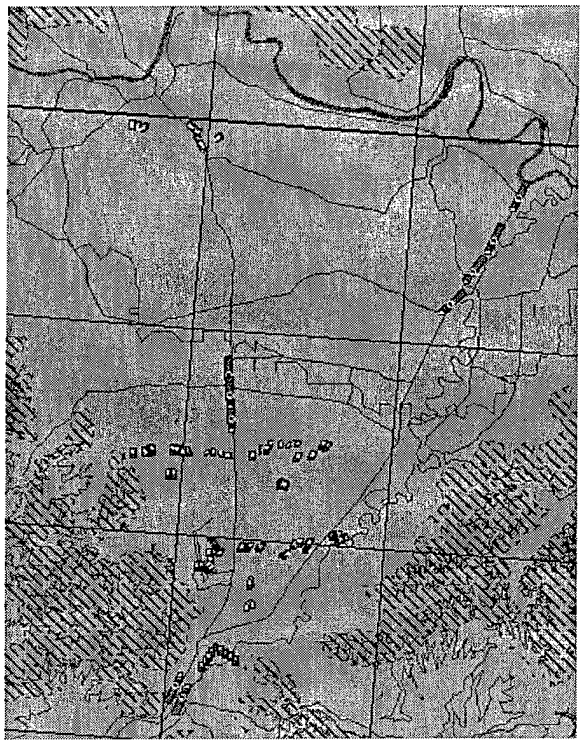


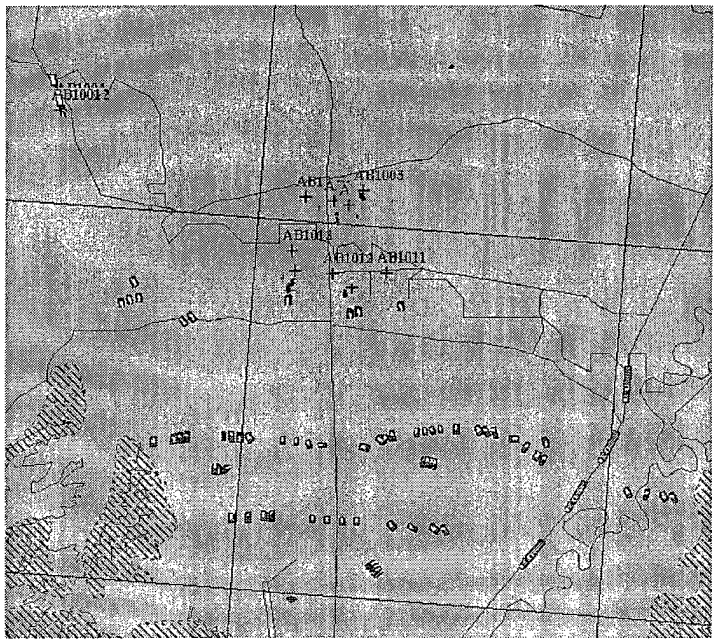




SC^4 System Screen Sample

The three screen captures below are provided as examples of the way information is presented while conducting a mission exercise using the SC^4 system.





APPENDIX C

SAMPLE MATERIALS OF DIGITAL STAFF DRILLS

This appendix provides sample materials of the Digital Staff Drills. It provides the reader with samples of selected training materials used in the guide. A complete set of materials can be found in Volume 2 (U.S. Army Research Institute for the Behavioral and Social Sciences, 2000).

The table of contents below provides a list of the sample materials of the Digital Staff Drills, which are taken from the slides, training plan outline, and worksheets. The first column in the table provides the title for each product. The second column states whether this appendix contains a partial or a complete sample of the product and the last column identifies the page number.

Whiteboard Drill Guidelines - Wolfpack 53

Tactical Situation

Your task force, 3rd Squadron, 2nd Battle Force has just arrived by air and is currently located in assembly areas vicinity the airhead at TUZLA AIR FIELD (CQ180520). You have just been alerted that the OPFOR has begun an attack aimed at destroying your force and capturing the airfield.

Exercise guidance

For this drill's four Whiteboard (WB) events, you are **Wolfpack 53**, located in the Command 2 Node. During events 1–3, your WB participants will be **Wolfpack 5** and **Wolfpack 52**, co-located with you, and **Mad Dog 6**, located at his workstation. During event 4, your WB participants will also include **Wolfpack 99, 92, 93**, and **Lightning 6**. To complete the drill, perform the following sequence of activities. If you have a problem performing any activity, contact the RA for assistance.

Event	Action	Activity
1. INTSUM Analysis	Participate in **Wolfpack 52** Whiteboard Conference	• Select crewman access unit (CAU) Channel 3 for monitoring/transmitting. • **Wolfpack 52** will contact you on the radio and announce that he is initiating a whiteboard conference. • Follow the instructions that he provides and participate in his conference as directed.
2. Higher Headquarters Operations Order (OPORD)Analysis	Establish radio communications	• Establish radio contact with **Wolfpack 5**, **Wolfpack 52**, and **Mad Dog 6** on CAU Channel 3. • Inform them that you will use the SunForum® Whiteboard Tool to coordinate your analysis of an INTSUM from higher headquarters.
	Initiate whiteboard conference	• Open the SunForum® Window and initiate a conference with **Wolfpack 5**, **Wolfpack 52**, and **Mad Dog 6**. • Once the conference is established, open the Whiteboard window. • Use radio to verify participants are displaying a blank whiteboard window. • Open **ARI_BCR4_WBVIG_CMD2_BP** whiteboard file. • Verify participants are displaying right file.
	OPORD Analysis	• Use drawing tools to highlight specified task(s) in 2nd Battle Force OPORD. • Ask other participants to identify implied tasks. • Answer any questions about OPORD. • Announce that you are going to terminate the whiteboard conference.

Event	Action	Activity
2. Higher Headquarters OPORD Analysis, cont'd	Terminate whiteboard conference	• **Exit** the whiteboard window. • Do not save changes. • Once file closed, **Hang-up**.
3. Battle Position Selection	Participate in **Wolfpack 5** Whiteboard Conference	• Continue to monitor CAU Channel 3. • **Wolfpack 5** will contact you on the radio and announce that he is initiating a whiteboard conference. • Follow the instructions that he provides and participate in his conference as directed.
4. Course of Action Development	Participate in **Wolfpack 5** Whiteboard Conference	• Set CAU to Channel 4. • **Wolfpack 5** will contact you on the radio and announce that he is initiating a whiteboard conference. • Follow the instructions that he provides and participate in his conference as directed.
5. AAR	Drill AAR	• Node RA will conduct AAR in place. • Move to classroom for unit AAR.

Rules of engagement

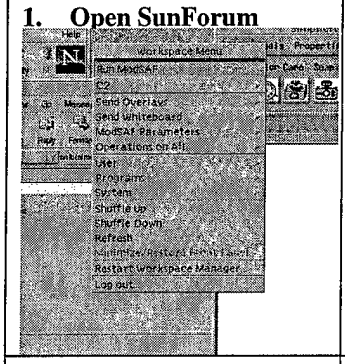
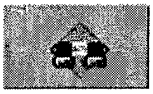
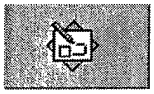
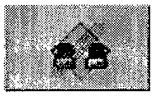
While you are participating in Whiteboard conferences initiated by other staff members:

- Follow their lead.
- Do not open Whiteboard Window until directed.
- Do not lock the whiteboard drawing tools unless the conference leader directs you to do so.
- Do not save any changes to the whiteboard file.

When you initiate a Whiteboard Conference

- Go slowly enough to allow other staff members to keep up.
- Verify by radio that all staff members have the right Whiteboard files displayed.
- Only lock the whiteboard file drawing tools when necessary.
- Do not save any changes to the whiteboard file.

SunForum Whiteboard Job Aid

Action - Icon	Description
1. Open SunForum 	• Cursor in desktop open area • Click right mouse button. • Using the left mouse button, click on **C2** heading • Click on **SunForum** heading • Use left mouse button for all subsequent actions.
2. Find Addresses  **Address Book**	• When SunForum window has opened • Click **Address Book** • Click on individual address
3. Call Participants  **Call**	• Click the **Call** button • Select and call additional participants until everyone has been called.
4. Verify Participants  **Current Call**	• Click **Current Call** button to make sure that everyone is in the conference. • Repeat Action 3 as necessary
5. Initiate Whiteboard  **Whiteboard**	• Click **Whiteboard** button • When the whiteboard window opens, click on the **File** pull down menu and then **Open** • Select the desired whiteboard file and begin the conference.
6. Terminate Conference  **Hang Up**	• Click **File** pull down men and then **Exit** • Click **Hang Up** button • Resize, close, or minimize the SunForum Window to provide more room on your desktop.

APPENDIX D

SAMPLE MATERIALS OF TEAM TRAINING SESSIONS TRAINER GUIDE

This appendix provides sample materials of the Team Training Sessions (TTSs) Trainer Guide. It provides the reader with brief samples of selected training materials used in the guide. A complete set of materials can be found in Volume 4 (U.S. Army Research Institute for the Behavioral and Social Sciences, 2000).

The table of contents below provides a list of the sample materials of the TTSs trainer Guide, which are taken from the slides, training plan outline, and worksheets. The first column in the table provides the title for each product. The second column states whether this appendix contains a partial or a complete sample of the product and the last column identifies the page number.

The overview section of the TTSs Trainer Guide provides the trainer with general information regarding the TTSs overall design, training prerequisites, training audience, trainer responsibilities, and proposed training schedule.

Roles and Functions

Overview

Introduction

The Roles and Functions training session provides the training audience the opportunity to ensure each member of the staff knows and understands what the other staff members will be doing while executing tactical training exercises. This training session can be beneficial for both digital and analog units.

It is particularly beneficial for staffs that have experienced substantial changes in personnel, organization, or mission.

Purpose of these materials

To provide the necessary materials to prepare the trainer to conduct the Roles and Functions training briefing and Structured Practice Exercise (SPE).

Roles and Functions process

The Roles and Functions exercise is intended to include the entire staff and is conducted after receiving the initial briefing at the start of a tactical training event. During a Roles and Functions exercise, unit members will:

- Identify who they report to (and who reports to them if applicable) and the tasks within their area of responsibility for the upcoming training event
- Identify from whom they will receive task related information or products
- Identify to whom they will provide task related information or products
- Brief that information to the other staff members
- Discuss solutions to any conflicts regarding information or product flows

Commander's Read-Ahead

The Commander's Read-Ahead is provided to familiarize the commander with the TTSs. It provides the Commander with information regarding the TTSs design, Commander's role, descriptions of the benefits and process for conducting each training session, and additional background information.

Commander's Read-Ahead

The only way to develop teamwork is for team members to do things *together*. This applies to training.

FM 22-102, Soldier Team Development

Introduction

This Commander's Read-Ahead describes five staff training exercises called Team Training Sessions (TTSs) that will be implemented during BCR IV.[1] The purpose of the TTSs described here is to improve the staff's teamwork skills by allowing them to practice doing things together. Such training is particularly important when units face new missions, new organizations, new roles, new equipment, and/or major revisions to standing operating procedures (SOPs). Background information, at the end of this packet, examines how the TTSs relate to basic teamwork skills.

Team Training Sessions

The TTSs provide brigade and battalion level staffs the opportunity to train and practice teamwork and decision-making skills. The TTSs are: Roles and Functions, Information Management, Pre-Execution Brief, Situation Update, and Team Decision-Making Debrief. Figure 1 provides a recommended timeline for implementing the TTSs in a tactical training event (e.g., CFX, FTX), including Battle Command Reengineering. Each TTS includes a short familiarization brief and exercise requiring approximately 30 minutes. The primary training audience for the TTSs is the commander and his staff.

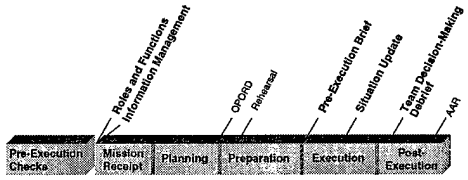


Figure 1. Recommended TTS training timeline

Briefings and exercises for the Roles and Functions and Information Management TTSs are designed for a classroom-type setting, prior to the planning phase of the overall conducted during each tactical training exercise. It is recommended that these three TTS exercises be repeated for each change of mission during a training event.

[1] Note: The Team Training Sessions Trainer Guide provides a more complete description of the TTSs and how they are to be executed.

Training Objectives

Before describing the TTSs, the desired outcome or training objective of each exercise is identified in Figure 2.

Team Training Sessions		Outcomes
1. Roles and Functions	→	Understand team members' roles, functions, and tasks.
2. Information Management	→	Get the right data and information to the right people at the right time
3. Pre-Execution Brief	→	Address problems not previously identified.
4. Situation Update	→	Share a common understanding of the current situation, the mission, and commander's intent.
5. Team Decision-Making Debrief	→	Improve the decision-making process.

Figure 2. Anticipated outcomes of each Team Training Session

Roles and Functions

Roles and Functions provides you and your staff an opportunity to ensure each member of the team understands other team members' roles and functions. This session encourages individual soldiers to consider how their roles and responsibilities contribute to the overall functioning of the staff. During this exercise, unit members review team roles and functions by:

- Writing down who they report to and the tasks within their area of responsibility
- Identifying from whom they will receive task related information or products
- Identifying to whom they will provide task related information or products
- Briefing key aspects of that information to the other staff members
- Discussing solutions to any conflicts regarding task flow

Roles and Functions Training Plan Outline

The Roles and Functions Training Plan Outline provides the trainer with the foundation from which a training plan can be developed that focuses the training for the current operating environment.

Training Plan Outline

Roles and Functions briefing introduction

Title Slide. The Roles and Functions activity is used to ensure the staff members understand what the other members of the staff will be doing and how information should flow for the upcoming mission. Though everyone knows, in general, what each person does and who is responsible for what task or information, this exercise provides a framework to openly discuss these issues as they relate to the upcoming tactical training event. This training will include the following information:

- A short briefing on the purpose, benefits, and process of conducting the Roles and Functions training session;
- An SPE to use the concepts presented during the briefing

The Roles and Functions training session should take approximately one hour. This estimate includes the briefing, discussion, and conduct of the SPE.

Slide 2. Topics to be discussed during the briefing.

Roles and Functions briefing content

Slide 3, Purpose

Discuss bullets…

- It provides staff members the opportunity to verbalize what they believe they are to do during the particular tactical training event or exercise.
- After hearing the staff members state their roles and expected contributions to the training situation, everyone better understands what to expect from others.
- By understanding what each person intends to do, how the team will work together during the exercise becomes clearer.
- This session also establishes a simple process to quickly modify unit SOPs (e.g., who attends orders briefings, message traffic flows) and when adopted into a regular training process, it can allow new staff members to more quickly become acclimated to the team.

Note: Roles and Functions is a good exercise to conduct each time the staff conducts any type of training event. The key point is to focus the discussion to the current staff training event or exercise. This is not a general discussion of what each staff position is, but a focused dialogue regarding information elements each person intends to monitor, will need from others, and will be prepared to provide.

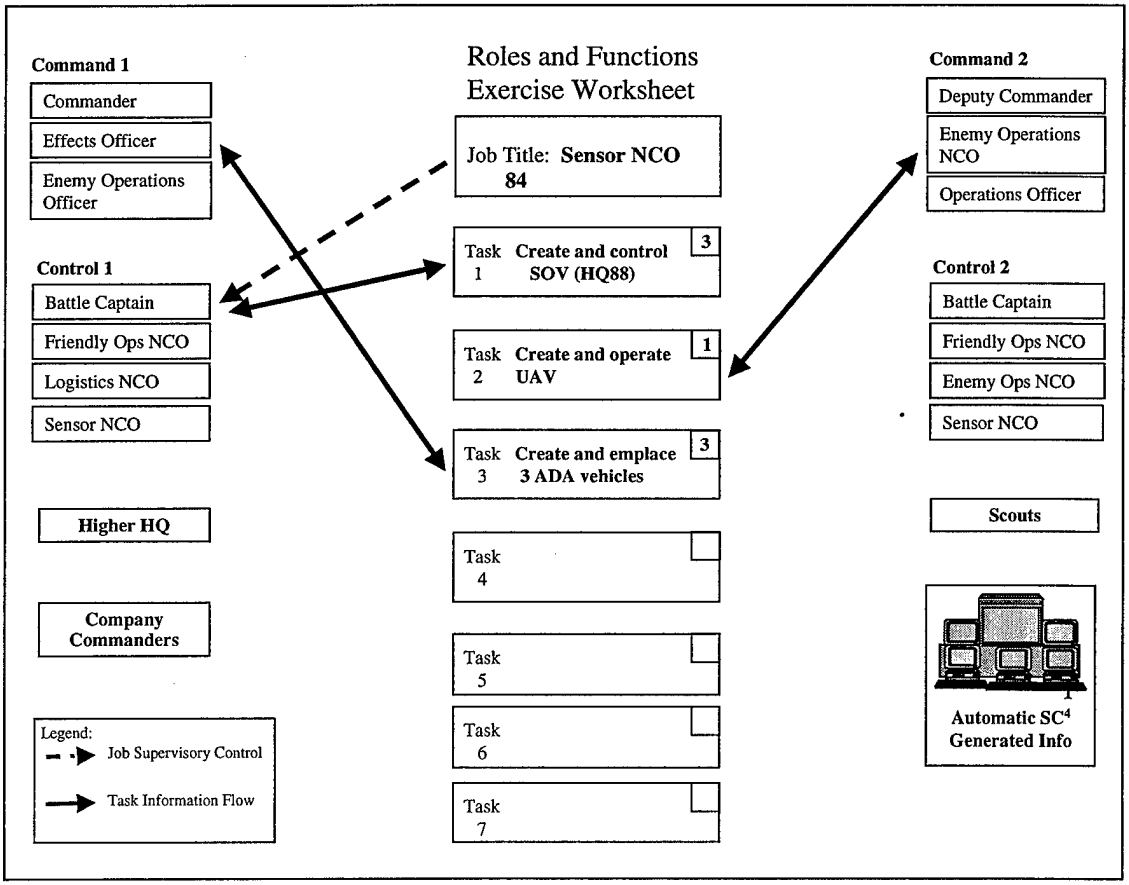
Continued on next page

Team Training Session Roles and Functions Worksheet

The Roles and Functions Worksheet is used by the staff members to document their own responsibilities so that they can easily, and concisely, brief the information to the rest of the staff. As a member of the staff, the procedure for using the worksheet is to:

- Write in your position title
- Identify several key tasks you are responsible for during the training event
- Draw a dotted arrow indicating to whom you report to for supervisory guidance, if you directly supervise someone, draw a dotted arrow from that person(s) to your box
- Draw a solid arrow indicating from whom you receive task related information or products for each task
- Draw a solid arrow indicating to whom you send your task related information or products

The sample below is a completed worksheet for the Sensor NCO (84) position for Battle Command Reengineering (BCR) IV.



Team Decision-Making Debrief Exercise Outline

The Team Decision-Making Debrief Exercise Outline provides the trainer or commander with steps for conducting the TTS exercise.

Team Decision-Making Debrief Execution Outline

Steps	Action
	Exercise Objective : Staff members will identify and provide a briefing regarding: 1) key decisions, 2) resources needed and available, 3) whom the decision was conveyed to, and 4) type of feedback received. *Materials/Equipment* : Photocopies of the Team Decision-Making Debrief Worksheet Overhead slide copies of the Team Decision-Making Debrief Node Worksheet Overhead slides, projector, and overhead projector pen Whiteboard or butcher paper, with several markers
1	Once mission exercise has stopped, ask the Senior Staff members to meet with their staff for approximately 5 minutes to identify a key decision (good, bad, easy, hard) made by each person in their group during the tactical training exercise. Ask them to complete the **Team Decision-Making Debrief Node Worksheet** (found on page 8-24) paper and/or transparency, then have the entire staff move to a central location (briefing room, classroom). The worksheets (paper and/or transparency) are used to conduct a briefing on the decision they selected. (This could be limited to only Senior Staff members)
2	Review Team Decision-Making Debrief Process poster. Review Team Training Sessions General Rules poster. Review the questions on the Team Decision-Making Debrief Process poster. (Or use **Slides 1-3** that are found after this section)
3	Have the staff members (or Senior Staff only) provide a briefing of the following information, without interruption. **Display the Team Decision-Making Debrief Example (Slide4).** *(From the BCR Experiment)* *Command 1, Friendly Operations: "The decision was that the main supply route (MSR) forward of line of departure was unusable due to the combination of battle damages and wash out from the rain; therefore, a new MSR had to be designated. The resources that were needed were a route reconnaissance from the scouts map reconnaissance, and the Co 1SG reports. The resources were not available from the scouts, but the Co 1SGs provided feedback on trafficability. The maps and PVD display were not current enough to base the decision. The decision was conveyed by the Deputy Cdr and the FSC Co Cdr. The Deputy Cdr and the Co 1SGs approved the route, while the FSC Co Cdr reported that the route was sufficient."* Note: Ensure the unit is aware that the whiteboard or butcher paper and pens are available should they wish to appoint someone to record or make notes of each person's briefing

Continued on next page

The Team Decision-Making Debrief Worksheet provides the staff a common format from which they can use to discuss decision-making information with the entire staff.

Team Decision-Making Debrief Node Worksheet

This worksheet provides each node the opportunity to identify a key decision and answer questions based on the identified decision to use during the Team Decision-Making Debrief.

1. Identify a key decision (good, bad, easy, or hard) that was made in the node during the tactical training exercise. Use the space provided to write down the decision to help in answering the following questions.

_____
_____
_____
_____

2. Using the decision identified above, answer the following questions and prepare to discuss the answers during the debrief.

a. What resources were needed (e.g., information, products)?

_____
_____
_____

b. Were all the resources available?

_____
_____
_____

c. To whom was the decision conveyed?

_____
_____
_____

d. What type of feedback was received?

_____
_____
_____