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**Managing Force XXI Change: Insights
and Lessons Learned in the Army's
First Digital Division**

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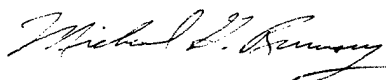
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FOREWORD

The U.S. Army Research Institute for the Behavioral and Social Sciences (ARI) has long investigated ways to improve Army training and assessment. The importance of the ongoing work is highlighted by the Army's in-progress transformation into a future force fully capable of responding across a broad spectrum of missions. As units transition to new doctrine, organization, and digital equipment, leaders are forced to deal with numerous challenges resulting from rapid change. The process spawns critical insights and lessons learned that need to be passed on from one leader to the next. As part of ARI's program supporting the future force, the current effort examined approaches and issues for helping experienced leaders pass their hard-won knowledge on to their successors.

The Fort Knox Armored Forces Research Unit (AFRU) of ARI conducted this study to explore methods for capturing and sharing knowledge in the Army's Force XXI environment. The study focused on challenges related to managing change, as encountered by senior leaders in the Army's First Digital Division—the 4th Infantry Division (Mechanized), or 4ID. This report presents the insights and lessons gained from the digital leaders and from study team experts. The results will assist Army leaders as they continue to find ways to enhance the Force XXI transition process. The methodology and findings will help researchers working to push the technology for organizational learning and collaborative knowledge exchange. The work was supported through a Memorandum for Record between the Chief, ARI AFRU, and the Chief of Staff, U.S. Army 4th Infantry Division. The subject of the Memorandum is Commanders' Insights and Assessments Leading and Managing at the Speed of Change in Force XXI: Techniques and Tools for Documenting and Sharing Lessons Learned, dated 9 August 1999.

The results of this study have been briefed to key personnel in the 4ID, and a computer-based Leader's Tool built around a relational database has been provided for the division's use.



MICHAEL G. RUMSEY
Acting Technical Director

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Without the support of the 4th Infantry Division (Mechanized), this project would not have cleared the launch pad. LTG W. Scott Wallace sparked the study and instrumentally contributed both knowledge and inspiration. The authors thank MG Ben Griffin, COL Ted Kostich, COL Oscar “Randy” Anderson, and COL Robert Cone. They gave generously of their time to share their knowledge in interviews, review analytical products, and participate in a user trial of the Preliminary Leader’s Tool. In addition, MG Richard Cody participated in an early interview.

We thank Mr. Peyton Randolph and Mr. Ron Mast of TRW for their unstinting efforts to make the Preliminary Leader’s Tool a reality, and Dr. Beverly Winsch of TRW for her invaluable contributions to planning, managing, and executing the project. We are grateful to Ms. Wilma Sanders of TRW for transcribing interviews and editing/producing the Study Report. We also thank Mr. Ward Critz, LTG (Ret) Don Holder, LTG (Ret) Robert Coffey, Mr. Randy Hill, Mr. Darrel Charlton, and Ms. Karen Longoria, all of TRW, and MAJ Kent Cook and MAJ William Rademacher.

MANAGING FORCE XXI CHANGE: INSIGHTS AND LESSONS LEARNED IN THE ARMY'S FIRST DIGITAL DIVISION

EXECUTIVE SUMMARY

Study Requirement:

As the Army continues its push to exploit information age technology, rapid and dynamic change has become a hallmark of the Force XXI environment. Leading units through complex transition demands change management skills not taught in Army schools. It also highlights the critical need for experienced warfighters to pass on their unique knowledge so their successors do not have to relearn critical lessons. The digital leaders of today and tomorrow need tools enabling them to harness and build upon the growing body of Force XXI knowledge. To meet these needs, the Fort Knox Armored Forces Research Unit of the U.S. Army Research Institute for the Behavioral and Social Sciences embarked on an investigative study. The practical goal was to facilitate collaborative knowledge exchange and organizational learning to enable future leaders to benefit from the hard-won lessons of their predecessors.

Procedure:

The study team began by developing categories of change-related problems (Focal Areas), along with second-level Focal Topics, to organize the capture and analysis of knowledge. They then elicited knowledge in structured interviews with senior leaders in the Army's First Digital Division. Next they converted the interview transcripts to Nuggets (discrete chunks of knowledge), classified the Nuggets against the Focal Topics, and derived practical guidelines (Rules and Principles) for facilitating change. In parallel, the team designed and developed a preliminary, computer-based Leader's Tool to help the limited target audience define and solve change-management problems. They populated the tool with the cumulative Nuggets, Rules, and transcripts. A key feature of the Leader's Tool was the ability for users to add their own insights and lessons learned, creating a self-sustaining environment for keeping the knowledge base current.

Findings:

The report discusses the team's lessons learned for capturing knowledge and organizing it in a form convenient for others to use. The report then presents insights regarding the study's methodology for designing, developing, and testing digital tools for collaborative knowledge exchange. Recommendations for leveraging and extending the project's methods, including the Leader's Tool technology, are offered.

To illustrate the knowledge that can be assembled using the specialized methodology, the report documents digital leaders' insights regarding Force XXI transition. The leaders' insights address the process of managing Force XXI transition as well as the transition's impact on tactics and doctrine.

Utilization of Findings:

The findings will assist Army leaders as they continue to find ways to enhance the Force XXI transition process. They will also help researchers working to advance the technology for capturing and sharing transition-driven knowledge, especially as it pertains to managing change.

MANAGING FORCE XXI CHANGE: INSIGHTS AND LESSONS LEARNED IN THE ARMY'S FIRST DIGITAL DIVISION

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MANAGING FORCE XXI CHANGE: INSIGHTS AND LESSONS LEARNED IN THE ARMY'S FIRST DIGITAL DIVISION

Introduction—The Journey

The only real failure is the failure to learn.

Sullivan & Harper, 1996, p. 193

Imagine a tool that would enable Force XXI transition leaders to “pick the brains” of pioneers who blazed the trail before them. Imagine, too, a living tool that would grow as Army leaders add their own insights to the expanding knowledge base. The tool would inform a user of approaches that have helped others to solve change-related problems. And it would provide a gateway to useful information available via the Internet. In short, the tool would be a one-stop source of assistance for leaders who confront the rigors of managing change every day.

The journey to that tool—a Leader’s Tool for managing change—is chronicled in this report. More importantly, the report distills the insights and lessons learned during the development phase of the journey. The lessons will help warfighters on the cutting edge of information warfare as well as researchers advancing tools for managing change.

Purpose and Scope of the Study

In the Spring of 1999, the U.S. Army Research Institute for the Behavioral and Social Sciences (ARI) launched a study known as “Managing at the Speed of Change in Force XXI” (MASC-XXI). The study responded to the Commanding General of the Army’s First Digital Division (FDD), who was concerned that the “how” of digitization at the operational level was not being adequately documented. He described “getting from point A to point C” without a clear record of how he got there. A key implication was a concern that leaders in the midst of rapid change often were forced to make critical decisions based on an incomplete understanding of root causes and ramifications.

Under the leadership of investigators in ARI’s Fort Knox Armored Forces Research Unit (AFRU), the MASC-XXI study set a course to help leaders in a Force XXI division pass critical knowledge on to their successors and to facilitate organizational learning. The ARI team established the following technical objectives:

- Develop a scheme to efficiently represent leaders’ concerns about managing change in their digital units.
- Gather knowledge from selected FDD leaders, focusing on their process for managing change.
- Develop a transition book as an interim product to assist unit leaders.
- Design and develop an easily accessible Leader’s Tool in preliminary form, using relational database technology.
- Populate the Leader’s Tool with knowledge organized around problem-focused topics.

The ARI team targeted the senior leadership of the FDD—the 4th Infantry Division (Mechanized), or 4ID, at Fort Hood, Texas—as the primary audience for the Leader’s Tool. Accordingly, knowledge gathering centered on the same leaders. The project’s duration allowed the team to gather knowledge both early and late in a leader’s tour of duty. The Leader’s Tool concept called for a preliminary product with room to enhance and expand the tool, depending on the needs and desires of the users.

Background

A diverse mix of trends and developments shaped the journey to the Leader’s Tool. Chief among them were:

- The challenge of exploiting new digital warfighting systems.
- The spiral development environment of Army modernization efforts.
- The increasing importance of change management skills among tactical leaders.
- Research techniques for eliciting and analyzing knowledge from domain experts.
- Relational database technologies for powerful information storage and retrieval.

The Army faces significant challenges in indoctrinating and training soldiers to exploit the full potential of new digital combat systems. Digital command, control, communications, computers, and intelligence (C4I) technologies such as the Army Battle Command System (ABCS) offer substantially improved capabilities on the battlefield. Success in battle will hinge on the full exploitation of complex systems such as the ABCS, which is really a “system of systems.” The ABCS and similar advancements point to how the battlefields of the 21st Century will rely increasingly on information technologies to acquire, exchange, and employ timely digital information throughout the battlespace (U.S. Department of the Army, 2000). However, the introduction of new systems for digital operations necessitates new doctrine and force structure, which in turn will drive new approaches for training and leader development.

The Army has for several years relied on a “spiral development” process to bring about rapid, multi-dimensional modernization advances. This complex process for bringing new warfighting concepts and technologies online is well illustrated in the Army’s Transformation Campaign Plan (Shinseki, 2000). In simple terms, the process involves simultaneous changes in combat systems, force structure, combat doctrine, and training strategies—all interacting in a progressive spiral (Dierksmeier et al., 1999). In tactical units, warfighters must develop new tactics, techniques, and procedures (TTPs) as they learn to use new equipment. They must also leverage new organizational structures and maintain proficiency on legacy systems that are not yet phased out. In the meantime, new training products arrive which warfighters must fit into their unit training program as they prepare for the next event in the digitization process. As the new systems are being updated, altered functionality means the TTPs must evolve to keep pace. Hence, the spiral development process imposes a requirement to maintain currency on evolving TTPs and systems (e.g., updated hardware and software), and to incorporate training program and technology improvements into the unit’s training in incremental phases. This vastly complicates the digital leader’s challenge to implement change and maintain combat readiness.

If you walk away from this for a month, it progresses so rapidly that you hardly recognize it when you return.

MG Ben Griffin, 3 May 00

Leading units immersed in modernization demands management skills not typically required of conventional unit leaders. Constantly evolving systems and doctrine require commanders and staff members to stay technically and tactically current in an extremely dynamic environment. Managing change is now an important skill for both the commander and his staff. Change management has been recognized by corporate America as an important dimension for some time (e.g., Conner, 1992; Smith, 1996), along with the concept of the learning organization (Senge, 1990). Many of the lessons learned from industry apply to and may benefit the Army as it transitions to the future force. Sullivan and Harper (1996) provide an institutional perspective, suggesting that a key aspect of change management for Army leaders is developing the skills associated with learning to anticipate the unexpected. Lessons regarding the skills needed by commanders and staffs to win the information war come from the Advanced Warfighting Experiments (AWEs) conducted since 1997. These and other efforts have produced leaders and staffs in the 4ID who are now experienced digital warriors. Their lessons learned are crucial to the success of transitioning to the future. However, the press of getting ready for the next major event often overshadows documenting such lessons.

The digital leaders of today and tomorrow need tools that enable them to harness and build upon the growing body of Force XXI lessons learned. A key need is to track the process and progress of transitioning to digital operations with new organizational structures. The spiral development environment only heightens the need to capture, document, and disseminate transition-critical knowledge. The training environment is significantly complicated by the complexity of new technologies and the speed at which they are being introduced or modified. In the Army's FDD, commanders and staffs possess unique knowledge about "getting from point A to point C" along the Force XXI path. That hard-won knowledge needs to be captured and passed on to their successors to avoid relearning the lessons that previous experience has taught.

Capturing insights and lessons learned from tactical leaders depends on suitable methods for gathering knowledge. Much of the knowledge is tacit—gained through practical experience and previously undocumented, calling for specialized techniques (Horvath et al., 1994). Recent research has generated knowledge elicitation methods (e.g., Klein, 1997; Horvath et al., 1996) that could be useful for capturing tacit knowledge about leading and managing change during Force XXI transition. For analyzing elicited knowledge, techniques such as category grouping (Horvath et al., 1994) and concept mapping (Novak & Gowan, 1984) have been used. The knowledge elicitation and analysis techniques available from the research literature provide a foundation for capturing and organizing leaders' insights and lessons learned.

Developing a tool to give digital leaders easy, user-friendly access to knowledge hard won by their predecessors demands information storage and retrieval technology suitable for today's digital environment. The traditional Army "transition book" is an established tool for disseminating information to new officers, but it has not taken advantage of information-age capabilities. Relational database technology offers powerful capabilities to store knowledge and empower users to search for information with flexibility and precision (Hernandez, 1997). One of the advantages of database technology is its ability to support self-growth with minimal technical support. When coupled with browser technology, a relational database approach can provide job-aid assistance to digital leaders in flexible, user-friendly fashion. Commercial-off-the-shelf software is readily available to build browser and database applications in an integrated

environment. The concept of a computer-based tool that addresses the unique issues of a digital division holds promise for facilitating collaborative knowledge exchange and organizational learning in the transition to information warfare.

The MASC-XXI project focused on eliciting, documenting, and sharing the knowledge held by the experienced commanders and their staffs. The principal product—the Leader’s Tool—harnessed the change-driven insights and lessons learned by commanders and staffs as they transitioned to digital operations.

Organization of the Report

The remainder of the report, describing the MASC-XXI study’s methods and findings, is organized in the following sections:

- *Capturing and Organizing Sharable Knowledge* narrates the research team’s insights and conclusions on the process for gathering, organizing, and protecting knowledge for others to use.
- *Creating Tools for Managing Change* details the research team’s lessons regarding the design, development, and implementation of user-friendly systems to disseminate knowledge to leaders managing change in a Force XXI environment.
- *Leaders’ Insights on Force XXI Transition* illustrates the information resulting from the knowledge gathering and organization methods developed during the project. The insights and lessons learned address both the process of managing change and the impact of Force XXI on tactics and doctrine.
- *To the Future* outlines considerations for downstream research and development, to include technical and management issues, the value of sharing knowledge on Force XXI change, and recommendations for future steps.
- *Golden Nuggets* distills the themes and findings of the study in capsule fashion.

Capturing and Organizing Sharable Knowledge

The road to the Leader’s Tool began with developing and implementing a methodology for capturing the hard-won knowledge of 4ID leaders. A problem-focused schema was created to structure the capture of change-related knowledge, and it also served to shape the analysis of the knowledge. A method was established to organize the knowledge for others to use, cast in a problem-solving and action-oriented framework. The resulting methodology provided the engine for documenting a unit’s progress while “getting from point A to point C” on the way to Force XXI operations.

The MASC-XXI project focused on tacit knowledge—previously undocumented knowledge that is acquired through practical experience (Horvath et al., 1994). To capture Force XXI leaders’ insights and lessons learned, the team used a basic knowledge elicitation technique in the form of structured interviews. This followed the tacit-knowledge acquisition method reported by Horvath et al. To process and organize the knowledge gained in the interviews, the team developed and implemented a special knowledge analysis method. The “chunk-classify-translate” method entailed several steps to create discrete chunks (Nuggets) of knowledge from interview transcripts, classify the chunks into problem-focused categories (Focal Areas and Focal

Topics), and then translate them into procedural guidelines (Rules and Principles). Table 1 outlines the knowledge elicitation and analysis procedures.

Table 1

Summary of Knowledge Elicitation and Analysis Procedures

Phase	Activity	Steps / Outcomes
<i>Analytical Framework</i>		
Structuring	Establish basic categories of knowledge	- Review frameworks from open literature - Characterize contents of preliminary transcripts - Develop and refine list of Focal Areas - Verify utility of Focal Areas for knowledge sorting Outcome: Focal Areas (basic categories of knowledge)
Expansion	Enhance precision of basic knowledge categories	- Characterize contents of early transcripts - Develop and refine topics under each Focal Area - Verify utility of topics for knowledge sorting Outcome: Focal Topics (sub-categories under Focal Areas)
<i>Knowledge Elicitation*</i>		
Preparation	Develop procedures for structured interviews	- Determine questions of interest, based on Focal Areas - Develop and refine interview protocol (guide) - Rehearse procedures with interview team Outcome: Interview Guide, ready team (facilitator, recorder)
Execution	Conduct one-on-one interview sessions	- Provide read-ahead package to participant - Discuss questions of interest, per SME (peer) facilitator - Tape record entire session Outcome: Interview tapes
Documentation	Prepare transcripts of interviews	- Draft verbatim transcript for each interview session - Refine transcript (facilitator and recorder) - Obtain participant's review and approval of transcript Outcome: Participant-approved transcripts
<i>Knowledge Analysis</i>		
Chunking	Break transcript contents into discrete units of knowledge	- Establish criteria for suitable Nuggets - Create Nuggets, add tag lines, edit for clarity and brevity - Reach consensus among analysts, adjust as needed Outcome: Nuggets with focal meaning
Classification	Classify units of knowledge	- Determine Focal Topics for which Nugget has significance - Verify goodness and strength of fit - Reach consensus among analysts, adjust as needed Outcome: Nuggets organized in classification scheme
Translation	Generate and organize practical guidelines	- Develop Principles from open literature frameworks - Translate a Nugget's contents into action-oriented Rules - Link each Rule to one Principle (best fit) - Reach consensus among analysts, adjust as needed Outcome: Rules organized in classification scheme

* Three rounds of interviews were conducted: Preliminary (departing leaders), Round 1 (9-10 months into the job), and Round 2 (20-21 months into the job).

Four terms are critical for understanding the discussion in this section. Because they are not standard terms, they are defined below:

1. A *Focal Area* is a category of problems or issues related to change. It is part of a systematic scheme for organizing knowledge. It is subdivided into several Focal Topics.
2. A *Nugget* is a chunk (discrete, focused unit) of knowledge expressing a leader's perspective on a problem or issue. It is a piece of an interview transcript selected/edited to meet criteria for unity, stand-alone character, etc.
3. A *Principle* is a generalized truth about leading units during transition. It provides a basis for organizing solutions to change management problems.
4. A *Rule* is a how-to guideline for handling change-related problems. It is a form of practical advice offered for consideration. It is specific to an operational context.

Appendix A presents the final list of Focal Areas and Topics. Appendix B contains the protocols used to conduct the interviews. Appendix C lists the Principles with descriptors. Appendix F provides sample Nuggets and Rules to illustrate the knowledge analysis products.

In the course of the project, the team captured its lessons regarding knowledge elicitation and analysis. The remainder of this section discusses the integrated insights and themes, along with methodological points that may be of value to future teams. The following subsections organize the discussion:

- Understanding what others need
- Eliciting knowledge
- Sorting knowledge
- Translating knowledge for use
- Protecting the innocent

Understanding What Others Need

The emphasis on tacit knowledge was a cornerstone from the start. The team felt strongly that 4ID leaders would attach great credibility to knowledge coming from their colleagues, especially if it provided new insights. The emphasis on new, undocumented knowledge led to the need for data collection techniques suitable for uncovering what leaders knew based on their practical experience.

Because the goal was to gather *tacit* knowledge in a highly dynamic environment, asking the target audience to articulate their information needs was of limited value. How would leaders know what they don't know? Instead, the team relied heavily on the change management literature to point the way. The resulting estimate of information needs was later subjected to target audience confirmation during external testing of the Leader's Tool.

Substantial energy went into developing a scheme suitable for organizing knowledge related to managing change in a digital division. The team began with a simplistic concept of "Focal Areas," defined as categories of change management problems and challenges. Fourteen Focal Areas emerged (Appendix A), based on the topics that arose during early interviews with 4ID leaders and augmented by themes identified by change management authors (especially

Sullivan & Harper, 1996; Smith, 1996; Conner, 1992). Both sources provided essential input, with the literature inputs helping to ensure a comprehensive set of categories. Later the team decided that subcategories within each Focal Area were needed to provide a finer level of sorting capability. Under each Focal Area the analysts developed Focal Topics (numbering between three and eleven), using again the early interview results. Most Focal Areas had from four to seven Focal Topics. This yielded 75 working topics to be used for structuring both knowledge elicitation and knowledge analysis (see Appendix A).

As development of Focal Areas began, the team assembled a set of criteria to guide the selection of candidate topics. These were driven largely by expectations of the target audience's interests, habits, and preferences. All criteria were approximately equal in weight.

- Sensibility—each Focal Area should be easily recognizable to 4ID leaders.
- Face validity—it should be readily apparent that a Focal Area encompasses a family of change management problems/issues.
- Clarity—a Focal Area should have an unambiguous meaning.
- Uniqueness—a given Focal Area should minimally overlap others.
- Critical mass—a Focal Area should be parent to a significant quantity of knowledge.
- Resolution—no Focal Area should be parent to an excessive quantity of knowledge.
- Completeness—the set of Focal Areas should accommodate the full spectrum of change management knowledge.
- Multi-domain applicability—the set should accommodate garrison, experimentation, training, unit administration, and deployment domains.
- Quantity—the number of Focal Areas should be reasonable (12-16 maximum).
- Consensus—agreement among team members should be unanimous.

In general, participating 4ID leaders indicated that the interview sessions helped them document lessons they realized needed to be captured. Because the team structured the interviews primarily around project objectives, the immediate benefit to the leaders was largely coincidental. Future teams might consider involving the target audience in developing the data collection instrument(s) so the participants realize greater benefit.

As transition leaders progress through their tour of duty, their information needs as change managers can be expected to evolve. Such evolution would largely reflect growing experience, but also could reflect changing personal attitudes, expectations of others, external influences, and shifts (perhaps subtle) in unit culture. The MASC-XXI project did not directly probe the changing information needs of new versus experienced leaders. Although the team acknowledged the role of experience as a design consideration, it was not deemed feasible to implement an experience-sensitive Leader's Tool in this project. It remains an important dimension that merits attention in future efforts.

Eliciting Knowledge

After weighing various knowledge elicitation techniques, including verbal reconstruction and problem-solving probes, the team selected a simple structured interview technique. The decision resulted from a desire to cover the broadest possible range of topics in a forum familiar to the target audience. The expectation of as few as two knowledge elicitation sessions with

each participant was a key consideration. The team also reasoned that using a consistent technique for all sessions would simplify the knowledge analysis process and come closer to standardizing the form of the resulting knowledge destined to populate the Leader's Tool.

Past the preliminary interviews, the Focal Areas and Focal Topics established early in the project guided the development of interview questions. For the first round, the team crafted a procedure for the participants to informally prioritize the Focal Areas in terms of the magnitude of the 4ID transition challenges encountered. They then asked the participants to discuss specific challenges and solutions for the higher priority items. Also addressed were the leaders' thoughts on the lower priority items. For the second round, the team prioritized the Focal Areas based on the relative density of knowledge already obtained. Additionally, the input received earlier from Alpha testers helped determine where more knowledge was needed.

In developing both of the primary interview instruments (see Appendix B), the team found it challenging to limit the questions to a number that could feasibly be discussed in 1-2 hours. The purpose and objectives for each knowledge elicitation session were defined to focus the query process, and then refined to sharpen the vision. In the end, the team prioritized the questions, in case time limits prevented getting through all of them.

As an adjunct to knowledge elicitation, the team originally planned to observe key events by using a "shadowing" technique. In this method, the team's subject matter experts (SMEs) followed leaders as they participated in meetings and training events. However, shadowing activities were discontinued after only a few sessions due to negligible payoff. The snapshot nature of the shadowing technique largely missed the stream-of-history context that threads through transition issues and problems. It appears that observing unit events in isolated fashion offers marginal value for illuminating change management in a tactical unit, especially without follow-up clarification of the observations. In today's electronic world, email trails might well reveal more about how a unit handles change management challenges.

Initially the team planned to elicit knowledge from the target audience at three successive points—early, midway, and late in an individual's tour of duty. The intent was to follow the maturation of transition knowledge. Due to the leaders' crowded calendars and project resource constraints, only two points on the tour-of-duty learning curve were sampled. The first occurred at the 9-10 month mark and the second took place at 20-21 months of an approximately 24-month tour. While the resulting data were sufficient for the Leader's Tool, future efforts should consider charting the maturation of knowledge by sampling multiple points in the course of the leaders' tours. Command emphasis would be critical to ensure availability of participants.

To assure full readiness of the interview team, every member participated in a train-up and rehearsal session prior to the start of each round of interviews. This enabled the team to pretest the interview protocol, discuss issues and problems, and clarify responsibilities. In the case of the first round of interviews, the rehearsal led to refinements in the interview guide.

As a routine step, the team delivered a read-ahead copy of the interview guide to the participant a few days in advance of the scheduled interview. To accommodate this, the interview guide contained a section of instructions for the participant. The read-ahead package,

along with the personal interaction that accompanied its delivery, was valuable in setting the stage for an optimal interview session.

The desire for quotable leaders' comments led to an exacting process for preparing interview transcripts. The process started with transcription from a tape recording, then was followed by at least two members of the interview team reviewing the draft transcript. Reconstructing unintelligible passages, smoothing awkward wording, translating acronyms, and identifying unfamiliar personal names proved to be frequent challenges. The team asked the interview participant to review the near-final transcript, identify changes needed, then approve the final document for posting in the Leader's Tool. The multi-step process was time consuming, manpower intensive, and dependent on strict quality assurance (QA) standards.

Sorting Knowledge

The team emphasized the importance of transforming the interview transcripts into Nuggets with rigor and consistency. The analysts established a set of criteria to ensure the creation of stand-alone "chunks" of information and to enhance the utility of the Nuggets in the hands of the users. The characteristics of the target audience heavily influenced the criteria and their application. The criteria for the Nuggets were:

- Substance—containing knowledge of significant value.
- Brevity—short enough to read and digest quickly (one-third page maximum).
- Unity—preferably containing one central theme (two at the most).
- Completeness—capable of painting a complete picture.
- Durability—preferably free of elements likely to become dated within a year.
- Independence—understandable without external information.
- Conciseness—free of redundant verbiage.

The team desired short Nuggets that a user could digest quickly. The knowledge analysts targeted an upper limit of one-third page and rarely violated that ceiling. Most Nuggets consisted of one to three short paragraphs occupying less than a quarter-page. An occasional Nugget extended to a half-page in order to tell a complete story or to keep a laundry list intact. Where possible, the analysts edited out redundant verbiage to produce a more compact Nugget. Sample Nuggets can be found in Appendix F.

The analytical process produced several types of Nuggets. Anecdotes took the form of "We tried this on that occasion." Imperative "truths" frequently emerged regarding logistics management, budgeting, experimentation, personnel stabilization, etc. Often Nuggets reflected an intellectual process of integrating and distilling information to form general conclusions. Sometimes a leader provided a mini-tutorial in the form of a seriated list of ingredients or steps, leading to a procedural nugget. Others offered recommendations for improving tactical procedures, unit organization, personnel management, professional development, etc. Yet others provided warnings about the dangers of high-risk conditions, usually related to the budget. A few Nuggets conveyed individual convictions or biases on topics such as tactics or Army culture.

The process of creating Nuggets necessarily removed information from its original context. To ensure each Nugget possessed true stand-alone quality, the analysts inserted

explanatory verbiage where needed. This included spelling out uncommon acronyms. The analysts discovered a separate editorial step worked best to accomplish such finishing touches.

To provide at-a-glance identity for each Nugget, the team developed a “tag line.” This element was designed to convey the primary theme of the Nugget in abbreviated fashion. The analysts chose a declarative noun form (e.g., “Absolute requirement for synchronization”) as the most straightforward representation (see additional examples in Appendix F). The typical tag line ranged from four to seven words in length, only rarely extending to a dozen words or more. The tag line served to represent the Nugget when shorthand presentation was in order.

The classification process called for placing a given Nugget in as many Focal Topics (see Appendix A) as were reasonably applicable. If a Nugget spoke clearly to some aspect of a Focal Topic, the analyst noted the relationship accordingly. To avoid later redundancy during a user’s search process, the analysts tried to limit the number of Focal Topics per Nugget to three (see Appendix F). If more appeared justified, the analyst considered breaking off part of the Nugget to form another Nugget. Typically two or three Focal Topics captured a Nugget’s problem-related connections. Figure 1 illustrates the relationship between Nuggets and Focal Topics.

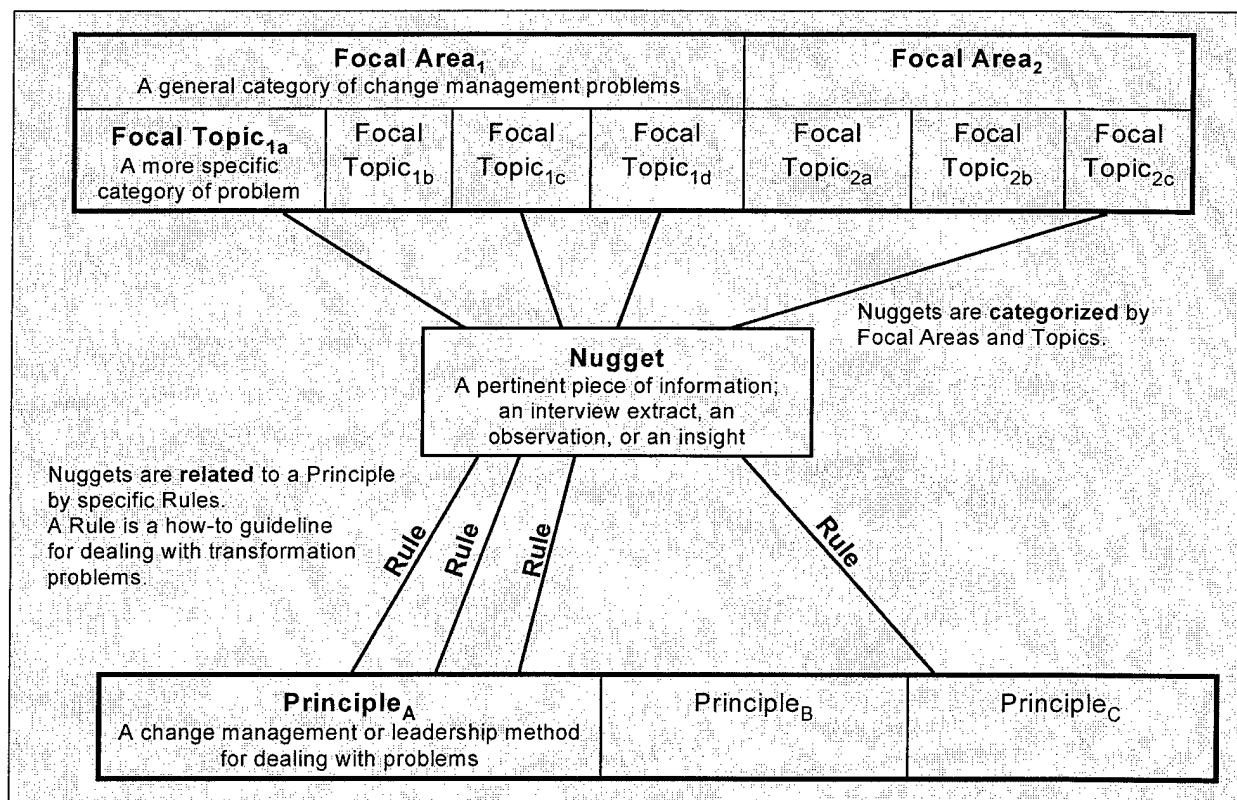


Figure 1. Diagram of the relationships between Nuggets, Focal Topics, and Principles.

The additional granularity provided by Focal Topics was intended, in part, to make it easier for the Leader’s Tool user to manage his search activities. The scheme would enable the user to find desired information by searching under a Focal Topic, permitting greater precision

and speed than searching under the broader Focal Area. Unfortunately, it increased the workload during analysis of transcripts—with 75 Focal Topics versus 14 Focal Areas (see Appendix A).

The process of creating Nuggets, balancing simplicity of theme against completeness of thought, crafting tag lines, and classifying the contents against Focal Topics proved to be very demanding. To ensure consistency, the team restricted knowledge analysis activities to two analysts, with each reviewing the work of the other. Where differences of opinion occurred, the two analysts conferred until agreement was reached.

Translating Knowledge for Use

Contributing to the professional development of the target audience was an important Leader's Tool objective. Beyond the new insights inherent in the tacit knowledge obtained from the leaders, the team felt that practical advice on solving transition problems would be essential. The quest for practical advice led to a decision to derive "how to" guidelines from the interview-based Nuggets. In terms of time and effort, this decision set in motion a mushrooming component of the knowledge analysis process that grew by leaps and bounds.

The concept for "how to" guidelines began as a vague notion of "evident heuristics" but soon evolved into a literature-based collage of "convictions, principles, and rules." In the final analysis, the team adopted a two-tiered framework with Principles serving as higher-level generalizations (or truths) and Rules conveying procedural (try this) or declarative (essential ingredients) heuristics.

The value of the Principles lay in their ability to set a high-level framework for leaders to think about solving transition problems. By ordering the domain of approaches and techniques for resolving problems, the Principles (see Appendix C) provided a systematic schema for addressing the division's change management challenges. Whereas the Focal Areas were designed to order the identification and understanding of problems, the Principles took on the role of ordering solutions to those problems. In the end, the Principles furnished the structure for organizing the Rules.

The team developed the Principles by first examining the high-level constructs found in the open literature (especially Sullivan & Harper, 1996; Smith, 1996; Conner, 1992). The analysts adapted the basic constructs, merging some and reshaping the wording to fit the Army transition environment. A special challenge lay in ensuring that each Principle was intuitively meaningful while maintaining a broad, general scope. The team explored a bottom-up approach of building Principles from early Rules, but discarded it when it became clear it would be difficult to reach a sufficient level of generality using a manageable number of Principles.

The team began development of the Principles in accordance with a loose set of criteria. As knowledge analysis progressed, clarification and refinement of the criteria occurred hand-in-hand with the derivation of Rules, likely reflecting a symbiosis between Principles and Rules. The final set of criteria for Principles included:

- Insightful—offering a fresh perspective for facilitating change.
- Recognizable—intuitively meaningful.

- Generic—applicable across a variety of transition settings.
- Unique—free of distracting overlap with other Principles.
- Effective—capturing a valuable number of Rules.
- Comprehensive—accommodating the full spectrum of approaches/solutions.
- Manageable—not exceeding 12-16 in number.
- Economical—enabling efficient sorting of Rules.

Initial efforts to adapt Rules from open literature sources produced unsatisfactory results, because the resulting context was too generic. This may have stemmed from the fact that open literature Rules were anchored to no particular environment, whereas the Leader's Tool targeted the Army tactical environment. As a result, the team decided to generate Rules by translating Nugget statements into action-oriented guidelines (see Appendix F for sample Rules with their associated Nuggets). The knowledge analysts then codified each Rule under a single Principle. This procedure was time consuming and it produced a relatively large number of Rules. See Figure 1 for an illustration of the working relationship between Nuggets, Rules, and Principles.

As the team developed the Rules, ad hoc criteria evolved. Most of the criteria were apparent at the start, but a few (e.g., practicality) emerged in the course of knowledge analysis. It would be unfair to say that the analysts explicitly applied all the criteria from the beginning. In truth, some of them operated implicitly, as unstated guidelines. By the end of knowledge analysis, the following set of criteria for Rules was apparent:

- Action—identifying a specific step to take.
- Value—offering advice of significant value for a specific challenge.
- Simplicity—focusing on a single approach or consideration.
- Meaning—easy for warfighters to understand and place in context.
- Durability—offering suggestions with lasting utility.
- Brevity—concisely worded without sacrificing clarity of meaning.
- Fidelity—reflecting the scope and context of the parent Nugget.
- Uniqueness—avoiding duplication of or overlap with related Rules.
- Practicality—implementable at the user's level.

Conner (1992) cautions that hard and fast rules (rigid laws) can be counterproductive in effectively managing change. Given the complex and dynamic nature of change, he argues for relying on patterns and principles instead of rules. His *patterns* describe how people typically behave as they respond to change. For Conner, *principles* flow from patterns and hinge on verbs such as *recognize*, *know*, and *understand*. He also identifies action-oriented *skills*, using verbs like *establish*, *facilitate*, and *encourage*. In crafting Rules, the MASC-XXI team used verbs such as *understand*, *know*, *realize*, *consider*, *expect*, *monitor*, *establish*, *build*, *use*, *ensure*, and *help*. Semantically it thus appears that the Rules in the Leader's Tool are closer to what Conner calls principles and skills. The team designed the MASC-XXI Rules as guidelines for addressing transition problems in flexible fashion, not rigid laws. It might be instructive in future efforts to explore basing guidelines on change-related patterns as opposed to problems.

One challenge was to capture all of the significant "advice" inherent in interview comments without overwhelming the Leader's Tool user with a large number of Rules. Most Nuggets spawned more than one Rule (see Appendix F). The analysts set no hard limit on the

number of Rules per Nugget, but they tried to observe a general limit of no more than three. A typical Nugget generated two or three Rules, but an occasional Nugget yielded up to seven Rules. Not surprisingly, more complex Nuggets yielded a greater number of Rules.

To meet the criterion for uniqueness of Rules, the team first identified those that partially or largely overlapped. Compiling the cumulative rules in a single file organized by Principles, with tags indicating the source of each Rule, facilitated this. Next the analysts merged closely related/overlapping Rules to produce a common version fitting several Nuggets. This created a retrofit situation requiring the team to replace original Rules with the merged Rules. This imposed a special burden in the case of Rules that had already been entered into the Leader's Tool database. In the future, project managers may want to sequence the knowledge analysis and database population steps for economy of execution, taking care to freeze the criteria for finalizing Rules as early as possible.

Analysis of a relatively small number of interviews (seven) led to Rules numbering in the hundreds. This created a situation where a user looking for "simple" advice could end up inundated with Rules, all with some measure of relevance to a specific problem. In future efforts it would be valuable for SMEs to integrate and synthesize the cumulative Rules to produce a more compact collection. Doing so would require substantial resources and would sacrifice to some degree the close fit with original problems.

Codifying each Rule under a single Principle sometimes boiled down to a judgment call. A Rule might appear to fit equally well under two different Principles, depending on the relative emphasis chosen. The team adopted conventions to specify the appropriate Principle for certain types of Rules. For example, learning environment rules were placed under the Principle *Only people can make transformation happen*. And rules encouraging new leaders to learn from the experience of predecessors or others fell under the Principle *Soldiers learn by doing*. Sometimes the lack of any good fit forced a somewhat arbitrary decision, which was deemed preferable to creating new Principles for outlying Rules. As a matter of routine, the knowledge analysis procedures required the two analysts to agree on the codification of every Rule.

Protecting the Innocent

Because the knowledge gathered from the 4ID leaders was intended to be shared in the Leader's Tool, sensitivity issues arose early. The issues revolved around the delicate balance of being willing to share information about personal experiences, even mistakes, within the organization so that others could learn with the possible repercussions of having one's mistakes made public. Taken out of context, statements could be misused or misinterpreted. Early on the leaders themselves were nearly unanimous in dismissing serious concerns about unintended consequences. Nevertheless, the team invested substantial effort in avoiding embarrassment to individuals and organizations. As the time to start up the Leader's Tool approached, some of the leaders began to agree with the team's concerns.

During knowledge elicitation and analysis the team took deliberate steps to protect the participating leaders. First, the facilitator obtained the interview participant's verbal consent at the start of each session. Then the team took great pains to transcribe the session with accuracy while guarding against wording that might be misinterpreted. The team routinely filtered out

potentially offensive language during the transcription process, without changing the meaning or the emphasis. Next the transcript was reviewed and edited by the leader himself to ensure that he was comfortable with the contents. The process climaxed with the leader's approval to release the transcript. At all points access to the transcript files and printouts was tightly controlled.

From the start the interview participants were willing to have their personal names associated with their transcripts. However, the team debated whether to identify the contributors by duty position instead of by name. That would make it somewhat difficult to determine the exact source of the comments, although the small target audience certainly narrowed the field of candidates. Ultimately the team decided on personal attribution, on the grounds that doing so would significantly enhance the credibility of the knowledge in the eyes of other warfighters. Whether that decision will stand the test of time remains to be seen.

The emphasis on protecting individuals and organizations from embarrassment contrasted with the leaders' avowed commitment to sharing their knowledge. The leaders were willing to stand by their statements in the interest of contributing to the Army's transition efforts. The creation of tools that disseminate individual knowledge to a potentially broad audience is relatively new to the Army. Fundamental issues regarding the balance between sharing knowledge and safeguarding its contributors will initially be resolved on a case-by-case basis.

The following section discusses the last stage of the road to the Leader's Tool, with emphasis on lessons learned. The design and development of the tool was a key step in establishing the capability for leaders to pass on their hard-won knowledge to their successors. Illuminating the process of "getting from point A to point C" along the Force XXI pathway was the overarching goal.

Creating Tools for Managing Change

The most tangible objective of the project was to create a user-friendly, computer-based tool—the Leader's Tool—capable of helping digitization leaders manage change. By design, the automated tool was the key to passing critical knowledge from one generation of leaders to the next. In practice, the Leader's Tool provided a means of sharing the change-driven knowledge acquired during the project. The team organized the creation of the tool into three stages: (a) exploration of basic parameters, (b) design based on users' needs, and (c) development and testing. The exploration took place in the context of producing a Senior Leader Transition Book as an interim product. The key to the design stage was a front-end analysis (FEA) conducted to determine what users needed in terms of functionality and contents. The development and testing stage revolved around internal and external review cycles. The explore-design-develop-test-revise method is outlined in Table 2.

A "design big, implement small" framework guided the design and development activities. This meant designing to the full potential of the concept, but developing an immediately supportable subset of functions and contents during the MASC-XXI project. It meant building the Leader's Tool with robust capabilities for expansion and improvement in the future. Throughout the project there was a tendency to expand the "implement small" boundaries.

Table 2

Summary of Preliminary Leader's Tool Development

Phase	Activity	Steps / Outcomes
<i>Interim Change Management Tool (Transition Book)</i>		
Exploration*	Develop interim tool around traditional Army concept	- Select delivery medium (CD ROM) - Outline and develop HTML** pages and contents - Conduct internal and customer review, then revise Outcome: Senior Leader Transition Book (computer-based)
Try-out	Conduct informal trial with actual and surrogate users	- Conduct try-out with senior leaders (4ID and others) - Compile participants' comments and suggestions - Document issues for design of Preliminary Leader's Tool Outcome: Input for Preliminary Leader's Tool FEA
<i>Design of Preliminary Leader's Tool</i>		
Requirements	Perform FEA of user functional needs	- Gather data on user needs and operating environment - Identify required functions and contents - Prepare description of primary and transparent functions Outcome: User Functional Description document
Approach	Establish technical approach	- Define operating and development environments - Specify tools for database and interface development - Prepare user interface guidelines (approaches, features) - Prepare integrated description of technical approach Outcome: Technical Approach document
Design	Develop technical design of database	- Develop database architecture (tables, relationships) - Outline pre-defined queries (search functions) - Document technical design parameters Outcome: Logical Design document
<i>Development and Testing of Preliminary Leader's Tool</i>		
Development	Establish database and user interface	- Implement database in Microsoft Access 2000® - Develop user interface using Microsoft FrontPage 2000® - Perform internal QA review, followed by revision Outcome: Draft Preliminary Leader's Tool (unpopulated)
Population	Populate data tables with knowledge analysis products	- Load Focal Areas/Topics and Principles - Format knowledge analysis products for database entry - Load Nuggets and Rules (copy/paste), enter relationships - Load intact transcripts and directory pointers - Conduct internal QA review, followed by revision Outcome: Draft Preliminary Leader's Tool (populated)
Testing & Revision	Conduct internal and external testing	- Conduct informal customer review, then revise - Conduct formal trial using contractor SMEs, then revise - Conduct user trial (demonstration), then finalize - Prepare user and system administrator documentation Outcome: Preliminary Leader's Tool

* No design phase was programmed for the Transition Book, given the availability of the traditional Army model.

** HTML = Hyper-Text Markup Language

Four concepts are critical for understanding the discussion in this section:

1. The *target audience* for the MASC-XXI products consisted of a small set of senior leaders in the 4ID—Commanding General (CG), Chief of Staff (CofS), and maneuver brigade commanders. The narrow composition required no assumptions about applicability of the contents (given the source of the MASC-XXI knowledge base) and it permitted the team to work through security issues with minimal risk.
2. The *Senior Leader Transition Book* was a computer-based reference tool modeled after the traditional Army transition practice. It mainly contained a small set of FDD leaders' interviews broken into Nuggets, classified by Focal Areas, and viewed in Web browser fashion (see Appendix D). It served as a stepping-stone to the Leader's Tool.
3. The *Leader's Tool* was a Web-server software package (see Appendix E) intended as a professional development venue, a personal coach, and a knowledge capture tool. Designed for easy use and near-zero overhead, it combined a Web browser interface with a relational database to provide quick access to Nuggets, Rules, and Principles. It enabled users to add contents (self-growth) within limits. The Leader's Tool was considered *preliminary* because of the constraints of the exploratory project.
4. A *relational database* is a computer-based system for storing and retrieving various types of data. It represents state-of-the-art technology that offers excellent flexibility in searching for data. Commercial-off-the-shelf (COTS) relational database software packages are readily available.

The Leader's Tool was designed mainly to enable 4ID leaders to tap their unit's previous experience with digitization and pass their knowledge on to their successors. The preliminary version developed in the MASC-XXI project helped leaders to (a) search for useful insights and advice from their predecessors, (b) connect with Force XXI-related Web sites, and (c) document their own transition knowledge for use by their successors. The tool's primary functions are listed in Appendix E. A user could employ the Leader's Tool as a problem-solving coach for Force XXI challenges. For example, a new brigade commander could start by familiarizing himself with previously encountered training problems, searching for Nuggets under the Focal Area *Training*. He could next pursue a specific question, such as "How can we get the greatest training value out of our scheduled system test?" To that question he could seek an answer by searching for Nuggets under the Focal Topic *Mixing training and testing*, extending his search to view Rules (action-oriented guidelines) linked to the Nuggets. He could also review all the Rules linked to the Principle *Soldiers learn by doing*, to get a broader picture of training practices in the Force XXI environment. As he develops his own observations and insights about digital training, he could add them to the database so they would be available to others.

As an exploratory effort, the work on the Leader's Tool yielded lessons regarding the design, development, and testing of tools for sharing practical knowledge. The remainder of this section discusses the lessons learned, including methodological points that may be of value to future teams. The reader will find the following subsections:

- Developing the blueprint
- Understanding the target audience
- Building the tool
- Putting the tool to work

Developing the Blueprint

The “design big, implement small” concept enabled the team to think beyond the resource limits of the MASC-XXI project and envision a futuristic Leader’s Tool. In reality this led to a two-stage design process—far-term and near-term. The “design big” credo placed a large premium on design options for expanding the tool at a later time. The “implement small” maxim required the team to make early judgments about potential value and affordability in the context of the MASC-XXI project.

Before design of the Leader’s Tool began the team, including customer representatives, made early decisions regarding target audience, purpose, and scope of contents. The initial definition of the target audience eventually changed to reflect the priorities of the 4ID CG; fortunately, the change had no serious impact on the tool’s design. The purpose—to assist, advise, and document—remained stable throughout the project. The scope of contents—digital leaders’ insights and practical guidelines—also remained stable, although the concept of practical guidelines grew substantially as knowledge analysis proceeded. Stable foundation decisions provide the backbone for the development of change management tools.

At the start, the team agreed on a relational database approach as the core for the Leader’s Tool application system. The decision was based largely on a desire to enable the user to locate critical information much faster than by reading documents. A relational database approach supported systematic searching for information, with the interface serving as the “search agent” responding to the user’s input. The relational database would also facilitate the tool’s self-growth by making it easy for users to add new contents. However, the decision was made prior to systematic analysis of functional requirements and alternative approaches (e.g., document management system searchable by hypertext means). The resource environment precluded testing of alternative approaches, and verification of the suitability of the relational database approach remained beyond the team’s grasp. Future efforts should seriously consider formal analysis of feasible technical approaches following establishment of functional requirements.

The customer’s designation of a widely used COTS suite (Microsoft Office 2000[®]) for developing and implementing the Leader’s Tool conferred the advantage of ready availability in Army circles. Based on prerelease claims from the software manufacturer, the team planned to use the suite’s native features, especially the Data Access Pages (DAPs) supported by Microsoft Access 2000[®], as the primary programming tool for Web-based access. As it turned out, the software imposed some serious restrictions on supportable capabilities for conducting searches and entering data (discussed later). That led the team to expand the programming environment in order to achieve the desired functionality. Future teams should consider contingencies in weighing the pros and cons of alternative software suites during the bid development process.

The target operating environment evolved during the course of the project. The initial concept of a stand-alone system residing on a user’s personal computer gave way to a server-based approach. The latter approach eventually developed into the final Web interface providing network client access, with serious implications for the level of effort during development. An early notion for a mobile (stand-alone) version of the tool was discarded because of security

concerns and the difficulty of standardizing the contents of the database. A more definitive analysis of functional requirements and the target operating environment during the FEA might have avoided the “moving train” phenomenon.

The team achieved only limited success in estimating the resource impact of evolving design parameters, especially changes in the programming and operating environments. Consideration of risk management as part of the deliberate planning process becomes especially important in the research and development environment. Future teams should expect to analyze risk factors, contingencies, alternative approaches, ramifications, and flexibility. They should also plan to update the risk analysis when needed, and reevaluate the technical and resource implications.

In the MASC-XXI study environment, characterized by exploration and innovation, one of the challenges was to design the Leader’s Tool with no legacy system or existing product as a point of departure. The most difficult component to design was the user interface. Beyond a start-up decision to use a common browser (Microsoft Internet Explorer®) as the framework, the vision of the interface was nebulous. The team established the following interface guidelines:

- Full compatibility with the target audience’s office computer environment
- Consistent look and feel (formatting, iconology, terminology, and labeling)
- Display features (font, color, etc.) consistent with user’s software experience
- User-friendly organization and functionality
- No requirements for special input and output devices
- User-controlled pathway and pace, with predominance of on-demand menus
- Situational awareness features to avoid getting “lost”
- Data entry features that encourage user additions to the database
- Reliance on basic computer features for email, file exchange, printing, etc.
- Flexibility to accommodate user preferences and differences
- Minimal time required for user orientation and spin-up
- Capability for user operation without written instructions or technical assistance

The User Functional Description (UFD) was prepared from an operator’s perspective, with no delineation of the interface linkage to the database contents. A limited usage scenario was constructed as an adjunct to the UFD, but it incompletely portrayed data requirements and criteria for satisfactory query responses. A more operational framework for specifying functional requirements, with complete threading of user “challenges,” would be worth considering in future efforts.

The Leader’s Tool design combined resident information unique to the database with hyperlink access to pertinent World Wide Web information, effectively making the tool a networked collection of resources. This approach capitalized on a diverse array of existing information and extended the tool’s reach. However, it made the tool subject to content and availability changes beyond the control of the developers or users. A design option would be to incorporate information from external sources, with necessary approvals, so it becomes resident information. Such an option should be carefully analyzed for impact on system maintenance requirements.

Search options were limited to a set of predefined queries, to accommodate the limited scope of the tool. Simple versus detailed options were included. There was a certain amount of redundancy among the various options, with alternative paths for reaching the same information. The user trial participants exhibited different preferences for search techniques (e.g., problem-driven hierarchical approach vs. Focal Area browsing), reinforcing the provision of flexible search methods.

An important design goal called for a user-sustained system. Accordingly, the team designed the Leader's Tool to minimize requirements for administrative support and system maintenance. Still, a few important functions were assigned to a system administrator—system installation, user registration, adding new Focal Areas and Principles, and at-large editing of contents. This rendered use of the tool dependent on the unit's willingness to commit qualified personnel to part-time support roles.

The team's initial notion of user documentation in printed form eventually evolved into a digital approach, in recognition of the target audience's digital operating environment. Both user and system administrator documentation was prepared in read-me file form, suitable for distributing electronically and printable if desired. In today's advanced technology environment, system documentation should be digital. Any apparent need for paper documentation should be scrutinized closely.

Understanding the Target Audience

Designating the members of the target audience proved to be more complicated than expected. The team began with the three most senior leaders in the 4ID—CG, Assistant Division Commander – Maneuver (ADC-M), and Assistant Division Commander – Support (ADC-S). Subsequent input from the new CG led to replacing the two ADCs with the division's Chief of Staff and the 2nd Brigade Commander (because of the brigade's pivotal role in the Division Capstone Exercise, or DCX). Shortly thereafter the team added the 1st Brigade Commander, bringing the target users to four. The target audience membership defined not only intended user status, but also knowledge elicitation participation. If knowledge elicitation resources had not been at stake, the approach to defining the target audience might have been more expansive. The team's experience during knowledge analysis suggested that insights gathered from one position could apply to other positions, but there was no opportunity to verify that empirically. It would be worthwhile to investigate the applicability or generality of elicited knowledge.

Involving the target audience in the design of the Leader's Tool proved very difficult, because of time and scheduling constraints on the part of the users. The team developed an FEA survey which included potential contents (e.g., leader interviews, information papers, audio and video materials, references) for the leader to rate. However, only one member of the target audience was available to complete the survey. In the end, the team relied mainly on Transition Book feedback obtained from senior leaders and on the judgment of surrogate users (SMEs on the study team). Future teams should include SMEs who can serve as user surrogates, and their input should be weighted heavily.

Early in the project, the team became aware that unit personnel outside the primary target audience might become users of the Leader's Tool. This realization acknowledged the potential for the target audience to expand beyond the design boundaries, as users might recommend the tool to their colleagues and subordinates. It set the stage for a concern that different positions and echelons require different knowledge. From a design perspective, the team reserved expansion of the target audience to the "design big" realm (i.e., future work). From a practical perspective, the team reasoned that no great harm would come from unplanned users gaining access to the tool, so long as all were aware of sensitivity issues.

The prospect of providing the Leader's Tool to other units engaged in transition arose from time to time. Candidates included the 1st Cavalry Division (1CD) and the Interim Brigade Combat Team (IBCT). The MASC-XXI investigators became convinced that secondary target audiences would most likely have different information needs, user preferences, and operating environments. Such differences would result in large part from each unit being at a unique point or stage along the transition path. Accommodating such challenges was beyond the scope of the MASC-XXI project. As Army transition efforts proceed, future development teams can expect to deal with issues of divergent target audiences.

The division's office computing environment obviously influenced the target audience needs, especially in terms of the system operating environment and the user interface. Information on the expected automation and networking environment was obtained from the office of the installation's Directorate of Information Management (DOIM). Through no fault of DOIM personnel, some of the projected capabilities did not materialize fully (e.g., user display capabilities, availability of web servers, and server operating systems). Future teams should be prepared to build sufficient flexibility into the system design and the implementation plans to accommodate unforeseen contingencies.

Security considerations are important to protect the target audience and their units from unintended consequences. Candid information and opinions could be misinterpreted or misrepresented if taken out of context. Security provisions should consider the complete target audience, including unintended users. It can be hard for prospective users to articulate their security desires in early, abstract stages. As a result, a conservative security approach is generally desirable as a starting position. Security concerns can become a limiting factor in defining the target audience (i.e., restricted access).

Building the Tool

The team began with a paper-based concept of the Senior Leader Transition Book, in keeping with Army practice. However, the delivery medium evolved relatively quickly into a computer-based mode. The key consideration was the digital environment of the 4ID. The end product for the Transition Book (Appendix D) was a compact disc (CD) containing HTML pages viewable with the user's browser software. In the information age environment of today, the role of printed products meant to serve as job aids should be analyzed carefully.

As originally envisioned, Web-based access to the Leader's Tool database was to rely on DAPs, a native feature of Microsoft Access 2000[®]. In practice, the DAPs proved inadequate.

Contrary to prerelease claims from the software manufacturer, DAPs could not support selecting query variables from drop-down lists, they could not support more than one query variable at a time, and they could not support data entry, a key feature of the Leader's Tool. The shift from DAPs to Active Server Pages (ASPs) required Structured Query Language (SQL) scripting, which consumed much more effort than had been estimated for DAPs. Further, initial decisions about project staffing did not call for ASP expertise, which led to an unexpected learning curve for the programmers supporting development. The likely need for future teams to weigh the pros and cons of alternative software suites was noted earlier.

In developing the Leader's Tool interface to meet the requirements specified in the UFD, conflicting expectations arose between customer representatives and the team's SMEs and programmers. Differences in definitions, global concepts, individual preferences, etc. became apparent. The team attempted to use storyboards to explore a suitable theme—a division Tactical Operations Center (TOC)—for the interface, with limited success. Flowcharts and outlines may have been more appropriate for visualizing the database-driven tool, rather than storyboards best suited for linear or branching computer-based products (e.g., courseware). In future efforts, suitable interface visualization aids should be specified early in the design phase.

After exploring two themes (a division TOC and a library-like knowledge center), the team settled on a “flat” Web-site approach similar to the interface layout and color scheme of common ABCS systems. Two primary considerations led to that decision: the team's SMEs felt that the familiar layout would appeal to the users, and a review of acclaimed Web sites revealed a strong preference for simple menus and site maps instead of theme-based frameworks. Developing a sophisticated, colorful, and animated user interface is much more labor-intensive and time-consuming than developing the underlying database. However, without an attractive interface even the best functions may go unused. When resources are limited, as in the MASC-XXI project, an early decision should be made on how to balance the development effort between function and interface. Both function and interface should receive detailed attention during the FEA, particularly when no legacy or “model” system exists.

The initial version of the Leader's Tool included a text search feature as a way of narrowing a user's search for desired information. However, the text search feature was eliminated because of negative feedback from Alpha testers and actual users. The problem centered on the literal match required to “find” desired information. Exact matches occurred infrequently, leading to “No records found” in most cases. This proved frustrating to the user. Without an intelligent search capability, text searches in systems such as the Leader's Tool appear to be impractical.

When developing a knowledge-focused database lacking inherent structure, there is a strong interdependence between database development and knowledge analysis. In practice, search capabilities were limited by constraints in the knowledge analysis method. For example, by design the set of Focal Areas and Focal Topics defined (and limited) the primary dimensions for structuring searches for Nuggets. In a different vein, alphabetic sorting of Nuggets and Rules in search returns was necessary because judging Nugget or Rule “value” was not programmed. Expansion of search capabilities would have required a dramatic increase in knowledge analysis effort.

Development of the Leader's Tool required the team to resolve several security issues that arose along the way. Chief among these issues were attribution of Nuggets and transcripts (by name or position), cautionary measures, and the potential to copy contents for outside (uncontrolled) dissemination. After considerable debate, the team decided to attribute Nuggets and interview transcripts by personal name in order to maximize their credibility in the eyes of the users. For cautionary measures, the team chose to place explanatory statements about unintended consequences in the tool's Orientation and the user documentation. Beyond the cautionary statements, no steps were taken to limit copying of contents.

Using the tool's native data entry and editing features to populate the database bypassed the need to create special data entry capabilities for the developers. However, the manual, multi-step population process placed considerable demands on the person entering knowledge analysis products into the database. The process was susceptible to human error, and the mechanism for verifying entries by using the resident search function was laborious. An automated process for entering the knowledge analysts' products directly into the database would be a major advantage where the volume of materials to be entered is large. Future teams might conduct a cost/benefit analysis to determine if developing an automated population process would be worth the investment of time and resources.

Internal QA was a continuous, hand-in-glove component of the development process. The team membership included SMEs (surrogate users) and behavioral scientists who could participate routinely in internal QA. The presence of SMEs capable of serving as surrogate users would be very beneficial in future development efforts, as would human factors experts capable of evaluating interface and functionality characteristics.

The conventional software testing model (Alpha and Beta testing) may not be appropriate for a research-oriented project with a small target audience. A formative evaluation approach (internal review, internal trial, user trial/jury) was used with reasonable success for the Leader's Tool, and should be considered for similar projects in the future (see, e.g., Tessmer, 1993).

The principal programmer maintained the in-progress Leader's Tool on a Local Area Network (LAN) accessible via a corporate Intranet, with password-protected access for members of the team. This led to the need to establish a dial-in capability to enable customer representatives to review the tool. A corporate Web site accessible to customer representatives would have been helpful, with acceptable security provisions. Password-protected Web space outside the corporate firewall may be worth considering in the future.

User testing of the Leader's Tool occurred in the actual implementation environment, an imperative from the team's perspective. This not only exercised the ultimate operating environment, it also reduced the burden on the user-participants. In some cases the convenient access made the difference between a user being able to participate or not.

In the SME try-out of the Senior Leader Transition Book and the internal SME trial of the Leader's Tool, evaluation of interface and contents was structured in the same session(s). The participants showed a strong tendency to focus on interface features (look and feel) at the

expense of contents. It may be desirable in the future to organize trials in two phases addressing interface and contents separately.

Putting the Tool to Work

The handover of the system to the target audience should include steps to (a) secure command emphasis, (b) resolve implementation issues (e.g., security), (c) provide follow-up technical support, (d) ensure resident system administration support, and (e) institutionalize the tool's role in the unit. A transition plan should be developed in advance of handover and coordinated closely with the unit.

Establishing ownership among the target audience is a key step to promote use of a tool. In the MASC-XXI project the team briefed the unit leaders at the outset, then provided update information as the project unfolded. Creating the Leader's Tool contents from target audience interviews and involving the users in external evaluation helped foster a sense of ownership. The team also worked to enlist the support of key personnel (e.g., the division's Information Management Officer) as proponents for the tool.

Maintaining the currency of the contents will be a major factor in determining the success of the Leader's Tool. The database depends on users to update and expand the contents. The team counted on the premise that an easy-to-use system and a leader's sense of dedication would be sufficient to keep the database growing. However, that premise was not tested or verified. In self-growth tools, understanding and then verifying the user's motivational framework is crucial. As with C4I systems the users must be convinced quickly that the tools bring value-added to their jobs. Future efforts might consider embedding change management (lessons learned) tools in the digital systems that the users employ routinely.

One member of the target audience noted the need for an evaluation to determine the benefits realized by using the Leader's Tool. Such an evaluation was beyond the scope of the MASC-XXI project due to resource constraints. Future project managers would be wise to program post-implementation evaluation as a means for ensuring success of the new system. Such an evaluation should focus, in part, on how well the self-growth features (user additions) are working.

Promoting continued use of the Leader's Tool as new leaders take the reins is expected to be a challenge. Means should be pursued to institutionalize the tool as an ingrained, routine asset. This would make the tool a programmed, integral part of the new leaders' transition process.

Hyperlinks to Web sites will become non-functional as time passes. Provisions for updating, replacing, and deleting the links should be created to ensure currency. This should be one of the system maintenance functions, with implications for the qualifications of system administrators (i.e., knowledge of Web page editing).

The "design big" maxim of the MASC-XXI project created provisions for expanding and enhancing the Leader's Tool. The conditions for realizing the full potential of the tool can be

substantially improved by progressively upgrading its scope and functional capabilities. Ideas that emerged during the course of the project for enhancing the tool appear in Appendix G.

The methodology discussed in the two preceding sections resulted in the preliminary Leader's Tool populated with the products of the MASC-XXI knowledge elicitation and analysis methods. The initial database contained insights from 4ID leaders regarding transitioning to Force XXI operations. The following section illustrates the type of knowledge produced by the methodology developed and implemented in the project.

Leaders' Insights on Force XXI Transition

The study team interviewed senior leaders who held four key positions in the 4ID during the project: CG, CofS, 1st Brigade Commander, and 2nd Brigade Commander. All of them were interviewed 9-10 months into their jobs, and all except the CG were interviewed again at 20-21 months. In addition, the team interviewed two departing leaders at the start of the project—CG and ADC-M, who had been in their jobs for two years and one year, respectively.

The interviews produced a total of nine transcripts. Through knowledge analysis, each transcript yielded Nuggets representing a mix of anecdotes, insights, tutorials, convictions, cautions, and recommendations. The team's analysts integrated and synthesized the Nuggets to derive generalizations offering value in the broad context of Force XXI transition. When appropriate, they injected their own knowledge to amplify a basic theme or crystallize the implications of leaders' comments. The results of this analytical step clearly reflected the Leader's Tool contents, but in a distilled form with implications added.

Force XXI transition has produced significant insights and lessons regarding the process and impact of change. The results illustrate the value of capturing leaders' hard-won knowledge so it can be shared with others. This section presents the noteworthy insights and lessons, organized according to Focal Areas (with minor modifications). Actual quotes of participating leaders are included in text boxes. The first subsection groups Focal Areas dealing with the management of Force XXI transition, while the second subsection deals with the Force XXI program's warfighting impact as captured under the *Tactics and Doctrine* Focal Area.

The Process of Managing Force XXI Transition

Command Climate—Setting the Unit Tone

The greatest challenge ... any unit coming to digitization faces is not the TTPs, but the culture change that must take place.

COL Bob Cone, 15 May 00

Transition leaders must reshape the unit's warfighting culture. Old ways—of seeing things, thinking about things, doing things—must yield to new. Bringing about cultural change in leaders and soldiers is probably the greatest challenge. It's not likely to get easier for future

units, but creating a learning organization where discovery and new ideas are prized is an important first step.

Accepting the reality that digital performance standards do not exist is one of the hardest cultural adjustments early in digitization. At the outset, leaders can only estimate what “digital right” looks like. Digital tasks, conditions, and standards are under construction. To a warfighter who is used to standards, this can be a radical change.

A key to a learning organization is the acceptance of risk as a positive factor. Soldiers and leaders who know the commander expects mistakes are more likely to find creative solutions that make digitization work. Mistakes can play an important role in learning, feeding the unit’s lessons learned. A risk-tolerant climate also encourages people to think differently. When no one really knows what “right” looks like, there is no wrong answer.

When you tell people that they are supposed to learn, you take away the zero defect mentality.

BG(P) Richard Cody, 21 Jun 99

A unit has finite energy, so accomplishing the transition’s extra activities forces leaders and soldiers to achieve efficiencies. That means thinking differently, working smarter, and setting priorities. It means thinking through every aspect of change—doctrine, training, leadership, organization, materiel, soldiers, budget, etc. Successful transition leadership demands true systems thinking.

A transitional leader can get more out of the unit by stretching the organization vertically and horizontally. Vertical stretching means pushing responsibilities down to the lowest feasible echelon. Horizontal stretching means having like units (e.g., a company’s four platoons) doing different things simultaneously. Empowering and motivating subordinates is a key in both.

Command Climate—Motivating Leaders and Soldiers

Leading change from within encourages initiative and builds momentum quickly. This involves leaders sharing their vision of where the unit is going. It involves mentoring key people, putting them in the right places, and empowering them. It involves motivating soldiers and leaders by showing them how digitization is helping them do their jobs and how it improves combat effectiveness.

You have to communicate what the end state is and what you want [it] to look like.

COL Bob Cone, 15 May 00

Empowerment takes on a special meaning in the transitional environment. Soldiers and leaders at all echelons become agents of change, helping to discover new ways of doing things. Empowerment challenges the digital warfighter to embrace change, think differently, and create solutions—all in an environment with much greater uncertainty than is normally encountered.

Involving soldiers and leaders at all levels is a great transition catalyst. Letting people know that their input is valued and their feedback is being used leverages the talents residing within the division. With empowerment comes a personal sense of ownership and responsibility.

An ADC-M provided a good example of streamlining the division's TOC, where gathering inputs from all staff officers and soldiers led, through several iterations, to a dramatically smaller command post. Everyone played a part.

Soldiers judge things against their expectations, and good leaders manage their soldiers' expectations. Letting soldiers know that early versions of new systems are forerunners of bigger and better things reduces frustration. Staying focused on the ultimate destination and where the unit is on the roadmap keeps things in perspective.

Discipline plays a big part in successful digitization. Turning a digital system on must occur before it can be used. But discipline is by no means enough. Soldiers must want to use their digital systems because they believe it makes a difference. A conviction that digital systems enhance the warfighting process is a powerful motivator.

Forcing functions are important for focusing the transition. Any major event—National Training Center (NTC) rotation, test, or experiment—can and should serve as a forcing function. Such events give the entire unit anchor points for concentrating the organization's energies. They motivate soldiers and leaders to make the critical pieces come together. They discipline external organizations to deliver their inputs on time.

The whole organization must have some main effort upon which [to] focus.

MG Scott Wallace, 22 Jun 99

In motivating his leaders and soldiers to embrace digitization, one brigade commander found himself concentrating his energies on his combat and combat support elements. Because of time and energy constraints, the combat service support (CSS) elements received less attention. This may become a common pattern in tactical units. Getting CSS company commanders excited about digitization remains a challenge.

The distinction between testing and implementing can be significant for soldiers' expectations. Testing implies the Army has yet to make a commitment. On the other hand, telling soldiers that the Army has invested a lot of money in new systems and the soldiers' job is to make them work can be very motivating.

I can't afford to have \$7 million tanks fail because people refuse to use the commander's independent viewer.

COL Bob Cone, 2 Mar 01

Command Climate—Setting and Protecting Unit Priorities

Because transition involves multiple agencies, the division must consider the needs of system developers, experimentation proponents, and others. A key to protecting the unit's interests is establishing axes, both main and supporting, and using them to shape the playing field. The relative priorities of the axes may change, but the synchronization process remains the same. Synchronization and flexibility become more important with multiple axes. Balancing unit priorities with those of others may necessitate compromises, but the main axis provides the fulcrum.

The 4ID shepherded four major axes—readiness, modernization, reorganization, and experimentation—during the unit’s transition. The leaders steadfastly maintained readiness as the main axis, sometimes contending with pressures to downplay training and deployment in the face of high-priority fielding, turn-in, testing, and other requirements. To maintain the unit’s warfighting skills, they forged creative approaches to integrate training and readiness into every transition event. Readiness-driven training contributed to the success of transition.

Setting “trained and ready” as the enduring priority for the unit can positively impact the modernization process. It counters the “make or break” atmosphere that can surround tests and experiments, replacing it with a practical learning environment. It helps motivate soldiers to make new systems and concepts work toward combat effectiveness, regardless of immediate expectations or biases. It emphasizes the constructive aspects of after action reviews (AARs) and lessons learned, enhancing the feedback process. Knowing there is no right or wrong answer fosters objective, high-value results.

A unit frequently responds to the stress of high workload by skipping organizational management functions. Soldiers and leaders may be working so hard at getting the basic work done that accountability and assessment activities go untended. For example, after the reorganization downsized the brigade’s CSS structure, nobody was checking the maintenance work or the record keeping. Neglecting such functions can turn into a major problem.

Command Climate—Working with Others

The transition process vastly expands the cast of players with whom the division is expected to do business. Senior Army leaders, project and product managers, U.S. Army Training and Doctrine Command (TRADOC) system managers, doctrinal proponents, force developers, training proponents, test and evaluation agencies, consultants, and contractors of every hue will frequent the division’s stage. Traditional lines of authority often vanish. Knowing the players, their roles, their authority, and who is in charge demands a questioning mind and a king-size Rolodex®.

A strong outside teamwork focus is needed at all echelons of the transitional division, in contrast with conventional divisions. Critical teaming may link to experimentation proponents, system developers, or maintenance contractors. When it does, lack of control and diffusion of responsibility become routine factors to deal with. One simple truth reigns—the commander is responsible for his people and his unit. He is responsible for knowing whether his soldiers have the knowledge and proficiency they need. That becomes especially important when external personnel conduct operator training.

The individuals you are trying to hold to their timelines do not work for you, are not assigned to you, and have different constraints and restrictions.

COL Ted Kostich, 13 Mar 01

The division’s priorities are likely to conflict with those of external organizations. Project Managers (PMs), TRADOC System Managers (TSMs), testers, and others typically believe their programs are highest priority. Leaders in the division, starting with the CG, must be very firm in protecting the unit’s training and readiness priorities. External players should be

expected to align their plans with the division's priorities. It is imperative that outside organizations provide the resources and products needed by the division to accomplish externally generated missions.

Frequently, finding one person in charge of a system of systems has proven impossible. In the case of the new TOC, one team did the upgrades, another group provided the infrastructure, and a third team did the integration. Such circumstances can make resolving problems and issues especially difficult.

Test and experimentation events impose rigor and evaluation requirements not found in normal training events. The unit's training objectives may conflict with the test objectives. The need to control train-up and test conditions and implement elaborate data collection procedures may be foreign to soldiers and leaders. The potential impact of departing from the test plan is typically not apparent within the unit. This can lead to friction and misunderstanding.

Support organizations such as the Digital Force Coordination Cell (DFCC) and the Central Technical Support Facility (CTSF) need guidance from division leaders on what they can do to help the units. It may be feasible to involve support personnel in division meetings and reviews to promote exchange of information. Routine collaboration can facilitate transition.

Leveraging contractor capabilities hinges on holding system technicians and engineers accountable. Commanders must let contractors know what is expected of them and set the rules for working together. Maintaining an audit trail (e.g., sign-in log, linking up with the operator reporting the problem) can be very helpful. When one brigade instituted such procedures, the frequency of "operator-training problems" dropped dramatically, while the frequency of diagnosed software problems climbed accordingly. Ultimately, operators worked hand-in-hand with contractors to make the most of the new systems.

Exploiting Digital Technologies

The mystery of digitization can be intimidating to leaders coming from a non-digital background. The initial learning curve can be very steep. However, sound tactical skills and leadership talents are a digital leader's greatest assets. A digital leader is first a warfighter, who has inherited special tools to enhance combat capabilities. The primary challenge is not to master digitization, but to harness it creatively for the business of warfighting.

To realize the end state vision, leaders must push for the system functionality they need.

You get exactly what you are willing to tolerate in this business.

COL Bob Cone, 2 Mar 01

Accepting "Can't be done" may shortchange the unit and the Army. In talking with the right people, too-hard-to-do judgments have often turned into relatively easy fixes. Persistence frequently pays off.

The 4ID's framework for driving the technology envelope was a series of steps. Their process for identifying desired system enhancements proceeded incrementally, suggesting an evolution based on discovery learning. As a new capability was tried, it led to follow-up ideas

that weren't apparent before. It thus appeared that the front-end design stage was primarily useful to define a start point for complex C4I systems. An iterative develop-test-revise cycle yielded a living, growing design.

Thinking positively leads to thinking differently. Committing to successful change causes leaders and soldiers to find ways to make new doctrine and systems work. Unexpected, novel uses for new systems may materialize. A good example occurred when the division was executing a deep attack as part of a field exercise. The warfighters linked the division's Sentinel radars (air surveillance systems designed primarily for warning purposes) to monitor and control aircraft across a range exceeding 100 km. This departed from established doctrine for employing the Sentinel, but the novel solution worked quite well.

In the absence of recognized tasks, conditions, and standards for digital operations, transition leaders must intensively mentor and coach subordinates and soldiers. The discovery environment provides ideal conditions to involve subordinates in deciding what the new tasks, conditions, and standards should be. This helps establish ownership of the transition unit-wide.

We were at the forefront and no one really knew what "right" looked like.

BG(P) Richard Cody, 21 Jun 99

Leaders must redefine success in the transition environment. The old rule of "mission accomplishment means success" can work against new equipment when it fails at first to meet soldiers' expectations. Advising soldiers to expect new systems not to work can help protect them from disappointment and frustration. Successful transition depends on opportunities for new technologies to grow and improve.

Forceful steps may be needed to jump-start digitization. For example, a brigade commander in the 4ID banned the use of paper maps in command posts to force leaders and soldiers to use the new digital systems. The commander later credited that step for much of his unit's digitization success.

The state of digital technology has passed a critical threshold for selling itself. Early TV monitors with unfamiliar displays have evolved into large-screen devices (see Figure 2) that warfighters can recognize immediately as maps with value-added functions. And systems are becoming more and more reliable. This facilitates acceptance of the new technology.

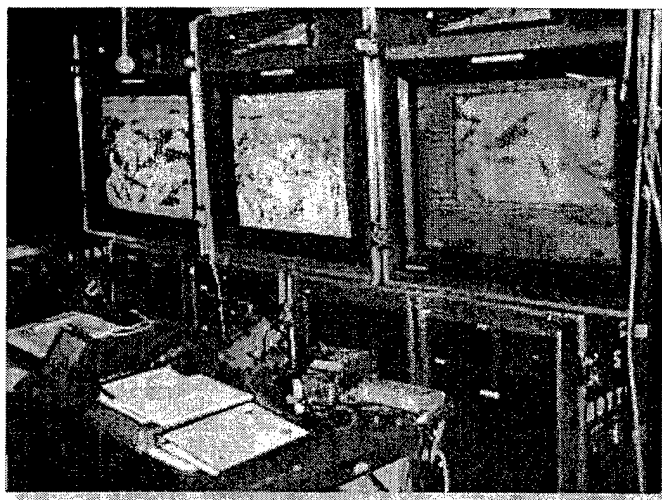


Figure 2. Large-screen displays in a digital TOC.

The various systems in the ABCS family have different stages of maturity. The All Source Analysis System (ASAS) and Advanced Field Artillery Tactical Data System (AFATDS) are quite mature, while the Combat Service Support Control System (CSSCS) is relatively

young. In the world of digitization, system youth can mean greater difficulties in using and managing the system. That poses a challenge for getting users to accept the system.

To discipline the impact of system evolution, forceful control of software changes is imperative. A senior division leader must personally take charge of all decisions to implement new software versions. The centralized decision authority considers the impact on the unit, especially the requirement for individual and collective training. The unit cannot expect developers to understand how their software changes impact unit training, scheduling, and competing requirements.

Infrastructure for Change—Army Culture

The pace of change in Force XXI is so rapid that information typically has a surprisingly short half-life. Equipment, doctrine, and organizational structure are all on an evolutionary fast track. Because of the nature of information age technology, the rapid change can be expected to continue into the foreseeable future.

Right now the Army is about "change." There isn't anything that is staying static, not even Table VIII.

BG(P) Richard Cody, 21 Jun 99

As a rule, groups that have little history with complex systems are slower to accept digitization and they experience more frustration. The M2A3 with its complex turret poses a big culture change for the infantry community. Infantrymen now have to get used to complex equipment—temperamental components, complicated troubleshooting, intermittent electrical problems, etc.—that tankers accepted years ago with the M1. The process of adjustment takes time, but the tankers can accelerate things for their infantry colleagues by sharing their understanding of advanced systems.

Digital techniques and procedures are changing the tactical unit's culture. A good example comes from one brigade's TOC innovations. The use of a networked headphone environment has enabled digital collaboration, to include electronic conferencing (digital staff huddles). The reduction in face-to-face interaction increases efficiency but changes dramatically the social environment for the deployed staff. The TOC is no longer a place where warfighters gather and chat over a cup of coffee.

The symbolic aspect of transition is important for highlighting key milestones. Ceremonies can help change the way soldiers think about themselves and their unit. They can build pride and excitement in soldiers, which in turn creates positive energy. The excitement becomes magnetic because it attracts people to join the unit. Celebrating a significant milestone can also pave the way for soldiers to embrace the next step on the transition path.

Even after we field [the 4ID], I think we're going to have to learn for the next ten years on where we need to go.

BG(P) Richard Cody, 21 Jun 99

As the Army proceeds to field new systems and doctrine, the establishment of digital performance standards may degrade the discovery environment. Performance standards tend to dampen risk-taking and discovery learning—

behaviors that are vital to successful transition. When warfighters are being graded against standards, they want to deliver the right answer. Preserving the discovery environment will become a significant challenge as the transition matures.

Infrastructure for Change—Enablers

In one brigade commander's view, leading units in transition requires "transformational" leaders, as opposed to "custodial" leaders. Transformational leaders reinvent units to become something completely different. They take the initiative, look to the end state and ask how the unit can get there. On the other hand, custodial leaders tend to concentrate on the way the unit already does business. Custodial leaders may be able to adapt to Force XXI change, but those who cannot may have to be reassigned.

Managing and implementing transition demands full-time dedicated personnel, not just "additional duties." A force integration cell within the division is indispensable for synchronization and coordination. Corps-level assets such as the DFCC and CTSF have proven their worth many times over.

Ideally, as units transition to new organizations, staffing, doctrine and equipment, they would be able to change one factor (e.g., personnel or equipment) at a time. This would enable isolation of problems and determination of a specific cause. The advantages of this approach are significant. However, more often units encounter multiple changes at one time. The result can be confusion, misinterpretation, and frustration.

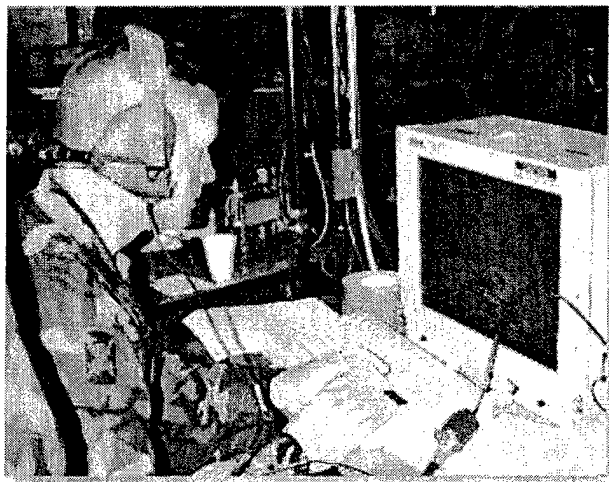


Figure 3. Headset use in a digital TOC.

Institutional trainers may lag behind the cutting edge units in their digital skills and knowledge. For instance, when one brigade staff transitioned to digital collaboration, observer/controllers (O/Cs) at the NTC noted with concern the lack of face-to-face interaction. It was difficult for the O/Cs to see the collaboration that was taking place via linked headsets (see Figure 3).

In the rapidly changing high-tech Force XXI environment, innovative options for training and professional development have become necessary. Establishing digital expertise and equipment in the Army's training institutions will take substantial time. For now, the primary responsibility for digital

training falls on the unit and the installation. In the Army's Fort Hood digitization arena, III Corps leaders are working to establish a digital training facility and build educational alliances with universities and colleges.

Personnel

Digital leaders and soldiers must be warfighters first. They need to master warfighting basics before they can harness digital tools. And they need to cultivate their leadership skills through progressive assignments that happen to give them practice with digital tools.

We need to be careful that we don't make our ABCS operators technicians instead of warfighters.

COL Ted Kostich, 13 Mar 01

Sustaining momentum during high personnel turnover rests heavily on mentoring staff officers (especially Captains) early in their tenure with the unit. After they have bought into the vision, they are placed in command positions as vacancies occur. The staff officers carry their vision and excitement into their new jobs as commanders.

While senior non-commissioned officers (NCOs) should play an important role in leading Force XXI transition, they may defer digital matters to junior NCOs who are more comfortable with the technology. The NCOs at all levels need digital leadership skills. This will become the norm as digitally smart soldiers work their way up through the ranks.

Young officers and soldiers are crucial to the success of digitization. Their comfort level with the digital technology enables them to solve technical problems and discover new ways of doing things. Smart leaders encourage and leverage their inventiveness. At the same time, young warfighters with limited experience may be most threatened by change. They have seen only one way of doing things, so they have not encountered major changes. This may seem paradoxical but probably relates to the individual's expectations based on his/her personal experience in the Army. A soldier's values, expectations, personal biases, and limitations influence his/her attitudes toward change.

Personnel issues loom large in the early stages of transition, when soldiers with specialized skills are scarce. Working those issues becomes a critical activity for the CG and his staff. By-name assignments, personnel stabilization, shifting experienced leaders to critical vacancies, battle rostering digital operators, and "grow our own Sergeant" programs have proved to be valuable means for ensuring that personnel assets fully support division readiness. As more of the Army becomes digitized, the need for stabilization and other special personnel provisions can be expected to fade.

Because of the critical nature of transition events such as the DCX, the 4ID used personnel stabilization much more extensively than normal. To be effective, stabilizing personnel means a one-year commitment. That's necessary to make sure individual and collective training can occur before the target event, and to ensure an orderly transition afterward.

The Army's personnel management system has an especially serious impact on a transitional division. This is because the mechanisms that normally compensate for personnel turnover (e.g., standard equipment, stable standing operating procedures [SOPs]) are compromised when systems and TTPs keep changing. In addition, the expense of training up

digital soldiers is great. As a result, new personnel generate a much greater training burden in the digital division.

Because NCOs typically focus on performance standards, proactive steps may be needed to facilitate their participation in digitization. Leaders can describe desired end states in terms of performance expectations for their soldiers. Digital operating guides can describe the basic parameters of C4I usage. Such measures establish a start point for the digitization journey.

In a streamlined division that is 2,500 soldiers smaller, 100 percent fill is indispensable. That's a tall order for the Army's personnel community, but the division cannot go to war with personnel vacancies. This axiom will not change as progress toward the future force continues.

Training—Fundamentals

Training is a powerful instrument for leveraging new technologies. Training events can stress soldiers and leaders in a way that forces them to get the most out of their new systems.

We created a training event that forces them to use the system if they are going to pass.

COL Bob Cone, 2 Mar 01

For instance, when the M2A3s replaced the M2A2s, techniques were developed to get soldiers to use the system's design capabilities. During lane training a company commander might give his M2A3 platoon a wider engagement area (compared to the M2A2) requiring the crews to use all of the M2A3's target acquisition capabilities. The AAR process then

reinforced desired behaviors. When challenged by such training, crews will not only measure up to the systems' potential, they will also invent new ways of getting the job done.

Digital training for a newly assigned leader or soldier begins with ABCS familiarization, which should commence immediately upon arriving in the unit. Immersion in the everyday world of ABCS launches the journey to digital proficiency.

Training in a transitional unit must address basic tactical (analog) tasks, tasks involving advanced platforms like the M1A2 SEP and M2A3, and digital tasks. While some have described the process as sequential, in reality the three domains overlap and sometimes play out in incomplete sequences. Iteration of sequences is driven by ABCS evolution and major events such as the Force XXI Battle Command Brigade and Below (FBCB2) Limited Users Test (LUT). No single training model is likely to be applicable.

Senior leaders in the 4ID recognized four key factors that determine the rate of a unit's learning: the frequency of repetitions, the amount of enabling learning between repetitions, stability of personnel, and consistency of focus. Changing any or all of those variables was said to make the learning curve steeper or shallower. While this may not be unique to a digital unit, the "model" becomes especially important in the multi-axis environment of transition.

In the early stages of transition, the train-assess-train cycle must be repeated multiple times to identify what needs to be learned—especially with new equipment and organizational

structures. Thus discovering what soldiers, leaders, staffs and units need to learn enters the training picture for transitional units.

Major transition events must be used to advance training. Tests and experiments are no exception. Transition leaders can work training and readiness into every event. Major events drive a preparation schedule, including all-important training. They motivate soldiers and leaders to sharpen their skills and achieve collective proficiency.

Personnel stability is a major factor in achieving high quality training. Personnel turnover causes the unit to retrain the same tasks with new people. The established personnel management system led the 4ID to orchestrate atypical personnel stability for major events. This enabled the units to get the most out of their training efforts and build team confidence.

Training—Special Groups

Where we have [taken] ownership of programs conducted at CTSF we've had the best learning outcomes.

COL Bob Cone, 2 Mar 01

right skills and knowledge. In part, this means integrating external operator training and unit collective training.

During the early stages of digitization, special efforts to train NCOs on digitization and digital leadership are needed because many senior NCOs are not comfortable with the technology. An NCO who does not understand about atrophy of digital skills, e.g., can hinder the unit's transition efforts. This issue will disappear as digital expertise spreads through the NCO ranks.

One brigade commander commented that the one-size-fits-all concept underlying individual operator training for ABCS systems is flawed. Operator training on FBCB2 (see Figure 4), for example, is the same regardless of an individual's role in the unit. This approach ignores the fact that echelon and duty position heavily shape the way an operator or leader uses the system. For example, platoon leaders do different things than company commanders and this gets reflected in their respective use of FBCB2. System training should take such usage differences into account.

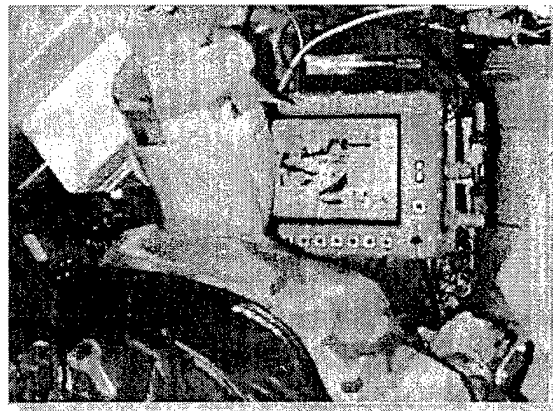


Figure 4. FBCB2 in a combat vehicle.

Training of ABCS operators must occur in a system-of-systems context. An ASAS operator, for example, must learn how his system interacts with the Maneuver Control System

(MCS) and other systems, what can and cannot be transferred freely. Thus each operator will become part of a horizontal team that collaborates through system interchange.

Differing levels of user-friendliness among the various ABCS platforms impact the operator training requirements in the division. The least user-friendly system (CSSCS) requires much more training than needed for other systems. Thus the time required to reach a standard level of operator proficiency varies across systems.

Training—Digital Training Methods

In keeping pace with digitization, training programs become very fluid. Individual and collective training requirements change as the equipment and software evolve. New training methods and techniques are needed to support emergent training requirements. Digital tasks and skills call for special performance measurement and feedback tools.

Individual system operator skills need to be expanded into operational, teamwork-centered skills. One technique for doing that is integration exercises where operators practice in a unit collective setting what they learned earlier in the day. The reinforcement of basic skills and the common understanding that result are invaluable. The timely reinforcement is especially important for the procedural knowledge required to operate ABCS components.

Digital tools can change the way soldiers and leaders interact, and this should be reflected in digital training programs. Collaborating through networked computers is different from interacting face-to-face. Conferencing on a multi-station headphone network is not the same, either. Digital training programs need to address the basic techniques that digital teams can use for collaborating electronically.

Balancing digital training with field craft and tactical training is a challenge unique to the digital division. Because information management skills atrophy more quickly than other skills, units are likely to devote more time to digital training. Maintaining both types of skills is essential. Fortunately collective events can train both types of skills. Further, the growing digital infrastructure is embedding the practice of digital skills in routine daily activities.

You cannot forget those staff and warfighter fundamentals. We practiced small unit training repetitively.

COL Randy Anderson, 6 Mar 01

A “training audience plus one” approach has been used to smooth the progression of collective training from one echelon to the next. The technique entails introducing a level of digitization one echelon higher than required to achieve the event’s training objectives. For example, the brigade TOC would participate in company lanes training to establish digital connectivity and functionality. The objective is to introduce technology early enough that the unit can resolve uncertainties before the technology becomes essential to the training process. In the long run, this approach reduces risk and increases the value of the training at each echelon.

One commanding general felt that traditional means of pre-command training are inadequate for digital leaders. Digital pre-command modules need to give new leaders actual

experience with digital equipment and doctrine. Digital operations are so divergent from analog operations that immersion in the digital environment is a prerequisite for true learning. The Army is currently developing digital pre-command programs for newly assigned leaders.

Digitization creates a special need for low-overhead simulations to enable easy-access, low-cost training. Existing constructive simulations are too large and too expensive to support multiple repetitions of digital training. Low-overhead simulations must enable units to link their TOCs and vehicles for a challenging training environment. A battlestaff trainer must enable the integration of battlestaffs in various combinations of live and simulation environments.

Budget

Digitization has spawned a spiraling concern about funding. Every new requirement sports a price tag, and deciding who will pay becomes a constant challenge. The high driver is logistics support of expensive new systems, especially repairing them.

Today's budget process invokes a new paradigm. New rules are in, and old assumptions are out. Budgeting for equipment turn-in, estimating credits for depot repairables, controlling the requisition of parts, paying for repair of non-standard items, mastering the single stock fund, and a host of other challenges greatly complicate the budget process.

The unit in transition must quickly master the new budgeting rules or become their victim. Every transition-driven change can impact budgeting. For example, the CSS redesign transferred many repair functions, reducing the division's options for low-cost repair. The new logistics rules invalidated the old cost models, and there were no historical figures for establishing new cost factors. This left the division struggling to come to grips with the new rules—with an adverse impact on the budget. Transition leaders are likely to be challenged to find creative ways to assess budget impacts of significant changes.

Mastering the budget is too crucial for senior leaders to learn the process on the job. With the complexity in the transition environment and the new logistics management procedures, budget mistakes can be very unforgiving.

Transition leaders spend an inordinate amount of time and energy on the budget. Some of this results from the large number of funding sources and some from new logistics management procedures. Leaders appear to accept this as part of reality.

Today's budget and accounting procedures require someone to manage them daily.

COL Ted Kostich, 12 Apr 00

The Army's cost factors are not keeping pace with modernization. A prime example comes from the training resources model, which specifies costing factors for each vehicle. The cost factors for the newly fielded M1A2 SEP and M2A3, based on historical figures for predecessor vehicles, have proven to be significantly conservative. This forced the 4ID to document actual costs and obtain relief from III Corps.

Transition is likely to bring unfunded requirements (UFRs). Consider the 4ID's UFR package submitted to cover the costs of equipment turn-in. Once the division's painstaking preparation of the package was complete, the submission and approval process had to be tracked closely. Future leaders must be prepared to defend their UFRs vigorously.

Training associated with force modernization and experimentation is frequently underfunded or unfunded. The transitional unit must turn to PMs, TSMs, testers, and others to fund transition-driven training. Failure to do so can produce serious shortages in the training budget.

If what you need is a \$20 training program, you can't make do with a \$1.98 training program.

MG Scott Wallace, 22 Jun 99

External funding sources typically require formal budget requests at least a year in advance. It takes hard work to project the unit's costs for digital events, submit the budget package, and then track the funding process.

Funds provided by modernization, reorganization, and experimentation agencies come with special accountability rules. Also, they usually come with strings attached. Different funding lines are not interchangeable.

Unit Organization—Reorganization Process

Reorganization is a high-risk enterprise for the initial units because they have to determine how well the new structure works. Unit leaders are forced to accept uncertainties and realize that perfection cannot be achieved on the first try. Evaluation is intertwined with implementation to produce sound feedback, which in turn leads to updating the new Modified Tables of Organization and Equipment (MTO&E). For the first unit(s) reorganized, it means additional challenges.

Planning and implementing reorganization takes much more energy than most leaders anticipate. That's partly because it is so hard to visualize the unit's end state in a hypothetical framework. Creating new organizations around capabilities that don't yet exist is also very difficult. Even with hard work and painful attention to detail, oversights and glitches will occur.

I don't think anybody understood when we said we are going to a new MTO&E, all the work that would be required.

COL Bob Cone, 15 May 00

The 4ID attempted to accomplish reorganization before tackling experimentation and modernization. The logic called for establishing a new structural baseline as a foundation for subsequent changes. But the spiral development process made that impractical. Reorganization ended up overlapping the other axes so that a complex interaction resulted. Future units undergoing transition can almost certainly expect the same circumstances.

Reorganization is likely to create a period when new responsibilities are not yet fully resolved. A reorganized unit needs to invest energy in establishing new SOPs, especially in the maintenance arena. Then someone needs to check to see how the new procedures are working.

Unit Organization—Impact of Reorganization

People-oriented leaders find ways to implement reorganization without creating a negative impact on individual warfighters. For instance, the transition of companies can be sequenced so each commander has enough command time when his unit is inactivated. Soldiers can be kept informed of pending actions so the physical move to new units (the duffel bag drag) goes smoothly. The dividends in terms of unit morale are well worth it.

In a 10-division Army, we can't afford to have one division C5 for three, four, five, or six months.

MG Scott Wallace, 22 Jun 99

Reorganization can have an unwanted impact on units' readiness status. The division's transition plan must carefully

sequence and synchronize the process for all subordinate units, to avoid status-reporting problems. "Trial" unit status reports can help determine when a subordinate unit is ready to begin reporting under a new MTO&E.

Unanticipated impacts of reorganization are common. Two examples from the CSS redesign are instructive. First, placing all of the division's mechanics in a central organization ended a long-standing practice of exempting mechanics from Charge of Quarters (CQ) duties, headcount, etc. That led to the maneuver battalions frequently ending up short on mechanics, with no options available. Second, moving the clerks who order repair parts to the central organization meant that outside personnel were spending most of the brigades' money. In turn, that increased the burden on brigade and battalion commanders to coordinate with the clerks and monitor their budget status. Such occurrences illustrate that it is easy beforehand to overlook some of the operational impacts of reorganization.

Fielding New Systems

The experimentation process brings non-standard equipment that evolves into MTO&E property. The support model for such equipment starts off non-standard, and then transitions to the conventional model. For example, repairing non-standard equipment usually means going to a contractor for systems under warranty. When the unit takes full ownership, support becomes a unit responsibility. The transition has to be carefully monitored.

"Out with the old, in with the new" does not work for digital equipment. Old equipment stayed in the 4ID after new equipment was fielded. Owning two sets of equipment complicates budgeting, training, and logistics. And the overlap tends to obscure the eventual requirement to turn in the old equipment.

Transition generates a huge equipment displacement burden. Careful planning and tracking of displacement is imperative to avoid siphoning off training dollars. If the only funds available are training funds, they can get diverted to pay for turn-in costs.

Documenting Critical Knowledge

Sharing information is an absolute must in the transition environment. When discovery learning is the rule of the day, the only way for others to know what someone else has learned is by prompt exchange of information. Soldiers should be encouraged and reinforced for reporting problems as well as positive insights. Both formal and informal mechanisms can be useful. Ultimately the unit must share its feedback with those who can improve the systems—PMs, TSMs, and contractors.

Force XXI transition has changed the way the Army develops TTPs and doctrine. Units undergoing transition now play the pivotal role in generating how-to-fight guidelines. This means empowering subordinates to determine what works digitally. The unit-generated TTPs become a prime driver for doctrine. This bottom-up process runs counter to the traditional Army model for doctrine development.

Obtaining valid assessment data and lessons learned demands a reasonable level of individual and collective proficiency on C4I and weapon systems. This enabling condition (similar to a “gate”) applies to tests, experiments, and training events. Achieving proficiency requires adequate time to train on the equipment before the event begins. Wise transition leaders insist on a cut-off date for system changes to protect the training time needed. This often means fending off system developers who come with a last-minute fix for some problem.

An audit trail of unit transition—issues, decisions, things tried and not tried, etc.—is indispensable if new leaders are to fully benefit from the experience of their predecessors. It is especially important for the division’s general officers to know what has been tried, who made what decisions, what worked, and what was discarded. Otherwise, the unit may end up reinventing solutions and rediscovering lessons learned in the past.

Transitional units tend to invest their lessons-learned energy in SOPs, with a natural connection to the AAR process. Capturing lessons about managing change and measuring digitization progress often falls in the “too hard to do” box. Thus a transitional unit may inadvertently limit its effectiveness as a learning organization. The unit may benefit by obtaining outside help from Army research agencies, TRADOC proponents, contractors, etc.

Frequent changes in equipment functionality can make system-specific lessons learned obsolete in a short time. Transitional units can avoid short-lived lessons-learned by concentrating on generalities and warfighting functions.

Force XXI Transition’s Impact on Tactics and Doctrine

Impact of Technology

The future has arrived. Digitization’s goal of enhancing the command and control process is becoming a reality. Leaders are enthusiastic about the visualization and planning advantages gained by using the new tools. In the hands of skilled warfighters, the tools are proving their worth on the battlefield.

Digital systems are not a magic panacea. They are tools to help warfighters plan, prepare, and execute military operations. Digitization will not make up for lack of basic warfighting skills.

The digital tools' precision for visualizing enemy elements has boosted our ability to recognize patterns on the battlefield. This enables the brigade to set the conditions desired for destroying the enemy. For example, an enemy's assailable flank or the most favorable point for penetration can be determined with precision and confidence.

There is tremendous precision in what we do now. A major factor [is] our ability to recognize patterns ... the exact circumstances that we wanted.

COL Bob Cone, 2 Mar 01

Enhanced situational understanding is enabling remarkably bold and aggressive maneuver. The precision of the common operating picture gives leaders the confidence to move quickly and decisively. In effect the digital tools and battlefield sensors reduce the risk of maneuvering against the enemy.

Modernization gives the brigade greater capabilities to shape the fight and fight deep. That results mainly from the brigade reconnaissance troop (BRT), engineer reconnaissance assets, artillery, and close air support (CAS). Engineer assets can be used as far forward as the BRT to shape the fight with pinpoint obstacles.

Digitization opens up possibilities for doing things that were not feasible before. A good example occurred when the division faced a challenge tracking aviation assets during a deep attack. They used the division's Sentinel radars to form an ad hoc airspace command and control network reaching 118 km. The non-doctrinal approach worked remarkably well.

The signal battalion has become the Achilles heel of digital operations. Maintaining digital networks and connectivity depends absolutely on signal capabilities. The impact of digital failures during distributed combat operations could be harsh. Experience will tell whether redundant companies are needed in the signal battalion to prevent catastrophic failures.

I don't have enough people to be inside the TOC working ASAS and then running outside the track and changing the analog stuff on the maps and wingboards.

COL Bob Cone, 2 Mar 01

The division is not manned to conduct operations using both digital and analog (map-and-grease-pencil) systems. However, it is likely unfeasible to make the leap to digital operations quickly and cleanly. Mixed operations place a special burden on tactical units.

Digital Operating Procedures

Shared visualization of the battlefield is the key to digitization's impact on command and control. The digital tools enable the commander to share his vision of the fight with his subordinate commanders in a way that was not possible before. He then can monitor patterns during execution and share his updated vision.

Situational dominance results from situational awareness (SA) and situational understanding (SU), layered on a foundation of basic tactical skills. The SA delivered by digitization pictures the basic elements of the battlespace, but it does not project what's going to be or what the unit can do about it. The SU exists in the mind of the warfighter, who weighs various courses of action to reach a decision. Situational dominance requires both SA and SU.

The need for digital staffs to perform at a higher level than before has spawned the concept of the "lethal staff." Developing SU from the mass of digital information arriving in the TOC is very demanding. Realistic standards for the trained and ready battlestaff are needed.

The strong push to streamline the TOCs is creating new ways of doing business. As leaders and soldiers learn how to leverage digital systems, they are transforming the approach to command and staff functions. One brigade commander had shrunk his TOC from 14 SICPS (Standardized Integrated Command Post System) shelters to 8 and was targeting only 4 shelters. This took substantial energy, but the payoff was high.

New TOC capabilities are transforming the way staff members interact. Collaborative headphone systems coupled with touch-control computers have reduced the need for face-to-face interaction. Staff huddles have morphed into electronic conferences. This improves the efficiency and speed of accomplishing staff functions.

Digital capabilities have significantly facilitated the planning process. They enable the commander and his staff to develop and rehearse a plan with several courses of action, something rarely done without digital tools. The shared analysis and wargaming of enemy options becomes much more comprehensive. The understanding that emerges among the subordinate commanders is a huge advantage.

During digital operations, the brigade and battalion leaders have begun to analyze what the enemy is doing in real time, rather than focus strictly on friendly force activities. Precise visualization appears to encourage analytical thinking—determining what the enemy is going to do—in place of simple declarative exchanges. The interaction on the command net reflects higher levels of analysis as events unfold.

Any scout who enters a spot report shares that information across the entire system.

COL Bob Cone, 2 Mar 01

Digital communications enable the integration of all scout assets, to include the maneuver battalions' scout platoons, in a brigade-wide reconnaissance/surveillance network. This expands exchange of enemy information and synergizes scout elements across echelons.

Graphic control measures such as boundaries and phase lines remain essential in the digital environment. Experience at the NTC backs this up. Their greatest value lies in supporting the integration of maneuver and fires to achieve true synergy.

Powerful C4I and weapons capabilities at all echelons can create competition between echelons. For example, the division can see and strike deep targets, much as the corps can.

Leaders at multiple echelons should collaboratively develop SOPs that fully realize the potential of advanced systems without tying the hands of subordinate units.

Digitization is changing how the brigade manages indirect fires. Laser range finders on tanks and Bradleys give each vehicle the capability to initiate accurate FBCB2 calls for fire. The role of the Fire Support Team (FIST) is shifting to a focus on managing calls for fire against the commander's priorities.

Combat Engineer functions are benefiting from the power and precision of digital tools. For example, the terrain analysis and line-of-sight functions in FBCB2 help locate engagement areas. Information for placement of obstacles is then shared with the engineer, resulting in superior engagement areas with almost perfectly placed obstacles. Obstacle locations are then circulated via digital tools. The same principle works for reporting enemy obstacles.

You have scouts forward, limited visibility, heavy fog and you see them coming about 30 mph just zigzagging right through the obstacles.

COL Bob Cone, 2 Mar 01

Battlespace Factors

Successful operations in the expanded battlespace depend critically on new C4I and weapon systems. Advanced sensors and C4I systems—both organic and external—enable the division to disperse forces, while highly precise and lethal weapons enable massing of effects.

It did not bother me to have gaps between brigades, as long as I had electronic sensors to keep looking at those gaps.

MG Scott Wallace, 22 Jun 99

Electronic sensors are the prime enablers for managing the expanded battlespace. Sensors within the division (e.g., the Unmanned Aerial Vehicle [UAV]) and outside (e.g., the Joint Surveillance Target Attack Radar System [JSTARS]) give the commander confidence in the unit's coverage of the battlefield. Gaps between brigades become acceptable when electronic sensors provide a robust

picture of the battlespace.

Operating with dispersed forces in the expanded battlespace increases the importance of intelligence, aviation, and fire support assets. Intelligence assets enable the commander to track the enemy and identify dangerous gaps. Aviation provides the flexibility to deal with tactical and logistical contingencies when ground systems cannot cover large distances quickly enough. Fires can also be shifted quickly from one area to another.

Digital systems can transform the commander's approach to positioning himself on the battlefield. Mobile C4I capabilities enable him to direct the fight from any location. This enhances the commander's ability to see the battlefield without degrading his decision making process.

Logistics

Digital tools have enhanced casualty evacuation procedures on several counts. The unit can send precise locations of casualties. The medic knows where evacuation assets and available treatment facilities are located. The digital systems feed the medical supply network. These capabilities lead to faster evacuation, faster treatment, and better allocation of medical resources. Because the digital systems make their jobs easier, medical personnel use them.

When a unit is the only organization to possess a new system (e.g., M1A2 SEP), it cannot rely on regular supply channels for repair parts nor on organic assets for skilled technicians. The first unit equipped with advanced systems has relied on contractors for maintenance and repair services. The gateway for that service typically resides with a PM. In high-visibility field exercises contractor technicians have been flown directly to the site of the inoperative system.

The high cost of turning in an expensive item for depot-level repair has led the division to emphasize unit-level diagnostics. The 4ID has invested heavily in diagnostic equipment and training of their own mechanics. Courtesy of pinpoint diagnostics, only the defective component(s) are repaired or replaced. This is a case of financial incentives shaping unit behavior.

Having maintenance assets organic to the maneuver battalions is a time-tested principle. In the aftermath of the CSS reorganization, the division returned to attaching Forward Support Companies (FSCs) to the maneuver battalions. The feedback from the units has been singularly positive. An important consideration is budget accountability, which suffers when clerks in the Forward Support Battalion are spending the maneuver unit's money.

Today commanders and leaders have to be much more visionary in terms of [maintenance] requirements.

COL Ted Kostich, 13 Mar 01

The maintenance infrastructure to support digital units requires constant attention. For example, leaders working with the new infrastructure must find out-of-the-box maintenance solutions for NTC training. Key issues include pre-

positioned (depot) versus take-along repair parts, reduced stockage levels, 24-hour availability of parts, and source of funding. The problems are not unique to digital units, but they are more severe.

Digitization has also transformed deployment logistics for digital rotations to the NTC. The NTC cannot provide the digital equipment required by the division. Units have to take their own. This impacts railhead, funding, and logistics requirements.

Degraded Operations

Early concerns about reliability of the C4I systems are fading. One brigade commander described the ABCS capabilities in the TOC as "self-healing." When a system such as MCS goes down, another system such as AFATDS is used to follow the battle while the primary system is recovered. The redundancy across systems has enabled the brigade and its battalions to

sustain digital operations in the field for weeks on end. The current state of the technology requires humans to decide which backup system to use.

In vehicles where alternative digital systems are not available, the paper map provides backup. The unit SOP may call for each vehicle crew to update a paper map every 30 minutes. If the FBCB2 goes down, the unit fights off the map until the FBCB2 is restored.

Exceeding the capacity limitations of a digital platform can crash the system. Thus technology constraints can clash with operational needs. To the enthusiastic operator, the limitations may seem intangible until it's too late. The risk of a crash places a premium on simpler graphics, proactive filtering, housekeeping (e.g., removing old graphics), etc. The units end up addressing these issues in their SOPs. The long-term solution entails greater bandwidth.

Some guy at DTAC hits "reorganize" and all of a sudden in the middle of a fight we begin to drop out of FBCB2.

COL Bob Cone, 2 Mar 01

Unit Tasking Reorganization functions have yet to reach a desirable level of maturity. If the process is not coordinated carefully, subordinate units can be caught by surprise. The operational impact of losing digital connectivity can be severe, especially in the middle of a fight. The current

functional limitations can cause commanders to avoid changing their task organization.

The following section looks to the future by examining how the MASC-XXI methods and products could be leveraged to support the emerging force of the future.

To the Future

The MASC-XXI road to the Leader's Tool has paved the way for future efforts to capture and share knowledge about managing transition. The project's methodology for documenting the process of "getting from point A to point C" holds promise for aiding the Army's high-visibility efforts that are bringing about widespread change. This section discusses key aspects of leveraging the lessons learned and facilitating the Army's transition process. Discussion topics include issues and concepts for building on the MASC-XXI methodology, expected value of sharing knowledge, and recommendations for follow-on efforts.

Issues

The methodology and results of the MASC-XXI project form a start-point rather than an end-point. The project revealed only a small amount of the transition knowledge that is emerging, with a vast quantity remaining to be documented. The Leader's Tool technology represents only a preliminary demonstration of what is achievable in terms of tools for sharing knowledge. Operational feedback on utility and self-growth of the tool is pending.

The change management knowledge base to date encompasses only three positions at the division level (CG, ADC-M, and CofS) and one position at the brigade level (commander). The capture of tacit knowledge should no doubt include at least division through platoon echelons, with reasonable representation of positions at each echelon.

The validity of generalizing tacit knowledge from one position/echelon to others is unknown. Likewise, the applicability of knowledge to other units is uncharted. Understanding these issues could become a key to defining how broadly change-driven knowledge can be shared credibly.

The MASC-XXI project has examined the change management process in only one Army transition arena—the Force XXI axis at Fort Hood, Texas. The newer arena of the IBCT at Fort Lewis, Washington remains virgin territory. The Army's transition arenas will continue to expand with time. The number of units across the force that could benefit from capturing and sharing hard-won lessons learned will continue to grow.

In its preliminary form, the Leader's Tool technology exhibits deliberate limitations resulting from the "implement small" strategy. The tool's interactive features—especially searching, entering or editing data, and obtaining help—are relatively simplistic, leaving significant room for upgrading to dynamic wizards or intelligent agents. The search functions include no capability for intelligent, user-created queries. The contents focus on written (verbal) information, with substantial room for adding graphic, video, and audio materials. And the one-style-fits-all interface accommodates different user preferences and needs to a relatively small degree.

As an automated professional development forum, the initial Leader's Tool technology is relatively passive—providing simple prompts and responding with stored insights and rules. Digital leaders, especially those new to the job, could benefit from more active, collaborative assistance in solving problems and making decisions. Exploration of a more active role for change management tools (e.g., interactive problem solving aided by an intelligent agent) may be in order. Collaboration could be extended to direct interaction among the tool's users, by means of message boards, user groups, etc.

The initial Leader's Tool approach uses an operational model where the medium for documenting and sharing insights and lessons learned (independent database) is separate from the medium generating many of those insights and lessons learned (C4I systems). Perhaps it would be desirable to explore linking or merging the two media.

Security of contents is an issue whenever individual knowledge and opinions are placed in a sharable forum. Sensitivity concerns take on added importance when individual users make decisions about the acceptability, suitability, and/or validity of contents being added. As more units participate in transition, the risks of sharing information will grow.

The potential lack of post-implementation evaluation would leave a void in terms of feedback on utility, benefits, and sustainability of the Leader's Tool. It would also neglect an important source of ideas and suggestions for improving the technology and its utilization.

During the course of developing and testing the preliminary Leader's Tool, the study team identified numerous targets for enhancing and expanding the technology for sharing change-driven knowledge. The candidate enhancements are listed in Appendix G.

Value of Sharing Knowledge

The MASC-XXI methodology offers benefits to any unit transitioning to new doctrine, organization, and equipment (e.g., 1CD, IBCT, follow-on units). The practical experience and insights of leaders who've gone before can accelerate the learning curve for those faced with managing change. Defining and solving problems in the unique digital environment can benefit from the collective wisdom of previous digital leaders. The MASC-XXI methodology can be applied in various arenas, and unit-specific products can be developed as needed.

Experience-based insights and guidelines can rapidly enhance the change management skills of transition leaders, especially those new to the job. The typical Army leader is a de facto change manager with no specific preparation for managing change. The availability of an automated coach such as the Leader's Tool should promote proactive transitional leadership. It should help leaders identify potential change-related problems and deal with them effectively.

As a result of proactive leadership based on proven techniques, subordinates and soldiers in transitional units can be expected to experience less frustration in a spiral development environment. Knowing what to expect and how to anticipate problems can create learning opportunities instead of disappointment and hostility. In turn, this can foster creative forces for turning transition goals into reality.

The Leader's Tool technology can provide a lever for the learning organization. By facilitating the capture and dissemination of hard-won lessons learned, the tool can become a central agent for passing key knowledge from one generation of warfighters to the next. The resulting efficiencies in terms of harnessing previous solutions and avoiding earlier mistakes can pay high-yield dividends in units over-committed to high-priority requirements. In an important sense, the Leader's Tool technology can offer new leaders a personal head-start program.

Verification of the value of the Leader's Tool technology in the hands of the users is pending, but the leaders who participated in the user trial were enthusiastic about the tool, especially its search capabilities. One participant commented, "New leaders should spend 30 minutes a day just reading nuggets."

Recommendations

To realize the potential value of the MASC-XXI approaches and methodology, follow-on efforts are needed. Two types of recommendations are offered—systematic research to extend the methodology and implementation steps to leverage the Leader's Tool technology.

Knowledge-Centric Research

1. Investigate the extent to which change-driven knowledge gathered from one position in a particular unit can apply to other positions and other units.
2. Fully map the knowledge requirements of change managers in various positions, echelons, and units.

3. Compare alternative techniques for eliciting knowledge, and develop a refined methodology suitable for diverse transition settings.
4. Apply the knowledge elicitation methodology to establish comprehensive, multi-echelon knowledge bases for the 4ID, IBCT, 1CD and other transition arenas.
5. Validate the knowledge analysis methodology, to include its suitability for organizing change-related knowledge across echelons and units
6. Compare the knowledge analysis products from various transition arenas to assess similarities/differences and their practical impact.
7. Analyze the implications and risks of disseminating individual knowledge and opinions.
8. Develop and validate a comprehensive model of knowledge acquisition, capture, organization and sharing for the Army transition environment.

Implementation of Leader's Tool Technology

1. Institutionalize the MASC-XXI Leader's Tool as a routinely used tool in the 4ID, under the auspices of a designated proponent.
2. Conduct post-implementation evaluation of the value and sustainability of the MASC-XXI Leader's Tool.
3. Evaluate the issues for potential use of the Leader's Tool by other units.
4. Expand and enhance the functional capabilities of the Leader's Tool to optimize its characteristics as a user-friendly, high-value asset.
5. Develop policy for disseminating individual knowledge and opinions, with risk management guidelines.

By building on the MASC-XXI methodology and technology, the Army can fully leverage the hard-won knowledge of transition leaders. The benefits can facilitate the critical transition to a future force capable of meeting the challenges of the 21st Century.

Summary of Lessons Learned

The collective insights and lessons learned in the MASC-XXI project boil down to a manageable handful. Figure 5 captures the essence of these lessons.

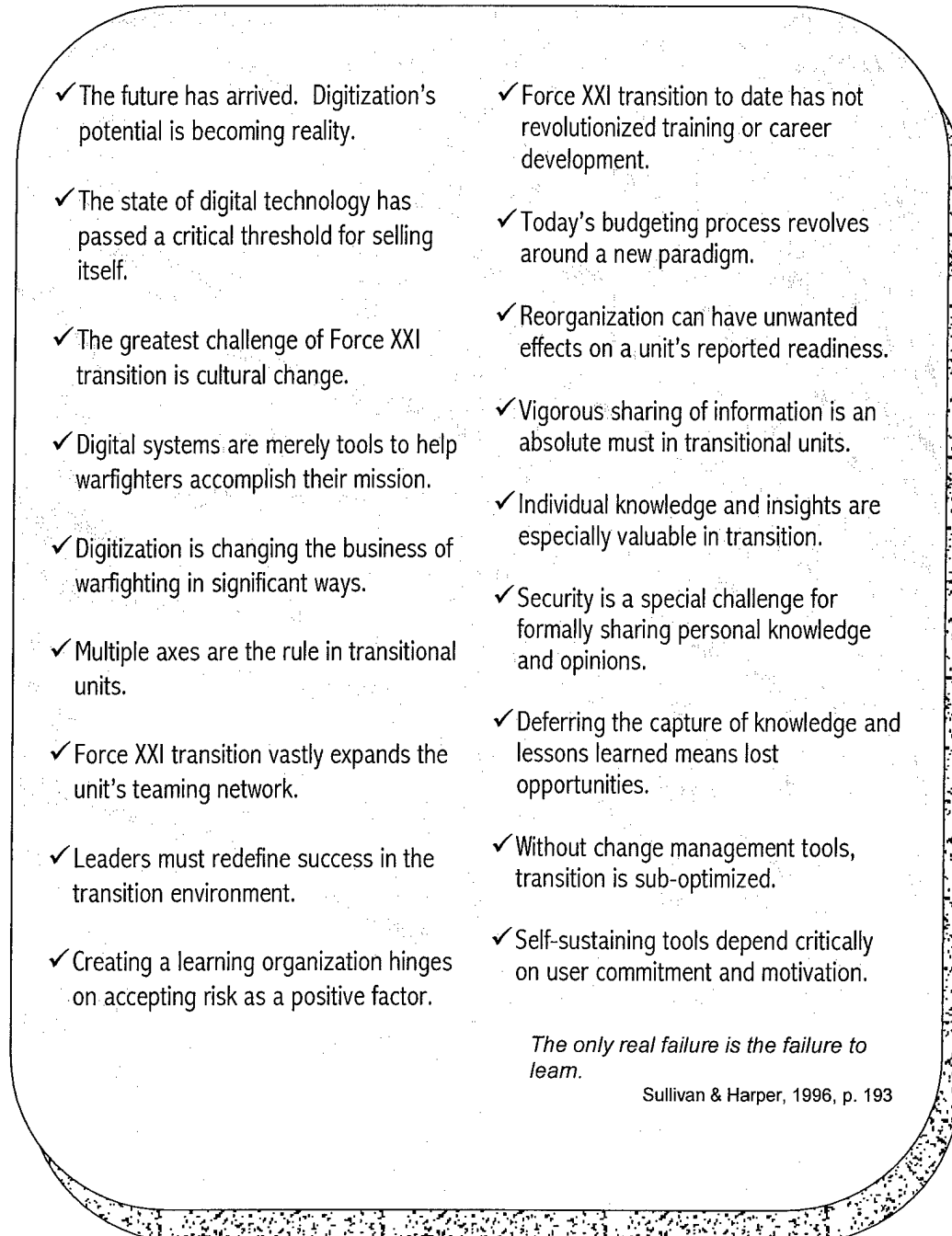


Figure 5. Summary of Lessons Learned.

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Appendix A

Focal Areas and Topics

Command Climate: The unit environment for fostering the achievement and acceptance of change; reflected in policies, procedures, guidelines, and practices; shaped by Army values, leaders' vision, and leadership style.

1. Setting the unit tone (risk tolerance, learning environment, commander's philosophy, etc.)
2. Setting and protecting unit priorities (vision, unit axes, priorities, enforcement, etc.)
3. Motivating leaders and soldiers (e.g., guidance, empowerment, involvement, feedback)
4. Working with force modernizers, developers and testers (rules of engagement)
5. Taming the tyrannical schedule (key events, timing, integration, workload, etc.)

Tactics/Doctrine: Impact of change (digitization, reorganization, weapon platforms, new doctrine, etc.) on warfighting principles and practices; may involve doctrinal manuals, TTPs, SOPs, and related materials.

1. Warfighting principles (basic principles for planning, preparing and executing missions)
2. Battlespace factors (e.g., extended battlespace, dispersion, mobility, agility)
3. Seeing the battlefield (sensors, common picture, shared visualization, etc.)
4. Impact of technology (warfighting effects of individual or combined systems)
5. Logistics (CSS structure, responsibilities and duties, operations, constraints, etc.)
6. Digital SOP (e.g., ABCS utilization, information flow, staff operations)
7. Degraded operations (system failure, backup procedures, half-analog mode, safeguards, etc.)

Budget: Acquiring, controlling, conserving, and accounting for funds for all aspects of unit operations; emphasis on the pace and impact of change.

1. Budget requirements (e.g., training, reorganization, experimentation, deployment)
2. Budget and accounting process (responsibilities, decision authority, control of expenditures, cost factors, automated ordering, etc.)
3. Leader skills (required knowledge, training needs, special considerations)
4. Funding constraints (realities, unfunded requirements, cautions, how to cope, etc.)
5. Impact of modernization (displacement of equipment, reorganization costs, etc.)
6. Logistics aspects of budget (e.g., equipment repair, turn-in costs, credits)
7. Outside sources of funds (specific agencies, request process, constraints, etc.)

Training: Planning and accomplishing unit training (home-station, CTC), new equipment training, institutional training, and self-development.

1. Training fundamentals (essential ingredients such as focus, time, stable personnel, iteration)
2. Training calendar/schedule (e.g., challenges, integration, sequencing, coordination)
3. Assessing performance (measurement, feedback, observer/controllers, AARs, etc.)
4. Training specific groups (e.g., battlestaffs, NCOs, logisticians, equipment operators)
5. Training RC personnel (unique requirements, AC support, planning, scheduling, etc.)
6. Institutional vs. unit training (e.g., allocation of responsibilities, near-term realities)
7. Self-development (courses, self-study, professional development)

8. Balancing digital and analog training (relative emphasis, trade-offs)
9. TADSS (limitations of current systems, leaders' vision, future needs)
10. Training support packages (currently available packages, future requirements, etc.)
11. Mixing training and testing (priorities, rules of engagement, challenges)

Logistics: Supporting the unit's Army and non-Army systems and equipment; encompasses sustainment, transportation, evacuation, replacement, contractor support, etc.

1. CSS organization (redesign, unit structure, suitability, limitations, etc.)
2. CSS fundamentals (e.g., new realities, responsibilities, impact of transition)
3. CSS enablers (essential ingredients such as digital tools, trained personnel, diagnostics)
4. Budget aspects of logistics (resourcing, depot-level repairables, avoiding crises, etc.)

Personnel: Acquiring, assigning, qualifying, utilizing, and retaining military personnel assigned to and supporting the unit; includes career management considerations.

1. Staffing requirements (type and quantity of specialists, shortfalls, etc.)
2. Personnel qualifications (e.g., capabilities, skills, experience, standards)
3. Assignment practices (Army policy, career management, unit procedures, utilization)
4. Personnel stability (turnover, turbulence, stabilization)
5. Role of specific personnel (e.g., NCOs, mechanics, Fire Support Officer)

Fielding New Systems: Receiving, inventorying, distributing, and readying new systems; also displacing old systems; includes hardware and software, systems of systems, sub-systems, and components.

1. Staying in control (knowing players and their authority, enforcing unit priorities, etc.)
2. Impact of modernization (systems of systems, non-Army equipment, iterative software versions)
3. Displacing equipment (sequencing, scheduling, controlling, etc.)
4. Scheduling (synchronization, lead-time, resolving conflicts, etc.)
5. Avoiding pitfalls (e.g., do's and don'ts, cautions, obstacles)

Unit Organization: Basic TO&E structure and task organization; reflects Reserve Component and split-base elements; emphasis on dynamics of change, to include the process and impact of reorganization.

1. Organization requirements (operational needs, both met and unmet)
2. Unit structure (type and number of units, span of control, shortcomings, etc.)
3. Task organization (e.g., mission considerations, unit roles, location of key assets)
4. Reserve Component integration (e.g., integration process, challenges, hurdles, impact of transition)
5. Split-base issues (e.g., planning, coordination, integration, hurdles)
6. Reorganization process (controlling the transition, protecting individuals, etc.)
7. Reorganization impact (roles and functions, operational issues, resource aspects, etc.)

Exploiting Digital Technologies: The process of optimizing the operational benefits of new systems, both hardware and software; includes soldier dimensions such as proficiency and “ownership.”

1. Battlefield requirements (needs of commanders and staffs, battlespace factors, etc.)
2. Operational impact of new systems (warfighting functions such as information sharing)
3. Digital proficiency (basic requirements, characteristics, skill maintenance, etc.)
4. Involving warfighters (leveraging the special talents available within the unit)
5. Support requirements (e.g., technicians, diagnostic capabilities)

Infrastructure for Change: Organizations, facilities, equipment, systems, networks, etc. for planning, coordinating, controlling, and supporting change; includes training infrastructure.

1. Change-focused organizations (specific elements, roles and missions, etc.)
2. Training infrastructure (special facilities, systems, networking, simulation capabilities, etc.)
3. Enablers (digital platforms, connectivity, personnel, resources, etc.)
4. Army culture (e.g., global culture, local culture, values, traditions, practices)

Documenting Critical Knowledge: The process for documenting new insights and ideas about change management, doctrine and TTP, operational requirements, etc.; encompasses capture, dissemination, and institutionalization.

1. Information requirements (change management, doctrine and TTP, operational needs, etc.)
2. Capture process (who, where, what, how, when)
3. Dissemination process (who, where, what, how, when)
4. Institutionalization of new procedures (updating of unit and Army documents)

Readiness: The impact of change on unit readiness, deployability, and status reporting.

1. Operational status (factors contributing to or characterizing operational effectiveness)
2. Status reporting (unit status reporting process, unwanted consequences, etc.)
3. Impact of transformation (operational indicators of combat effectiveness)
4. Training deficiencies (shortfalls in individual or collective proficiencies)

Measuring Progress: The process of measuring the progress and impact of change; mechanisms for tracking and documenting changes.

1. Roadmap for change (goals, objectives, milestones, timetable)
2. Definition of success (concepts, expectations, criteria, standards)
3. Evaluation process (framework, methods, techniques, procedures, conditions, timing)

Sources of Additional Support: Sources of information and assistance, actual or desired; includes resources internal and external to the unit.

1. Pre-assignment options (e.g., pre-command modules, self-study)
2. Leveraging internal experts (experienced leaders, staff officers, and operators within the unit)
3. External sources of help (DFCC, CTSF, TSMs, PMs, contractors, etc.)
4. References (e.g., books, information papers, AWE reports, transcripts)

Appendix B

Interview Guides

Contents:

1. Structured Interview Guide for Early Sessions
2. Knowledge Elicitation Guide (Round 1)
3. Knowledge Elicitation Guide (Round 2)

STRUCTURED INTERVIEW GUIDE
for
EARLY SESSIONS
(PT No. 60-26A)

PURPOSE

This guide provides instructions for Team members when they conduct interviews with leaders of the 4ID regarding management of change in the EXFOR environment.

INSTRUCTIONS

- A. The purpose of the interview is to capture the leader's insights and recommendations on the process of managing change in the Army's cutting-edge digitization arena. We are focusing on how the commander and key staff members dealt with critical requirements and issues during a period of dramatic change.
- B. The interview team will include the facilitator and at least one member to take careful notes of the discussion. One member will operate the tape recorder.
- C. Review the separate list of topics/issues before the interview starts. The interviewee will have an advance copy of the list.
- D. Verify the total time available as the interview starts. We have to assume we won't be able to run over.
- E. After introductory comments, ask the interviewee what items he wants to discuss. The Team should follow the lead of the interviewee, until he looks to the facilitator for the next question.
- F. All Team members should be unbiased participants. Avoid leading the interviewee with our own expectations.
- G. Give the interviewee plenty of time to digest the questions, think things through, and ponder the issues before he answers. This may mean some silent periods.
- H. Be sure we understand what the interviewee is saying. Ask for clarification when needed. Avoid opening up new areas of discussion.
- I. The note-taker(s) should capture sufficient detail so we will only have to use the recording for *backup* purposes. One note-taker should keep track of which issues have been deferred, in case a "what's left?" point arises.
- J. After the interview, organize your notes and enter them into a file as soon as you can. One person may integrate all the notes into a unified set.

Interview Questions Early Sessions

Purpose: The purpose of the ARI interview is to capture the lessons you have learned and recommendations you have for those that follow you as to how to successfully lead and manage at the speed of change in Force XXI. We are interested in your insights and assessments from the last one/two years and especially any tools and techniques you have developed. Our intent is to document and share the lessons you have learned. As we execute this effort, we will expand our information gathering.

1. Preparing for the Job (What did you have? What did you need?)
 - Pre-Command Course?
 - Orientation tour?
 - Mentor/access to previous commanders?
 - Focus of preparation?
2. Learning the Job (What did you face? How did you deal with it?)
 - External influences – TRADOC (AWEs), Test Community (FDTE, IOTE), III Corps (Red Cycle), ADO (Software Drops), FORSCOM (Operational Missions).
 - Internal influences – Training calendar nearly locked, mostly new and inexperienced personnel, fixed budget
 - Climbing the learning curve
 - Transition programs
 - OPDs -- formal and informal
 - What were the glass balls that you had to keep in the air and how did you juggle them?
3. Creating the Environment that Supports Change
 - Continuous change
 - Risk takers
 - Team building
 - Spiral development (DTLOMS)
 - Infrastructure

4. Training

- Maintenance of digital skills
- Integration of new personnel
- Step 1, Step 2, Step 3 Methodology
- Simulation vs. live training
- Digital education/training
- NCO involvement in digitization
- Integration of analog assets into Division (personnel (RC) and units)

5. Transitioning to New Division Structure

- Organizational changes (e.g., CSS)
- Fielding of materiel and software
- Enablers
- Readiness
- Resource management

6. Summary

- What would you do different?
- What did we miss?

KNOWLEDGE ELICITATION GUIDE (Round 1)

(PT No. 60-26B)

INSTRUCTIONS FOR FACILITATOR

- Explain the purpose of this initial session (see below).
- Get permission to tape record the entire session. Have a team member take notes.
- Lead the participant thru the questions that begin on the next page, in dialog mode.
- Follow the questions in sequence, working thru as many as possible.
- Adjust to the participant's interests and strengths: speed ahead if appropriate, pursue detail if something's especially important to him.
- Keep an eye on the clock, using the benchmark times on the next page as a guide.
- Afterwards, prepare a transcript ASAP, then give it to the participant to review.
- Put your own notes and insights in a Word file within 24 hours.

INSTRUCTIONS FOR PARTICIPANT

During this interview we want to gather knowledge about managing change in digital units that is not written in manuals or taught in courses. The kind of knowledge we are interested in is sometimes referred to as tacit. Tacit knowledge is more likely to be learned from practical experience, rather than in a classroom or other formal setting.

Our goal in this session is to gather lessons you've learned about managing change in your current job. We are especially interested in problems you've run into and solutions you've tried. What you share with us today should be useful to future leaders who will someday fill your shoes.

During our work on this project, we've identified 14 focal areas that were voiced by previous leaders. Let's take a few minutes now to look at those focal areas and their definitions (attached). We'll be referring to them as we discuss our questions of interest.

With your permission, we'll tape record the session. Within a few days you'll receive a copy of the transcript for your approval.

Do you have any questions before we start? Let's begin.

INTERVIEW QUESTIONS (Round 1)

1a. What are the 3 most important lessons you've learned since you started this job?
(5 minutes)

1b. NOTE TO FACILITATOR: Follow-up each lesson with a specific question that asks the participant to craft specific guidance for his successor. Ask clarifying questions.
(5 minutes)

2. Rank order the focal areas (attached) in terms of the difficulty of challenges presented by each one. (1 is highest, 14 is lowest)
(5 minutes)

3a. For each of your top five focal areas, please describe at least one specific challenge and the lesson you learned from it.
(10 minutes)

3b. NOTE TO FACILITATOR: Follow-up each example with a question that asks the participant to craft specific guidance for his successor in dealing with the challenge. Ask clarifying questions.
(10 minutes)

4a. Based on our past interviews, we're particularly interested in a few focal areas where previous leaders didn't have much to say. Would you care to comment on the following areas, if not already discussed above?
(10 minutes):

- | | |
|------------------------|---------------------------|
| • Budget | • Getting Help |
| • Fielding New Systems | • Capturing New Knowledge |
| • Readiness | • Measuring Progress |

4b. NOTE TO FACILITATOR: Ask clarifying questions. Follow-up each comment with a question asking the participant to craft specific guidance for his successor.
(10 minutes)

5a. Lots of books give broad guidelines on managing change in large organizations. From some of those books we've culled the following categories:

- Coping with the challenges unique to the 4 ID
- Approach to training
- Empowering and motivating subordinates
- Values and culture of the Army and 4 ID
- Vision of the Army and 4 ID
- Leadership style in the 4 ID

During your tenure in this assignment, you may have made some adjustments because of the unique nature of the digital division. For the above six categories, please give examples of adjustments you've made. *(10 minutes)*

5b. NOTE TO FACILITATOR: Try to restate the answer in terms of a lesson learned. Ask the participant to craft specific guidance for his successor for each example given. *(10 minutes)*

6a. Please comment and share lessons learned on the following as they relate to managing change within the 4 ID. *(10 minutes)*

- Split-base operations
- Reserve Component integration
- Using Army test events as forcing functions to meet training requirements
- Use of civilian contractors to provide support

6b. NOTE TO FACILITATOR: Remember to get (or restate) the answer in terms of a lesson learned. Ask the participant to craft specific guidance for his successor for each lesson learned. Have him place each lesson learned in one or more focal areas. *(10 minutes)*

FOCAL AREAS OF CHANGE

A. Command Climate Setting unit tone and priorities, accommodating the pace of change, fostering acceptance of change, learning to think differently, motivating leaders and soldiers	B. Tactics/Doctrine Impact of change (digitization, new weapons, reorganization, etc.) on doctrine, TTPs, SOPs, and related materials
C. Budget Acquiring, managing, and conserving funds for all aspects of unit requirements/operations	D. Training Unit training (home-station and NTC), new equipment training, institutional training
E. Logistics Supporting the unit's combat systems and equipment, post-fielding; may include transportation, evacuation, replacement, etc.	F. Personnel Acquiring, assigning, qualifying, utilizing, and supporting military personnel assigned to and supporting the unit
G. Fielding New Systems Receiving, inventorying, distributing, readying, and troubleshooting type-classified systems	H. Unit Organization TO&E structure, to include reorganization, split-base elements, RC components, etc.
I. Exploiting Digital Technologies The process of optimizing the operational benefits of new systems, both type-classified and experimental	J. Infrastructure for Change Organizations and facilities for supporting change/transition; mechanisms for tracking and documenting changes; Army culture
K. Documenting Critical Knowledge The process for capturing new insights and advice about change management, doctrine and TTP, operational requirements, etc.	L. Readiness The impact of change on unit readiness, deployability, and status reporting
M. Measuring Progress The desirability and process of measuring achievement of unit goals and objectives	N. Sources of Additional Support Sources of information and assistance, actual or desired; may include institutional training, self-development, and leveraging previous experience

KNOWLEDGE ELICITATION GUIDE (Round 2)

(PT No. 60-26C)

INSTRUCTIONS FOR FACILITATOR

- Explain the purpose of this KE2 session (see below).
- Get permission to tape record the entire session. Have a team member take notes.
- Lead the participant thru the questions that begin on the next page, in dialog mode.
- Follow the questions in sequence, working thru as many as possible.
- Adjust to the participant's interests and strengths: speed ahead if appropriate, pursue detail if something's especially important to him.
- Keep an eye on the clock, using the benchmark times on the next page as a guide.
- Afterwards, prepare a transcript within 2 working days, then give it to the participant.
- Put your own notes and insights in a Word file within 24 hours.

INSTRUCTIONS FOR PARTICIPANT

During our first interview we explained that we were gathering knowledge about managing change in digital units. We want to continue to capture your insights on managing change.

Our goal during this session is to gather lessons you've learned about managing change since last summer. We are especially interested in problems you've run into and solutions you've tried. What you share with us today will extend the knowledge base we are assembling.

Inside this guide you'll find questions to structure this session. At the same time, we want to be sure to cover things that are especially important to you.

With your permission, we'll tape record the session. Within a few days you'll receive a copy of the transcript for your approval.

Do you have any questions before we start?

INTERVIEW QUESTIONS (Round 2)

1a. What are the 3 most important lessons you learned during the past 6-8 months? Consider your experiences from one or more of the following, as appropriate:

- FBCB2 Customer Test
- NTC Rotation
- Division Warfighter
- DCX ramp-up

(15 minutes)

1b. NOTE TO FACILITATOR: Help identify guidance for his successor. Ask about solutions. Remember to focus this and following on how change was managed as the unit transitioned to the digital force.

2a. How has digitization changed doctrine and TTP? Consider:

- Battlespace factors
- Maneuver
- CS
- CSS

(15 minutes)

2b. NOTE TO FACILITATOR: How are digital operations different from analog operations? For CSS, facilitate discussion on garrison operations as well as tactical operations.

3a. Based on your recent experience (Customer Test, NTC Rotation, Division Warfighter, DCX ramp-up, as appropriate), how has digitization impacted training for combat operations?

Consider:

- Digital leader skills
- Battle staff proficiencies
- Sustainment tasks

(15 minutes)

3b. NOTE TO FACILITATOR: Try to identify the 3 most important skills/ proficiencies/tasks.

4a. What advice would you give your successor about fielding new systems, beyond displacing old equipment?

(10 minutes)

4b. NOTE TO FACILITATOR: Focus on equipment fielded in unit during last 9 months and how it has impacted tactics, battlespace, training, and maintenance. Some may want to start with their experience with TOC delivery. Others may want to start with fielding of M1A2 SEP and M2A3.

5a. What have you done to define and measure the progress your unit has made along its digitization path? *(5 minutes)*

5b. How did you determine that your unit was ready to execute the Customer Test, NTC Rotation, Warfighter, DCX (as appropriate)? *(5 minutes)*

5c. What would you do differently if you had it to do over? *(5 minutes)*

5d. NOTE TO FACILITATOR: Be prepared to explain the importance of measuring progress that comes from Sullivan & Harper and other literature.

6a. How did you capture lessons learned during training? *(10 minutes)*

6b. How did you disseminate the lessons learned and implement changes within your unit? *(10 minutes)*

7. What other topics would you like to discuss?

Appendix C

Principles of Managing Change in Force XXI

1. Transformation is hard work • Effort and discomfort of change • Overcoming human resistance • Facilitating behavior change	2. Values and culture anchor transformation • Protecting culture and values • Values as stability factors
3. Everyone needs to understand the destination and how to get there • Clear vision of the future • Creating, focusing, harmonizing energy • Stakes for organizations, individuals	4. Only people can make transformation happen • Leaders and soldiers as keys • Empowerment
5. Transformation is a team sport inside and outside the division • Alliances, teams, cohesive groups • Distributing leadership • Expanding responsible players	6. Surprise should be no surprise • Unexpected events and processes • Flexibility and resilience • Exploiting opportunities • Working through setbacks
7. Balancing today's requirements against tomorrow's is key • Today vs. tomorrow • Future resource requirements	8. Better means becoming a more effective fighting force • Doing different things • Establishing an edge, winning
9. Forcing functions are essential to focus transformation • Unit events and activities as focusers • Testing new paradigms	10. Soldiers learn by doing • Experiencing the future • Sharing new knowledge
11. Synchronization meshes the gears of transformation • Coordinating vertically, horizontally • Integrating and sequencing efforts	12. Leaders must continuously assess progress and process • Measuring progress against goals • Communicating status and progress
13. Transformation costs, usually more than expected • High expense of transformation • Surprise as a cost accelerator	

Sources: Sullivan & Harper, 1996; Conner, 1992; Smith, 1996

Appendix D

Overview of Senior Leader Transition Book

Purpose: To provide new 4ID leaders (a) lessons learned by previous leaders and (b) links to resources provided by other organizations.

Target Audience (4ID): Commanding General, Chief of Staff, and Brigade Commanders

Technical Characteristics:

- Web browser interface optimized for Microsoft Internet Explorer®
- Contents stored as standard HTML pages
- Internet links implemented as standard HTML hyperlinks
- Delivery medium = compact disc (installation and operation)
- No support infrastructure required

Major Functions:

- Select major functions via homepage menu buttons
- Review Nuggets from interviews with 4ID leaders
- Review complete interview transcripts
- Learn about Force XXI-related organizations (including hyperlink)
- Learn about and reach digitization POCs (via link to DFCC)
- Get how-to-use instructions by reading Orientation

Contents:

- Transcripts from 4 interviews with 4ID leaders
- Nuggets from 4 interview transcripts, indexed by Focal Areas
- Descriptions of Focal Areas and their origins
- Descriptions of key organizations involved in Force XXI
- Library of hyperlinks to external resources
- Transition Book Orientation

Appendix E

Overview of Preliminary Leader's Tool

Purpose:

- Facilitate a learning organization environment in tactical units
- Assist 4ID senior leaders in defining and solving change-related problems
- Provide professional development, personal coach, and reference functions
- Enable users to enter their own insights and lessons learned

Target Audience (4ID): Commanding General, Chief of Staff, and Brigade Commanders

Technical Characteristics:

- Web browser interface optimized for Microsoft Internet Explorer® 5.0
- Primary contents stored in relational database (Microsoft Access 2000®)
- Interface-database interaction via Active Server Pages
- Supplemental contents stored as HTML documents
- Internet links implemented as standard HTML hyperlinks
- Operating environment = Web server running Microsoft Internet Information Services®
- Client environment = PC connected to Intranet (no user installation)
- Restricted access (user authorization table, password protection)

Development Tools:

- Microsoft FrontPage 2000®
- Microsoft Access 2000®, Microsoft Database Engine® (database environment)
- Hyper-Text Markup Language (HTML)
- Structured Query Language scripting (Active Server Pages)

Major Functions:

- Navigate via always-present menu bar
- Get how-to-use instructions by reading Orientation
- Learn about Focal Areas, Focal Topics, and Principles
- Search for Nuggets by Focal Area or Focal Topic
- Search for Rules by Nugget or Principle
- Review complete interview transcripts
- Learn about and reach Force XXI-related organizations (including hyperlink)
- Translate acronyms on commercial Web site (via hyperlink)
- Enter/edit Nuggets, Rules, and Focal Topics (with "private" option)
- Enter/edit Focal Areas and Principles (system administrator only)
- Find out who entered (and when) Focal Areas, Focal Topics, Principles, and Rules
- Edit contents at large (system administrator only)
- Obtain help on using Leader's Tool functions

Contents:

- Leader's Tool Orientation
- Nuggets and Rules (user-expandable), indexed by Focal Topics or Principles
- Transcripts from 16 interviews with 4ID leaders
- Descriptions of Focal Areas, Focal Topics, and Principles
- Library of hyperlinks to external resources
- Descriptions of key organizations involved in Force XXI
- Help file
- Read-me files (user documentation, system administrator documentation)

Support Environment:

- No routine operating support required
- Unit-furnished system administrator (part-time) for maintenance functions
- User documentation and system administrator documentation (read-me files)

Pre-Planned Enhancements:

- Expanded target audience (vertically and horizontally)
- Interactive wizard for intelligent search of database contents
- Audio/video library for orientation, familiarization, and professional development
- Army and unit-specific reference documents (e.g., SOPs, MTPs)
- Interactive wizard(s) to support solving change-related problems
- Interactive wizard(s) to support change-related decision making
- Remote access (on-the-road or in-the-field)
- Interactive help wizard, with frequently asked questions
- Text-to-speech and speech-to-text conversion capabilities
- Job aids in the form of checklists, templates, guides, etc.
- Collaborative interaction via chat rooms, message boards and/or user groups
- Interactive wizard for system administration and maintenance functions
- Manual, cued, and automated customization of the interface

Appendix F

Sample Nuggets and Rules

This appendix contains sample products of the MASC-XXI project's knowledge analysis method:

- Nuggets (pieces of interview transcripts) with tag lines
- Focal Topics into which each Nugget was classified, grouped under Focal Areas
- Rules derived from each Nugget, grouped under Principles

Sample #1	
TAG LINE: Pushing for digital capabilities	
NUGGET: You get exactly what you are willing to tolerate in this business. If you are willing to accept no red icons on an MCS screen, that you are not getting a red feed, then that's what you're going to get. But if you say, "No, that's unsatisfactory," then you can get red icons on the screen. A classic example happened with the 6.1.1 software. I did a Janus exercise in October. The 1st BCT had just finished an NTC rotation. The ADC-M came back and said, "No, you can't do that." I didn't know we couldn't. I said to [the technical manager in the CTSF], "Terry, we have to get this thing fixed." He sent people to look at the problem. They said, "Oh, that's just a patch." Talk to the right people, get the right things. It's unsatisfactory to accept that a UAV can't pass that information, it's got to be written on a piece of paper and carried across the TOC. Time out, get the right guy and get the thing fixed. In this case, within hours the problem was fixed. What you can and cannot do is not as hard and fast as some people would lead us to believe. The biggest thing you have to do as a commander is be wary of people who tell you the stuff can't work. You have to believe in the stuff.	
FOCAL AREAS	FOCAL TOPICS
Command Climate	• Setting the Unit Tone
Exploiting Digital Technologies	• Battlefield Requirements
Fielding New Systems	• Avoiding Pitfalls
PRINCIPLES	RULES
Only people can make transformation happen	• Push to get the digital capabilities you need—find the right people to make it happen
Transformation is hard work	• When people tell you something can't be done, challenge the right person to find a way

Sample #2	
TAG LINE: Reinforcing procedural knowledge for digital warfighting	
NUGGET: Unit leaders have to be involved. We were under great pressure to get the 6.2 drop implemented. It was estimated that would take 3 weeks and we had only one week to do it. We looked at the POI in terms of what tasks the soldiers had to learn in the classroom. Then we set up TOCs in the CTOC. The soldiers operated out of the BN TOCs set up in the CTOC at night. We would have 2-8 Infantry pass information to 1-67 Armor and vice versa. What the soldiers learned during the day, they executed at night with repetition between one another to reinforce the work, under their chain of command supervision so we all had a common understanding of what they learned each day. This is not how we typically conceptualize training. It is not really individual to collective. It is more a series of individual training events. I am an individual operator and I'm going to build a common operating picture with another individual operator and I'm going to send message traffic, etc. etc. It's an additive group of individual tasks. We tried to identify what they could do as a result of the individual training in CCTT and then rehearsed in the CTOC. For that kind of procedural knowledge you really have to reinforce it.	
FOCAL AREAS	FOCAL TOPICS
Training	• Training Fundamentals • Training Specific Groups
PRINCIPLES	RULES
Soldiers learn by doing	• Immediately put new system-specific skills to work in practical unit exercises • Deliberately link individual training with collective training exercises, to reinforce the progression of digital skills

Sample #3	
TAG LINE: “Out-of-the-box” logistic solutions for NTC training	
NUGGET: We are making progress at solving some of these [logistics] issues, especially with regard to things that we are doing now for DCX. The logistics community is working with DLA [Defense Logistics Agency], AMC [Army Materiel Command], and others to pre-position some parts in depots very close to the NTC (or whatever training site you may have). We have identified the requirements. At issue is the funding to support those requirements. I believe funding is an issue in everything we do. One of the reasons we wanted the parts pre-positioned in the depots as opposed to the ASL is that as soon as they are pre-positioned in your ASL you buy the parts. This is out-of-the-box type logistics support that we have not had to deal with in the past. Before, the cost of maintaining our systems and parts was considerably less and we could afford to maintain our systems. We no longer have that luxury.	
FOCAL AREAS	FOCAL TOPICS
Logistics	• Budget Aspects of Logistics • CSS Fundamentals
PRINCIPLES	RULES
Transformation costs, usually more than expected	• Consider pre-positioning repair parts in depots close to remote training sites such as the NTC, as a means of reducing the impact maintenance has on the budget

Sample #4

TAG LINE: Incremental process for improving ATCCS

NUGGET:

We [consider] what capabilities we want that we don't have and what capabilities the system is supposed to provide that it does not. That drives us back to ... making the fixes required incrementally. For example, we find that MCS light and MCS heavy can exchange graphics. That's fairly significant because the majority of our MCS systems are the lights and the majority of the planning is done with the lights. The plans are then passed to the heavy systems, because multiple folks can work on them simultaneously. We now have books that describe what the system should be able to do. DFCC can provide copies of those.

The challenge is that this is incremental. If one of the things you wanted to be able to do is share graphics, you never know what you want beyond that until you are able to share graphics. Now I know that I can share graphics. Now what do I want to be able to do? You attack this incrementally because until you know what one thing will do, you often don't know what to ask for next.

FOCAL AREAS	FOCAL TOPICS
Exploiting Digital Technologies	• Battlefield Requirements
Fielding New Systems	• Impact of Modernization
PRINCIPLES	RULES
Leaders must continuously assess progress and process	• Identify system improvements that will enhance warfighting capabilities, then push to get the improvements implemented
Only people can make transformation happen	• Push to get the digital capabilities you need—find the right people to make it happen
Balancing today's requirements against tomorrow's is key	• Plan on an iterative process for improving new systems because you will be identifying requirements incrementally, in progressive fashion

Sample #5

TAG LINE: Combining training and testing in the same event

NUGGET:

Well, we had to go back and look at the battle tasks and the METLs. We had to ask ourselves, Which ones can we master and which ones do we not have time for? Time was the problem more than anything else was.

We recognized we had to do a LUT with the 1st Brigade. All right, while we are doing the LUT, we also have a combat mission that we may have to perform. Can we in the construct of that LUT—above and beyond the gathering of data for that LUT, which is very important to the Army for FBCB2—build a scenario that actually trains the battle staffs and companies for their combat mission at the same time? Where do they differ? And in some cases in doing these tests, you take risks. And you say, “Well, we should do it this way because this is how we would prepare for combat, but they can't gather the data to do it”. ... We will have to do it this way no matter what, just so the data can be gathered. That is where you have to balance. You say, “Okay, not an optimum solution, but are we getting something out of it?” I think that was the biggest challenge with 1st Brigade in particular. Every time we put them [units] out there with FBCB2, we have to ask, “Are we getting something from it?”

FOCAL AREAS	FOCAL TOPICS
Command Climate	Setting and Protecting Unit Priorities
Training	Mixing Training and Testing
PRINCIPLES	RULES
Synchronization meshes the gears of transformation	Work multiple purposes, or axes, into the same event. For example, build a scenario that gives battlestaffs combat-relevant training during a system test.
Leaders must continuously assess progress and process	Assess training calendar events in terms of their contribution to unit axes/priorities. What is the unit getting out of each event?
Balancing today's requirements against tomorrow's is key	- Whenever possible, plan events so they support more than one axis. Normally this will contribute to both today's and tomorrow's requirements. - Realize that the data collection environment may limit what the unit gets out of a test in terms of preparing for combat

Sample #6**TAG LINE:** Overcoming the zero-defect mentality**NUGGET:**

When you tell people that they are supposed to learn, you take away the zero defect mentality. Also, the AAR process became very healthy because it became learning, rather than stump the chump. ... When the division commander says, "I've learned something today," and he relays that to the soldiers, you have a healthy environment.

Let me use an example. Specialist so-and-so showed us that when we pushed this button and sent that report back, it would clog up the system. We didn't know that was going to happen. That doesn't mean that the unit messed up by clogging up the system with somebody's Spot reports. It meant that we discovered something. That was a trained and ready soldier who was at the tip of the spear and said, "Here is what I see." Then he put it in the report and sent it back. Oh, by the way, everybody else sent it back and it clogged up the system. That is a hardware and software problem, not a soldier problem.

FOCAL AREAS	FOCAL TOPICS
Command Climate	• Setting the Unit Tone
Exploiting Digital Technologies	• Involving Warfighters
Documenting Critical Knowledge	• Capture Process
PRINCIPLES	RULES
Only people can make transformation happen	• Create a learning environment by communicating that one of the unit's jobs is to learn how to fight digitally—there is no right or wrong way • Create a non-threatening environment by communicating that learning is the key, not placing blame • Use learning-focused AARs to maintain a healthy, constructive environment
Soldiers learn by doing	• Encourage soldiers to share what they've learned about systems and procedures—both positive and negative

Sample #7**TAG LINE:** Critical role of sensors for surveillance**NUGGET:**

As the Division Commander in the Division AWE and subsequently in the Corps Warfighter and the exercises in between, it did not bother me to have gaps between brigades, as long as I had electronic sensors to keep looking at those gaps and tell me if there's anything there that I needed to worry about. It didn't bother me that I didn't have ground forces sitting there to report to me. It caused me some concern, but it wasn't sufficient to cause the Division to do something like locking arms and become more linear in our thinking.

Of course, there certainly are some great dangers in what I just said. We aren't going to have JSTARS flying overhead all the time. Maybe we will have sufficient time, if theater commanders recognize the fragility of this Division and the necessity to have the Division spread out on the battlefield. They must recognize that there has to be some priority given to the Division ... to give us JSTARS downlinks to make sure we can see, perhaps at the expense of what the theater commander wants to do with JSTARS. There is going to be a lot of push and tug and pull and stretch and all that.

In the Division, both at the division and brigade level, we are constantly conducting deep and close fights and are very dependent on the UAV to give us critical information that we would not get otherwise.

FOCAL AREAS	FOCAL TOPICS
Tactics/Doctrine	• Impact of Technology
Exploiting Digital Technologies	• Battlefield Requirements
PRINCIPLES	RULES
Better means becoming a more effective fighting force	• Rely on electronic sensors (JSTARS, UAV) to cover gaps between ground forces • Carefully coordinate the division's JSTARS requirements with higher echelons

Sample #8**TAG LINE:** Imperative to have focus-events and personnel stability for effective training**NUGGET:**

If you want good, solid training, understanding of change, and results in the exercise that you've got down the road a couple of months, then there are a couple of things that you have to have. The first thing is focus. You have to have something that you're looking forward to, something that you're focused on. Once upon a time we called it forcing functions. The ... [Division AWE] forced the Division and the entire community to focus exclusively on that event. All the different pieces and parts ... would come together, because everybody was looking forward to it. Be it an experiment, training event or whatever ... the whole organization must have some main effort upon which ... [to] focus.

The second thing you have to have is some degree of stability in people. ... To get the most out of an organization, you must have the same people around when you go through preparatory exercises—1, 2, 3 and 4—for all the learning that takes place in each and all the corrections that take place in between them. In the absence of that, you ... are going to have to reteach people over and over again.

FOCAL AREAS	FOCAL TOPICS
Training	• Training Fundamentals
Command Climate	• Setting and Protecting Unit Priorities
Personnel	• Personnel Stability
PRINCIPLES	RULES
Forcing functions are essential to focus transformation	• Focus unit activities by anchoring to a major event such as the DCX or an NTC rotation
Only people can make transformation happen	• Take steps to ensure a high degree of personnel stability for major events • Recognize that poor personnel stability will force you to retrain the same tasks over and over

Appendix G

Candidate Enhancements for the Leader's Tool

The following targets for enhancing and expanding the Leader's Tool technology were identified during the course of the MASC-XXI project. They are listed without regard to priority or resource requirements.

- Expand the target audience, both vertically and horizontally, through additional knowledge elicitation and analysis
- Convert data entry functions to an interactive wizard
- Develop an interactive wizard for intelligent search capabilities
- Add user-desired reference materials (e.g., unit SOPs, tactical task lists)
- Develop a graphics library illustrating digital equipment and operations
- Add a multi-media library (video files with sound, etc.) for digital familiarization and professional development
- Synthesize Rules to produce a more compact library
- Expand the Help file to an interactive wizard
- Add Frequently Asked Questions based on early implementation experience
- Establish intranet chat rooms, message boards, and user groups for collaborative interaction and knowledge exchange
- Develop interactive wizard(s) to support change-related problem solving and decision-making
- Develop capabilities to tailor the tool's features based on user-entered preferences, unit/echelon/experience, and/or usage history
- Add speech-to-text and text-to-speech conversion capabilities to accommodate sensory preferences of users
- Develop interactive wizard(s) to support system administration and maintenance functions

Appendix H

Suggested Reading

In addition to the sources listed in the *References* section, the following materials are suggested for learning more about managing change and transformation.

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Appendix I

Acronyms and Abbreviations

1CD	1 st Cavalry Division
4ID	4 th Infantry Division (Mechanized)
AAR	After Action Review
ABCS	Army Battle Command System
AC	Active Component
ADC-M	Assistant Division Commander — Maneuver
ADC-S	Assistant Division Commander — Support
ADO	Army Digitization Office
AFATDS	Advanced Field Artillery Tactical Data System
AFRU	Armored Forces Research Unit
AMC	United States Army Materiel Command
ARI	US Army Research Institute for the Behavioral and Social Sciences
ASAS	All Source Analysis System
ASL	Authorized Stockage List
ASP	Active Server Page
ATCCS	Army Tactical Command and Control System
AWE	Advanced Warfighting Experiment
BCT	Brigade Combat Team
BRT	Brigade Reconnaissance Troop (now Brigade Cavalry Troop)
C4I	Command, Control, Communications, Computers, and Intelligence
CAS	Close Air Support
CCTT	Close Combat Tactical Trainer
CD	Compact Disc
CG	Commanding General
CofS	Chief of Staff
COTS	Commercial Off the Shelf
CQ	Charge of Quarters
CS	Combat Support
CSS	Combat Service Support
CSSCS	Combat Service Support Control System
CTC	Combat Training Center
CTOC	Configurable Tactical Operations Center
CTSF	Central Technical Support Facility
DAP	Data Access Page
DCX	Division Capstone Exercise
DFCC	Digital Force Coordination Cell
DLA	Defense Logistics Agency

DOIM	Directorate of Information Management
DTAC	Division Tactical Command Post
DTLOMS	Doctrine, Training, Leader Development, Organization, Materiel, and Soldiers
EXFOR	Experimental Force
FBCB2	Force XXI Battle Command Brigade and Below
FDD	First Digital Division
FEA	Front-end Analysis
FDTE	Force Development Test and Evaluation
FIST	Fire Support Team
FORSCOM	United States Army Forces Command
FSC	Forward Support Company
HTML	Hyper-Text Markup Language
IBCT	Interim Brigade Combat Team
IOTE	Initial Operational Test and Evaluation
JSTARS	Joint Surveillance Target Attack Radar System
KE	Knowledge Elicitation
LAN	Local Area Network
LUT	Limited Users Test
MASC-XXI	Managing at the Speed of Change in Force XXI
MCS	Maneuver Control System
METL	Mission Essential Task List
MTO&E	Modified Table of Organization and Equipment
MTP	Mission Training Plan
NCO	Non-Commissioned Officer
NTC	National Training Center
O/C	Observer/Controller
OPD	Officer Professional Development
POC	Point of Contact
POI	Program of Instruction
PM	Project Manager
QA	Quality Assurance
RC	Reserve Component

SA	Situational Awareness
SICPS	Standardized Integrated Command Post System
SME	Subject Matter Expert
SOP	Standing Operating Procedures
SQL	Structured Query Language
SU	Situational Understanding
TADSS	Training Aids, Devices, Simulators, and Simulations
TO&E	Table of Organization and Equipment
TOC	Tactical Operations Center
TRADOC	United States Army Training and Doctrine Command
TSM	TRADOC System Manager
TTP	Tactics, Techniques, and Procedures
TV	Television
UAV	Unmanned Aerial Vehicle
UFD	User Functional Description
UFR	Unfunded Requirement