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The Army Command and Control Evaluation System (ACCES)

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U.S. Army Research Institute

June 1996

Fort Leavenworth Research Unit

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

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14. ABSTRACT *(Maximum 200 words)*:

This report provides an overview of the Army Command and Control Evaluation System (ACCES) theory and methodology. ACCES was initially developed by Defense Systems, Inc. (DSI) in the period October 1986 to January 1990 under the direction of the Fort Leavenworth, KS, Research Unit of the U.S. Army Research Institute for the Behavioral and Social Sciences (ARI). In the spring of 1990, ARI awarded two follow-up contracts: one to Quantum Research International (QRI) for support in conducting ACCES applications and the second to Evidence Based Research, Inc. (EBR) for specific required enhancements to the ACCES system. Both contracts expired near the end of 1993. This report provides a description of ACCES Version 93 and is current as of the end of December 1993. No further modification of ACCES methodology is planned at this time.

A Companion publication, "The Army Command and Control Evaluation System (ACCES) 93 Documentation," ARI Research Report 95-09, provides a detailed discussion of the mechanics of implementing ACCES.

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Training Systems and Education

FOREWORD

The U.S. Army Research Institute for the Behavioral and Social Sciences (ARI) is conducting research to develop improved methods for measuring the performance of commanders and their staffs at the corps, division, and brigade levels. The materials provided here were developed as part of the second phase in the development of the Army Command and Control Evaluation System (ACCES). This document is intended to be the basic resource for anyone attempting to use ACCES to measure command and control performance during free play command postexercises. The ACCES system was developed for assessing the performance of division command posts but has also been applied at the corps level.

There was general agreement that the first-phase ACCES approach provided valuable evaluative and diagnostic information in support of command and staff training. In this second-phase effort, ACCES measures were modified to bring them more in line with doctrinal tasks and standards and to refine the data collection and analysis procedures to proved more accurate and complete feedback during and after a several-day training exercise.

This research was conducted as part of Research Task 1122, Battle Command: Improving Commander and Staff Effectiveness, in coordination with the Command and Control Directorate of the Combined Arms Command-Combat Development (CAC-CD), and the Training and Doctrine Command (TRADOC) System Manager, for Army Command and Control Systems (TSM ACCS). COL Dials, TSM ACCS, formally requested, 20 April 1994, that the Operational Test and Evaluation Command (OPTEC) apply ACCES to the evaluation of the Army Tactical Command and Control System (ATCCS). Budgeting considerations and planning lead-time precluded the requested application in 1994, but OPTEC has stated its intention to explore future applications of ACCES. A reduced version of ACCES was used to generate insights on the impact of MOBILE Strike Force technologies during Prairie Warrior '94.

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ACKNOWLEDGMENTS

The ACCES methodology described in this paper has benefited greatly from the contributions of many people in the past 9 years.

Several key Army officers provided not only support and encouragement, but also the critical feedback that helped to shape our vision of ACCES. MG Granrud, then Director of Command, Control, and Intelligence in the Combined Arms Combat Development Activity, was the first to recognize the potential of ACCES in support of systems' evaluations, and he provided extremely valuable encouragement and support during the early phases of this project. MG Stephenson, Commander of the Operational Test and Evaluation Command (OPTEC), directed his staff to work with us to realize that potential and apply ACCES during tests of the Army Tactical Command and Control System (ATCCS). MG Clark, then Director of the Battle Command Training Program (BCTP), challenged us to use ACCES to provide feedback to his training audiences and provided us with invaluable opportunities to be included in the BCTP team. MG Ernst, COL (Ret.) Sturbois, and BG Ryneska have continued that tradition during their respective tenures in BCTP.

Dr. Richard Hays and Mr. Rick Layton were involved with ACCES through most of its development, first with Defense Systems, Inc., and later with Evidence Based Research, Inc.; without their scholarship, commitment, and creativity, the ACCES methodology today would be very different and very much more limited in its potential. Dr. Carol Girdler and Dr. Bill Ross made significant contributions to our efforts to move ACCES from the theoretical to the practical realms of Army Command and Control (C^2). Dr. Lloyd Crumley and, more recently, Dr. Douglas Spiegel, served tirelessly as the ARI in-house ACCES "gurus."

The evolution of ACCES relied heavily on feedback gained through field applications. LTC Edward Sullivan, MAJ Douglas Litavec, and MAJ Lawrence Miller were indispensable during their respective tenures as R&D Coordinators for the ARI Field Unit at Fort Leavenworth; their hard work alone kept several of the applications from becoming administrative and logistical nightmares, and their insightful evaluations of the methodology made the applications worthwhile.

Despite the important role played by the individuals listed above, and by the many others who worked to develop and apply the methodology, there would be no ACCES if it had not been for the support and encouragement of Dr. Robin Keesee, Director of ARI's Systems Research Laboratory, through virtually the entire life of the project. He was the first to see the importance of both the scientific and the application issues, and he provided us continuing technical advice, moral support, and budgetary largess as we addressed those issues.

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THE ARMY COMMAND AND CONTROL EVALUATION SYSTEM (ACCES)

Overview

Introduction

This report provides an overview of the Army Command and Control Evaluation System (ACCES) theory and methodology. ACCES was initially developed by Defense Systems, Inc. (DSI) in the period October, 1986 to January, 1990 under the direction of the Fort Leavenworth, Kansas, Research Unit of the U.S. Army Research Institute for the Behavioral and Social Sciences (ARI). In the spring of 1990, ARI awarded two follow-up contracts: one to Quantum Research International (QRI) for support in conducting ACCES applications and the second to Evidence Based Research, Inc. (EBR) for specific required enhancements to the ACCES system. Both contracts expired near the end of 1993. This report provides a description of ACCES Version 93, and is current as of the end of December, 1993. No further modification of the ACCES methodology is planned at this time.

The ACCES methodology largely predates a major paradigm shift which occured in the Army in the summer of 1993: the shift in emphasis to Battle Command rather than command and control (C^2). However, the ACCES concepts in many ways anticipated that shift; in particular, the ACCES model of C^2 discussed below defines the role of a commander in the C^2 system in a way which is clearly consistent with Battle Command concepts. The measures of effectiveness obtained with the ACCES system remain valid measures of the C^2 systems which support battle command. For the sake of historical continuity we have choosen not to rename either ACCES itself or any of the measures.

Background

MACOM commanders and the Training and Doctrine Command (TRADOC), through the Battle Command Training Program and the Support to Exercise Program, provide frequent opportunities for brigade, division, and corps staffs to train in Command Post Exercises (CPXs) and Field Training Exercises (FTXs). The commanders and staffs are exposed to varying environments and situations and are given the opportunity to practice and hone their ability to function as effective command and control (C^2) systems. The Operational Test and Evaluation Command (OPTEC) is frequently called on to evaluate C^2 materiel systems. Less formal system evaluations are conducted throughout C^2 systems' life-cycles by agencies such as the Battle Command Battle Laboratory, Fort Leavenworth, Kansas, and the ATCCS Experimentation Site, Fort Lewis, Washington.

Both training and test and evaluation (T&E) exercises require some measure(s) of system performance. In the training environment, exercises provide little benefit unless participants are provided feedback on their performance. In the test and evaluation environment, measures and criteria of system success or failure are obviously critical. However, while measures have been developed which address the efficiency of selected aspects of C^2 performance (e.g., throughput rates for certain types of messages within certain communication systems), there is no accepted overall measure of C^2 effectiveness (See Crumley, 1989 for a complete review of C^2 measurement alternatives.) Under the sponsorship of the Combined Arms Command – Combat

Development (CAC–CD), ARI took steps to address this need for C^2 measurement through the development of ACCES, a measurement system to evaluate the effectiveness of C^2 at various levels. ACCES differs from traditional force effectiveness measures (e.g., force loss ratios) which address the **headquarters** primarily in terms of its **subordinates'** efforts. In contrast, ACCES is based on the premise that C^2 effectiveness may be defined as the effectiveness of a **headquarters staff**; in this view, C^2 effectiveness measurement requires an understanding of the processes that are performed by the staff to facilitate the performance of subordinate elements. Thus, we need a means to measure quantitatively how well the critical staff processes are performed.

The ACCES methodology has evolved over the last several years. During that period ACCES has provided the framework for data collection and analysis at seventeen division training exercises and one corps training exercise. During or after many of these exercises the unit commanders and their principal staff were provided feedback on their C^2 effectiveness based on the ACCES observations and measures. While no one will claim that ACCES is the ultimate system which captures all aspects of C^2 effectiveness, there has been general agreement that the ACCES approach has provided valuable evaluative and diagnostic information in support of C^2 training. Follow-on developmental efforts have modified ACCES measures in order to bring them more in line with doctrinal tasks and standards and refined the data collection and analysis procedures in order to provide more accurate and complete feedback during and after a several day training exercise. OPTEC is exploring the application of ACCES to the evaluation of the Army Tactical Command and Control System (ATCCS).

The second section of this paper contains an expanded description of the ACCES model, procedures, and measures.

ACCES in a Training Environment

Despite the word "evaluation" in the label "Army Command and Control Evaluation System", it must be emphasized that ACCES does not provide a rating of C^2 effectiveness; i.e., ACCES does not grade a division HQ as having passed or failed against some set of criteria. Rather, ACCES provides indicators of C^2 effectiveness. It is precisely these indicators which are of value to a commander during and after a CPX. A major strength of the Army's Battle Command Training Program (BCTP) is the quality and quantity of feedback provided to the training audience by BCTP personnel. ACCES indicators provide additional detail and a different perspective on C^2 effectiveness than currently provided by BCTP. Unfortunately, one of the strengths of ACCES, the ability to draw from behaviors occurring in different locations at different times, also is a weakness of the system when applied in a training environment with its requirement for rapid feedback. A major focus of the recent ACCES development effort was the exploration of means to simplify ACCES data collection and analysis procedures and techniques so as to reduce the time required to provide substantive feedback to the unit being observed. This effort was less than fully successful. While a knowledgeable ACCES analyst can, by virtue of his own observations and discussions with ACCES observers, provide unique insights to the unit during the course of the exercise, most of the specific, quantitative ACCES Measures still cannot be calculated until several days after the end of the exercise.

ACCES in a Test and Evaluation Environment

In the typical test of a materiel system, the goal is to evaluate the system against system requirements which specify performance objectives or standards. However, there are few if any accepted performance objectives or standards for C^2 systems. We believe that the key to C^2 test and evaluation is the use of a stable baseline of system performance data which can be used for comparison. Rather than defining *a priori* standards of "successful" C^2 system performance, we argue that the most appropriate evaluation strategy is one which compares the new system to the old. ACCES measures are targeted to critical C^2 system performance characteristics and a collection of ACCES measures across several units can provide a stable baseline for such comparisons.

There are at least two types of C^2 system evaluation which could utilize ACCES. One target would be the examination of the effectiveness of the overall C^2 system in a test unit which is trying out a change in the C^2 system itself (e.g., a unit using a new command post structure, or one using a new computer-based system). A second target would be the examination of the effectiveness of the overall C^2 system in a test unit which is trying out some change in one of the supporting systems. The argument here is that while a sub-system like Intelligence or Fire Support should be evaluated in its own right to determine whether it is reliable, usable, etc., it is also necessary to determine whether that subsystem provides any value-added to the overall C^2 system in the context of the overall Army Tactical Command and Control System (ATCCS). In both types of C^2 test and evaluation, the use of a stable ACCES baseline can be used for comparison to establish the incremental changes in C^2 system performance during the test.

The continued evolution of ACCES has made it difficult to establish a stable baseline. The ACCES (version 93) which is described in this paper is the last in a series stretching back five years. Each of the "versions" of ACCES has differed in some significant respects from prior and subsequent versions; we have evolved the ACCES model of command and control, we have changed the focus of our measurement, and we have changed our data collector training procedures (and hence have changed the way data are collected and analyzed). These improvements have been at the expense of creating a stable baseline of similar data elements similarly collected under similar conditions from similar units. However, many of the major measures have remained sufficiently constant to enable the creation of a useful database comprising ten CPXs of which eight were BCTP Warfighter exercises.

Example Scenario

To provide a context for describing the elements of ACCES, this section of the paper provides a sketch of a typical scenario for a five-day division-level training exercise. In such an exercise, the division headquarters elements and the headquarters of the major subordinate commands would be in command-post mock-ups, or deployed to a field training site. They would use their organic communications equipment to communicate with subordinate elements represented by personnel interacting with a simulation such as the Corps Battle Simulation (CBS; also known as JESS) or First Battle-BC. Information on the battle being played within the simulation flows from lower echelons to brigade and division staffs; information, directives, and requests for information flow from the headquarters to the lower echelons. The corps headquarters and adjacent division headquarters are represented by small groups of personnel who also have access to the simulation.

In our "typical" scenario, let us assume that the Corps has directed the Division to protect the northern flank of the Corps for a seven-day period as the Corps prepares for and executes a counter-attack to the east. Some time before the beginning of the exercise, the Division Commander chooses an aggressive strategy which involves moving his maneuver elements rapidly to the north to engage the expected Enemy Force in a series of meeting engagements, followed by occupation of strong points and a hasty defense. The Division Commander further intends to launch counter-attacks as appropriate rather than establishing prepared defenses at the strong points. Based on this concept of operation, the Division operational order (OPORD) is prepared which details mission, task organization, and boundaries for the elements of the Division. Shortly after the beginning of the exercise, a fragmentary order (FRAGO) is issued with additional information on the schedule for the 1st Brigade to secure river crossings and support the 2nd and 3rd Brigades as they pass through. As the fight develops over the next three days, several FRAGOs are issued: a) adjusting schedules due to unexpected early success; b) adjusting resource allocation; c) adjusting boundaries as the units set for a hasty defense; d) changing mission ("withdraw and reconstitute"); and e) changing task organization. By day three it becomes clear that the Corps no longer has the resources to support the Division's aggressive posture, and a Corps FRAGO adjusts the Division's rear boundary, allowing the Division more depth in which to defend against the continuing series of attacks by fresh Enemy Forces. By day five the Division has expended roughly 70% of its resources (including its original resources and those provided by Corps during the exercise), is still defending within its assigned sector, and apparently will be able to accomplish the original mission of protecting the Corps' northern flank.

Neither ACCES nor any other known methodology can evaluate the Division Commander's basic concept of operations in this scenario. For example, how could we determine whether the unit's success was "worth" the expenditure of personnel, equipment, and other resources? How could we determine what would have or could have or should have occurred in the execution of a different concept? Analytical wargaming techniques may be able to provide some clues to the relative merits of alternative concepts given identical start-points, but the typical training scenario, like the real world, is too complex to allow sufficient replications in sufficient detail. Furthermore, we must keep in mind that we are observing training exercises. The commander may select a particular course of action suspecting that it may be relatively ineffective tactically compared to a more conservative approach, but choosing to challenge his staff and subordinate commanders with novel problems and circumstances. Rather than subjectively examining the commander or the "quality" of his decisions, ACCES objectively examines the C^2 **process** and the **outcome** of that process (i.e., plans and directives).

Many of the questions which would come to mind in considering staff performance in our example above are quite straightforward. Who was in a position to obtain information about the evolving enemy situation? Who was keeping tabs on friendly unit status? Did those individuals or staff sections share their knowledge with one another? Was the information they obtained timely? Accurate? Complete? Was the information used to make reasonable projections to possible futures? Were the information and projections fully presented to appropriate decision makers? Once decisions were made, were subsequent plans and orders based on timely, accurate, and complete information? Were the plans and orders consistent with the decision? Were they coordinated with all necessary staff sections, and with higher, lower, and adjacent commands to anticipate and avoid problems in execution? The challenge in attempting to **measure** C^2 performance is to answer all of these questions, and others, within a coherent framework so that the answers provide meaningful insights into the C^2 process. ACCES provides a framework for addressing these questions through a **model** of the C^2 process, **measures** of the process which are derived from that model, and **analysis techniques** which guide a systematic process of deriving quantitative measures from observational data.

The focus of ACCES is on the observable outcome of C^2 processes; the methods and techniques employed are of secondary interest, and then only to the extent that they may provide clues to identify problems that may be affecting the quality or timeliness of the outcomes. For example, a staff might use one or more techniques to insure that the order they develop is consistent with the guidance provided by the decision maker. These techniques include: a) effective note taking during discussions with the decision maker; b) checking with others who were present when the guidance was given; c) incorporating the decision maker into the discussions during the planning and orders-development process; d) informal or formal "brief backs" to the decision maker; or e) a combination of these techniques. There is no ACCES measure based on observing which, if any, of these techniques is used. Rather, there is an ACCES measure of the outcome of the process, in this case the match between the guidance from the decision maker and the order issued.

ACCES Model of C^2

As we begin to examine the conceptual model of C^2 which provides the context for other elements of ACCES, it is important to define what we include in our use of the term "C^2." We view command and control as an observable behavioral process. People command, and people control. The headquarters elements of a unit (e.g., the division Main Command Post, brigade Tactical Command Post, etc.) comprise people whose primary function is to provide the command and control outputs which serve to structure and guide the actions of subordinate units. Those people work within constraints established by tradition, doctrine, training, and experience. They are supported by, and further constrained by, various C^2 systems which function to gather, manipulate, and transmit information within and among headquarters. The ACCES conceptual model of C^2 assumes that the headquarters of a unit, the groups of people who do command and control combined with their supporting information systems, may themselves be viewed as a "system". This headquarters "system", i.e. the overall C^2 system, establishes goals and objectives for subordinate units (based on goals and objectives provided by the senior unit), within an environment characterized by a great deal of uncertainty. This overall C^2 system actively obtains information about the environment, reviews that information to determine whether the goals and objectives are achievable, and aperiodically generates new outputs in the form of new or revised goals and objectives for subordinate units. In simplest terms this "adaptive control system" seeks to achieve a balance between the desired and actual state within its environment by monitoring the state of the environment and making any necessary changes in the actions of the elements it controls.

The overall effectiveness of the C^2 system, the headquarters of a unit, can be judged by the viability of their outputs, and the critical outputs are the "plans" and related directives which establish the goals and objectives for subordinate units. Good plans can be executed without need for modification beyond the contingencies built into them and remain in effect throughout their intended life. Alternatively, a headquarters may find that its plans (in decreasing order of effectiveness):

- require minor adjustment in the course of their execution, without change to the basic plan;
- require execution of a contingency, significantly different from the intended course of action, but provided for in the initial plan; or
- require cancellation and issuance of an entire new plan.

This conceptual model of C^2 was used to guide the development of measures of the C^2 process within the progenitor of ACCES, the Headquarters Effectiveness Assessment Tool (HEAT); see Crumley, 1990, for a detailed discussion of HEAT and alternative models of C^2. Measures were developed by asking what observables could provide some insight on the functioning of such an adaptive control system. The focus in HEAT and, more recently, in ACCES has been on the primary C^2 outputs of the headquarters, plans and directives, and on the information which provides the headquarters with an understanding of the environment.

The overall ACCES measures of C^2 system effectiveness address primarily the extent to which plans remain in effect for their intended period, without the need for unanticipated changes in the plan. "Effective" headquarters are those which: a) develop stable plans (presumably based on very accurate and insightful analyses of current and likely future status); b) issue directives concerning missions, assets, schedules, and boundaries which are successfully executed without change; and/or c) issue directives which permit flexible responses in rapidly developing situations (contingency planning).

ACCES also provides diagnostic measures of the quality of processes by which C^2 system functions are performed. An exercise timeline and its associated C^2 cycles are used in ACCES as the framework to describe the information transformation processes engaged in by a staff and the decision maker, from the acquisition of data to the issuance of plans and directives. ACCES also looks at the performance of individual functional cells and the interactions between the cells. The general approach, as illustrated in Figure 1, is built around the following concepts:

- The "environment" within which this adaptive coping process is attempting to maintain control consists of subordinate and higher headquarters, plus the elements of METT-T (Mission, Enemy, Troops, Terrain, and Time).
- The staff is understood to engage in a number of actions in order to support decision making and its implementation:
  - Collecting information through monitoring the environment and receiving reports,
  - Synthesizing information,
  - Developing and evaluating alternatives,

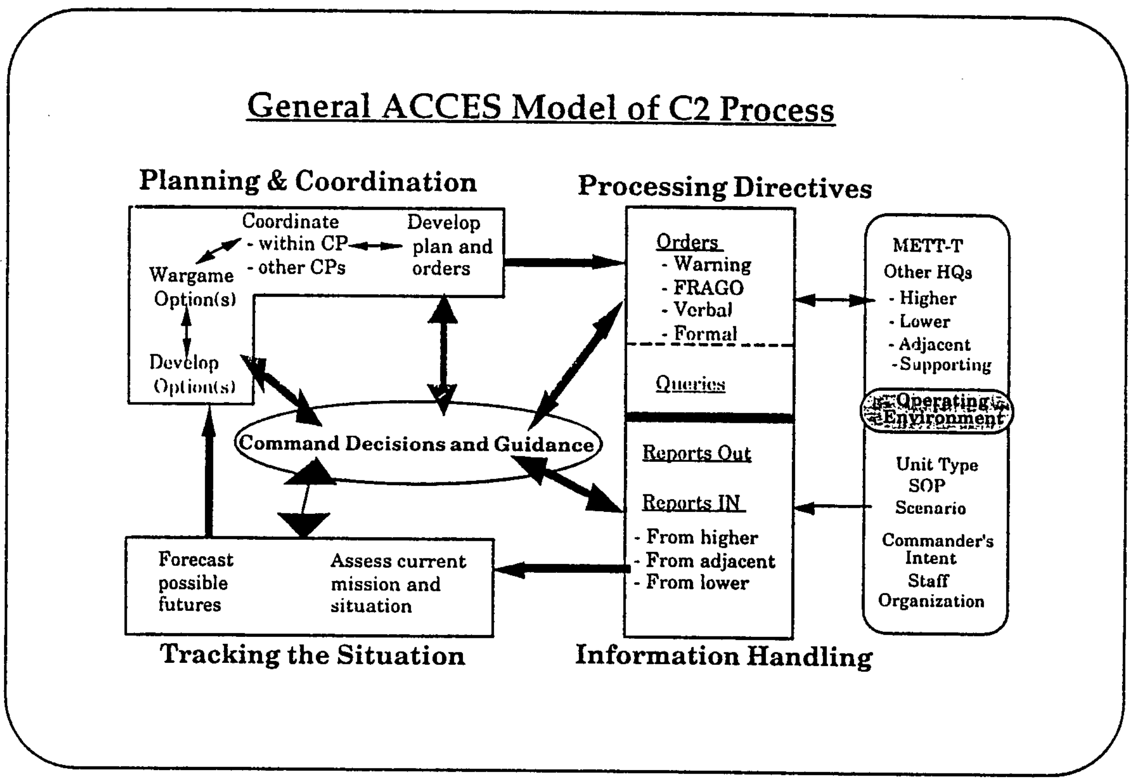

Figure 1. ACCES C^2 Processes

- Reviewing recommended courses of action,
- Planning implementation,
- Reporting,
- Coordinating,
- Inquiring (seeking information), and
- Disseminating information in messages and reports

◦ A full C^2 cycle in ACCES begins with the receipt of information about the environment, and continues with evaluation of the status of the situation *vis a vis* the current plan, recognition of a need for change(s) in the plan, exploration of alternatives, a decision on change(s), and detailed plan development, and concludes with preparation and issuance of a directive.

◦ ACCES C^2 cycles will not always involve all of the above steps; for example, the exploration of alternatives and detailed plan development may both be by-passed under conditions of very high stress (severe time pressure while trying to address a crisis) or very low stress (confirmation that it is time to execute a pre-planned branch or sequel to the current plan).

◦ The actions of the staff, outlined above, yield a series of products which are <u>observable</u> elements of the ACCES C^2 cycles:
- Information about the environment,
- An initial understanding of the situation,
- The estimate of the situation, including a set of alternative actions, their expected results, and consequent recommendations,
- Decisions by the Commander (or in some cases the staff, acting for the Commander),
- Inquiries (for information),
- Reports that inform others, including answers to incoming queries,
- Command guidance, and
- Plans and directives.

The concepts upon which ACCES is built assume that effective staffs look ahead in time and develop plans that are robust (i.e., plans that will support mission accomplishment despite changes in the elements of METT-T). ACCES v. 93 (as shown in Tables 1-7) includes 56 primary measures of performance; of these, 7 of the measures deal with the planning process as a whole and the remainder are descriptive measures which focus on the process steps separately. An additional 107 subordinate measures provide a rich source of additional diagnostic information for an analyst examining a particular exercise.

Two additional categories of measures are also developed in ACCES. Table 8 lists the six descriptive "measures" of the decision context: for example, for each decision recorded, who made the decision? What unit(s) is/are affected? Appendix D of ACCES Documentation (Hayes, et al., 1995) lists 16 primary and 13 subordinate descriptive "measures" of the exercise and scenario; these elements of ACCES come into use as we aggregate and compare data across different exercises.

Table 1
PRIMARY ACCES MEASURES - v. 93

GENERAL MEASURES (Overall planning process)			
Item ID	Title	Brief Definition	Subordinate Measures
G 1.0	Plan Duration	Time from implementation of the plan to time it is changed in some substantive way or completed	4 – Duration of each of the four major plan elements: Mission; Task Organization; Boundary; and Schedule.
G 2.0	Plan Stability	A percentage based on time: Plan Duration (G 1.0) *vs.* the intended life of the plan (PD 5.0)	4 – Stability of each of the 4 major plan elements: Mission; Task...
G 3.0	Plan Execution	A percentage based on the number of all major plan elements which are completed within original contingencies, indicating sufficient leeway for adaptation to battlefield conditions	0 – However, note that each of the 4 major plan elements could be called out separately when summarizing across time.
G 4.0	Planning Success	A percentage based on the number of plans which are completed without change ("dominant") or within original contingencies ("adaptive") compared to the total number of plans	0 – However, requires computation of: total number of plans; number of plans which were "dominant" ; number of plans which were "adaptive."
G 5.0	Planning Initiative	The percentage of all plans which are "proactive" (assume any changes in the battlefield will be under own force's control) or "contingent" (anticipate some change which will be handled by established contingencies) rather than "reactive" (assume own force has little or no control over possible changes in the battlefield)	0 – However, requires computation of: number of plans which were "proactive"; number of plans which were "contingent".
G 6.0	Planning Cycle Time	The time from awareness of need to the time directive is issued	3- Planning cycle time under each of three conditions" Low; Moderate; or High "planning stress". The degree of planning stress is a function of the degree of success of the prior plan.
G 7.0	C^2 Impact on Plans	The percentage of changes to plans that are not attributable to the failure of C^2 processes	6 - Impact of I, SA, CA, PD, IE, and O processes.

Table 2
PRIMARY ACCES MEASURES – v. 93

INCOMING INFORMATION HANDLING (Formal and Informal Reports)			
Item ID	Title	Brief Definition	Subordinate Measures
I 1.0	Scheduled Situation Reports (SITREPs) Received	The number of Scheduled SITREPs received is tallied by 24 hour period. These are formal, scheduled reports on friendly units that contain: unit ID, capability, combat activity, and location.	2 – Percentage received late and Degree of lateness
I 2.0	Scheduled Intelligence Summaries (INTSUMS) Received	The number of scheduled INTSUMS received is tallied by 24 hour period. These are formal, scheduled reports on enemy units that contain: unit ID, capability, combat activity, and location.	2 – Percentage received late and Degree of lateness
I 3.0	Scheduled SITREP Elements Reported	The number of elements that are included in the scheduled SITREPs	0 – However, note that the four elements could be tallied separately.
I 4.0	Scheduled INTSUM elements reported	The number of elements that are included in the scheduled INTSUMs	0 - However, note that these elements could be tallied separately.
I 5.0	Scheduled SITREP accuracy	The percentage of reported **non-location**, scheduled SITREP elements that are correct. Elements which reflect **location** accuracy are reported seperately.	4 – Percentage correct for each of: Unit ID, capability, and combat activity; deviations in meters from Ground Truth for locations.
I 6.0	Scheduled INTSUM accuracy	The percentage of reported **non-location**, scheduled INTSUM elements that are correct. Elements which reflect **location** accuracy are reported seperately.	4 – Percentage correct for each of: Unit ID, capability, and combat activity; deviations in meters from Ground Truth for locations.
I 7.0	Unscheduled SITREP accuracy	The percentage of unscheduled SITREP **non-location** elements which are correct. Elements which reflect **location** accuracy are reported seperately. The elements tallied for the scheduled and unscheduled SITREPs are the same.	4 – Percentage correct for each of: Unit ID, capability, and combat activity; deviations in meters from Ground Truth for locations.
I 8.0	Spot Report Accuracy	The percentage of **non-location** report elements which are correct. Elements which reflect **location** accuracy are reported seperately. Spot reports are unscheduled, informal reports of knowledge of enemy units. The same elements are tallied for Spot Reports as for INTSUMS.	4 – Percentage correct for each of: Unit ID, capability, and combat activity; deviations in meters from Ground Truth for locations.
I 9.0	Queries to Scheduled SITREPs	The percentage of scheduled report elements which are queried	1 – Percentage of unscheduled report elements queried
I 10.0	Queries to scheduled INTSUMs	The percentage of scheduled report elements which are queried	1 – Percentage of unscheduled report elements queried

Table 3
PRIMARY ACCES MEASURES – v. 93

SITUATION ASSESSMENT MEASURES			
Item ID	Title	Brief Definition	Subordinate Measures
SA 1.0	Accuracy of Assessments of the Friendly Situation	The percentage of SAs about friendly forces that turned out to be correct A Situation Assessment conveys an understanding of the operating environment that goes beyond factual details to an appreciation, forecast, or estimate.	4 - distinguishing comprehensive from casual SAs and counting the elements considered The elements of a friendly SA are: mission, task organization, disposition, activities, status, and support.
SA 2.0	Accuracy of Assessments of the Enemy Situation	The percentage of SAs about enemy forces that turned out to be correct	4 - distinguishing comprehensive from casual SAs and counting the elements considered The elements of an enemy SA are: composition, disposition, combat power, activities, and capabilities (which includes intentions).
SA 3.0	Alternative Futures	The number of alternative futures explicitly considered during SAs	0
SA 4.0	Time Span of Assessments	The time from the expression of an assessment to the end of the period that the assessment covers	0
SA 5.0	Assessment agreement within CPs	The percentage of agreement within CPs (between CP sections) on situation assessments (SAs) of friendly and enemy forces.	2 – separate tallies for friendly and enemy
SA 6.0	Assessment agreement between CPs	The percentage agreement between CPs on SAs of friendly and enemy forces	2 – separate tallies for friendly and enemy

Table 4
PRIMARY ACCES MEASURES – v. 93

OUTGOING INFORMATION HANDLING (Periodic Reports and Spot Reports)			
Item ID	Title	Brief Definition	Subordinate Measures
O 1.0	Scheduled Situation Reports (SITREPs) Sent	The number of scheduled SITREPs sent, tallied by 24 hour period	2 – Percentage of scheduled SITREPs sent late and times late of those sent late
O 2.0	Scheduled Enemy Intelligence Summaries (INTSUMs) Sent	The number of scheduled INTSUMs sent, tallied by 24 hour period	2 – Percentage of scheduled INTSUMs sent late and times late of those sent late
O 3.0	Scheduled SITREP Elements Reported	The number of scheduled SITREP elements included in reports	0
O 4.0	Scheduled INTSUM Elements Reported	The number of scheduled INTSUM elements included in reports	0
O 5.0	Scheduled SITREP Accuracy	The percentage of reported non-location, scheduled SITREP elements that are correct	4 – 1 each for unit ID, capabilities, combat activities, and location
O 6.0	Scheduled INTSUM Accuracy	The percentage of reported non-location, scheduled INTSUM elements that are correct	4 – 1 each for unit ID, capabilities, combat activities, and location
O 7.0	Unscheduled SITREP Accuracy	Parallel to O 5.0 The focus here is on Friendly Spot Reports rather than the periodic reports considered in O 5.0.	4 – Same as for O 5.0
O 8.0	Spot Report Accuracy	Parallel to O 6.0 The focus here is on Enemy Spot Reports rather than the periodic reports considered in O 6.0.	4 – Same as for O 6.0

Table 5
PRIMARY ACCES MEASURES – v. 93

INFORMATION EXCHANGE (within and between CPs)			
Item ID	Title	Brief Definition	Subordinate Measures
IE 1.0	Coordination Cycle Time Within CPs	The time between the recognition of a need for coordination and the resolution of the issue	2 – time from recognition of need to initiation of action and from initiation to resolution These two sum to IE 1.0.
IE 2.0	Coordination Frequency within CPs	The number of recognized circumstances requiring coordination within a CP	2 – Percentage of recognized coordinations initiated and percentage of initiated coordinations completed
IE 3.0	Coordination Cycle Time between CPs	The time between recognition of the need for coordination and the time an issue is resolved. NOTE that "coordination" is <u>not</u> information seeking, but rather is the request for substantive comment on, or input to, a plan or SA.	2 – Same as IE 1.0 but **between** CPs
IE 4.0	Coordination Frequency between CPs	Parallel to IE 2.0, with the focus here on coordinations <u>between</u> different CPs (TAC, MAIN, REAR, and BDE).	2 – Same as for IE 2.0 but **between** CPs
IE 5.0	Information Seeking Cycle Time within CPs	The time between the recognition of a need for information and the resolution of the issue	2 – time from recognition of need to initiation of action and from initiation to resolution These two sum to IE 5.0.
IE 6.0	Information Seeking Frequency within CPs	The number of recognized circumstances requiring information seeking within a CP	2 – Percentage of recognized seekings initiated and percentage of initiated seekings completed
IE 7.0	Information Seeking Cycle Time between CPs	The time between the recognition of a need for information and the resolution of the issue	2 – time from recognition of need to initiation of action and from initiation to resolution These two sum to IE 5.0.
IE 8.0	Information Seeking Frequency between CPs	The number of recognized circumstances requiring information seeking between CPs	2 – Percentage of recognized seekings initiated and percentage of initiated seekings completed

Table 6
PRIMARY ACCES MEASURES – v. 93

COURSE OF ACTION ANALYSES			
Item ID	Title	Brief Definition	Subordinate Measures
CA 1.0	Number of Staff Participants	The median number of staff members actively participating during COA Analyses	0
CA 2.0	Variety of Staff Participants	The median number of staff sections represented during COA Analyses.	0
CA 3.0	Number of COA's	The median number of COA's explicitly considered during COA Analyses.	1 – the number seriously and carefully considered
CA 4.0	Completeness of COA Analyses	The percentage of COA Analyses which included explicit discussion of <u>all</u> of the following: predictions of enemy reactions; likelihood of mission accomplishment; residual capacity of friendly units; residual capacity of enemy units.	4 – 1 for each of the four elements of analysis listed in the definition.
CA 5.0	Time Span of COA Analyses	This measure parallels SA 6.0 SA 6.0 addresses the time span of situation assessments ("This is what is happening and is likely to happen"), while COA 5.0 addresses the time span of "what if" analyses during development of a plan.	0

Table 7
PRIMARY ACCES MEASURES – v. 93

PREPARATION OF DIRECTIVES*			
*Note that COA analyses and the preparation of directives may be occurring simultaneously, and may involve many of the same people. Discussions which serve both purposes are counted in both sets of measures.			
Item ID	**Title**	**Brief Definition**	**Subordinate Measures**
PD 1.0	Number of Staff Participants.	The number of staff members actively participating during preparation of directives.	0
PD 2.0	Variety of Staff Participants	The number of staff sections represented during preparation of directives.	0
PD 3.0	Directive preparation time	The time interval between a decision and the issuance of the implementing directive.	0
PD 4.0	Warning Order Time	The time interval between a decision and the issuance of a warning order	0
PD 5.0	Time Span of Directive	The length of time that the directive is to be effective For example, "On order, move to position xxxyyy and prevent enemy penetration of your sector for 24 hours" has a 24 hour time span. Many directives neglect start time, end time, or both, and cannot be assessed.	1 – Percentage of directives that are event driven (rather than specifying times)
PD 6.0	Directive match with decision	The percentage of directive elements that are consistent with the elements of the decision The decision maker's decision with respect to mission, task organization, boundaries, and schedule (as stated during initial guidance or follow-up discussions) are compared to the elements of the directive(s) issued.	0
PD 7.0	Clarity of Directives	The percentage of directives which do not require clarification by the issuing HQ.	0
PD 8.0	Consistency of Directives between CPs	The percentage of directives issued by alternate CPs that do not conflict with directives issued by the primary CP	0
PD 9.0	Lead-Time for Directive planning	The time from receipt of a directive by a subordinate command to the time the first element of the directive is to be executed.	3 – The ratio of (PD 9.0) to: [the time the first element of the plan is to be implemented minus the time from the first perception of need for a directive]; a parallel measure of lead time provided by warning orders; and a similar ratio for warning order lead time.
TOTALS: 56 Primary Measures			107 Subordinate Measures

TABLE 8
ACCES MEASURES OF DECISION CONTEXT – v. 93

DECISION CONTEXT			
Item ID	Title	Brief Definition	Subordinate Measures
DC 1.0	Decision Maker	Position of the person making a given decision Could include Commander, a subordinate in the commander's name, ADC(S) or ADC(M), COS, G3/S3, etc.	0
DC 2.0	Affected Units	Listing of subordinate units affected by the decision to change an element of the plan	0
DC 3.0	Decision focus	Listing of the element(s) of a plan affected by a given decision. Could include mission, task organization, schedule, etc.	0
DC 4.0	Contingency	Did a given decision involve activation of a previously planned contingency?	0
DC 5.0	Decision time	Time at which a decision was made	0
DC 6.0	Type of operation	Identification of the type of operation affected by the decision. Categories of operations are taken from ARTEP 71-100-MTP.	0

Application of ACCES

The application of ACCES comprises five stages:

- Prior coordination with the unit and "customization" of ACCES procedures and measures if required;
- Obtaining and training data collectors;
- Data collection;
- Data analysis; and
- Report preparation

Each of these stages will be discussed in turn.

Prior Coordination and Customization. The key to ACCES measures is information exchange within and between C^2 elements. The ACCES model of command and control implies that an effective staff:

a. knows about and understands the meaning of the tactical situation ("seeing the battle");

b. shares that information and knowledge with other elements of the staff, with the commander, and with higher, lower, and adjacent units ;

c. uses that information and knowledge in conjunction with the commander's guidance to develop plans ("planning" and "wargaming");

d. provides the necessary information to the commander to allow him to make an informed decision on the preferred course of action;

e. creates and communicates operational orders (OPORDs) or fragmentary orders (FRAGOs) which convey to subordinate commanders an unambiguous statement of the commander's intent and guidance, particularly with respect to mission, assets, boundaries, and schedule.

ACCES can track and assess all of these steps, but only if the information being captured, shared, and used is noted by an ACCES data collector or is obtained through other means. It is straightforward to assess the timeliness, completeness, and accuracy of the "see the battle" staff processes if data collectors note what information is available within a given staff element and what discussions occur, and if there is a "ground truth" available for comparison purposes. However, the data collectors can never hope to obtain more than a sample of all information available and being discussed at a given location; furthermore, there are obvious practical limits on the number of CP elements which can be observed and on the number of observers within a given location. It is therefore necessary to focus the observers' attention on the relevant staff actions.

The prior coordination step is an important element in a successful ACCES application because it provides the information on the scope and purpose of the exercise, providing the proper focus for the data collection efforts. If a given exercise is primarily to evaluate a modified Combat Service Support (CSS) system, then the data collectors will need to be located where CSS information is handled. Furthermore, some of the measures which focus on tactical situation information will need to be re-defined to incorporate the CSS focus. If a given exercise involves only one echelon or one or two staff elements within an echelon, then measures of staff coordination will be downplayed or ignored altogether in the training, data collection, and analysis phases. The one ACCES failure was due to problems in this phase of the application. We attempted to apply ACCES during an evaluation of the All Source Analysis System (ASAS) but were unable to collect any meaningful data. In this instance, there was prior coordination, but the scope and form of the test was modified several times in the final weeks before the exercise; we were not able to obtain enough information early enough to successfully customize ACCES for this atypical exercise.

In our recent experience with ACCES applications, the units hosting our ACCES observers have all been involved in Battle Command Training Program (BCTP) training exercises, known as Warfighter Exercises (WFXs). The conditions for WFXs and many division-level CPXs (usually conducted by the division with corps involvement) are quite similar in terms of the number and types of CP elements which are involved. Under these circumstances, little or no special advance preparation is required to conduct a successful ACCES data collection effort. However, our past experience has shown us that apparently minor variations from the norm can severely disrupt data collection and data analysis to the point that few if any useful data are obtained, and few if any insights are generated from the analyses.

Obtaining and Training Data Collectors. ARI took steps to establish and maintain a trained cadre of ACCES observers (data collectors) standing ready to go to an exercise. A task-order contract was awarded to Quantum Research International for ACCES data-collection and analysis support. Under this contract Quantum was committed to provide up to eight data collectors on any given exercise, and to support ARI in the analysis of the data following the exercise. The combination of the eight Quantum data collectors, one or two from within the Fort Leavenworth Field Unit staff, and one or two from other ARI elements put us well on our way to finding the 16-20 data collectors required for an ACCES application. However, it is unlikely that any one agency, including ARI, will long be able to maintain enough experienced data collectors to provide more than a solid core of the necessary people. Even with experienced people, some refresher training is necessary. General practice was to obtain supplementary volunteer data collectors from a variety of Army agencies and from government contractors. The benefit to the data collectors is the opportunity to see the C^2 processes in an actual unit, an invaluable experience for a young TRADOC staff officer or civilian contractor involved in designing the next-generation C^2 system. Data collectors will have a wide range of experience in tactical C^2, with many having very little such experience at the division echelon. Thus, training was required both on the ACCES procedures and on tactical C^2. Latest practice was to gather the team of data collectors near the exercise site three days prior to the exercise. Two days are spent reviewing the ACCES procedures and other material; time is also allowed for orientation and coordination visits to the exercise sites and for discussions with BCTP personnel. EBR and their subcontractor, BDM, have developed training packages including Programs of Instruction (POI) and detailed back-up material for two-day initial training and for advanced training for ACCES analysts. See ACCES Documentation (Hayes, et al., 1995) for these POIs.

Data Collection. During the exercise being observed, data collectors are stationed at "critical" C^2 nodes, as determined by the scope and purpose of the exercise. A given observer is stationed in the same location each day, and he or she occupies that position for roughly 12½ hours each day, including the 10-15 minutes required at each end of the shift to hand off to the person on the alternate shift (assuming a 24 hour-per-day exercise schedule). The location may be one small area which can be observed almost entirely from a fixed point (e.g., the G3-Plans cell at division Main) or may require movement among different points in order to be able to capture the data (e.g., a division Tactical CP). Data collectors are provided with a clipboard and data sheets and are asked to record all relevant information exchange. (Figure 2 shows a replica of the data collectors' log sheets.) Discussions of the quality of the field rations are ignored, but receipt of a status update from a maneuver brigade, discussions of the likely intent of an enemy unit, or an assessment of the situation provided during a formal briefing or a shift-change briefing should always be noted. Periodically the data collector will record the location and other information about critical friendly and enemy units as posted on map overlays or status boards.

An additional data collector is stationed at the exercise simulation center. This person is responsible for capturing the simulation "ground truth" for later use in assessing the unit's timeliness and accuracy of information handling, their accuracy in forecasting future battlefield situations, etc. This observer needs to also maintain a clear awareness of the critical tactical and training events throughout the exercise. Our later analysis of data collected by each CP observer must be done in the context of the overall exercise, and only the simulation-center observer is in a position to provide that context. This observer also obtains descriptive information about the unit and exercise as detailed in ACCES Documentation (Hayes, et al., 1995).

Data analysis. The analysis of the raw data proceeds in two steps. The first step involves the "reduction" and "collation" of the data, as it was recorded on the logs kept by the data collectors, onto a set of intermediate "data-reduction forms". There are seven of these forms titled in accord with Tables 1-8 except that a single form serves for both Incoming and Outgoing Information Handling. An example of one of these is given in Fig. 3. Some of the work done here could logically be grouped with the subsequent detailed analysis step; the practical distinction between the two is that the data reduction and collation draws from the hastily scrawled notes of several observers at different physical locations and different times, while the detailed data analysis draws primarily from the intermediate data forms.

OBSERVER JOURNAL

Observer:________ DTAC ☐ DMAIN ☐ DREAR ☐ Brigade ____ Date -time-group________

Current Ops ☐ Plans ☐ Command ☐ Intelligenc ☐ CSS ☐ Fire Support ☐ Special Staf ☐

DTG	EVENT	CODE

Figure 2. Data Collection Log Sheet

DECISION CONTEXT MEASURES (DC) ACCES 93:

Observer:__________ Date -time-group__________

DTAC DMAIN DREAR Brigade __________

Current Ops Plans Command Intelligence CSS Fire Support Special Staff

Stimulus for decision:__________

Time stimulus perceived at CP:__________

What was the decision?__________

What time was the decision made?__________

What officer made the decision?

Commander

Assistant Division Commander

Chief of Staff or Executive Officer

G-1/S-1 G-2/S-2 G-3/S-3 G-4/S-4

Subordinate in commander's name

Other__________ Unknown

What unit(s) were affected?__________

What elements did the decision concern?

Mission Task Organization Schedule Boundaries

Other__________ Unknown

Identification of directive:__________

Type of operation (as per attached list):__________

Was a contingency activated? Yes No

If Yes, title or other ID of the contingency:__________

Other related data sheets:__________

Figure 3. Decision Context Data Reduction Form

The key ACCES concept which guides the data reduction and collation is the notion of a CYCLE variously referred to as a C^2 cycle, planning cycle, or decision cycle. As discussed on pages 5-8 above, the overall effectiveness of a C^2 system can be described in terms of the extent to which the plans generated by that system are robust. If the plans require only minor "course corrections", then the staff may be said to be more effective than if major adjustments to mission, organization, assets, schedule, or boundaries are required. Many staff elements are simultaneously engaged in many of the activities which make up the C^2 cycle; i.e., handling incoming information, tracking the situation (assessing the current situation and forecasting possible futures), planning and coordinating, and processing directives (see Figure 1, page 7). There are even cases where decisions are being made simultaneously in different locations. To make sense of this very complex set of activities, we work from decisions backward and forward through the data.

For example, assume that one of the data collectors has noted that, at a given time, the Assistant Division Commander for Maneuver (ADC(M)) told a G3 staff officer, "I had hoped we would have more time, but it is clear that the covering force will have to withdraw before the 1st Brigade is in position. Tell them to begin withdrawing within 30 minutes and see if we can get some more artillery in there to give 1st Brigade more time." During data reduction and collation, these decisions are noted, and that observer's notes, and any others which are relevant, are scanned to determine the circumstances of the decisions. What information did the ADC(M) have available to him? Was it accurate, timely, complete? What interpretations or understandings had been stated? What predictions had been made? The data are also scanned to see the consequences of the decision. How long did it take before an order was issued? Did the order match the decision? Was the order unambiguous? Or did subordinate commanders request clarification? If clarification was requested, how long a delay ensued before the clarification was provided? Were the subordinate commands allowed enough lead time between issuance of the order and the scheduled execution time for them to do their own planning and preparation?

In addition to the data reduction based on C^2 cycles, some data reduction is based on time intervals. Periodically, at pre-scheduled times, all data collectors will have noted the location and status data on critical units as posted within the CP they are observing This "monitoring" data is also transferred to one of the intermediate forms for later comparison against ground-truth data.

Depending on the number of ACCES personnel available, the intensity of the exercise, and the exercise schedule (8 *vs.* 12 *vs.* 24 hour days), some data reduction may take place during the exercise. Typically, however, thorough data reduction requires all data collectors to work together for two days following the exercise.

The second step of the data analysis is the more difficult and time consuming. During this phase two or three experienced analysts work together to develop the necessary quantitative ACCES measures from the information on the data-reduction sheets. For example, a judgement is made for each decision as to whether it involved changes to an existing plan or activation of a contingency within that plan. The information available to the decision maker is compared to ground truth to determine whether he had an accurate, timely, and complete picture of the battlefield when he made the decision. Percentages and averages are computed, and tables, charts, and graphs are prepared.

The following tables (9-11 and 13-15) taken from Quantum reports on ACCES applications 91-1 (Castro, Collingwood, and Ervin; 1991), 91-2 (Castro, Hicks, and Ervin; 1991), and 91-3 (Gould, Collingwood, and Ervin; 1991), illustrate some of the results obtained. For comparison, Table 12 gives an aggregation of the Plan Duration data over nine exercises and Table 16 shows Completeness of Situation Assessments for those same nine exercises. Figures 4 and 5 show in graphic form the results of Tables 12 and 16.

Table 9
Plan Duration (Hours) (Application 91-1)

	DAY					
CP	1	2	3	4	5	AGGREGATE
DMAIN	14.0	3.5	3.0	-	-	12.0

Discussion: Scores for this measure were based on the 13 FRAGOs issued by the division. All FRAGOs were issued by DMAIN. The median plan duration was 12 hours; however, on Days 2 and 3 four plans had duration times of less than four hours. This was due to mission and schedule changes necessitated by congestion on the main supply routes (MSRs) delaying the advance of division units. Median values for plan duration could not be derived for Days 4 and 5, as a plan implemented on Day 4 was still in effect at ENDEX, 29.9 hours later, as was a Day 5 plan that had been in effect for 12 hours. Duration of the division's plans reflects the battle activity: long duration plans in first days during marshalling operations, short duration plans during initial contact, and longer duration plans again during preparation for and conduct of the defense.

Table 10
Plan Duration (Hours) (Application 91-2)

CP	DAY 1	2	3	4	5	AGGREGATE
DMAIN	-	0.8	3.2	4.8	-	3.8
DREAR	-	6.9	-	-	-	6.9
ALL	-	3.9	3.2	4.8	-	4.2

Discussion: Scores for this measure were based on nine of the ten FRAGOs issued by the division after STARTEX. One plan, implemented on Day 4, could not be scored, as it was still in effect at ENDEX, after 27.3 hours. DMAIN issued all FRAGOs except for one which was issued by DREAR. The median plan duration, based on the nine plans scored, for the division was 4.2 hours. As indicated in [the table] on Day 2, one plan lasted less than an hour due to schedule changes necessitated by congestion on the main supply routes (MSRs) that caused the division to prioritize unit movement on the MSR. This schedule change was implemented in the FRAGO issued by DREAR.
There were no plans implemented on Day 5, and median value for plan duration derived for Day 4 is not a true representative because of the plan that was still in effect at ENDEX. Duration of the division's plans reflected the battle activity; short duration plans during the offense and longer duration plans during preparation for and conduct of the defense.

Table 11
Plan Duration (Hours) (Application 91-3)

CP	DAY 1	2	3	4	5	AGGREGATE
DMAIN	6.2	3.4	12.7	5.0	-	5.5
DTAC	-	-	4.5	-	-	4.5
DREAR	-	4.0	4.5	2.8	-	4.0
ALL	6.2	4.0	6.4	4.0	-	4.5

Discussion: The division issued 33 FRAGOs for this exercise, seven of which were issued prior to STARTEX and not scored. Of the remaining 26 FRAGOs, five were administrative directives (e.g., division CSM setting up division training program) and one still in effect at ENDEX could not be evaluated for duration. The median duration of the plans implemented by the 20 FRAGOs scored was 4.5 hours. The short duration of plans was driven by numerous task organization and mission changes designed to maintain offensive momentum and control of the MSRs (traffic, refugees, and enemy interference). The division was compelled to change task organizations on 12 different occasions during the exercise because of unexpectedly strong enemy reaction.

Table 12
Plan Duration (Hours) (Aggregate of 9 exercises)

CP	DAY 1	2	3	4	5	AGGREGATE
DMAIN	13.4	3.5	4.5	5.3	5.3	4.8
DTAC	-	14.3	4.5	3.5	-	4.0
DREAR	-	4.5	4.5	2.8	-	4.5
MNVRBDES	13.9	8.5	6.1	-	-	8.5
ALL	13.4	4.0	4.5	5.1	5.3	4.9

Discussion: These are medians, in hours, of Plan Durations for a total of 106 plans over nine division exercises.

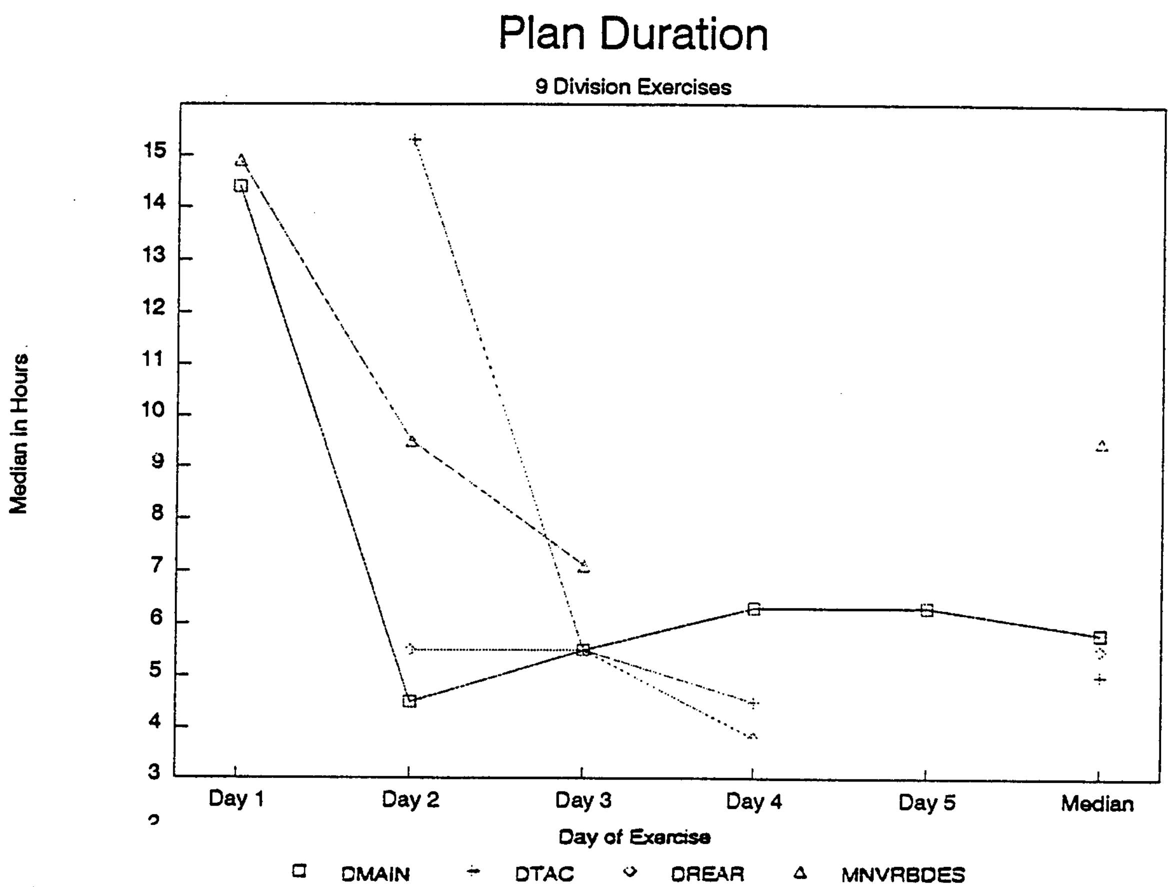

Figure 4. Plan Duration for Nine Division Exercises

Table 13
Completeness of FSAs (%) (Application 91-1)

CP	DAY 1	2	3	4	5	AGGREGATE
DMAIN	-	0[0/4]	-	0[0/1]	-	0[0/5]
DTAC	17[1/6]	0[1/19]	11[1/9]	0[0/10]	0[0/3]	4[2/47]
DREAR	-	0[0/1]	-	-	-	0[0/1]
3d Bde	0[0/1]	0[0/12]	0[0/8]	0[0/5]	0[0/1]	0[0/27]
ALL	14[1/7]	0[0/36]	6[1/17]	0[0/16]	0[0/4]	3[2/80]

Note: Numbers outside the brackets are percentages; frequency ratios of assessment elements discussed to total elements are in the brackets.
Discussion: Staffs at all levels prepared incomplete assessments of the friendly situation. Discussion of combat service support was missing more than 80% of the time, and discussion of task organization was missing more than 60% of the time. During formal briefings the FSAs included only unit activities. Incomplete FSAs led to a misunderstanding on Day 1 of the status of fuel at the refuel-on-the-move (ROM) sites, which held up progress in movement of a brigade. Missing CSS elements in FSAs necessitated several "quick looks" to identify possible shortages of FASCAM and artillery ammunition.

Table 14
Completeness of FSAs (%) (Application 91-2)

CP	DAY 1	2	3	4	5	AGGREGATE
DMAIN	50 [1/2]	40 [2/5]	0 [0/3]	33 [1/3]	0 [0/2]	27 [4/15]
DTAC	0 [0/5]	33 [1/3]	33 [1/3]	0 [0/2]	0 [0/1]	14 [2/14]
DREAR	-	50 [1/2]	100 [1/1]	-	-	67 [2/3]
2d Bde	-	0 [0/2]	-	-	-	0 [0/2]
ALL	11 [1/9]	40 [4/10]	29 [2/7]	20 [1/5]	0 [0/3]	24 [8/34]

Note: Numbers outside the brackets are percentages; frequency ratios of assessment elements discussed to total elements are in the brackets.
Discussion: Staffs throughout the division prepared incomplete assessments of the friendly situation. Discussion of combat service support was missing more than 60% of the time, and discussion of task organization was missing more than 45% of the time. Some incomplete assessments led to confusion regarding which units were in division reserve for the attack phase on Day 2 and led to doubt as to the adequacy of combat power in conducting a river crossing.

Table 15
Completeness of FSAs (%) (Application 91-3)

CP	DAY 1	DAY 2	DAY 3	DAY 4	DAY 5	AGGREGATE
DMAIN	-	25 [1/4]	13 [1/8]	0 [0/4]	0 [0/9]	8 [2/25]
DTAC	0 [0/2]	33 [2/6]	100 [2/2]	60 [3/5]	-	47 [7/15]
2d Bde	100 [1/1]	100 [1/1]	-	-	100 [1/1]	100 [3/3]
ALL	33 [1/3]	36 [4/11]	30 [3/10]	33 [3/9]	10 [1/10]	28 [12/43]

Note: Numbers outside the brackets are percentages; frequency ratios of assessment elements discussed to total elements are in the brackets.
Discussion: Staffs at all levels prepared incomplete assessments of the friendly situation. Division planners, in reacting to a succession of failed plans, began using only the most readily available friendly situation information, usually friendly activity and status, in their haste to publish yet another plan. Thus a series of planning cycles resulted in the publication of plans which failed, in part, due to incomplete FSAs.

Table 16
Completeness of FSAs (%) (Aggregate of 9 exercises)

CP	DAY 1	2	3	4	5	AGGREGATE
DMAIN	52[69/132]	47[169/360]	47[148/318]	72[56/78]	38[27/72]	49[469/960]
DTAC	67[80/120]]	60[115/192]	69[58/84]	58[66/114]	46[11/24]	62[330/534]
DREAR	-	46[11/24]	89[16/18]	-	-	64[27/42]
MNVRBDES	55[72/132]	42[107/252]	31[51/162]	33[28/84]	92[11/12]	42[269/642]
AVNBDE	-	25[3/12]	17[1/6]	17[1/6]	-	21[5/24]
ALL	58[221/384]	48[405/840]	47[274/588]	54[151/282]	45[49/108]	51[1100/2202]

Note: Numbers outside the brackets are percentages; frequency ratios of assessment elements discussed to total elements are in the brackets.
Discussion: Staffs at all levels prepared incomplete assessments of the friendly situation. Mission was discussed 55% of the time, task organization: 41%, disposition: 55%, unit activities: 70%, unit status: 50%, and combat service support was discussed 32% of the time.

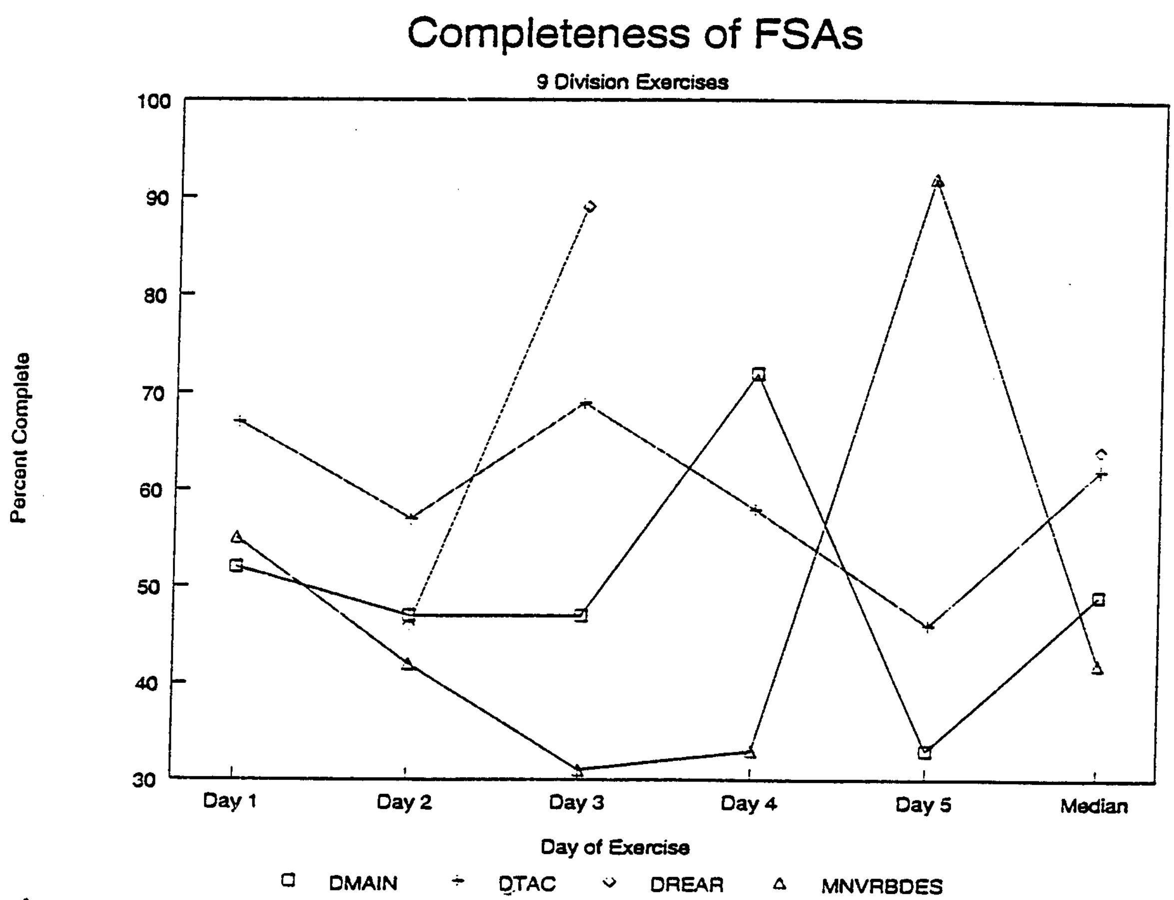

Figure 5. Completeness of Friendly Situation Assessments

Planning Cycle Time is the time from the first recognition of the need for a change in mission, assets, boundaries, and/or schedules to the time the directive making the change is issued. Figure 6 shows median Planning Cycle Times for nine division exercises in which the cycle times for 125 directives were recorded. Thirty-four of these times were effectively

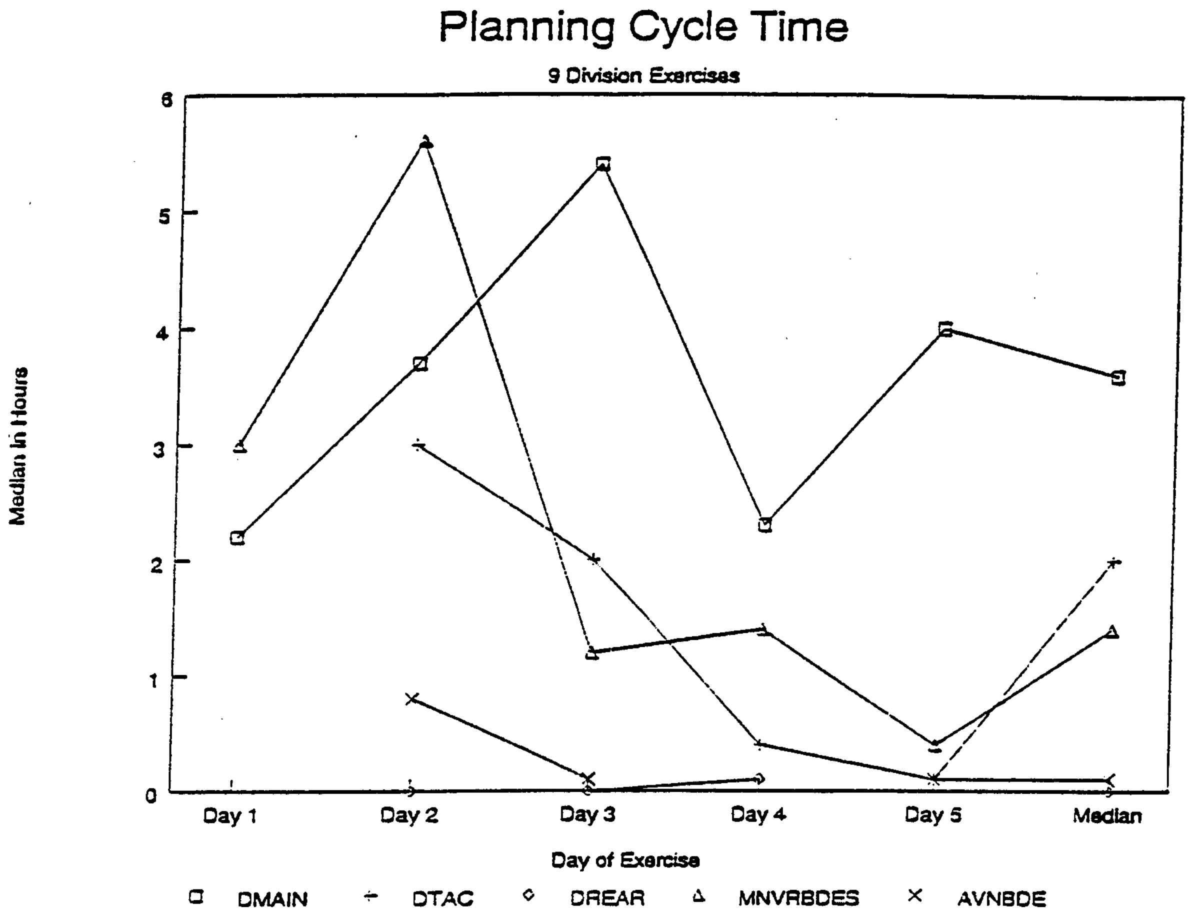

Figure 6. Planning Cycle Time

zero, that is, the directive was issued immediately upon recognition of the need. The medians reported here are of only the non-zero values. The grand median of non-zero times for all CPs over all days was 2.3 hours. Eighty directives were timed at DMAIN CPs; sixty-two of these were measurably greater than zero and had a median of 3.6.

Measures I 3.0 and I 4.0 are combined in Figure 7, which is here called Completeness of Incoming Reports. SITREP and INTSUM elements are combined in this figure and the percent reported out of the total number of elements that could have been reported is given for each CP and each exercise day. Combining over CPs and Days, 82% of the total of 432 elements were reported.

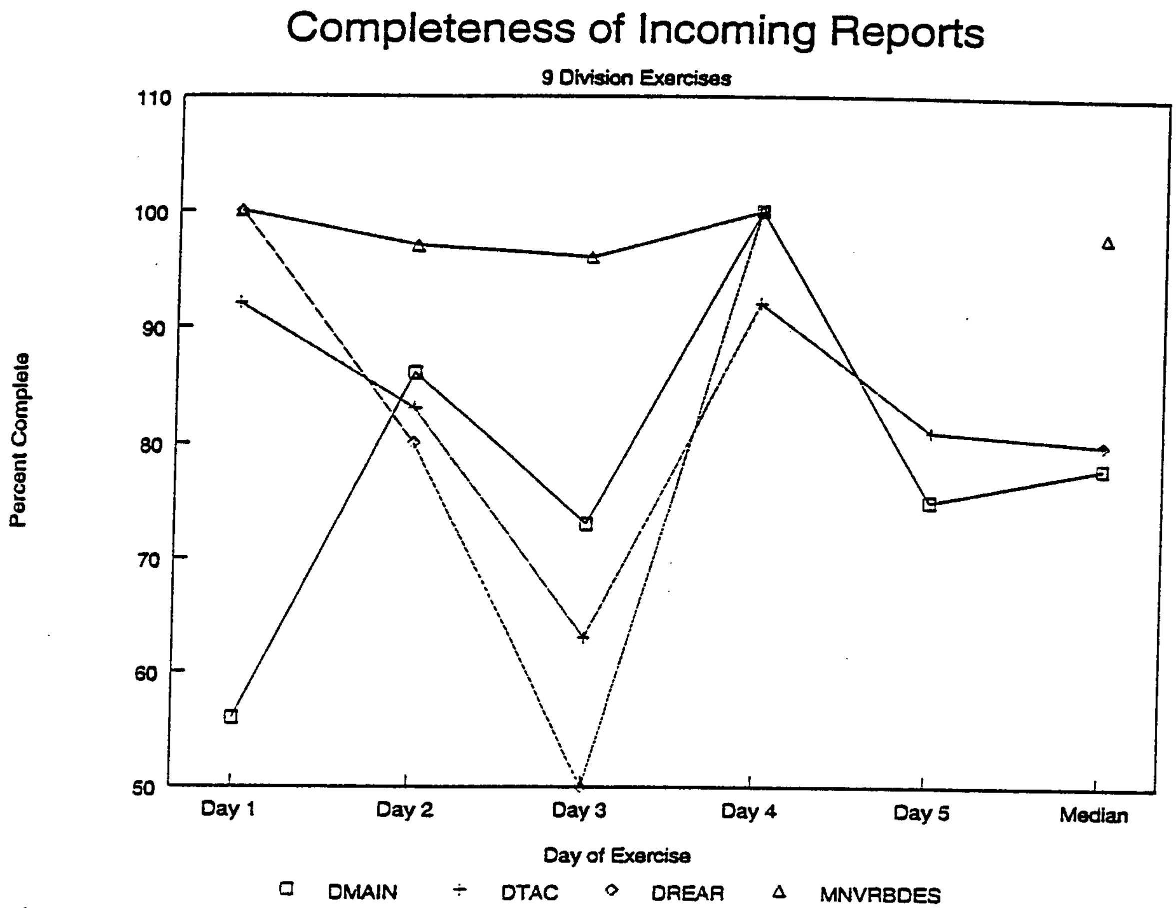

Figure 7. Completeness of Incoming Reports

Figure 8 shows the combined accuracy of SITREPs and INTSUMs for non-location elements. DREAR, at 58%, is somewhat below the other three CPs but that figure is based upon only 19 elements out of a total of 310 for all CPs.

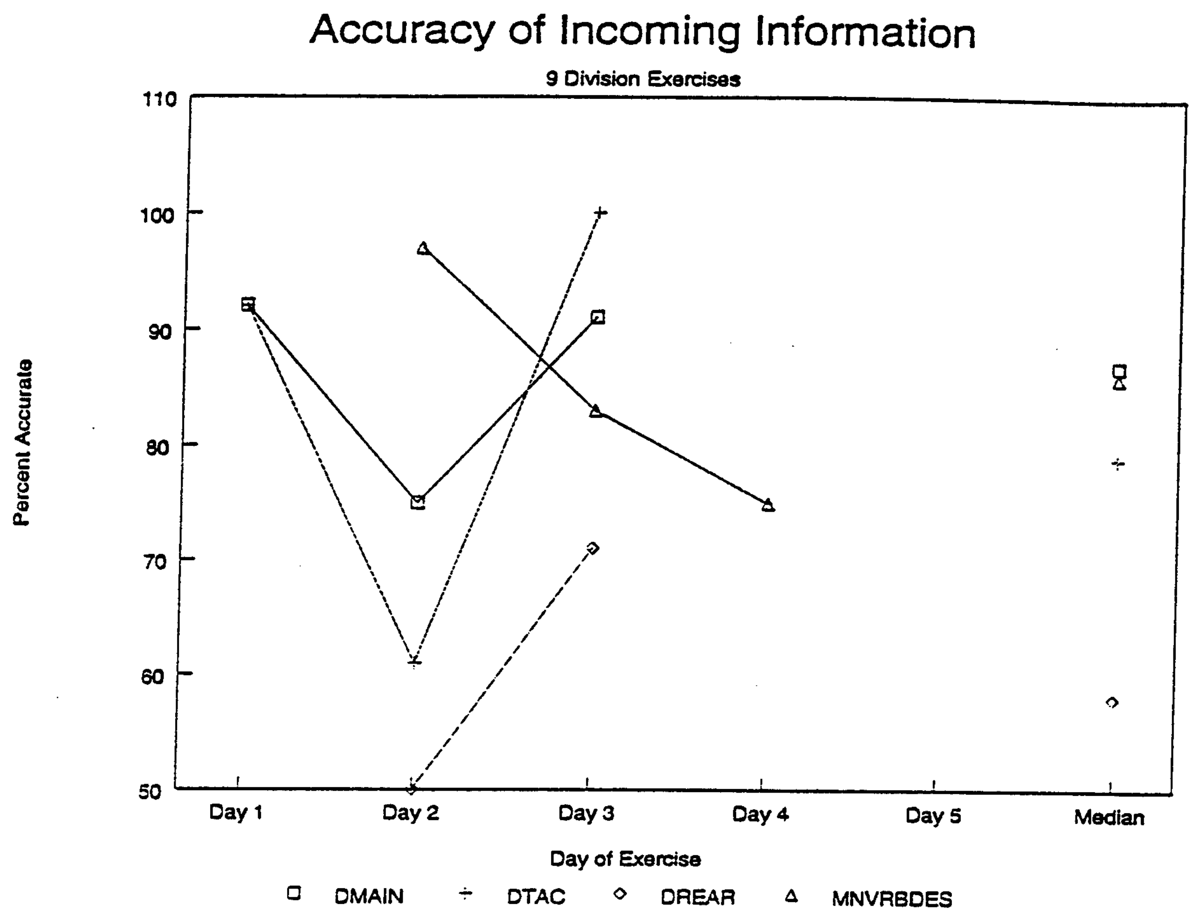

Figure 8. Accuracy of Incoming Information

Report preparation. Once the data have been analyzed and formatted into summary form, a report is written which provides an assessment of the C^2 processes observed during the exercise. This stage requires considerable expertise if the report is to be of any value to the unit or to an outside agency such as OPTEC. A finding that the TAC CP had accurate information (as defined by the unit's SOP) on the location of critical enemy units only 70% of the time is practically meaningless without some context information. How does this compare with other similar units which have been observed? Did the data collectors note any problems in the data flow between the G2 and the TAC CP? Was an inexperienced, unsupervised soldier misreading the grid coordinates when he posted the information? Did the ADC(M) or a G3 staff officer note the problem and attempt to obtain more accurate information? Were any minor, moderate, or major planning cycles initiated on the basis of faulty information?

During our most recent ACCES applications (four in 1991, four in 1992, and one in 1993) we focused a great deal of attention on the form and content of ACCES exercise reports. One of the difficulties we encountered was balancing the two somewhat contradictory goals of: a) preserving all possible information about the exercise for archival purposes and to facilitate later analyses; and b) providing succinct, meaningful feedback to the host unit. As ACCES evolved, we tended, at first, toward collecting and reporting more and more detailed information. Version 93, described in this report, reverses that trend. By identifying new "primary" measures, most of which are aggregations of existing measures, we believe we have achieved a more intelligible structure for reporting and explaining our data.

ACCES Status

ARI has completed the planned development of ACCES. The second phase ARI effort described here had three primary objectives: a) bringing the measures into synchrony with tasks and standards as described in Army doctrine; b) streamlining the data collection process; and c) streamlining the data analysis process. The goal was to provide the Army with a "turnkey" measurement system which could be used easily and effectively by a unit conducting a CPX, by a Test and Evaluation agency, or by researchers concerned with specific aspects of command and control. A parallel project, being conducted in cooperation with the Center for Army Lessons Learned, is developing a C^2 performance database for BCTP Warfighter exercises which will allow analysts to identify communalities in unit performance through examination of ACCES and other data collected during several exercises.

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