EVERYBODY'S TALKING AT ME:
INFORMATION FLOW IN A COMMAND AND CONTROL ENVIRONMENT

by
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ABSTRACT

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Increasing requirements to enhance mobility, coupled with a need to defend troops from the lethality of the modern battlefield, are causing the Army to consider new organizational arrangements and new communication and information technologies for the command and control (C2) of battalion-level combat units. It is important to understand the role information plays in enhancing the ability of C2 team members to make critical decisions.

This study describes an information flow analysis, using four concurrent and correlated coding schemas, of videotapes taken of an active Army combat unit engaging in a combat simulation exercise. Coding of 135 out of 1035 minutes of simulated combat in an artillery Tactical Operations Center seems to indicate that information flow in such a task environment is constant, diverse, both directional and omnidirectional, both focused and generalized, and germane to multiple levels of situational awareness at the same time.

Headings:

Command and control systems
Communications – methodology
Human information processing
Small group decision-making

ACKNOWLEDGEMENTS

This paper could have never seen the light of day were it not for the outstanding efforts of numerous individuals. Thanks must be given at the start to the soldiers who participated in the battlefield simulation and who provided the raw material that formed the basis of this study. Their unceasing efforts in the hot summer of 1997 not only to perform their simulation tasks, but also to try as hard as they could to win the simulated battle they were engaged in, resulted in very valid data from which valuable lessons may be drawn. This paper looked at information flow in a C2 environment, but the fidelity of the soldiers in the performance of their duties provides data that may be used for other studies involving combat and command and control of combat units.

Thanks must also be directed to the staff of dedicated soldiers and civilians who designed and implemented the computer simulation that allowed the C2 participants to practice their wartime duties in so realistic a situation. The intellectual and physical effort that went into setting up and running the simulation was not insignificant. While few outsiders can appreciate how much work it entailed, the staff (and the author of this paper) surely know that when things run smoothly and efficiently it is because they have worked so diligently to think out as many problems as possible in advance and to fix as many unexpected problems as possible when such problems made unwelcome appearances.

Thanks to Dr. Linda G. Pierce, Chief of the U.S. Army Research Lab at Fort Sill, Oklahoma for facilitating data collection during the period of the simulation. Dr. Diane H. Sonnenwald collected the data. Data collection was

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Speaking of Dr. Sonnenwald, she must be singled out for special thanks. It was the inspiration of her and Dr. Pierce's studies into interwoven situational awareness that generated my interest in this topic. As I have sought to put my thoughts into some coherent order, she has been an unceasing and tireless source of invaluable intellectual stimulation, research direction, and critical analytic thinking. Her multiple readings of various drafts have helped immeasurably to clarify my thinking and guide me to sources of additional information.

Finally, I have to thank my wife Dru for her graphical assistance and for so much more. I only have to describe what I am thinking about and she creates it in graphical format for me. She bolsters my spirits when they flag and tempers my overzealousness when it starts to get out of control. I am a lucky man.

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INTRODUCTION

The increasing lethality of the modern battlefield compels the United States Army to consider new ways to protect troops exposed to this environment. This lethality, coupled with the increasing speed and mobility of Army combat units, is causing the Army to consider new organizational arrangements and new communications and information technologies for the command and control of combat units. One idea under serious consideration is the development of the C2V (Command and Control Vehicle), a highly mobile vehicle with room for four personnel and their associated communications and information systems equipment. The C2V concept calls for digital information systems to increase transfer and sharing of battlefield communications by decreasing the amount of face-to-face communications between command and control elements and personnel. (Sonnenwald & Pierce, 1998, p. 19). According to the concept, digitization will result in “large amounts of information becoming available within

Some work has been done to develop test batteries to assess team cognitive performance functions that C2V crews will be expected to do. (McGlynn, Sutton, Sprague, Demski & Pierce, 1997). But digitization and the proposed organizational structure will change the amount and type of communication during the command and control (C2) process. Hence, there seems to be a need to characterize the information flow as it occurs today to gain insights about how new organizational structures as well as new information and communication systems can support that new C2 process.

This study was undertaken to look at how C2 personnel interact with the flow of information through their current work and task environment. Since these are the people who, in the near future, may well find themselves operating in four person teams in C2Vs, it seemed likely that investigating how they cope with information flow today might provide insight about what may be deemed expendable in a future four-person, one-vehicle, digital information exchange world.

The following is a study of information flow in an Army Tactical Operations Center (TOC). This paper focuses in part on the S3 position in C2 at the battalion level because the S3 is the director of the TOC and should be the recipient of the most and most diverse information that flows through a battalion TOC. Since the locale of study and the subjects of the study are all military personnel, it seemed useful to adopt military date and time terminology for this paper. Accordingly, all dates in this paper are expressed in the military standard day-month-year format and all times are expressed using a twenty-four hour clock.

This paper looks at real people engaged in as near-to-actual information task behavior as is possible to simulate in a semi-controlled environment. The situation and the subjects in this study were not performing an artificial task for the purpose of social science research. These are the real people who may be buttoned up with three of their mates in a mobile, digital, command and control vehicle on some future battlefield. The quality of their ability to do their jobs in the future might relate to the quality and quantity of the information flow they experience today as they do their battlefield jobs.

RELEVANT LITERATURE

Coordinated teamwork has been a key to success in many military settings throughout the centuries. For example, the ancient Greek phalanx was a successful effort to weld the efforts of individuals into an unbreakable team, and the coordinated efforts of Roman legions conquered the known world over two millennia ago. Scholars have studied team performance for decades, but there is still much to be learned about the internal workings of teams, about how teams work cooperatively in order to produce coordinated and successful team performance. Baker and Salas (1992) observed that most studies of team performance to that date had spent more time focused on individual team members' performance than on the measurement of collective teamwork skills. They felt that little effort had been expended in studying how team members interact with each other and that a good theory of team behaviors was still needed to provide the basis for measuring teamwork skills. Research since that date has addressed many of their points, but areas for fruitful research still exist.

Team Function Focus

One distinctive thrust in the study of team performance is the functions approach. In this approach, researchers have studied the functions the team is expected to perform or the functions individual members of a team must perform if the entire team is to be successful in its collective endeavor.

Within the function approach, research has tended to "decompose" team activities into smaller component parts to make them easier to grasp and to measure. This "decomposition" approach focuses on the performance of

individual members of the team, on the assumption that individual behaviors may be aggregated into a statement of team behaviors. The strength of this approach is that it permits researchers to identify specific functions in order to isolate which ones may be critical to team success (Hollenbeck et al., 1995). On the other hand, while the approach may be useful in studying a specific team event, it is not necessarily predictive of how the same team may perform in a different situation. Brannick, Prince, Prince and Salas (1995) propose that multiple observations of team processes seem necessary to assess the characteristics of team behaviors with any accuracy. The limitation of this particular observation is that it again seems dependent on the individuals that make up the team. Since Army command and control teams are dynamic and individuals are constantly being replaced, the team structure itself, not just the actions of individual members, needs to be studied to develop predictive assessments of team behaviors.

Fleishman and Zaccaro (1992) argued against the decomposition approach, feeling that team success requires synchronized rather than summed actions of team members. Their approach was to refine a categorization of team actions, breaking it down into multiple levels of team functions. Their taxonomy of team functions (table 1) was an attempt to identify activities that need to be performed in a coordinated or synchronized manner.

I. *Orientation functions*
   A. Information exchange regarding member resources and constraints
   B. Information exchange regarding team task and goals/mission
   C. Information exchange regarding environmental characteristics and constraints
   D. Priority assignment among tasks
II. *Resource distribution functions*
   A. Matching member resources to task requirements
   B. Load balancing
III. *Timing functions (activity pacing)*
   A. General activity pacing
   B. Individually oriented activity pacing
IV. *Response coordination functions*
   A. Response sequencing
   B. Time and position coordination of responses
V. *Motivational functions*
   A. Development of team performance norms
   B. Generating acceptance of team performance norms
   C. Establishing team-level performance-rewards linkages
   D. Reinforcement of task orientation
   E. Balancing team orientation with individual competition
   F. Resolution of performance-relevant conflicts
VI. *Systems monitoring functions*
   A. General activity monitoring
   B. Individual activity monitoring
   C. Adjustment of team and member activities in response to errors and omissions
VII. *Procedure maintenance*
   A. Monitoring of general procedural-based activities
   B. Monitoring of individual procedural-based activities
   C. Adjustments of nonstandard activities

(Fleishman & Zaccaro, 1992, p. 51)

Table 1: Taxonomy of Team Functions

This taxonomy was a significant contribution, helping to categorize thinking about how a team behaves in order to carry out its tasks. Numerous other researchers have built upon it to devise measures of how the team, rather than the individual, performed on tasks. A significant research effort, using a modified form of the Fleishman and Zaccaro taxonomy, identified 39 task performance tests, the output of which could be measured (McGlynn et al., 1997). This research effort highlighted both the strengths and limitations of the function approach. In all 39 tasks, the focus of the effort was on the output of the team, not on the specific behaviors or functions of individual team members. However, the taxonomy assumes that team members share a congruent view of the team task and that all their functions are rational steps taken in furtherance of the team task. It does not necessarily take into account that team members may unknowingly share different views of the team task.

A Norwegian effort to model team functions as part of a project to develop a Command, Control, Communications, and Intelligence (C3I) system for fast patrol boats also illustrates the strengths and limitations of the task/function approach. The designers broke down specific team and position functions into component parts in order to identify critical functions. At the junction between machine and machine operator, they switched their approach from function to task. “The analysis of decomposed system functions allocated to a human operator is referred to as task analysis”. They were confident that they had captured all the rule- and knowledge-based functions to be performed as well as the type of information that needed to be exchanged. They concluded that they

felt they could automate most of the C3I functions, but could not estimate the dynamic cognitive load on the operators. They recognized that the complexity of any particular task to be performed was affected by the contents of information being used to accomplish the task. Their function-transitioning-into-task approach could not factor in the need for team members to exchange information among themselves in order to reduce the complexity of the tasks each faced (Bråthen, Nordø & Veum, 1994).

Team Cognition Focus

The study of specific interactional processes within the team is another major focus of research in assessing team effectiveness. Stout, Salas and Carson's (1994) research on aircrew teamwork showed that team coordination had a more significant impact on team performance than did the specific skill levels of individual members of the team. Coordination within the team is improved and enhanced when the team members share mental models of the situation and/or of the responsibilities that the team faces. The same statement can be made for larger "teams." Organizations that undergo structural change show that valid shared mental models of organizational needs were built by enhanced information flow among all members of the larger organizational "team" (Zamanou & Glazer, 1994). Team performance (in this case, the organization itself operating as a team) was enhanced when more communication led to better understanding of the environment, understanding which evolved into shared mental models.

Shared mental models allow team members to anticipate fellow teammates' information needs and to perform team functions based on a common, sometimes unspoken, frame of reference. A key to the application of shared mental models is team situational awareness. When the entire team shares a fairly, though not exactly, congruent awareness of their situation, team performance can be enhanced. There is general agreement among researchers that communication is the one team process variable that is definitely related to situational awareness (Salas, Prince, Baker & Shresta, 1995). Research on the effect of information presentation and transmission showed that team success is enhanced when team members communicate with each other as clearly and as efficiently as possible. Salas, Prince, Baker and Shresta's research indicated that *minimal information efficiently transmitted* was more important for team success than was *near-perfect information slowly transmitted*. When team members had shared situational awareness, they knew the minimum information needed by teammates and were able to transmit it expeditiously. Reflecting on Fleishman and Zaccaro's view that team success requires synchronized rather than summed actions of team members, Caldwell and Everhart's (1998) research indicated that synchronous information flow was the key to situational awareness and mission effectiveness.

Team cognition research efforts have highlighted the need to understand how members of a team share information within their team task environment to effect coordinated actions. While the function approach looks at what functions

are done so that the team may perform its task, the cognition approach looks at how team members understand the functions that need doing.

Team Communication Focus

Team collaborative work requires that a communication be completed between at least two individuals. The United States Army has looked at the issue of the communication process within teams on at least one occasion. A 1980 research effort studied verbal transmission of information between different echelons in a command group and found that the percentage of information successfully transmitted and received seemed to be related to personality and position. The study focused on the impact of individual communications styles on team performance, but did not fully explore team information behavior itself (Kaplan, 1980).

Other researchers have looked at communication processes between individuals who together make up a group or team. Bales' interaction process analysis (1950) is a useful guide to understanding the role of interpersonal information flow between individuals. All such completed communications are *complementary relationships* in the sense that they fit together. A complementary relationship may take any form of common social relationships (dominant-submissive, question-answer, buying selling, giving-receiving, superior-subordinate, teaching-learning, etc.), but they are complementary in that they form a complete relationship (Fisher & Ellis, 1990, p. 109). Such relationships are not necessarily symmetrical, but each communicative act or

behavior is a part of a multipart relationship and serves to help complete that relationship.

Bales felt that there was an ongoing tension in any group between the group need to accomplish its task and its members' need to attend to social or interpersonal concerns. Said in another way, he saw a tension between task needs and process needs. His system of "interaction process analysis" provides a useful structure for understanding communication events for *what* they are. Each interpersonal flow of information within the team structure is either a positive action or a negative reaction in the social emotional area, or an attempted answer or a question in the task area (Fisher & Ellis, 1990, p. 150).

Team Situational Awareness Focus

The function approach, the cognition approach, and the communication approaches all recognize that team members and the team as a group must have some minimal understanding, or awareness, of their functions, their environment, and their teammates in order to be successful. By themselves, each approach illuminates a particular component of human information behavior within the team structure. However, to better understand how a team may perform, it seems there is a need for some sort of synthesis, or merging, of these approaches. One form of such synthesis is the situational awareness focus (figure 1).

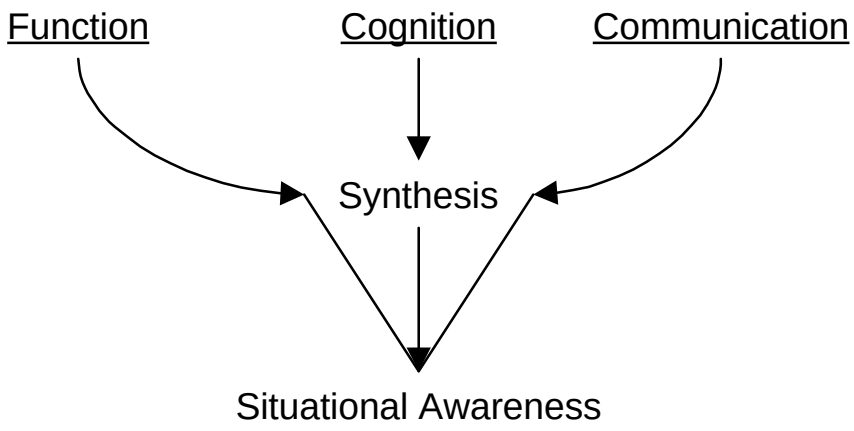
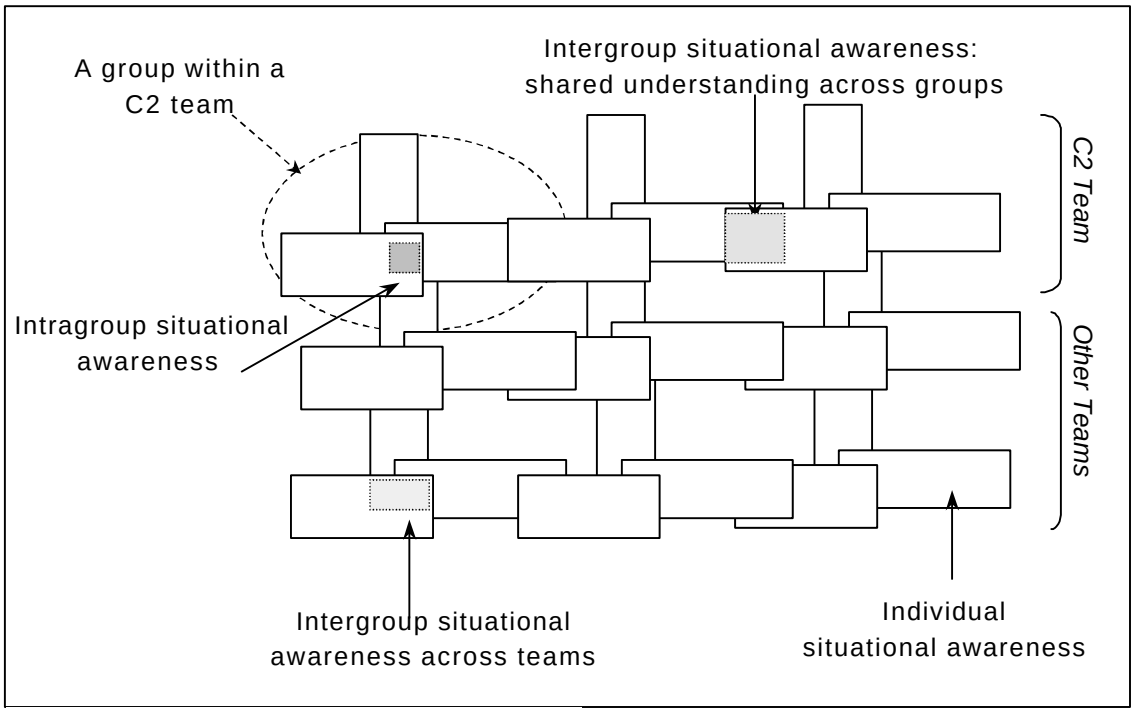


Figure 1: Synthesis of approaches

Individuals who identify themselves as members of a team understand that they succeed as a team when they are aware of the situation in which they perform. While team members do, in most cases, share some form of mental models and share some congruent situational awareness, the fact that they are individual human beings indicates that it is unlikely these mental models or situational awareness are exact matches for one another. Furthermore, because team members have different domain expertise and different task responsibilities, they do not share the same mental model and do not need identical situational awareness. This realization is captured in the concept that team members have an "interwoven situational awareness." Sonnenwald and Pierce (1998) suggest that command and control teams perform better when team members develop "an interwoven pattern" of awareness of the milieu in which they are operating, mixed with an awareness of what other team members are seeing or ought to be seeing. The concept is illustrated in Figure 2.



Sonnenwald & Pierce, 1998, p. 12

Figure 2: Interwoven Situational Awareness

Such interwoven situational awareness, however, is tied to the existence of dense networks of social interaction. Interwoven situational awareness develops when there is significant and continual communication between members of the team. The intensity of interpersonal relationships in military units is a basis for their very existence.[1] Sonnenwald and Pierce identified that all members of a command and control team need close and detailed communication between team members to ensure that the situational awareness

[1] There is an entire literature on this topic which is beyond the scope of this paper. Select examples of this literature include Keegan, J. (1976), Marshall, S.L.A. (1978), Holmes, R. (1985); Moran, L. (1987); and Baynes, J. (1988).

of each member was spread both horizontally and vertically throughout the conceptual information space in which the team exists.

Sonnenwald (personal communication) has developed this concept further. She has suggested that interwoven situational awareness may be thought of as composed of three distinct, but mutual reinforcing, types of "awareness."

Environmental awareness involves a recognition of the current state of activity inside the task environment. The task environment in this level of awareness is different for different tasks in the TOC. For individuals who have a narrow and specific task to perform, environmental awareness would be restricted to the particular task they must perform. For other individuals who have broader tasks that require them to interact outside of the TOC, environmental awareness includes both the physical environment within the TOC and the combat environment in which the TOC is controlling forces.

Domain or content awareness involves the individual team member recognizing something of importance to his particular task or conceptual area of responsibility.

Interpersonal awareness involves the individual's sensitivity to what teammates are thinking or feeling, how their emotions may be affecting their performance on team tasks or processes, or on their preferred work and communications styles.

Sonnenwald and Pierce made their observations on interwoven situational awareness without having the benefit of a microanalysis of information flow within

the teams they studied. Such microanalysis seems to be needed and may well provide fertile material for future research on information flow within teams. Their description of the command and control team's information space seems to indicate that there is a need for additional studies of the amount and type of close and detailed communication that occurs within teams.

METHODOLOGY

Command and Control

The U.S. Army defines “command and control” as

> *The exercise of authority and direction by a properly designated commander over assigned and attached forces in the accomplishment of the mission. Command and control functions are performed through an arrangement of personnel, equipment, communications, facilities, and procedures employed by a commander in planning, directing, coordinating, and controlling forces and operations in the accomplishment of a mission.* (U.S. Army, 1997)

Command and control (C2) exists all through the military structure anywhere there is a commander and a mission to be performed. Roughly stated, there are approximately 10 hierarchical levels of command within the Army and the battalion level is about at the mid-point in that structure. A battalion commander exercises command responsibilities with the assistance of a Tactical Operations Center (TOC). A support organization in the battalion organizational structure, the TOC is an operational staff composed of domain experts who merge their particular skills and knowledge into a collaborative effort help the battalion commander control the actions of 600-1000 soldiers as they move, load, aim, fire, and maintain their artillery pieces. The TOC helps the battalion commander understand both the physical environment (where the battalion is on the ground) and the task environment (what the battalion needs to be doing) in which he must perform his duties. The TOC is the information center for the commander, receiving information from and providing information to subordinate, lateral, and superior units, organizations, and individuals. To be effective in their collaborative tasks, TOC personnel must understand, know, and trust each other

as well as have a clear grasp on the commander's information needs and command intentions. (Sonnenwald & Pierce, 1998).

Study Setting and Participants

In the summer of 1997, the United States Army conducted a series of simulated battlefield exercises to test operational concepts for the command and control of a new generation of artillery weapon systems that may become operational during the early decades of the next century. The Army's superordinate goal was to evaluate fire support tactics, techniques, and procedures required to operate the new weapon system. To do this, an operational unit, using its organic communications equipment, carried out a simulated battlefield scenario. The soldiers who performed the evaluation were members of a combat-ready artillery battalion. They set up their Tactical Operations Center (TOC) as if to conduct actual combat operations, commanding and controlling the battalion's artillery units using information inputs generated by a separate exercise control team. The exercise control team used automated systems which generated information in accordance with two different simulated combat scenarios. For the TOC personnel, the simulation was an approximation of what they would do in the event they were sent into combat. The fact that the inputs were simulated did not affect the fact that the situation seemed real to the personnel in the TOC and their actions and behaviors reflected how they would act in combat.

This simulation, while primarily focused on providing data relevant to weapon system development, was an excellent opportunity to collect data on

operational command and control operations. The simulation reflected actual battle situations and the participants' behaviors approximated how they would behave in a real-life battlefield command and control situation. The Janus-Battle Focused Trainer was used to drive the training exercise. Janus was originally developed for analysis of nuclear weapons effects. Today, Janus is an interactive, multi-sided, closed, stochastic, ground combat simulation with an interactive mode of operation that allows commanders and staffs to exercise the decision-making process. (Donovon, 1997).

During the simulation exercise, two separate battlefield scenarios were enacted. In the first, the TOC conducted fire support for a divisional offensive combat operation. The scenario called for a battle during which the division would simulate moving into contact with enemy forces, making a hasty attack, breaching obstacles, and moving forward in a determined attack on enemy positions. The TOC was to plan and direct artillery fire support to suppress, neutralize, and destroy enemy forces who were trying to slow or stop the attacking divisional units.

In the second scenario, the TOC conducted fire support for a divisional defensive combat operation. In this scenario, the battle called for the division to respond to enemy penetrations of its lines by conducting area defense and counterattack. The TOC was to again plan and direct artillery fire support to suppress, neutralize, and destroy forces. The distinction this time was that the enemy was attacking and the division was defending.

Data Collection

The entire simulation exercise was carried out over a 14-day period. During these 14 days, the TOC participated in preparatory activities, simulated battle activities, and post-battle assessments of simulation events. Each simulated battle phase had early, middle, and end stages to the battle scenarios.

Data collection was designed and collected by Sonnenwald (1997). Videotape recordings of TOC personnel in action were made at periodic intervals on four of the 14 days of the simulation. Approximately 4-6 hours of activity in the TOC was captured on videotape on each of the filming days. Three cameras were used to photograph the key participants in the TOC as they prepared for and conducted their simulated combat operations. Cameras one and two (the two that were located at the greatest distances from the participants) were connected to omnidirectional microphones located close to the participants. These microphones were able to accurately record verbal interaction among the participants. The cameras ran simultaneously providing separate, but overlapping views of the activity. The videotapes captured TOC personnel communicating on both a social-emotional level and on a task level.

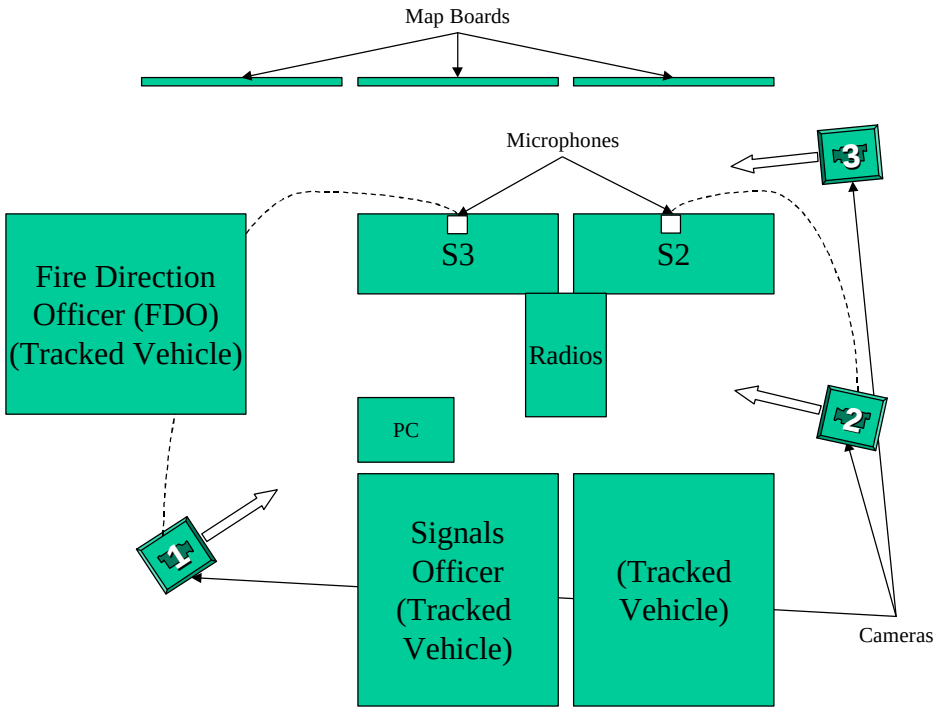


Figure 3: Camera and microphone positioning

Figure 3 above depicts the location of key participants as well as the locations of the three video cameras that filmed the activity. The S3 was always located at his desk, talking to the FDO to his left and the S2 staff to his right. Behind him on the radios were the Radio Telephone Operators (RTOs), junior personnel whose duty involved listening to specific radio frequencies and relaying on information to and from the S3. The Battle Captain, a junior officer who performed an executive assistant role to the S3, usually was located in front of the S3 and S3 tables.

Data Analysis

This study investigates information flow within a task environment. Using the position of the S3 as the focus of analysis, the study looked at the human information behaviors of individual team members as they acted, reacted, and were affected by the flow of information into, around, and out of the task environment.

Within the TOC organizational structure, the individual who occupies the position called S3 is the key actor. The S3 is the battalion commander's operations officer and he ideally should be the most well informed individual in the TOC. Accordingly, this study of information flow within the TOC focused on the S3. All information events analyzed for study involved the S3. All coded information events were events in which information either flowed into or out of the S3 position. Most of the events affected more than just the S3 position, but all coded events affected the S3.

The study did not seek to evaluate task proficiency of individual team members, nor did it seek to study team task proficiency. The study sought to look at how information flowing in the team's task environment, which in this case was the TOC, affected both the team and the team members engaged in performing the tasks.

The information events observed during the four-day exercise were characterized by using four separate analytic classification categories to code information events occurring in the task environment. The coding categories reflect in the approximate temporal order that an information or information event

occurs. The first category looks at how an information event arrives at an individual. The second category looks at how the event transitions from an input to an output. The third category looks at how the event departs from the individual. The fourth category looks at how the event affected the situational awareness needs of the individual. The categories are each distinct, but are closely interrelated.

The author of this paper coded the information events using the schema described in this section. He spent over 26 years as an officer in the U.S. Air Force and had extensive experience in command and control organizations, both during manual and computer simulations and during actual combat operations. Many of his command and control experiences consisted of both Air Force and Army personnel working together in the same organizational structure. His experience of “having been there” facilitated his ability to recognize and understand the environment under study and to analyze the data that was derived from the events under study.

Information environment

Events were coded first by categorizing how information manifested itself in the TOC. Table 2 shows how information events occurred in the TOC at three different levels, each level having slightly different areas of impact.

General	Omni-directional Everyone in the TOC can receive the information
Local	Single-point directed Everyone in the vicinity of the S3 can receive the information
Private	Point to point The S3 and some in the very close vicinity of the S3 may receive the information

Table 2: Information environment

General

Events characterized as “General” are events in which information manifests itself as an omnidirectional flow that everyone in the TOC may receive. General events are broadcast to everyone in the TOC, but not directed towards any individual in particular. They were intended for everyone in the total task environment. Figure 4 shows how a general event affected the TOC task environment.

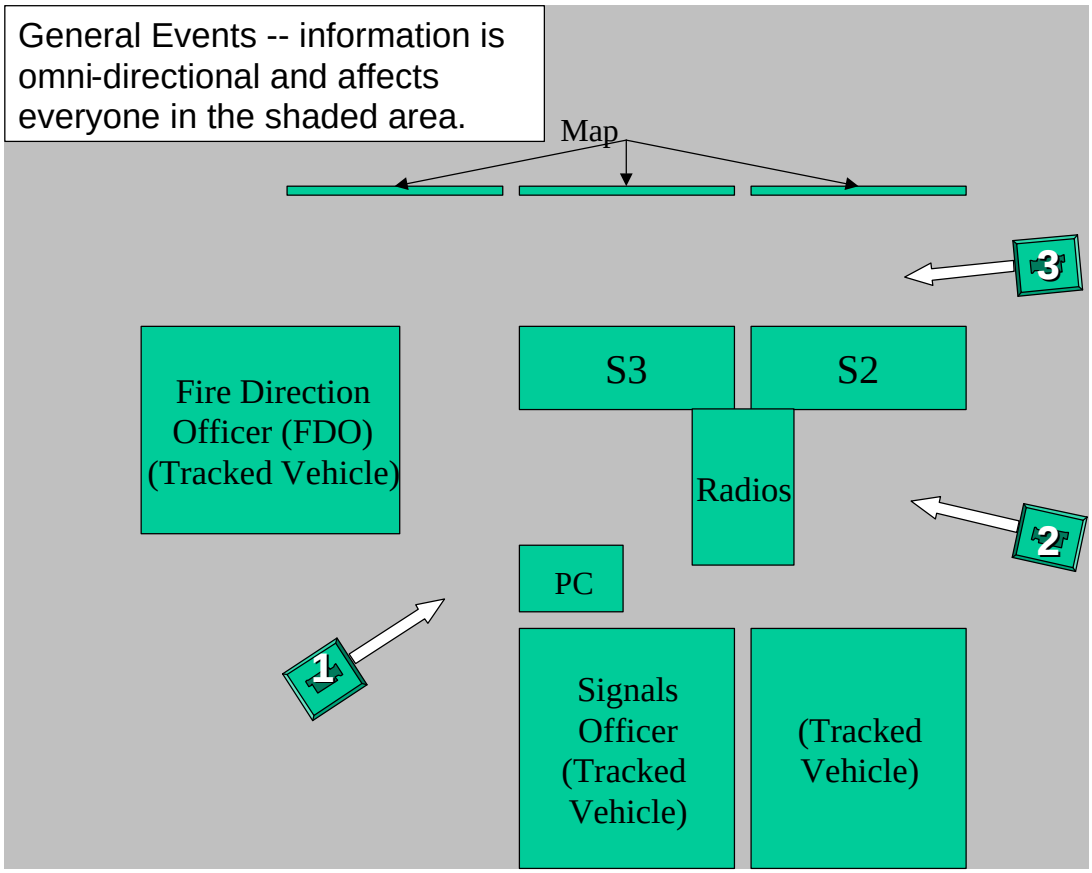


Figure 4: General event impact area

Local

Events characterized as “Local” were events in which the information manifested itself as a flow directed toward a single point or individual. While local events were directional, everyone in the general vicinity of the target of the information event was able to receive the information, whether or not it was intended for them. Figure 5, an illustration of the S3 local event impact area, illustrates how a local event may affect more team members than solely the intended recipient of the point-directed information.

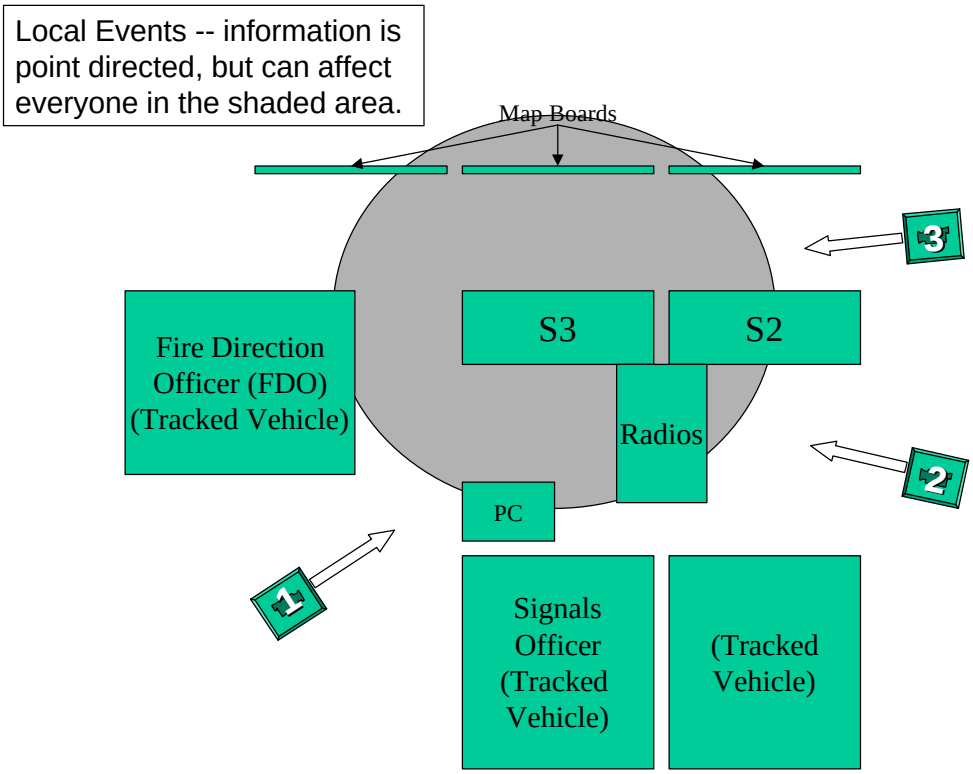


Figure 5: Example of a local event impact area

Private

Events characterized as “Private” were events in which the information manifested itself as a point-to-point flow. During the flow of private information events, individuals in the vicinity of the one or both of the two points (or the two termini) of the information event may have been able to also receive the information, even though it was not intended for them so to do. Figure 6 illustrates the conceptual impact area for a private information event. Even though the information was intended for one individual, the event could have an affect on others.

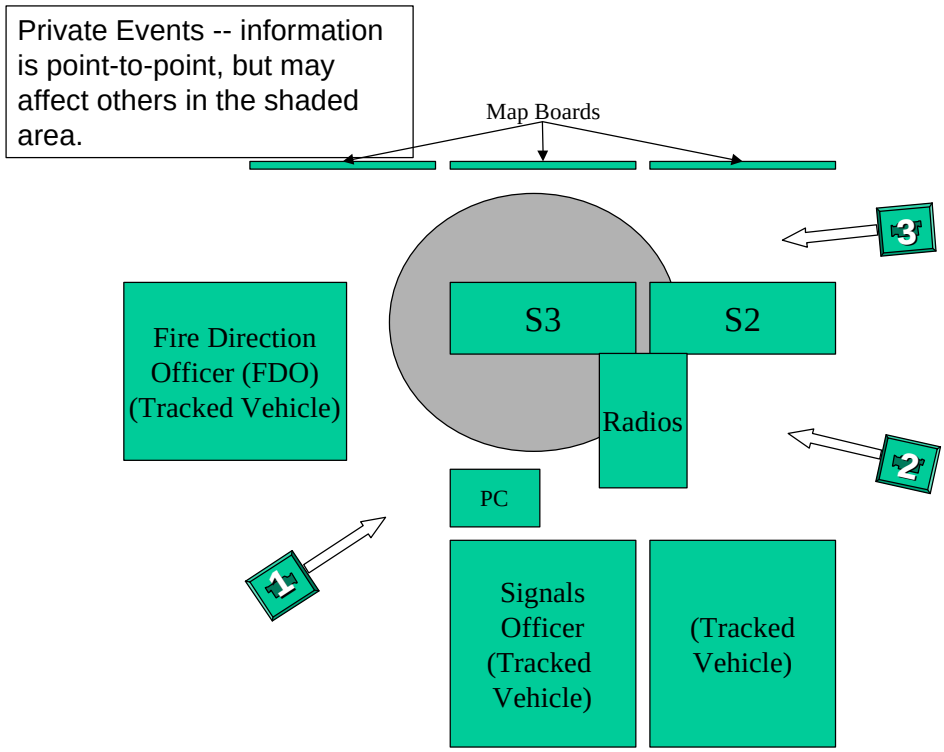


Figure 6: Example of a private event impact area

The information event environment codes distinguish an event by the spatial area in which it manifests itself. Information intended for a single individual in the environment may also be received by other than the intended recipient. The coding schema permits a characterization of the kinds of information flow in the TOC, enabling recognition of how often an individual member of a team is affected by an information event not necessarily directed at him or her. Discrete measurement of information flow to a particular position in the TOC may not capture the importance of serendipitous information events that the individual in that position may receive and be impacted by. Every event that involves the S3 in this study is coded for whether or not it was specifically intended for a single individual, a small group of individuals, or for everyone in the total environment.

Information event mode

Table 3 on the next page displays the second coding category. The information event mode characterizes the physical senses activated by each information event. Information flowing into a position in the task environment arrives at the position in one of four sensory modes where the individual who receives it processes it. When, and if, it flows out of the position, it departs in one of five sensory modes. The coding scheme is not symmetrical. Not every event that is received by the individual under study is acted upon. Some inputs do not transit the individual to be reborn as an immediate output. Each event was coded for the paired set of input and output modes displayed and the output mode could be nothing, or no observed response. In the information event mode

category, the source of the information event does not matter. This category captures only how the information was transmitted to the study subject and how the study subject subsequently disseminated it onwards.

Input	**Output**
Hear	(none)
	Say
	Write
	Look (at something in the environment)
	Non-verbal information
See	(none)
	Say
	Write
	Look (at something in the environment)
	Non-verbal information
Read	(none)
	Say
	Write
	Look (at something in the environment)
	Non-verbal information
Other Non-verbal	(none)
	Say
	Write
	Look (at something in the environment)
	Non-verbal information

Table 3: Information event mode

Most information events are thought of as spoken or written information that an individual may hear or read. Many significant information events, however, happen silently and privately as the study subject observes something in the environment. This second coding category captures those information events where the study subject notes something by seeing it. Such "seeing it" could be a purposeful look at a status board, an incidental glance at a co-worker, or a casual scan of the work area. This coding category also permits capture of non-verbal information such as when people signal to each other by touch unaccompanied by sight or sound.

Information event type

Table 4 on the next page displays the codes used to describe a information event in terms of the type of information observed as the event moved out of the receptor senses and into the transmission sense of the individual under study and then back into the information flow in the TOC. These codes are a direct application of Bales' (1950) *Interaction Process Analysis* schema. The fact that there is an ongoing tension in any group between the group need to accomplish its task and its members' need to attend to social or interpersonal processes is acknowledged and therefore coded using this schema. Although Bales built this analytical model almost a half-century ago, the inherent tension between "getting the mission accomplished" and "taking care of the troops" is well recognized as a fact of life in military organizations. The event type (positive versus negative, question versus answer, task versus social-

emotional) permits an analysis of how the study subject, the S3, is reacting to the flow of information through his position.

A. Social Emotional Area: Positive Reactions	**1.** Shows solidarity – raises other's status, gives help, reward
	2. Shows tension release – jokes, laughs, shows satisfaction
	3. Agrees – shows passive acceptance, understands, concurs, complies
B. Task Area: Attempted Answers	**1.** Gives suggestions – direction, implying autonomy for other
	2. Gives opinion – evaluation, analysis, expresses feeling, wish
	3. Gives orientation – information, repeats, clarifies, confirms
C. Task Area: Questions	**1.** Asks for orientation – information, repetition, confirmation
	2. Asks for opinion – evaluation, analysis, expression of feeling
	3. Asks for suggestion – direction, possible ways of action
D. Social Emotional Area: Negative Reactions	**1.** Disagrees – shows passive rejection, formality, withholds help
	2. Shows tension – asks for help, withdraws out of field
	3. Shows antagonism – deflates other's status, defends or asserts self

Table 4: Information event type

Information event effect on interwoven situational awareness

Since the analysis in this study builds on Stout and Salas' thought that team coordination behaviors are important, then the more that team members understand how their individual task situations fit into the team task situation, the better they may apply their individual skills and abilities to team tasks. Sonnenwald and Pierce's concept of Interwoven Situational Awareness (ISA) is built upon interpersonal and intertask relationships within the task environment. They observed that social and interpersonal concerns may be displayed in "dense social networks with n-way communication" of relevant information among team members. This density of information (often manifested in social,

interpersonal, or task-oriented information transmission) helps to create a shared, complementary, or interwoven situational awareness of the group task environment (Sonnenwald & Pierce, 1998, p. 22).

The fourth category portrayed in table 5 on the next page permits events to be coded for their effect on three types of awareness that all individuals in the task environment carries with them. Each information event could have had an effect on one, two, or all three of the awareness types noted below. Such an effect may occur for any of the individuals directly involved in the event or for other members of the team not directly participating in the event, but affected by the event by seeing or hearing it. However, as an event is coded, by the time it has moved into the third category (the Bales communication event type), it is an event tied to an individual. And, in this study, that individual is the person occupying the S3 position. Accordingly, an event was coded for its effect on awareness only for the individual at the heart of the event and for the individuals he directly communicated with.

(EA) Situational or environmental awareness	The event enhanced the individual's awareness of the current state of the activity inside the task environment, either within the TOC or within the combat environment outside the TOC
(DTCA) Domain, task, or content awareness	The event enhanced the individual's awareness of something of particular importance to his particular task
(IA) Interpersonal awareness	The event enhanced the individuals awareness of how a teammate was thinking or feeling, either in terms of social/emotional thinking or task thinking

Table 5: Interwoven Situational Awareness

Interrelationship of the four coding schemas

As noted earlier, these four coding schemas permit detailed analysis of each information event that comes out of the general information flow through the TOC and impacts on a single individual. The concentration here is on the non-stop flow of information and how that flow affects a single individual's ability to perform the task assigned to the position the individual occupies. The four schema serves as filters which capture each event as it manifests itself to the individual under study, assign it to specific input/output mechanisms (an individual may receive a information event through multiple input mechanisms and may pass it on through multiple output mechanisms), characterize the output side of the event in terms of its interactional value within the team setting, and

finally assess its impact on several concurrently occurring levels of situational awareness. The four filters enable each event to be minutely analyzed for its modality and for its affect.

Selection of coding sequences

Data for this analysis was drawn from videotapes of a TOC in operation. The tapes were shot on four non-consecutive days during a nine-day stretch and totaled 64 hours of tape, covering 24 hours of activity. Since this study is a microanalysis of information events in a simulated combat environment, the number of events per unit of time was quite large. During the development of the methodology it became clear that it would be impractical at present to attempt to code every information event captured on all the tapes. Accordingly, ten tape sequences were selected for coding.

The initial coded sequence took place before simulated combat had begun. During this sequence, the S3 spent most of his time considering how he wanted to structure the physical environment of the TOC in order to maximize his ability to exercise his command and control responsibilities.

The nine other coded sequences took place during simulated combat operations. Each sequence covered a fifteen-minute period of time. Three simulated combat sequences were coded on the first day of activity and two simulated combat sequences were coded for each of the three other days of activity. On each day, the first sequence took place early in the time cycle of the combat operations simulation, and the second sequence took place late in the time cycle. The third sequence coded for the first day of activity took place at

about mid-cycle in the combat operations simulation. Table 6 below illustrates the four days of taping activity and the periods of time that were selected for coding.

Time Periods	0900	1000	1100	1200	1300	1400
14 July Taping						
Battle Phase	Preparation		Offensive Maneuvers			
Coded Blocks	P	1		2	3	
Note: The coding block "P" above was an observation of activity during the preparatory time before the battle phase. The analysis to follow, however, includes only the nine coding blocks that occurred during the combat simulations.						
16 July taping						
Battle Phase	Offensive Maneuvers				Offensive	
Coded Blocks		4			5	
18 July taping						
Battle Phase	Defensive Maneuvers					
Coded Blocks		6		7		
23 July taping						
Battle Phase	Defensive Maneuvers					
Coded Blocks		8		9		

Table 6: Taping and coding sequences

RESULTS

Quantity of Events

The sheer volume of information events flowing through the S3 position is noteworthy and is illustrated in the charts to follow. Table 7 below depicts the legend used for the coding sequences used in figures in this section.

X Axis	Coding Sequence
1	14 July, 1050-1105
2	14 July, 1230-1245
3	14 July, 1350-1405
4	16 July, 1050-1105
5	16 July, 1320-1335
6	18 July, 1050-1105
7	18 July, 1230-1245
8	23 July, 1050-1105
9	23 July, 1240-1255

Table 7: Legend used for figures in the Results section

During the nine simulated combat coding sequences, the number of information events ranged from 30 to 54 per 15-minute sequence. The mean number of information events per coded sequence was 45.5. The number and mean are displayed below in figure 7. The mean may also be expressed as 3.04 events occurred each minute, or one information event occurred each 19.7 seconds.

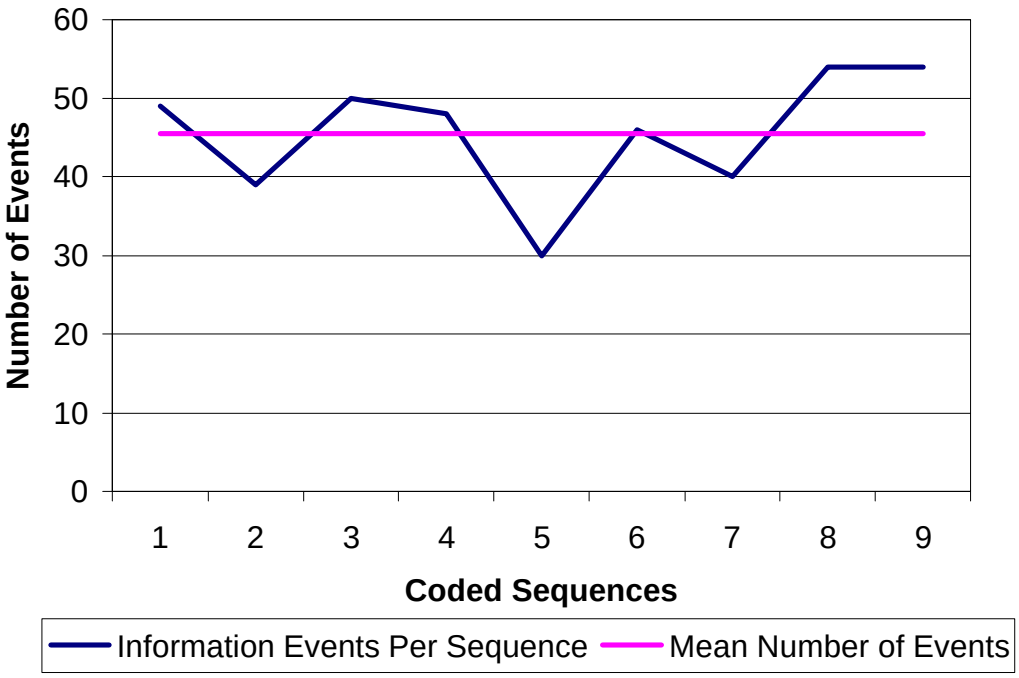


Figure 7: Information events

In eight of the nine sequences, the number of information events that occurred was within 10 of the mean. The only sequence in which the number of information events did not come within 10 of the mean was the second coding sequence on 16 July where only 30 events were noted. If this sequence is set aside as an anomaly, then the mean number of information events per 15-minute period climbs to 47.5, or 3.17 events occurring each minute, or one information event occurring 18.9 seconds. Figure 8 below illustrates the results of eliminating the anomalous sequence.

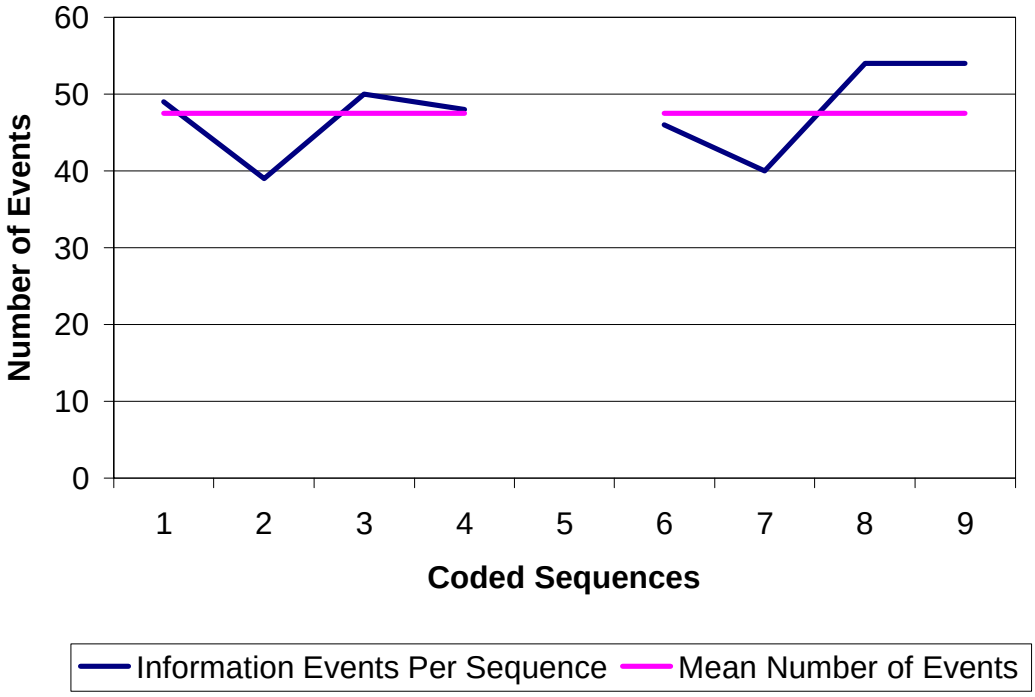


Figure 8: Information events without the abnormally low sequence

This pattern seems to indicate that the flow of information events during a combat sequence could well be characterized as sudden bursts of information, interspersed with periods of less information. Alternative characterizations could also include cyclical patterns tied to the activities of the combat units controlled by the TOC or increasing/decreasing patterns tied to the timing of the battle decision cycle. The short time spans covered by the coded sequences in this study do not permit a definitive answer and instead point towards a possible need for an elongation of the coding sequences to cover an entire combat cycle.

The pattern of information events did not remain constant across time during the 15-minute coded sequences. While most events were of short duration and occurred in close proximity, other events lasted over a minute. The highest number of events that occurred in any single coded minute was six and the fewest was zero. On those occasions when zero events were coded during a one-minute period, an event that had begun in the previous minute continued through the subsequent minute. There was no single sixty-second span of time during any of the coding sequences that an information event did not occur. Figure 9 below depicts the range of high and low numbers of information events per minute.

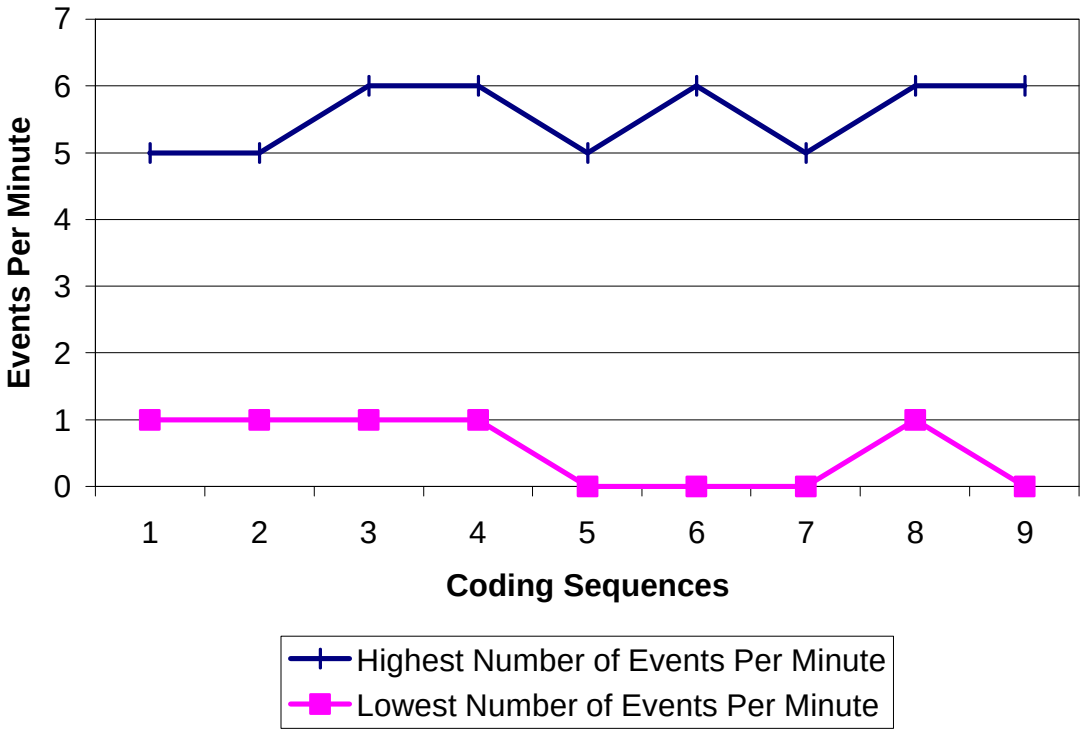


Figure 9: Information events per minute

The number of information events that occurred in an single minute was not seemingly tied to any particular cycle, but rather most often had to do with the

manner in which the S3 had to deal with individual events as they occurred. Depending on the context of the event, the S3 had to spend a varying amount of focus and time on the event.

The pattern of events was uneven. Figure 10 depicts a typical coding sequence, the initial combat coding sequence on 14 July. As explained in subsequent sections of this paper, when events occur in close proximity to each other, they are often events that tumble in on the S3, hitting him from all sides simultaneously.

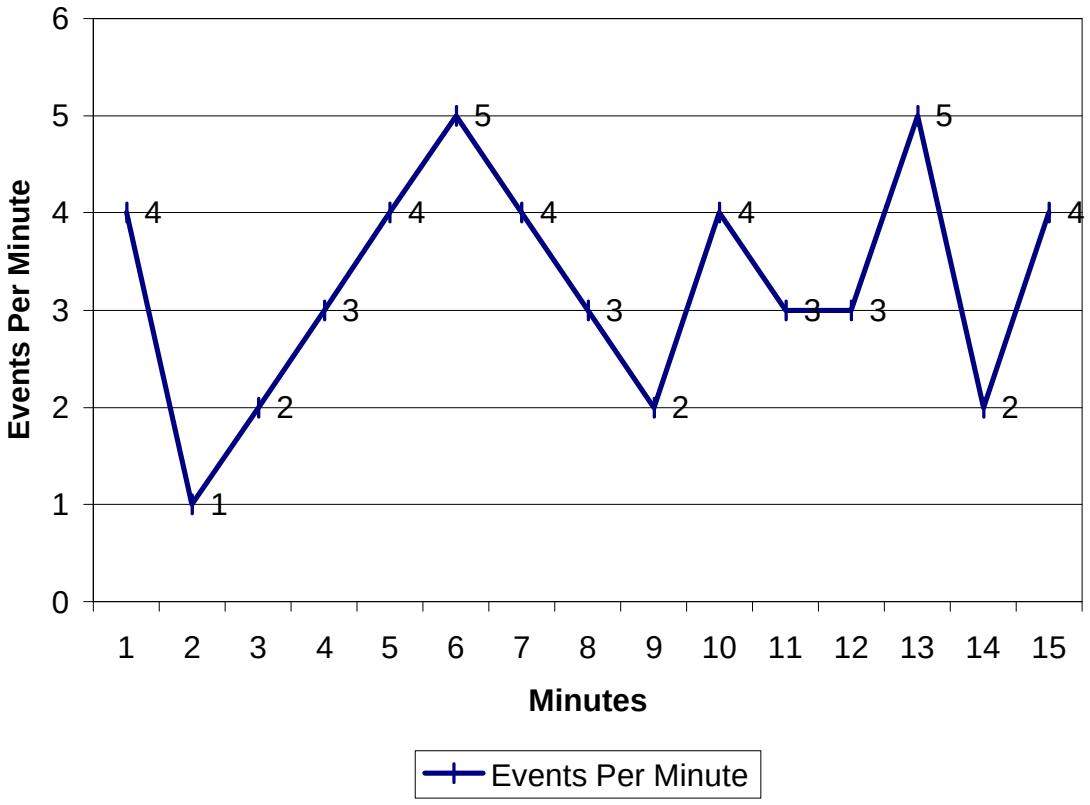


Figure 10: 14 July, first coded combat sequence

All in all, the TOC is an information-rich environment. The flow of information to any particular position is fairly constant, with information arriving from all sides and at all times. An examination of the information event environment illustrates this fact.

Event Environment

As noted in the foregoing methodology section of this paper, information flowing into the TOC can arrive at the S3 position in one of three manifestations, General, Local, or Private. During the nine coded simulated combat sequences, a total of 410 separate information events were noted at the S3 position. While each event arrived at the S3 in one of the manifestations, it also departed the S3 in one of them as well. More often than not, an event that manifested itself as affecting a Private information environment may well have departed affecting a Local environment, depending on how it was transmitted. Accordingly, since each of the 410 events did not affect the same information environment in the same form as they arrived and departed the S3 position, and since each did not necessarily change form as it transitioned from arrival to departure, the number of coded event environments fell between 410 and 820. Figure 11 atop the next page shows a breakdown of the 637 different event environments through which the 410 information events transitioned during the nine coded simulated combat sequences. Figure 12 shows the same data expressed in percentages.

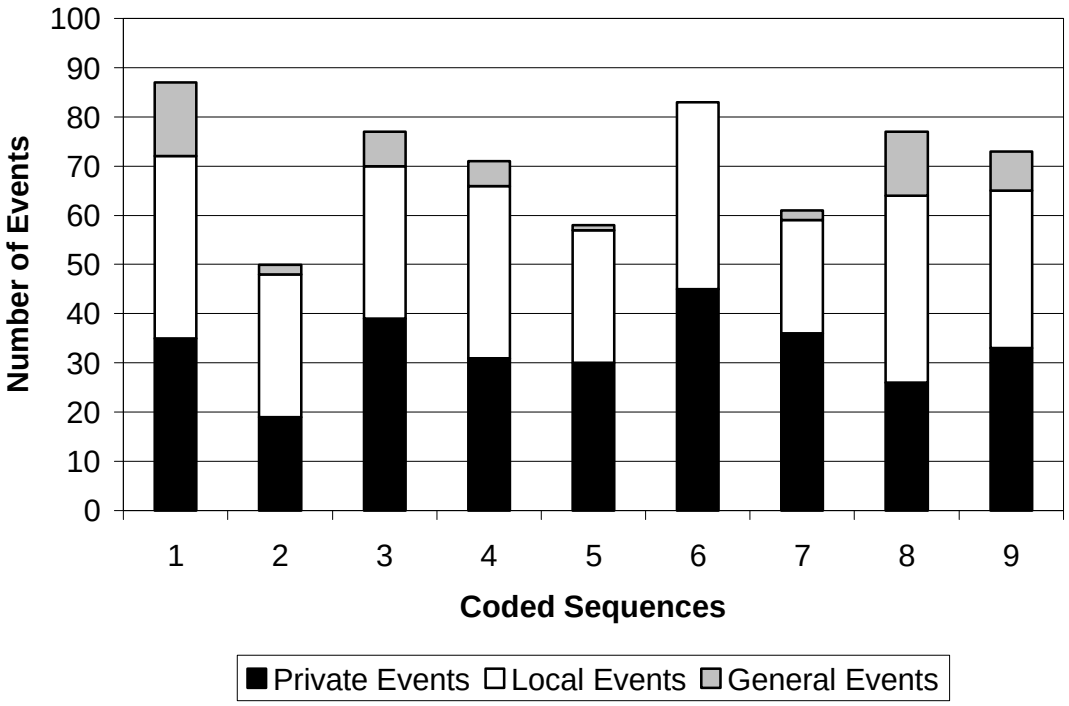


Figure 11: Information events by information environment

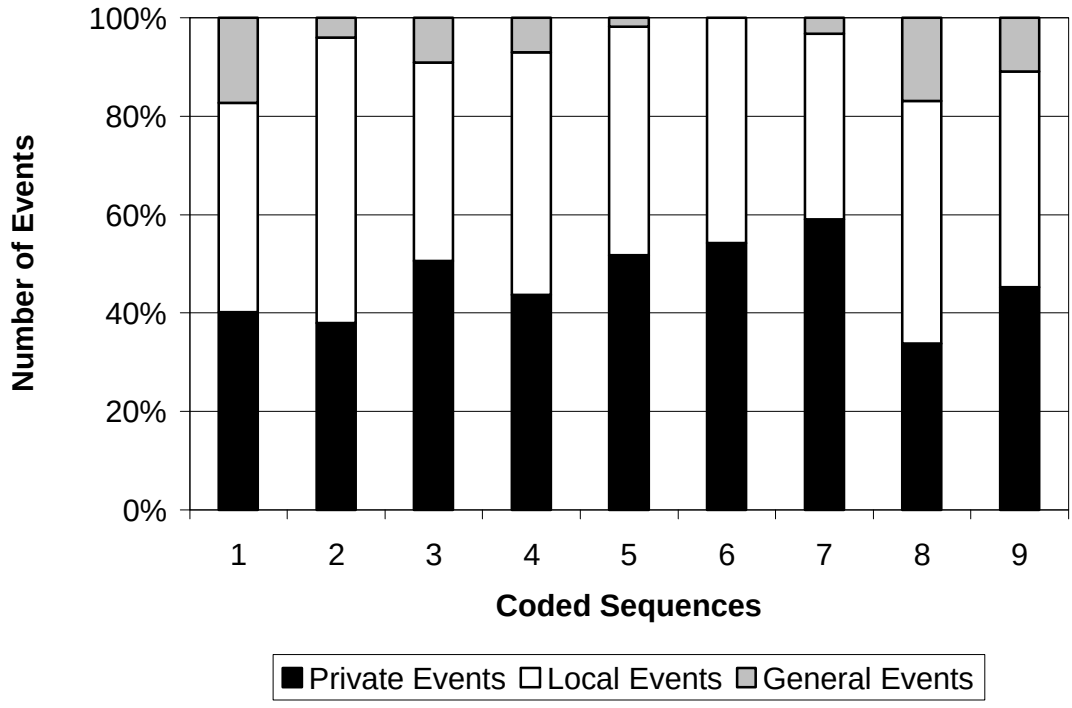


Figure 12: Percentage of information events by environment by sequence

Events that affected the general environment were the least observed (53 of 637). Only 8.3% of the events seen in the nine sequences were General events. An event that affects the general environment has the ability to affect more individuals in the TOC task environment, but far fewer of the events that involved the S3 were also events that affected everyone else in the TOC as well.

The majority of events affecting the S3 were about evenly spread between Local and Private events. Of the total 637 information events that affected an information environment, 290, or 45.5% of the total, affected the S3's local environment and 294, or 46.2% of the total, affected the S3's private environment. Very often, the S3 received a piece of information in a private manner and then broadcast it to his local area so that others in the vicinity would receive it.

Since almost half of the events involving the S3 were local and thus simultaneously available to other individual in his vicinity, the S3 did not need to rebroadcast the information to ensure fuller dissemination. In a future C2V information environment, a future S3 might feel a need to continually check to see if others also received some information if it was not specifically sent to them, but the S3 felt they might need to know it. Future information system planners may well need to ensure that information be made available to a much wider set of recipients. Those who "might need" to receive some information for a future, currently unrecognized need, could well be as important as those who "must" know something for a specified, currently identified need. The "local event impact area" will need to be modeled in the C2V information systems structure.

Input Senses Used

Every event in the TOC information flow that affected the S3 position was perceived in one of four ways – through hearing, through seeing, through reading, and through other non-verbal stimuli. While an individual obviously "sees" when reading, the distinction between seeing and reading in the coding schema was that reading involved the reading of a written communication. That written communication could have been in a book, on a sheet of paper, or on a computer screen. In every case where an information event was coded for having been perceived through reading, the S3 read the information in one of the three above formats. It is also obvious that an individual "reads" maps and "reads" the text written on status boards. However, for the coding schema, if the S3 looked at a map or a status board, the event was coded to show that the information was perceived by having been seen, not by having been read.

During the nine coded simulated combat sequences, 410 separate information events were noted. Because an event may be perceived through multiple senses simultaneously, each event was coded for each sense activated. Accordingly, the 410 separate information events were coded as 601 sense activations. Of the 410 events, 108 (or 26%) were perceived by more than one sense simultaneously. Figure 13 on the next page depicts how these 601 sense activations were divided among the four perception categories.

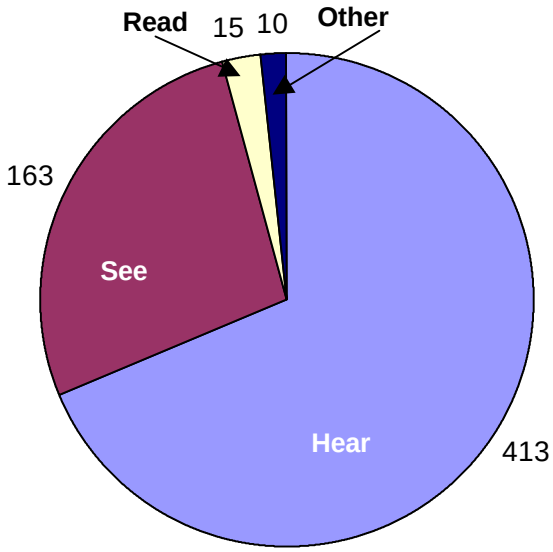


Figure 13: How information events were perceived

As Figure 13 above indicates, by far the sense of hearing was used most for perceiving information events. Expressed in terms of percentages, 68.7% of all information events came to the attention of the S3 through his having heard them. A little over a quarter of all events (27.1%) were perceived by having been seen, while information came to the S3 via having been read only 2.5% of the time. Relatively few information events (1.7%) were initially perceived by other senses. Usually, an event that was not perceived by either hearing, seeing, or reading, was perceived by the S3 when he seemed to sense the presence of something without directly looking at the something or without seeming to hear the something. A typical example was when the S3 felt the presence of another individual and turned to speak to him.

This seems to indicate that auditory input is key to information flow in the current TOC environment and since so much of the information that flows into the TOC comes in the form of radio calls, the observation does not come as a surprise. The S3 did, however, display a human inability to concentrate when multiple people were talking directly to him simultaneously whereas he was able to perceive information simultaneously through multiple senses. In modeling a future C2V information system, some consideration might be given to converting voice inputs into some other input method so that they may be perceived more quickly. One potential option would be to use voice recognition to automatically convert voice inputs into text form although a perhaps better option may be to automatically convert voice inputs into map displays which can be rapidly perceived through the visual channel.

Output Senses Used

The S3 was not only affected by information events, he also contributed to the information flow by generating events in order to affect some part of his task environment. Again here, the 410 discrete information events that were noted occurring during the nine coded simulated combat sequences resulted in more that one output sense being activated per event. The S3 generated 603 information outputs. Events that were initiated by the S3 occurred in four output modes – speaking, writing, looking, or other non-verbal. Some events generated one or more output modes. In 20% of the information events (82 out of 410), the S3 used more than one output mode simultaneously.

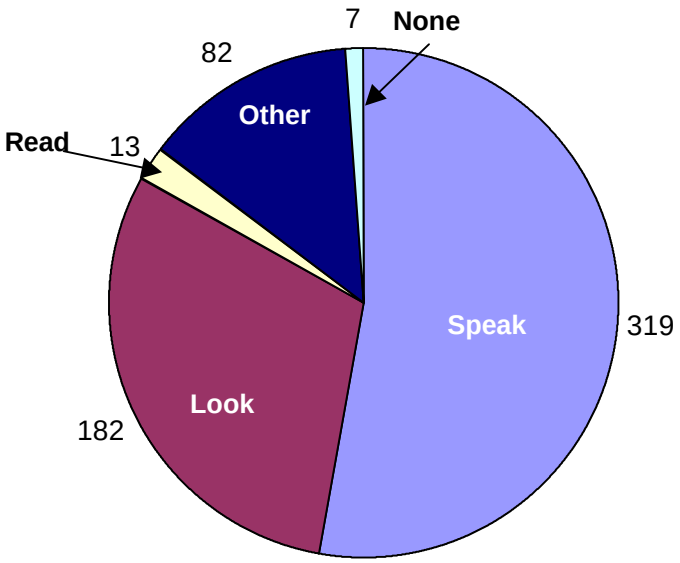


Figure 14: How information events were disseminated

As figure 14 above illustrates, most of the information events that the S3 initiated were spoken communications. The preponderance of initiated spoken information (52.9%) roughly matches the preponderance of perceived heard information. Initiating an event by looking includes behaviors such as looking at the map to orient himself to what he heard on the radio or looking at an individual to identify what the second person was doing made. As was the case with the perception side of the information event where seeing an event came in second, the initiation side shows looking as ranking second (30.2%). However, unlike the perception side, information events initiated through writing ranked fourth (2.2%) whereas non-verbal methods came in third (13.6%). Most of the non-verbal methods of communication involved the S3 indicating acknowledgment or agreement with a head nod or disagreement with a headshake. Many of these non-verbal events were directed at a particular individual while the S3 was in verbal communication with a second individual. These non-verbal communications were an efficient means of conveying unmistakable information with little effort. These are very natural behaviors in the current person-intensive environment of the TOC, but will be problematic to model in a distributed C2 system where most personnel will not be able to see each other.

However, on seven occasions, an information event that was perceived by the S3 did not result in any corresponding event being generated or initiated by the S3. On those seven occasions, he just took in the information and did not generate any output. Every event that the S3 inserted into the TOC information flow was initially begun by a stimulus of one of the senses on the perception (or

input) side of the event. While it is entirely conceivable that an information event can be initiated by an individual, can be generated from something internal to the individual without any external stimulus, this situation did not occur with the S3 during the nine coded simulated combat experiences. Every event he initiated was a result of some input he received. The volume of information events swirling around the S3 seemed to compel him to react to them. The situation did not call for, nor did it enable reflective behavior and self-initiated information events.

The Eyes Have It

No matter how much information came to the S3 through auditory channels, little of it had immediate impact on him until he could confirm it with his own eyes. Out of 413 information events that the S3 perceived by hearing them, he used his eyes 113 times to confirm what his ears had told him. For the S3 inside the TOC, the map and status boards in front of him were his external reality. Anything he perceived about the task environment outside the physical confines of the TOC had to be confirmed by fixing its location on the map in front of him. The S3 had very few negative verbal exchanges with individuals in his vicinity, but those that he did have most often involved his concern that information be accurately plotted on the map. Additionally, he was insistent that the information be plotted in a standard format and that there be no inadvertent double plotting of any information. For the S3, an information event did not become complete, did not become totally real, until he could fix its location on the map.

The eyes had another constant role for the S3. Whenever he had a lull between information events, he created his own information event by visually scanning his local environment. Over the course of the nine coded sequences, the S3 visually scanned his environment on average once every two minutes. His standard pattern was to look from one side to the other to see who was there and what they were doing. His behavior was entirely analogous to the behavior of a jet pilot, constantly rotating his head to see who and what is in the sky around him. The process of looking continually updated his situational awareness of the situation inside the TOC. The S3 continually scanned his physical environment to check on the status of people, on what they were doing, looking to see if their actions had created any information that the S3 might need to know, but which had not come to him yet. If information did not come to him, the S3 went to find it and he did it primarily by looking for it. In the future, such information seeking behaviors may well require other senses and affordances if the role of the eyes is to be replicated.

Multitasking

Information flow in the TOC is constant and multifaceted. At any given time, the S3 was barraged by simultaneous input. It may have been unique to the individual under study in the videotapes, but the S3 often had three or four people transmitting to him at the same time (the FDO from his left, the S2 from his right, the Radio Telephone Operators, or RTOs, from his right rear, and an unseen speaker over the radio handset he held to his ear). He often confirmed what he was hearing from one, some, or all of them by looking at the map and/or

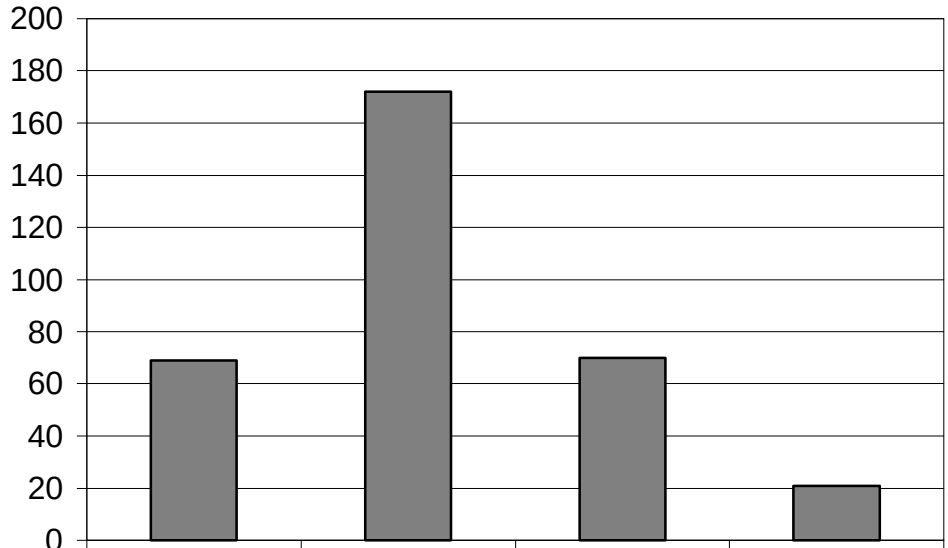
status boards to his front in order to get a sense for the actual location of the activity being mentioned by one, some, or all of the speakers. He often captured several people doing things in one glance.

He seemed comfortable coping with multiple simultaneous, or parallel, inputs which either came to him aurally or visually. However, the S3 was limited in his ability to disseminate information. While he seemed perfectly capable of listening to several auditory inputs simultaneously, on occasion he could not cope with several people talking directly to him at the same time. Perhaps it was because he needed to gather his thoughts in order to be ready to respond to one of the speakers, on occasion he had to stop the parallel talking and line them up in serial format in order to deal with them. He usually dealt with a single thing at a time. Whereas he was able to use parallel perception of information, he had to disseminate information in a serial manner.

Event Types

Analysis of the role of the senses involved in perceiving and disseminating information revealed that there were more sensory activations than there were discrete information events (410 discrete information events generated 601 sensory inputs and 603 sensory outputs). Analysis of the type of information event revealed the reverse. Each event was coded using the Bales *Interaction Process Analysis* schema (see table 4). However, many of the S3's information events were internal to himself and did not involve an interaction with any other individual. On numerous occasions, the S3 perceived an event that was not necessarily intended for him in particular, often by overhearing a conversation or a radio exchange. On the output side, the S3 often generated an information event that did not affect anyone other than himself. An example of the latter is when the S3 heard something and looked at the map to orient himself. In neither the input nor the output examples mentioned here did the S3 have an exchange that can be coded as an "interaction" with anyone else in his information area. Accordingly, the 410 discrete information events noted in the nine simulated combat sequences resulted in 332 interactions between individuals in the TOC.

Figure 15 on the following page illustrates how the 332 interactions were divided among the four major sub-areas in the schema.



	Social-Emotional: Positive	Task: Answers	Task: Questions	Social-Emotional: Negative
Number of Types	69	172	70	21

Figure 15: Information event type

As may be noted above, task issues occasioned most of the S3's information exchanges. Most of his effort during the nine simulated combat sequences was focused on fighting the simulated battle the TOC was engaged in. A smaller number of information exchanges were involved with social-emotional issues, probably because the simulated combat situation required a primary focus on the task at hand. However, it is interesting to note that the positive social-emotional exchanges almost equaled the number of exchanges involving the S3 asking task-related questions. On the surface, this seems to imply that, at least in this TOC during this period of time, that positive social-emotional exchanges may be as important as gathering information through

questions. Further investigation is required to understand the role of interpersonal social-emotional supports in a future C2V environment. Since fewer people will be involved and since they will have less personal contact with each other, will fewer social-emotional exchanges be required? Or, conversely, will performance degrade if the vast bulk of information exchanges between C2V personnel consist solely of task-related digitized transmissions? This study did not provide any definitive answers, but did seem to indicate that more study is warranted on the role of social-emotional support in next generation information systems.

In terms of task-related interactions, the S3 was far more often providing answers to queries than he was initiating queries of his own. It must be noted, however, that many of the "answers" provided by the S3 were in the form of acknowledgment that he had received and understood an information event. The transmitter of such events was thus able to confirm the successful accomplishment of an event through the S3's answer/acknowledgment.

In terms of social-emotional interactions, the S3 had over three times more positive interactions than negative interactions. While this may well be reflective of the personalities of the S3 and the people he interacted with, it is also likely that it is reflective of the organizational structure of the TOC, where most every individual knows and understands his role and responsibilities. The particular group under observation had worked together in similar situations before and knew each other. Figure 16 below shows how negative interactions spiked on several occasions.

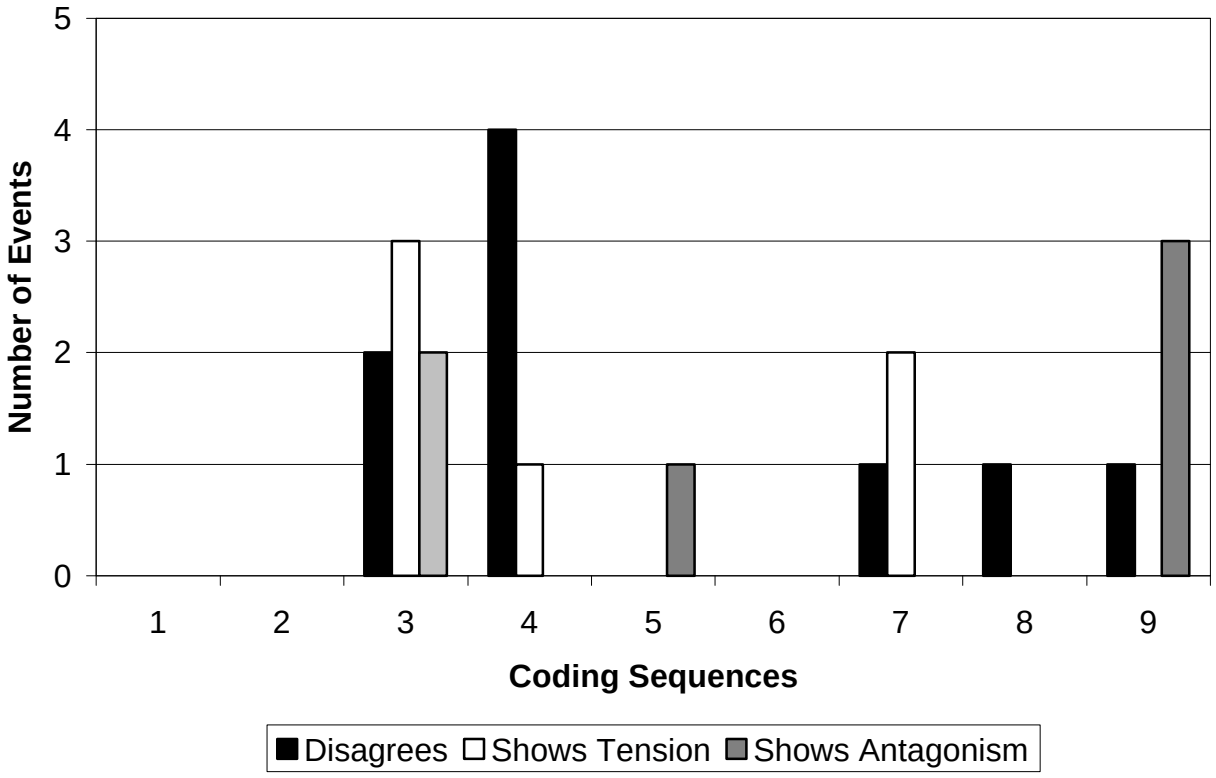


Figure 16: Negative social-emotional interactions

In the third coding sequence, the S3 became irritated when another individual in the TOC was not paying close enough attention to the specific task at hand. In the fourth sequence, the S3 engaged in an exchange with a soldier during which the S3 indicated that the soldier had an incorrect understanding of the situation. In the ninth coding sequence, the S3 had a difficult exchange with the same soldier who had irritated him during the third sequence, finally having to take away the soldier's task autonomy by telling him that the task would be done in accordance with the S3's desires, not the soldier's. Interestingly, in the immediate aftermath of the negative exchange, after the soldier had departed the immediate area, the S3 purposefully rebuilt the soldier's status among the TOC

personnel who had witnessed the negative exchange. The S3 clearly told the others (who were the soldier's superiors, peers, and subordinates) that the soldier had been technically accurate and correct in his desires, but that the S3 had felt that the task facing the TOC had compelled him to limit the soldier to a more circumscribed set of acceptable actions.

The Bales schema used in this part of the analysis of information flow in the TOC broke down events into Task or Social-Emotional groupings. Each of these two groupings was further decomposed into positive and negative, answer and question categories, which were each decomposed into three behaviors each. The twelve behaviors were then combined into six paired groupings to identify the problems each pair of interactions was focused on. Table 8 on the next page illustrates the decomposition and the grouping into the six pairs.

Social-Emotional	Positive	Solidarity	Integration
		Tension release	Tension management
		Agrees	Decision
Task	Answer	Suggestion	Control
		Opinion	Evaluation
		Orientation	Orientation
	Question	Orientation	Orientation
		Opinion	Evaluation
		Suggestion	Control
Social-Emotional	Negative	Disagrees	Decision
		Shows Tension	Tension management
		Antagonism	Integration

Table 8: Bales' category grouping

When the 332 event categories captured in the nine coded simulated combat sequences were analyzed in light of the paired categories, the results were as illustrated in Figure 17 on the next page.

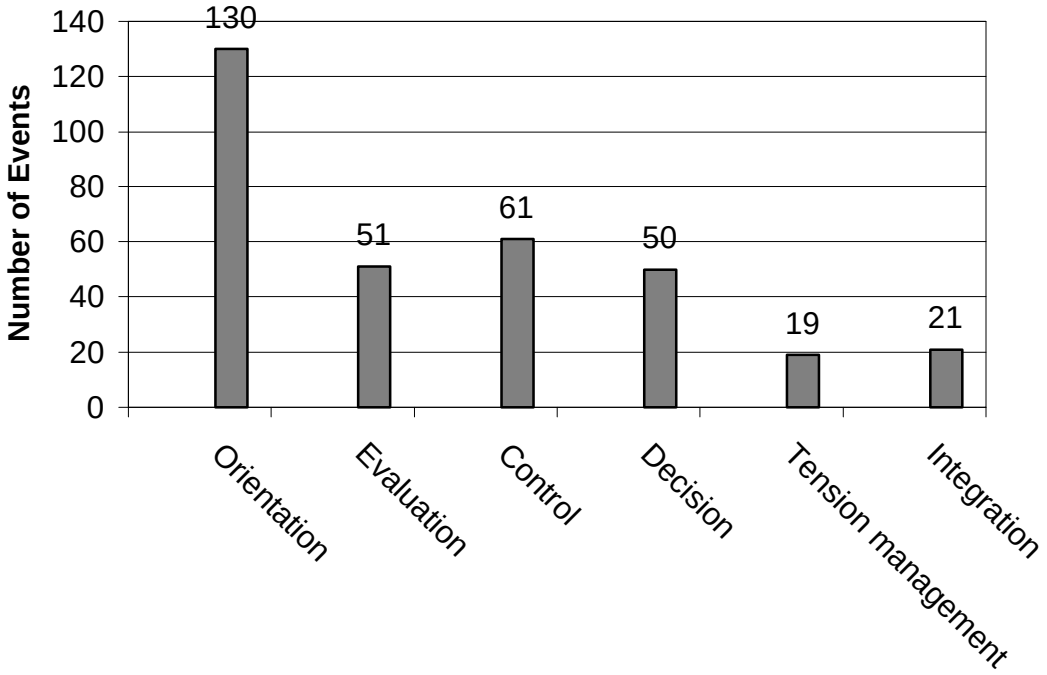


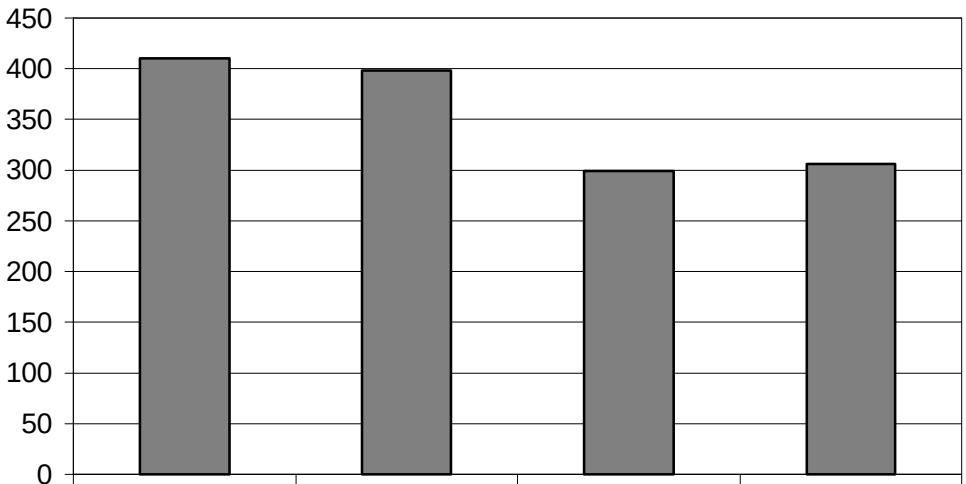
Figure 17: Event types by problem area

Figure 17 shows fairly clearly that the S3, as he conducted a simulated battle, engaged in task behavior most of the time. Task problem areas (orientation, evaluation, and control) ranked first, tied for third, and second in the number of times they happened during the nine coded sequences. The bulk of the information events required the S3 to understand his situation, weigh options, maintain control, and decide on what to do. These four problem groupings fit easily with the Army's description of command and control as "…planning, directing, coordinating, and controlling…." (U.S. Army, 1997).

The largest number of information exchanges involved orientation task behavior as the S3 sought to keep abreast of the situation he was in. This fact leads directly into consideration of interwoven situational awareness.

Situational Awareness

Figure 18 below illustrates the number of events coded during the nine simulated combat sequences and how many of the events were coded for the three levels of situational awareness. It is clear from the chart that most information events had an impact on several levels of the S3's situational awareness.



	Total # of Events	Environmental Awareness	Domain, Task, or Content	Interpersonal Awareness
Situational Awareness	410	398	299	306

Figure 18: Situational Awareness

An event in which the FDO told him about a firing battery and the problems it was encountering simultaneously affected all three of the S3's situational awareness areas. It affected his Environmental Awareness by telling him something about the task environment outside of the TOC in which he was operating. It affected his Domain, Task, and Content Awareness because it added something to his knowledge about the artillery system in use and of what he had to do in his specific job. This was especially true in this simulation

because participants were testing procedures for the use of a new type of weapon system, and the weapon system's firing capabilities in operation were not fully known by the participants.

And it affected his Interpersonal Awareness because each exchange with the FDO allowed the S3 to size up how the FDO was feeling and behaving. The number of interpersonal awareness events highlights how much of what the S3 does involves understanding how his subordinates are feeling. Since the S3 was the leader of the TOC and thus had to care for and about all the personnel who work in the TOC, almost any event that affected the S3's Interpersonal Awareness also had to affect his Domain, Task, and Content Awareness as well. Further study might well be needed to see if such interpersonal awareness is needed in future C2 systems. If, as the author of this paper suspects, it remains a constant that superiors and commanders will need to maintain a high level of interpersonal awareness on the future battlefield, some planning consideration must be given to finding a way to use digital transmission tools to share interpersonal awareness information.

Of the 410 events in the TOC information flow that affected the S3 during the nine coded sequences, most of them had an affect on his environmental awareness. This ties back to the task orientation illustrated in the event type discussion in the previous section of this paper. Most of the information events that the S3 participated in were directly related to the tasks he and the TOC had to accomplish. It is therefore little surprise to see that 97% of the events had an affect on his understanding of the task environment.

Over the course of the nine coded sequences, the relative importance of each of the three types of situational awareness remained fairly constant. Environmental Awareness always remained the most important, but the other two awareness categories switched off in importance. As might have been expected, whenever Interpersonal Awareness climbed into second place, the S3 was interacting more with the personnel in the TOC. Whenever Domain, Task, or Content Awareness climbed into second place, the S3 was interacting more with personnel external to the TOC (most of the exchanges with external parties took place over the radio). Figure 19 on the next page illustrates the trends over the period of the nine coded sequences.

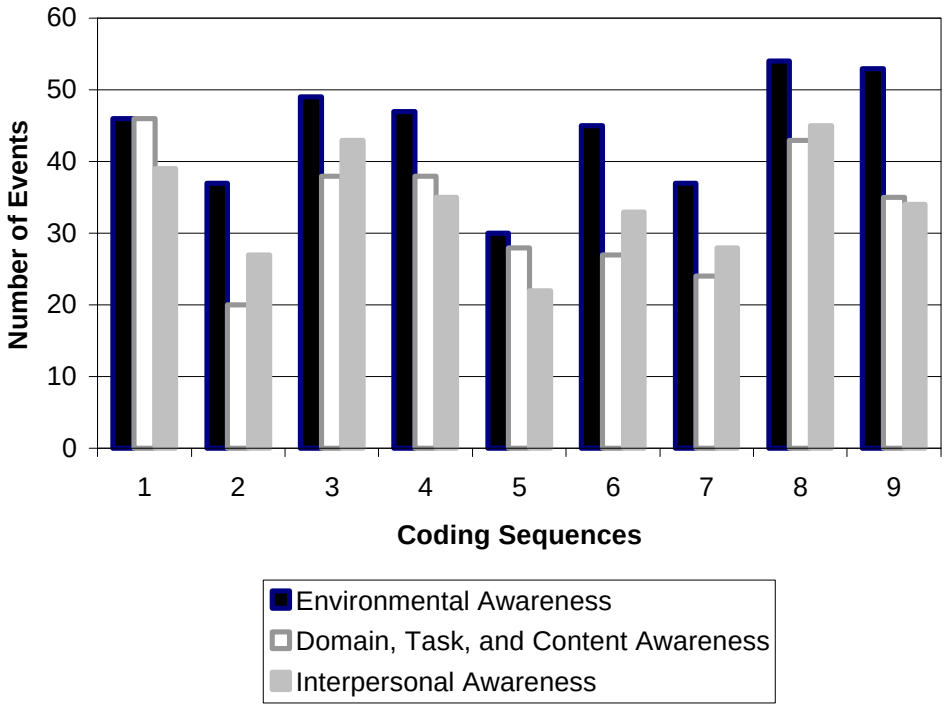


Figure 19: Situational Awareness trends

Serendipitous awareness of information contributing to enhanced situational awareness

The S3 was interested in everything that occurred within the TOC. However, not all the information flowing in the TOC was explicitly directed to his position. Whenever he was not specifically engaged in an information exchange with anyone, the S3 kept his eyes in constant movement, rotating his gaze from left to right across his environment, noticing what everyone from the FDO to the map plotters to the S2 to the RTOs were doing. Just as he kept his eyes constantly working to look for information, he also kept his ears working to pick pieces of information out of the flow. On several occasions, he heard some information being exchanged between other individuals in the TOC and, recognizing that something in the exchange could conceivable cause a problem later on, interjected himself into the conversation to correct the situation. An

example of this occurred on 16 July at 1053. While he was engaged in disseminating some task instruction to the RTOs, he heard a discussion ongoing to his right. Something in the conversation indicated that someone in the group did not fully understand a procedure. The S3 interjected himself into the conversation to correct the misunderstanding and to explain the reasons why correct procedure needed to be followed. In most incidents like this one, it was a serendipitous piece of information that he plucked out of the flow, a piece that was not intended for him, but one that had a bearing on his Domain, Task, and Content Awareness. His ability to capture such pieces of information allowed him to correct small problems before they became larger ones. This appears to be important to the S3's (or, for that matter, to any supervisor's) performance. Further study is needed to understand if this capability is needed in the C2V environment and, if it is, how to model it into the future C2V information systems.

Multiple levels of Situational Awareness

Situational awareness may be conceived of as a series of levels of consciousness, each level encompassing a different conceptual area. Each level overlaps other levels in some areas, but usually is not perfectly coincidental with any other level. One may visualize the concept as a series of transparent overlays on a map. A person's levels of situational awareness are these overlays. All overlays cover the conceptual location of the individual and may cover large areas that other overlays also cover. Figure 20 on the next page attempts to portray the concept graphically.

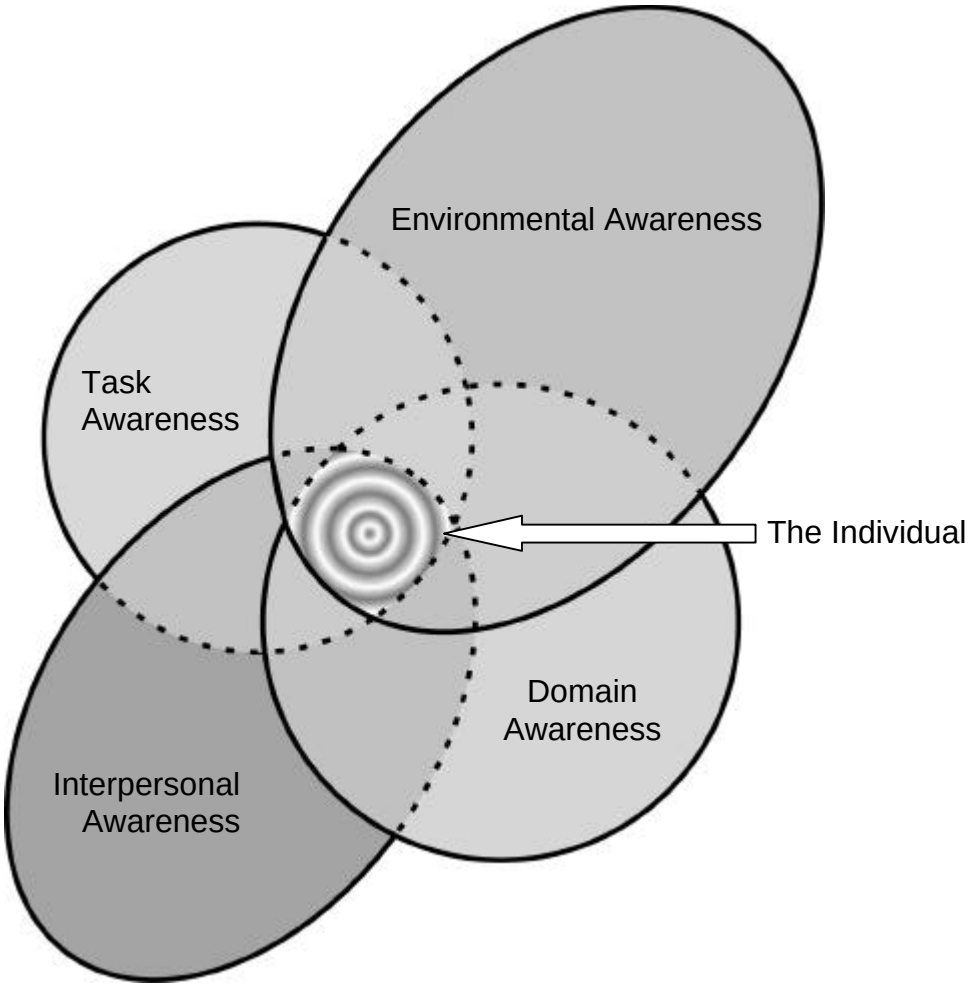


Figure 20: Multiple levels of Situational Awareness

In the TOC situation, the S3 was constantly and simultaneously aware of his situation in numerous different dimensions. He was continually measuring how well the other personnel in the TOC were performing their tasks at the same time he was checking on how they were feeling and behaving. For him to do his job as the boss of the TOC, he had to know how the other personnel were acting and reacting. He had to make spot corrections or do some instantaneous instruction whenever a subordinate was performing a task in an inadequate or

less than optimal manner. He had to know what they were thinking, had to continually question them to ensure he had a sense of their situational awareness.

He was also continually monitoring the outside world, usually by listening to radios, either directly through a handset or indirectly through the RTOs assigned to listen and report to him. His environmental awareness need meant he had to know what was going on in the task environment that is the inside of the TOC as well as in the task environment that is outside of the TOC where both friendly and enemy forces are maneuvering. He had to constantly check his awareness of what the remote combat units (the artillery batteries) were experiencing with his awareness of what the remote support units (the ammunition resupply units, for example) were capable of doing with what the TOC knew about both environments.

Sonnenwald and Pierce described a group as having interwoven situational awareness when team members share a working understanding of the situation. (Sonnenwald & Pierce, 1998, p. 13). Here the S3, as an individual, was compelled to have his own interwoven situational awarenesses of not only his own task environment and his own domain environment, but also his unit's task environment and the situational awareness sense of the people directly working for him. The S3's mental situational awareness areas are multilayered and complex, and require him to continually dip into a deep and fast-moving flow of diverse information.

The key issue raised by this study is the fact that, as the TOC is currently configured, the S3 has the tools available to enhance his ability to maintain multiple levels of situational awareness concurrently. Were the S3 to lose the personal contact he currently enjoys, lose the ability to instantly size up a situation at a glance, would his situational awareness suffer? As information system planners design new, smaller, more mobile, digitized C2 vehicles, will the individual who mans this new vehicle find him- or herself separated from the information environment of co-workers and will the current interwoven situational awareness structure become unraveled, with unforeseen consequences.

CONCLUSIONS

The foregoing effort to undertake a microanalysis, an intensive study, of information flow in a command and control environment and how that flow affects a single position in the environment revealed some interesting situations. Since this study only analyzed 135 minutes out of a possible 1035 minutes of videotaped activity, it would be risky to draw any absolute conclusions about generalized human information behavior. Additionally, it would also be risky to draw any absolute conclusions about information behavior in Army command and control teams by depending on this slice of data. However, a number of defensible conclusions may be drawn, conclusions which are certainly applicable to the people and place under direct study and which may well be applicable to a wider group of people and situations.

The group under study may not necessarily replicate all Army command and control teams, but they certainly were a combat-ready artillery battalion TOC and their behavior during the simulated combat sequences fairly closely mirrors how they expected to conduct themselves during actual hostilities against a foe who is shooting back. The focal point of this study, the S3, may not be entirely typical of every S3 in the Army, but his general demeanor and style were entirely consistent with what his commander expected him to do and with what the Army expects an S3 to do. His interpersonal style was certainly tied to his personality and experience, but his information behavior was in keeping with what the Army would like to see in field grade officers. This was particularly noteworthy on the numerous occasions when the S3 simultaneously directed a subordinate to do a

task while at the same time teaching the subordinate the proper way to do the task and why the task needed to be done in a specific manner.

The results of looking at 135 out of 1035 minutes of simulated combat in an artillery TOC seems to indicate that information flow in such a task environment is constant, diverse, both directional and omnidirectional, both focused and generalized, and germane to multiple levels of situational awareness at the same time.

The flow of information events during a combat sequence involves sudden bursts of information, interspersed with periods of less information. The pattern of events was uneven and when events occur in close proximity to each other, they are often events that tumble in on the S3, hitting him from all sides simultaneously. These may actually be cyclical patterns tied to the activities of the combat units controlled by the TOC or increasing/decreasing patterns tied to the timing of the battle decision cycle. An elongated study of information flow across an entire combat cycle may well reveal critical information flow periods.

Most of the information events that affected the S3 initiated were spoken communications, whether they were spoken to him or spoken by him. However, it was almost a constant that he checked all information with his eyes by looking at a map or at the speaker. Non-verbal methods of communication were an efficient means of conveying unmistakable information with little effort. These are very natural behaviors in the current person-intensive environment of the TOC, but will be problematic to model in a distributed C2 system where most personnel will not be able to see each other.

Since personnel in the TOC can now see each other, it seems that positive social-emotional exchanges may be as important as gathering information through questions. In a future C2V environment, fewer people will be involved and will have less personal contact with each other. The relationship between social contact and effective performance may need to be studied in the process of designing next generation information systems.

Finally, the key issue raised by this study is the fact that, as the TOC is currently configured, the S3 has the tools available to enhance his ability to maintain multiple levels of situational awareness concurrently. It is unclear if this ability can be sustained in an environment where the quantity and quality of human contacts are severely reduced. Information system planners designing new, smaller, more mobile, digitized C2 vehicles, need to consider whether the individuals who operate these new systems will still be able to draw from the information environment of co-workers in order to keep or, better yet, enhance their interwoven situational awareness structures.

This study has just scratched the surface. There seems to be ample opportunity to elongate the study from start to finish of the videotaped sequences, to connect the nine coded sequences in this study with the rest of the activity that was not coded, in order to track the flow of information and the reaction of TOC personnel to it. Over the long term, such an elongated study of information flow in the current operational command and control environment might provide a benchmark from which to extrapolate how information flow may affect the future, the C2V-era command and control environment. The study in

this paper and an elongated version of it can help to reveal how command and control personnel work together in the information flow environment that exists today so that it may be used in the future to see how current information behaviors may evolve, change, or be circumscribed as the Army moves to the digitized battlefield and the four person C2V teams.

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APPENDIX

Summary of All Coding Sheets

	Event			Mode																			
				I/O																			
	g	l	p	h/n	h/s	h/w	h/l	h/o	s/n	s/s	s/w	s/l	s/o	r/n	r/s	r/w	r/l	r/o	o/n	o/s	o/w	o/l	o/o
	0	32	8	0	9	0	2	12	0	10	0	9	5	0	1	0	0	1	0	0	0	0	0
970714.1	Type												SA										
	a1	a2	a3	b1	b2	b3	c1	c2	c3	d1	d2	d3	ea	dtca	ia								
	3	1	13	6	5	9	4	0	0	0	0	0	24	18	13								

32 Events	2.13 events per minute	Most events per minute - 5	09:25
	1 event each 28 seconds	Fewest events per minute - 1	09:27
			09:33
			09:37
			09:39

	Event			Mode																			
				I/O																			
	g	l	p	h/n	h/s	h/w	h/l	h/o	s/n	s/s	s/w	s/l	s/o	r/n	r/s	r/w	r/l	r/o	o/n	o/s	o/w	o/l	o/o
	15	37	35	2	30	3	7	7	1	12	2	4	1	1	1	0	0	0	0	2	0	0	0
970714.2	Type												SA										
	a1	a2	a3	b1	b2	b3	c1	c2	c3	d1	d2	d3	ea	dtca	ia								
	0	0	4	4	2	19	13	0	0	0	0	0	46	46	39								

49 events	3.26 events per minute	Most events per minute - 5	11:02
			11:03
	1 event each 18.4 seconds	Fewest events per minute - 1	10:51

	Event			Mode																			
				I/O																			
	g	l	p	h/n	h/s	h/w	h/l	h/o	s/n	s/s	s/w	s/l	s/o	r/n	r/s	r/w	r/l	r/o	o/n	o/s	o/w	o/l	o/o
	2	29	19	0	12	2	12	12	0	5	0	9	3	0	1	0	0	0	0	1	1	1	0
970714.3	Type												SA										
	a1	a2	a3	b1	b2	b3	c1	c2	c3	d1	d2	d3	ea	dtca	ia								
	0	0	5	0	0	16	3	0	0	0	0	0	37	20	27								

39 events	2.6 events per minute	Most events per minute - 5	12:38
			12:39
	1 event each 23.1 seconds	Fewest events per minute - 1	12:32
			12:33

	Event			Mode																			
				I/O																			
	g	l	p	h/n	h/s	h/w	h/l	h/o	s/n	s/s	s/w	s/l	s/o	r/n	r/s	r/w	r/l	r/o	o/n	o/s	o/w	o/l	o/o
	7	31	39	1	31	2	10	15	0	12	0	4	8	0	1	0	0	0	0	0	0	0	1
970714.4	Type												SA										
	a1	a2	a3	b1	b2	b3	c1	c2	c3	d1	d2	d3	ea	dtca	ia								
	0	1	9	7	5	10	5	0	0	2	3	2	49	38	43								

50 events	3.33 events per minute	Most events per minute - 6	13:53
			13:54
	1 event each 18 seconds	Fewest events per minute - 1	14:03

	Event			Mode																			
				I/O																			
	g	l	p	h/n	h/s	h/w	h/l	h/o	s/n	s/s	s/w	s/l	s/o	r/n	r/s	r/w	r/l	r/o	o/n	o/s	o/w	o/l	o/o
	5	35	31	0	36	2	12	7	0	10	0	4	3	0	3	0	2	2	0	0	0	0	0
970716.1	Type												SA										
	a1	a2	a3	b1	b2	b3	c1	c2	c3	d1	d2	d3	ea	dtca	ia								
	2	0	3	17	8	7	9	3	0	4	1	0	47	38	35								

48 events	3.2 events per minute	Most events per minute - 6	10:50
			10:52
	1 event each 18.75 seconds	Fewest events per minute - 1	11:01

	Event			Mode																			
				I/O																			
	g	l	p	h/n	h/s	h/w	h/l	h/o	s/n	s/s	s/w	s/l	s/o	r/n	r/s	r/w	r/l	r/o	o/n	o/s	o/w	o/l	o/o
	1	27	30	0	22	0	7	2	0	5	0	4	0	0	0	0	0	0	0	0	0	0	0
970716.2	Type												SA										
	a1	a2	a3	b1	b2	b3	c1	c2	c3	d1	d2	d3	ea	dtca	ia								
	0	2	0	4	4	4	7	4	3	0	0	1	30	28	22								

30 events	2 events per minute	Most events per minute - 5	13:34
	1 event each 30 seconds	Fewest events per minute - 0	13:23

	Event			Mode																			
				I/O																			
	g	l	p	h/n	h/s	h/w	h/l	h/o	s/n	s/s	s/w	s/l	s/o	r/n	r/s	r/w	r/l	r/o	o/n	o/s	o/w	o/l	o/o
	0	38	45	0	20	0	14	6	0	10	0	10	2	0	3	0	0	1	0	1	0	0	0
970718.1	Type												SA										
	a1	a2	a3	b1	b2	b3	c1	c2	c3	d1	d2	d3	ea	dtca	ia								
	1	2	6	8	3	4	4	2	0	0	0	0	45	27	33								

46 events	3.1 events per minute	Most events per minute - 6	11:03
	1 event each 19.4 seconds	Fewest events per minute - 0	10:54

	Event			Mode																			
				I/O																			
	g	l	p	h/n	h/s	h/w	h/l	h/o	s/n	s/s	s/w	s/l	s/o	r/n	r/s	r/w	r/l	r/o	o/n	o/s	o/w	o/l	o/o
	2	23	36	0	20	0	13	6	0	4	0	11	0	0	0	0	0	0	0	0	0	0	0
970718.2	Type												SA										
	a1	a2	a3	b1	b2	b3	c1	c2	c3	d1	d2	d3	ea	dtca	ia								
	2	1	8	2	4	6	4	1	0	1	2	0	37	24	28								

40 events	2.7 events per minute	Most events per minute - 5	12:33
			12:40
	1 event each 22.2 seconds	Fewest events per minute - 0	12:35
			12:36
			12:37

	Event			Mode																			
				I/O																			
	g	l	p	h/n	h/s	h/w	h/l	h/o	s/n	s/s	s/w	s/l	s/o	r/n	r/s	r/w	r/l	r/o	o/n	o/s	o/w	o/l	o/o
	13	38	26	0	30	0	24	3	0	11	0	5	0	0	0	0	0	0	0	0	0	0	0
970723.1	Type												SA										
	a1	a2	a3	b1	b2	b3	c1	c2	c3	d1	d2	d3	ea	dtca	ia								
	1	4	4	5	10	8	5	0	0	1	0	0	54	43	45								

54 events	3.6 events per minute	Most events per minute - 6	10:54
			11:00
	1 event each 16.7 seconds	Fewest events per minute - 1	11:01

	Event			Mode																			
				I/O																			
	g	l	p	h/n	h/s	h/w	h/l	h/o	s/n	s/s	s/w	s/l	s/o	r/n	r/s	r/w	r/l	r/o	o/n	o/s	o/w	o/l	o/o
	8	32	33	0	25	1	14	3	0	9	0	14	0	0	0	0	0	0	0	2	0	1	0
970723.2	Type												SA										
	a1	a2	a3	b1	b2	b3	c1	c2	c3	d1	d2	d3	ea	dtca	ia								
	9	3	2	10	3	2	4	2	1	1	0	3	53	35	34								

54 events	3.6 events per minute	Most events per minute - 6	12:45
	1 event each 16.7 seconds	Fewest events per minute - 0	12:41

970714.1 Coding Sheet

970714.1	Event			Mode																					
14-Jul-97				I/O																					
EventRef	g	l	p	h/n	h/s	h/w	h/l	h/o	S/n	s/s	s/w	s/l	s/o	r/n	r/s	r/w	r/l	r/o	o/n	o/s	o/w	o/l	o/o
09:25:06			x									x											
:17			x									x											
:21			x									x											
:34			x									x											
:48			x									x											
:26:07			x									x											
:14			x									x											
:27:40			x									x											
:28:07		x								x													
:43		x						x															
:29:12		x								x													
:41		x						x															
:54		x								x													
:30:01		x						x															
:10		x			x																		
:31:08		x						x															
:33		x						x															
:50		x			x			x															
:32:18		x			x		x	x															
:43		x			x					x													
:33:14		x						x					x										
:34:16		x					x					x											
:29		x			x			x		x			x		x			x					
:35:15		x			x																		
:45		x			x			x					x										
:36:10		x								x													
:24		x								x													
:56		x								x													
:37:31		x						x					x										
:38:15		x			x					x													
:30		x			x					x													
:39:00		x						x					x										

Type												SA			970714.1 14-Jul-97
a1	a2	a3	b1	b2	b3	c1	c2	c3	d1	d2	d3	ea	dtca	ia	EventRef
												x			09:25:06
												x			:17
												x			:21
												x			:34
												x			:48
												x			:26:07
												x			:14
												x			:27:40
						x							x		:28:07
		x										x			:43
						x							x		:29:12
		x										x			:41
			x										x		:54
		x											x		:30:01
		x	x									x	x		:10
														x	:31:08
		x											x		:33
		x			x									x	:50
		x										x		x	:32:18
					x							x	x		:43
		x			x							x	x		:33:14
		x											x		:34:16
		x			x							x	x	x	:29
				x								x		x	:35:15
x				x		x						x	x	x	:45
x	x		x	x	x							x	x	x	:36:10
		x	x	x	x							x	x	x	:24
		x	x	x	x							x	x	x	:56
x		x										x	x	x	:37:31
					x	x						x	x	x	:38:15
			x		x							x	x	x	:30
												x	x	x	:39:00

970714.1 Observation Notes

970714.1	
Camera 2/ Tape 1	
Time	**Observation**
09:25:06	Looking at setup in the TOC, standing in front of table watching activity of others as they set up.
:17	Shifts gaze to right, at another soldier.
:21	Shift gaze farther to right.
:34	Shift gaze back to desk.
:48	Walk to left, stop, look right outside TOC door.
:26:07	Walk behind desk, look at boards and at what soldier at table is writing.
:14	Pivot 180 degrees to see what soldier at computer is doing.
:24	Seems to be asking question.
:27:10	Back to in front of table, looking at situation. Rotates gaze from front to right and back.
:28:07	Asked about forms. Back to looking and listening.
:43	Was told about some activity, probably from FDO. Nodded acknowledgment. Listening to talk.
:29:12	Confirms how a task is to be done. Saw something, spoke to it. Back to looking and listening. Standing face to face with someone.
:41	Heard two soldiers talking about activity, nodded acknowledgment.
:54	Saw person at desk doing something. Gave advice.
:30:01	Heard callout from FDO, nodded acknowledgment.
:10	Short discussion with FDO about setup. Initiated by FDO. About both task and SA. Continues to look and think.
:31:08	Listening to two soldiers talking about situation.
:28	Watching people move into position, registering their presence.
:33	Someone gives him status report, nods acknowledgment.
:50	Soldier asks him for suggestion. Nods, agrees, gets sense of other soldier's SA.
:32:18	While talking to soldier, also listening to soldiers to his right talk about reports and setup. Processes both simultaneously.
:43	Discusses how he wants to reduce traffic flow in TOC.
:33:14	Looking about himself at things, gesturing with hands, giving both positive vibes to soldier and some clear desires/directives.
:34:16	Soldier points out something to him on map. He turns to look. Sees the gesture.
:34:29	Reads map at prompting, points out something while talking. Getting a sense of soldier, plus task, plus TOC SA.
:35:15	Prompted by discussion, goes into instructional mode, giving opinion and guidance. Causes soldier to pull out notebook to write something down.
:45	Soldier takes off hat and sits down. S3 leans down to look at him face to face while continuing discussion. Showed solidarity with soldier by leaning down to his level. Giving instructions to soldier to write down.
:36:10	Other soldiers in vicinity start to listen, S3 notices. Stands back up to address the group. Simultaneous teaching and informing. Some laughter.
:24	Explaining what he wants.
:56	Explaining how he wants TOC laid out and why. Five soldiers listen. Lots of nodding.
:37:31	Listening to soldier, nodding agreement, showing respect for speaker.
:38:15	Continues to listen to advice, gives advice.
:30	"We're going to rearrange the furniture." S3 spent most of this period standing in front of table, watching, listening and thinking.
:39:08	Listening to radio while watching soldier respond to it.
:23	S3 moves off camera to right in direction of S2 maps while soldiers move tables.

970714.2 Coding Sheet

970714.2	Event			Mode																				
14-Jul-97				I/O																				
EventRef	g	l	p	h/n	h/s	h/w	h/l	h/o	s/n	s/s	s/w	s/l	s/o	r/n	r/s	r/w	r/l	r/o	o/n	o/s	o/w	o/l	o/o
10:50:05		x			x	x																	
:20	x		x			x	x	x															
:44	x	x	x		x					x													
:59	x	x	x		x																		
:51:29		x			x			x															
:52:15		x			x			x															
:44		x	x		x									x									
:53:20		x	x		x										x								
:37		x	x		x																		
:50		x	x		x																		
:54:03		x	x		x																		
:40		x	x				x																
:55		x	x				x																
:59		x										x											
:55:11		x	x				x																
:27		x			x																		
:37			x							x													
:47		x			x					x													
:54		x																		x			
:56:06		x			x																		
:14		x			x					x													
:31		x								x													
:39	x	x	x				x					x											
:57:02		x	x		x			x															
:47		x	x								x												
:55	x		x			x		x															
:58:15	x		x								x												
:38			x																	x			
:59:04		x	x				x																
:15	x	x	x		x																		
:18	x	x	x										x										
:34	x	x	x					x															
11:00:18		x	x		x																		
:45		x	x		x					x		x											
:59		x	x		x			x		x													
:01:14		x	x		x																		
:39	x	x	x		x					x													
:56		x			x																		
:02:00		x			x					x													
:16			x	x								x											
:27	x	x	x	x					x														
:39	x	x	x		x																		

970714.2	Event			Mode																					
14-Jul-97				I/O																					
EventRef	g	l	p	h/n	h/s	h/w	h/l	h/o	s/n	s/s	s/w	s/l	s/o	r/n	r/s	r/w	r/l	r/o	o/n	o/s	o/w	o/l	o/o		
11:02:47			x		x																				
:03:22			x		x					x															
:26	x				x					x															
:04:02			x		x																				
:07	x	x			x		x																		
:24			x							x															
:36	x		x		x																				

Type												SA			970714.2
															14-Jul-97
a1	a2	a3	b1	b2	b3	c1	c2	c3	d1	d2	d3	ea	Dtca	ia	EventRef
						x						x	x	x	10:50:05
													x		:20
						x						x	x	x	:44
						x						x	x	x	:59
					x	x						x	x	x	:51:29
					x	x						x	x	x	:52:15
					x							x	x	x	:44
		x	x									x	x	x	:53:20
			x									x	x	x	:37
						x						x	x	x	:50
			x									x	x	x	:54:03
												x	x	x	:40
												x	x	x	:55
												x			:59
		x										x	x	x	:55:11
					x							x	x	x	:27
						x						x	x	x	:37
					x							x	x	x	:47
			x									x	x	x	:54
					x							x	x	x	:56:06
		x										x	x	x	:14
					x							x	x	x	:31
												x	x	x	:39
					x							x	x	x	:57:02
													x		:47
		x										x	x	x	:55
													x		:58:15
					x							x	x	x	:38
												x			:59:04
					x							x	x	x	:15
												x			:18
												x	x	x	:34
					x							x	x		11:00:18
					x							x	x	x	:45
					x							x	x	x	:59
						x						x	x	x	:01:14
						x						x	x	x	:39
					x							x	x	x	:56
					x	x						x	x	x	:02:00
												x	x		:16
												x	x	x	:27
						x						x	x	x	:39

Type												SA			970714.2
															14-Jul-97
a1	a2	a3	b1	b2	b3	c1	c2	c3	d1	d2	d3	ea	Dtca	ia	EventRef
					x							x	x		11:02:47
						x						x	x	x	:03:22
				x								x	x	x	:26
				x								x	x	x	:04:02
					x							x	x	x	:07
					x							x	x		:24
					x	x						x	x	x	:36

970714.2 Observation Notes

970714.2	
Camera 1 / Tape 1	
Time	**Observation**
10:50:05	S3, with handset to ear and pen on pad, asks S2NCO for information.
:20	Hears something on handset and/or on radio. Turns to map while listening. Writes note.
:44	Listening to radio and handset, turns right and asks RTO for information about a task. Saw something on map which generated the query.
:59	Asks for information from computer operator, gets verbal response from operator. Still with handset to ear and listening to TOC area radio. Gets verbal response, gives verbal response.
:51:29	Exchange with RTO who is telling him information. S3 responds with instruction, education, and direction (uses gestures).
:52:15	Drops handset, continues to gesture to RTO.
:44	S2 hands him piece of paper to read. Speaks up to someone in vicinity while reading, probably in response to what he just read.
:53:20	After reading, sees the problem, tells S2NCO what the problem is, agrees with S2NCO about S2NCO's opinion.
:37	Listens to S2NCO, then tells him what he needs to do to resolve situation. Then picks up handset again, signaling end of point to point conversation with S3NCO. RTOs listened to exchange.
:50	Hears a comment on handset. Turns and responds with confirming query.
:54:03	Hears something on handset, turns to RTO with direction for their tasks after finding out who did what.
:40	S2NCO calling out info. S3, with his ear to handset, looks at S2NCO, then glances to map to orient self.
:55	Listening to handset and S2, eyes flash back and forth between speaker and map boards.
:59	With handset on ear, senses individual come into TOC, rotates head to note who it is, registers that fact, goes back to listening.
:55:11	S2NCO gives verbal information and points to map. S3 hears him and looks at map.
:27	S3 relays information from S2NCO to map plotter.
:37	Sees new plot, asks question of plotter.
:47	Hears and sees information, registers that it's out of range, gives out that information verbally to S2NCO.
:54	Reflects pleasure that the previous information was positive, reflects that by repeating the information to the local area as he sees and notes newcomers entering the TOC.
:56:06	Exchange with newcomers, giving and getting information on the situation.
:14	Getting information from plotter, looking at board while listening. Nods acknowledgment.
:31	Sees something on boards which pleases him, turns and gives information to local area.
:39	Puts handset to ear while listening to radio and watching map plotters briefing him, looking to the front.
:57:02	Responds to S3NCO while listening on handset. What he hears S3NCO say causes him to point out something on board to S3NCO and engage him in B3-type orientation exchange. Hands seeming to instruct and direct.
:47	Previous period was longest single event to date. Something he saw or heard (probably saw) causes him to go to notebook to write.
:55	While writing, Battle Captain says something to him. Nods acknowledgment while listening to radio.
:58:15	Looked up at board for something, then continued writing while listening to radio.

:38	While writing, gives instruction to map plotter, and to local area. Puts book away.
:59:04	Finishes with notes, finishes conversation, looks around him, picks up handset.
:15	While on handset, reacts to global radio traffic with information for plotter.
:18	Noted entry of two individuals into TOC, then went back to looking at board, while listening on handset.
:34	S2NCO calls him. While listening to S2NCO, hears something over handset which causes him to lean back, take up another handset and listen to both simultaneously.
11:00:18	Starts talking on radio (through handset) while plotter listens in.
:45	Listening on handset, talking into mouthpiece, looking at boards. Plotter listening to him and reacting. Giving information from board to individual on other end of radio exchange.
:59	Shakes head in response to S3NCO while listening to handset and watching action on board. S3NCO responds to headshake and comments by moving to back.
:01:14	Asks RTO for information while on handset and listening to local area radio calls.
:39	Listening, looking, turns to left and asks FDO for information.
:56	Relays information from FDO to plotter.
:02:00	From what he saw, leaned back to RTO, gave short information burst, then asked for some. Then picked up handset and put it back down.
:16	Back to focus on board, looks at board, then at S2 board, then listening to radio.
:27	Rotates gaze to FDO to see what he's doing, then back to board while listening to radio.
:39	Listening to radios, rotates to RTOs and asks them to listen for something.
:47	Back to handset, listening to something and speaks, but cannot hear exactly what is going on. S3NCO and plotter are listening to him and getting information from what he's saying.
:03:22	On handset, looks at board, turns to RTO for more information.
:26	"ATTENTION IN THE TOC." S3: "we've got a problem." From what he just heard and saw, he's made an analysis of the situation and is giving it out to all verbally. Speaking directly to FDO, but all are listening.
:04:02	Turns to RTOs for continuation while listening to radio calls amplifying his previous statements.
:07	From what he's hearing, he's relaying direction to both FDO and plotter simultaneously. Seeing the results of his analysis.
:24	Looked at plot, tells plotter to move it.
:36	Heard something on radio, causes him to pick up handset to talk.
:58	Radio conversation ends.

970714.3 Coding Sheet

970714.3	Event			Mode																				
14-Jul-97				I/O																				
EventRef	g	l	p	h/n	h/s	h/w	h/l	h/o	s/n	s/s	s/w	s/l	s/o	r/n	r/s	r/w	r/l	r/o	o/n	o/s	o/w	o/l	o/o
12:30:30			x				x					x											
:57			x				x					x											
:31:14			x									x											
:36		x	x				x	x															
:32:12			x			x																	
:33:57		x	x									x											
:34:13		x	x		x					x													
:30								x															
:35:02		x	x		x	x																	
:12		x					x	x															
:43		x			x		x																
:36:04		x	x				x	x															
:17	x				x		x																
:34	x	x						x					x										
:43		x						x					x										
:37:03		x			x		x																
:10		x					x																
:18		x					x																
:38		x								x													
:38:00		x	x		x																		
:19		x						x				x											
:32		x						x				x											
:43		x	x							x													
:52		x	x		x								x										
:39:10		x						x				x											
:24		x						x															
:31		x						x															
:48		x	x							x													
:40:12		x	x		x					x													
:41			x												x								
:41:16		x	x		x																		
:43		x			x																		
:54		x			x																		
:42:30		x					x					x											
:43:00		x					x					x											
:25			x					x															
:43																					x		
:44:14			x																	x		x	
:55		x	x		x																		

Type												SA			970714.3
															14-Jul-97
a1	a2	a3	b1	b2	b3	c1	c2	c3	d1	d2	d3	ea	Dtca	ia	EventRef
												x	x		12:30:30
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		x										x	x		:36
												x			:32:12
												x			:33:57
					x							x	x		:34:13
		x										x	x	x	:30
					x							x	x	x	:35:02
												x	x	x	:12
					x	x						x	x	x	:43
		x										x	x	x	:36:04
					x							x	x	x	:17
												x		x	:34
												x		x	:43
		x			x							x	x	x	:37:03
												x		x	:10
												x		x	:18
					x							x		x	:38
		x			x							x	x	x	:38:00
												x			:19
												x			:32
					x							x	x	x	:43
					x							x	x	x	:52
												x			:39:10
												x		x	:24
												x			:31
					x							x	x	x	:48
					x	x						x	x	x	:40:12
					x							x	x	x	:41
						x						x	x	x	:41:16
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					x							x	x	x	:54
												x	x	x	:42:30
														x	:43:00
												x		x	:25
															:43
					x							x		x	:44:14
					x							x		x	:55

970714.3 Observation Notes

970714.3	
Camera 2 / Tape 2	
Time	**Observation**
12:30:30	Listening on handset, looking at map.
:57	Looks right and left to see who's where.
:31:14	Looks left to see who's there.
:36	Hears callout from FDO, nods acknowledgment.
:32:12	Hears something on handset, pulls out notebook, writes note. Quiet time. S2 talking, S3 listening.
:33:57	Looks left at someone entering door.
:34:13	Puts down handset, tells plotter to update board, S2 hears him. Picks up handset again.
:30	Gets briefed back by plotter, nods acknowledgment.
:35:02	With handset at ear, gets information from S2 and gives it to FDO while writing.
:12	Puts down handset, gets verbal input from FDO, checks it out on map, rotates head between FDO and map.
	Almost all verbal exchanges provide S3 IA for whoever he has exchange with.
:43	Hears something, turns to RTO to confirm and give guidance. Looks at map.
:36:04	Plotter tells him and shows him information on map, nods acknowledgment.
:17	"ATTENTION IN THE TOC"
:34	Looks to FDO, no acknowledgment.
:43	Looks to S2, no acknowledgment.
:37:03	Turns to listen to FDO who's talking, returns to map.
:10	Repeat of previous behavior.
:18	Repeat of previous behavior.
:38	Gives input to S2 after listening and looking.
:38:00	Gets input from RTO, turns to RTO to give further guidance.
:19	Looks at activity in FDO area.
:32	Looks at S2.
:43	Hears something on radio or from RTO, turns to give tasking to RTO.
:52	Gets verbal information from Battle Captain, gives information to RTO, looks at S2 activity.
:39:10	Looks to see what FDO is doing.
:24	Hears RTO, turns to listen.
:31	Checks out FDO.
:48	Looks at board, sees something, tells plotter to do something, they plot.
:40:12	After back and forth with Battle Captain and plotters, hears RTO, turns to tell them something.
:41	RTO gives him something he has written. S3 reads in and hands it to plotter.
:41:16	After input from Battle Captain, turns to right and asks Acting S2 for input.
:43	Listens to Acting S2, gives input.
:54	Relays some information to FDO.
:42:25	Noticed Acting S2 do a D3 behavior (belittling) with S3NCO.
:30	Rotates gaze to FDO and then back to map.
:43:00	Listening to S2NCO.
:25	Battle Captain talking to him, nods acknowledgment.
:43	Something caused him to write a note.
:44:14	Finishes writing, looks to see what RTO is doing, then turns to left to give direction to someone.
:50	Talking to FDO.

970714.4 Coding Sheet

970714.4	Event			Mode																				
14-Jul-97				I/O																				
EventRef	g	l	p	h/n	h/s	h/w	h/l	h/o	s/n	s/s	s/w	s/l	s/o	r/n	r/s	r/w	r/l	r/o	o/n	o/s	o/w	o/l	o/o
13:50:05			x				x																
:12			x			x																	
:21		x	x		x																		
:44		x	x					x															
:50		x	x		x																		
:51:05		x	x		x					x													
:33			x		x			x					x										
:59		x	x		x			x															
:52:19		x			x					x													
:32		x											x										
:39		x	x		x																		
:44	x				x		x																
:53:12		x			x			x															
:16			x									x	x										
:22			x									x	x										
:27		x			x					x													
:34		x	x					x															
:42		x	x		x																		
:54:06		x	x		x		x	x															
:49	x		x		x		x																
:55:08	x		x		x		x																
:19			x							x		x											
:30			x		x																		
:42		x	x		x		x			x													
:56:07		x	x		x			x															
:28			x		x																		
:37			x					x															
:58		x						x															
:57:18			x										x										
:30		x						x															
:58:10	x	x	x		x																		
:56		x	x		x					x													
:59:09	x		x		x					x													
:19		x	x		x																		
14:00:02			x		x					x													
:32			x		x			x															
:01:01		x	x		x			x		x			x										
:12			x							x			x										
:20	x						x																
:42		x										x											
:02:12		x	x		x	x																	
:19		x		x																			

970714.4	Event			Mode																					
14-Jul-97				I/O																					
EventRef	g	l	p	h/n	h/s	h/w	h/l	h/o	s/n	s/s	s/w	s/l	s/o	r/n	r/s	r/w	r/l	r/o	o/n	o/s	o/w	o/l	o/o
14:02:24		x	x												x								
:31		x	x					x					x										
:03:06		x	x					x															x
:04:00		x	x		x		x																
:09		x	x		x			x															
:29		x	x		x		x			x													
:48		x	x		x		x			x													
:51	x				x																		

Type												SA			970714.4
															14-Jul-97
a1	a2	a3	b1	b2	b3	c1	c2	c3	d1	d2	d3	ea	Dtc a	ia	EventRef
												x		x	13:50:05
												x	x		:12
					x							x	x	x	:21
		x										x	x	x	:44
			x									x	x	x	:50
											x	x	x	x	:51:05
									x			x	x	x	:33
			x							x		x	x	x	:59
						x						x	x	x	:52:19
									x			x		x	:32
			x	x						x		x	x	x	:39
			x									x	x	x	:44
										x		x	x	x	:53:12
												x	x		:16
												x	x		:22
					x							x	x	x	:27
		x										x	x	x	:34
	x														:42
		x				x						x	x	x	:54:06
					x							x	x	x	:49
					x							x	x	x	:55:08
						x						x	x	x	:19
			x									x	x	x	:30
					x							x	x	x	:42
			x			x						x	x	x	:56:07
											x	x	x	x	:28
		x										x	x	x	:37
												x	x	x	:58
												x	x		:57:18
												x	x	x	:30
		x										x	x	x	:58:10
		x										x	x	x	:56
						x						x	x	x	:59:09
			x									x	x	x	:19
												x			14:00:02
		x										x		x	:32
		x			x							x		x	:01:01
												x		x	:12
												x	x		:20
												x	x		:42
		x										x	x	x	:02:12
												x		x	:19

Type												SA			970714.4
															14-Jul-97
a1	a2	a3	b1	b2	b3	c1	c2	c3	d1	d2	d3	ea	Dtca	ia	EventRef
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				x	x							x	x	x	:31
					x							x		x	:03:06
												x	x	x	:04:00
				x								x		x	:09
				x								x		x	:29
				x								x		x	:48
					x							x	x	x	:51

970714.4 Observation Notes

970714.4	
Camera 2 / Tape 3	
Time	**Observation**
13:50:00	Listening on handset and looking at maps.
:05	Looks at RTO in response to what he hears them saying. No response.
:12	Leans forward to write based on what he hears on handset.
:21	Turns left to say something to FDO.
:44	S2 calls to him with information, acknowledges.
:50	Tells S2 something in relation to RTOs, tells RTOs something.
:51:05	S2NCO tells him something, he stops them and says "one at a time" (starting to get momentary sensory overload) because he's getting something else aurally as well.
:33	Engaged in talk with Battle Captain and plotter while listening to handset, gives guidance to Battle Captain with headshake before going back to concentrating on handset.
	Can hear other individual, probably the Acting S2, off camera engaged in other than pure task issues, more social-emotional. But S3 is locked in on task.
:59	Turns to left to comment to FDO, giving emphasis with left hand which holds handset, gesturing toward map.
:52:19	Watching plotter explain map to Battle Captain. Asks for additional information from local area (not directed at anyone in particular).
:32	Glances at talkative Acting S2 with slight irritation, then back to map.
:39	Turns right, tells Acting S2 to "listen up" about environmental changes he heard on handset. Same direction given to plotter. Negative comment directed to Acting S2, heard and acted on by plotter.
:44	"ATTENTION IN THE TOC." S3 immediately turns to RTO with direction to pay attention, then makes a quick comment to S2 on way back to look at status board which plotter is changing.
:53:12	Someone calls out a question. S3 replies "no" with headshake, does not look at them, but rather keeps focus on boards and handset.
:16	Glances at S2, then back to boards. Checking to see their state (and state of their boards).
:22	Repeat of above behavior.
:27	Hears Acting S2 say something to his right, turns to his left and relays information to FDO.
:34	Glances at FDO in response to comment. Nods acknowledgment.
:42	"He's been the real hero." General comment back to FDO while still on handset and keeping watch on boards.
:54:06	Looks to FDO, sees activity, asks for information, gets it, nods acknowledgment.
:49	S3 "ATTENTION IN THE TOC." Heard something on handset. Passing it out. Plotter confirms he already has it.
:55:08	Repeat of above behavior.
:19	Turns to FDO to confirm receipt, then to RTOs for same reason.
:30	Engaged in close conversation with RTOs.
:42	S2NCO asks for confirmation of last "ATTENTION …" call. S3 gives it to him. Corrects
:56:07	Still on handset, hears something from Battle Captain's area, turns to confirm what he heard. Confirms receipt with nod.
:28	Turns to right to comment to Battle Captain. Facial expression looks negative.
:37	Battle Captain confirms receipt, S3 nods acknowledgment.
:58	Turns to FDO to hear something. No reaction. Turns back.
:57:18	Checks watch.
:30	Turns to FDO to hear something. No reaction. Turns back.

:58:10	On handset, listens to global radio call, acknowledges confirmation of information to RTO.
:43	Listening and looking. Looks to Battle Captain, then back to map. Makes general comment about situation.
:59:02	Callout.
:09	Asks Battle Captain to find out something about a scout. Prompted by what he heard globally and what he's seeing on map.
:19	Turns back to RTOs to get them to focus on something he wants to know.
14:00:02	After sitting and listening and looking, turns left to FDO to say something, exchange of words.
:32	Someone comes in with something to show him. Close face to face. Nods acknowledgment.
:01:01	Looking to FDO, hearing something, signaling back with hand gestures.
:12	Looks back and forth between S3 map, Battle Captain on phone, S2 map. Gets confirmation of information, then returns to thoughts.
:20	Callout. Plotter goes to board. S3 looked at Battle Captain when he heard it.
:42	Sees what plotter pointed out. Leans back to get wider view of area.
:02:12	Listens to FDO give information, quick confirmatory responses, then to notebook.
:19	While writing, looked at S2NCO who leaned in to say something to Battle Captain.
:24	Commented to FDO after writing.
:31	Someone hands paper to Battle Captain. S3 looks at the paper, reads it, looks at Battle Captain who gave him hand signal ("2"). S3 responds with hand gestures to Battle Captain and local area. Holds up paper to reinforce what he gestured.
:03:06	Handed paper to Battle Captain.
	View blocked for a while.
:04:00	Looks to be listening to FDO, then rotates focus to boards.
:09	Continuing to talk with FDO, gestures with left hand.
:29	FDO conversation causes S3 to scan boards to S2 area, then back to respond to FDO.
:48	Repeat of above behavior.
:51	Global "change of mission" announcement. End of operational exercise period.

970716.1 Coding Sheet

970716.1	Event			Mode																					
16-Jul-97				I/O																					
EventRef	g	l	p	h/n	h/s	h/w	h/l	h/o	s/n	s/s	s/w	s/l	s/o	r/n	r/s	r/w	r/l	r/o	o/n	o/s	o/w	o/l	o/o
10:50:02		x	x		x			x		x			x										
:14		x					x																
:27		x			x																		
:41		x			x																		
:47		x				x																	
:52			x		x										x					x			
:51:10			x										x										
:20		x			x															x			
:50			x		x																		
:52:03		x			x																		
:08		x	x		x																		
:26			x		x																		
:34		x			x																		
:44		x			x					x													
:51			x				x					x					x						
:53:17			x							x													
:34		x			x			x															
:57		x	x				x					x											
:54:03	x				x																		
:22		x	x				x					x					x						
:50		x			x																		
:55:11		x	x		x					x													
:47		x	x				x					x											
:55			x		x																		
:56:11		x	x		x																		
:46		x	x		x					x													
:56		x	x		x			x															
:57:10		x	x		x																		
:15		x	x		x																		
:24		x	x		x					x													
:46	x	x	x		x					x													
:58:11			x		x			x															
:27		x	x		x																		
:57	x						x																
:59:31		x			x	x	x																
:51			x															x					
11:00:10	x	x			x					x					x								
:29		x	x		x																		
:40		x	x		x			x					x		x			x					
:01:18		x			x			x															
:02:06		x			x																		
:32			x		x		x																

970716.1	Event			Mode																					
16-Jul-97				I/O																					
EventRef	g	l	p	h/n	h/s	h/w	h/l	h/o	s/n	s/s	s/w	s/l	s/o	r/n	r/s	r/w	r/l	r/o	o/n	o/s	o/w	o/l	o/o		
11:03:03		x	x		x					x															
:38		x	x		x		x	x																	
:50		x	x		x					x															
:58		x	x				x																		
:04:07			x				x																		
:36	x	x			x		x																		

Type												SA			970716.1
															16-Jul-97
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			x									x	x	x	:08
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x												x	x	x	:50
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			x			x						x	x	x	:46
			x		x							x	x	x	:56
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			x									x	x	x	:24
					x							x	x		:46
				x					x			x		x	:58:11
				x								x		x	:27
												x	x		:57
			x			x						x	x	x	:59:31
									x			x		x	:51
					x							x	x	x	11:00:10
						x	x					x		x	:29
x			x		x							x		x	:40
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			x									x	x	x	:02:06
						x						x	x	x	:32

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															16-Jul-97
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						x						x	x	x	:38
							x							x	:50
												x		x	:58
												x			:04:07
				x			x					x		x	:36

970716.1 Observation Notes

970716.1	
Camera 2 / Tape 1	
Time	**Observation**
10:50:02	Listening to RTO, looking at map, giving direction about map
:14	Listening to S3NCO give verbal information to RTO to pass on, while watching map plotter
:27	Getting information simultaneously from S2 and RTO, tells them to "hold."
:41	RTO relays query from someone to S3, he replies "we're watching it," turns to FDO and asks FDNCO for confirmation of his information, gets confirmation.
:47	What he hears from FDO causes him to write in notebook.
:52	Turns to RTO to tell him to pass on information. He's reading what he wrote.
:51:10	Looked at board for information, then turned for coffee cup.
:20	Hears from NCO, agrees, confirms back verbally.
(:30)	(view blocked)
:50	Listening to radio, asks S2 for extra radio handset and gives tasking.
:52:03	Turns to FDO with guidance.
:08	Turns back to RTO, listens to what he's hearing, gives task to relay.
:26	Asks RTO for confirmation, gives direction to relay.
:34	Tells someone (loudly enough for all to hear) to do something about commo.
:44	Plotter asks question, responds with opinion ("it should be …").
:51	Rotates gaze to S2, then to notebook, then to board. Shaking his head, writes something down, while listening to radio and orienting self with map.
:53:17	After looking and listening, tells RTO to do something. Battle Captain listening.
:34	While giving task to RTO, hears comment from within the group to the right. Shakes a negation and follows with verbal reason why the negation.
:51	Gets input from person standing (FDO?). While listening, hears radio call, waits until call is clear, asks for information from RTO.
:54:05	ATTENTION IN THE TOC. Tells RTO to make a change.
:22	Rotating gaze between RTO (listening) and board (looking) while listening to radio on handset.
:50	Gets information verbally from FDO, confirms FDO's suggestion.
:55:11	Rotating focus between RTO, board, and FDO, then gives tasking to RTO.
:47	Another orientation sweep from FDO to S2 and back to board while listening to RTO.
:58	Listening to RTO, gives affirmation of message to relay.
:56:11	Told FDO to hold on so he could get information from RTO, while looking at his notebook.
:46	After asking for information from plotter and getting it, he hears radio call and relays that data on to FDO.
:56	Last message questioned, reaffirms data by telling plotter to mark position on map so FDO can see it.
:57:10	Explaining reasoning to local area.
:15	RTO gives information, S3 acknowledges receipt with nod.
:24	Tells plotter to alter board.
:46	ATTENTION IN THE TOC. Hears something from RTO, called out to group while confirming location on map.
:58:11	S3NCO leans down to talk privately to S3. S3 leans forward to be close to him. Listening, then points out situation in area as reply to what S3NCO just told him.
:27	Tells S3NCO why he's using Acting S2 as S2 today. (1st commo event in this sequence which did not relate directly to a combat task).
:57	ATTENTION IN THE TOC. Hears and looks at map.
:59:12	Conversing with civilian about the scenario.
:31	Information from FDO. Gives response back, then asks if S2 got it, then went to

	notebook.
:51	NOC shows him piece of paper. Quick headshake.
11:00:10	Rotates between FDO, board, S2, book. Hears something over radio, relates loudly to all.
:29	Talking with soldier who has entered TOC. Asks about outside environment.
:40	Soldier shows S3 piece of paper. Reads it, orients it to map, explaining why thing are done and gives soldier autonomy to act.
01:18	Explaining situation to solider, pointing at map and orienting soldier to map and to information. Event lasts until :56, one of longest single events.
02:06	Calls FDO to relay data. Offshoot of conversation with soldier.
:32	Hears something from RTO, turns to listen (tends to look at who's talking and to look at who he's talking to). Asks for information.
:03:03	Looking at map, listening to radio, turns to FDO with direction.
:38	Explains his recent tasking to S3NCO. Points out place on map.
:50	Teaching exchange with plotter. Asks them for their opinion.
:58	Heard S2/ ACTING S2, looked to see what they were doing, seemed satisfied.
:04:07	Picked up handset, listens and looks at map.
:36	Global call "counterfire."
:55	Initial reaction to "counterfire" when he asks FDO to verify his opinion.

970716.2 Coding Sheet

970716.2	Event			Mode																					
16-Jul-97				I/O																					
EventRef	g	l	p	h/n	h/s	h/w	h/l	h/o	s/n	s/s	s/w	s/l	s/o	r/n	r/s	r/w	r/l	r/o	o/n	o/s	o/w	o/l	o/o		
13:20:25		x	x				x																		
:36			x				x																		
:56		x	x		x					x															
:21:30		x	x		x					x															
:57		x	x		x																				
:22:06		x	x		x																				
:24:05		x	x		x																				
:43		x	x		x																				
:25:20		x	x		x					x															
:26:00		x	x		x																				
:19		x	x		x																				
:45			x				x					x													
:27:11		x	x		x																				
:32		x	x		x																				
:28:04		x	x		x																				
:31		x	x				x					x													
:44		x	x		x			x																	
:29:15		x	x		x		x																		
:30:11		x	x		x																				
:31:21		x	x				x	x				x													
:47		x	x		x																				
:32:00			x									x													
:24		x	x		x					x															
:46		x	x		x					x															
:33:25		x	x				x																		
:34:23		x	x		x																				
:35		x	x		x																				
:41		x	x		x																				
:50		x	x		x																				
:55	x	x	x																						

Type												SA			970716.2
															16-Jul-97
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						x						x	x	x	:26:00
			x									x	x	x	:19
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						x						x	x	x	:27:11
			x									x	x	x	:32
			x									x	x	x	:28:04
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	x							x				x	x	x	:30:11
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						x						x			:47
												x		x	:32:00
												x	x	x	:24
												x	x	x	:46
												x	x		:33:25
				x								x	x	x	:34:23
						x						x	x		:35
											x	x	x	x	:41
							x					x	x	x	:50
					x							x	x		:55

970716.2 Observation Notes

970716.2	
Camera 3 / Tape 2	
Time	**Observation**
13:20:00	Listening on handset, looking at map.
:25	Turns to look at FDO, something he heard.
:36	Leans forward, looks from map to book.
:56	Giving direction over radio to batteries, asking for input/advice as well.
:21:30	Another radio call while watching map.
:57	Turns to FDO, says something in questioning tone (something he heard?).
:22:06	Soldier responds while S3 is still on phone. Exchange of questions from S3, answers from soldier. Another soldier (probably from S4) stands and waits to talk, while waiting reads from notes. This exchange lasts until 23:24.
:24:05	Extends conversation to include FDO.
:43	Asks FDO what he's doing after listening on handset and to chatter from the S4.
:25:20	Asking for help from FDO. Still on handset. (sightline to S3 is blocked off and on by Radar CWO, but conversation between S3 and FDO can be heard).
:26:00	Asks for commo status from RTO. Looking right at RTO as he talks.
:19	Tells RTO to relay information to batteries. Still on handset.
:45	Puts down handset, leans back, looks at FDO.
:26:11	Asks RTO for more information, tells him to relay information.
:32	Looks tired, starts to take handset from RTO, changes mind from something he heard, turns to FDO to give direction.
:28:04	Watches FDO work, listening, giving direction.
:31	Rotates gaze from FDO to map.
:44	FDO starts to talk; S3 rotates back, responds with information, gesturing from RTO to FDO to ensure FDO understands who S3 is talking to. Laughter.
:29:15	Back on handset. Talking to someone, looks to left to FDO. Talks to FDO while listening to radio response to his query.
:30:11	Someone enters TOC with some sort of commo issue.
:25	"that's a valid point," then asks a question, seeking others' evaluation/opinion.
:31:21	Sitting way back, listening to visitors and pondering, watching boards.
:47	Short question for RTO.
:32:00	Looks over to FDO to see what he's doing.
:24	Talking to RTO. Looks at map, passes on information to RTO to relay.
:46	Rotates forward in chair as he looks at board and listens to soldier, then turns to soldier with additional information.
:33:25	Listening to radio calls, looking at map.
:34:35	Asks RTO for information.
:41	"so were you listening?" to RTO, then restates question.
:50	Hears FDO radio, asks for clarification.
:55	ATTENTION IN THE TOC. S3 calls out location.

970718.1 Coding Sheet

970718.1	Event			Mode																					
18-Jul-97				I/O																					
EventRef	g	l	p	h/n	h/s	h/w	h/l	h/o	s/n	s/s	s/w	s/l	s/o	r/n	r/s	r/w	r/l	r/o	o/n	o/s	o/w	o/l	o/o
10:50:46		x	x					x					x										
:51		x	x		x					x													
:51:23		x	x										x										
:31		x	x							x													
:47			x									x											
:52:02		x	x				x																
:06			x									x											
:15		x	x		x																		
:53:02			x				x					x											
:12		x	x				x					x											
:25			x				x																
:39		x	x				x					x											
:54		x	x					x															
:55:00		x	x		x					x													
:12		x	x		x																		
:29		x	x				x																
:54		x	x		x		x																
:56:20		x	x		x																		
:29		x	x		x																		
:36		x	x		x																		
:46		x	x		x										x								
:57:24		x	x		x										x								
:59		x	x		x										x								
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:09		x	x					x															
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:02:00		x	x							x										x			
:09		x	x					x															
:37		x	x				x																
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:03:06			x				x					x											
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970718.1	Event			Mode																					
18-Jul-97				I/O																					
EventRef	g	l	p	h/n	h/s	h/w	h/l	h/o	s/n	s/s	s/w	s/l	s/o	r/n	r/s	r/w	r/l	r/o	o/n	o/s	o/w	o/l	o/o		
11:03:57			x				x																		
:04:37		x	x		x					x															
:55		x	x				x																		
:05:00		x	x		x																				

Type												SA			970718.1
															18-Jul-97
a1	a2	a3	b1	b2	b3	c1	c2	c3	d1	d2	d3	ea	dtca	ia	EventRef
		x										x		x	10:50:46
			x									x		x	:51
												x			:51:23
			x									x		x	:31
												x		x	:47
												x	x	x	:52:02
												x	x		:06
			x	x								x	x	x	:15
												x		x	:53:02
												x		x	:12
												x			:25
												x		x	:39
x												x		x	:54
			x									x	x	x	:55:00
			x									x		x	:12
												x	x		:29
						x						x	x	x	:54
			x									x	x		:56:20
					x							x	x	x	:29
					x							x	x	x	:36
		x										x	x	x	:46
						x	x					x	x	x	:57:24
					x							x	x	x	:59
												x	x		:58:29
						x						x	x	x	:34
		x				x						x	x	x	:59:00
												x			:09
	x											x	x	x	:45
												x			11:00:08
												x		x	:24
		x										x	x	x	:51
				x								x	x	x	:01:11
				x								x	x	x	:30
	x														:02:00
		x										x	x	x	:09
												x	x	x	:37
												x			:54
												x			:03:06
												x			:23
			x									x	x	x	:40
					x							x	x	x	:47
			x									x	x	x	:53

Type												SA			970718.1
															18-Jul-97
a1	a2	a3	b1	b2	b3	c1	c2	c3	d1	d2	d3	ea	dtca	ia	EventRef
												x	x	x	11:03:57
							x					x	x	x	:04:37
												x			:55
		x										x	x	x	:05:00

970718.1 Observation Notes

970718.1	
Camera 1 / Tape 1 and Tape 2	
Time	**Observation**
10:50:00	View blocked by soldier, can hear S3 talk to soldier.
:46	Listening to ActingS2, nodding acknowledgment.
:51	Turns to standing soldier, gives advice/recommendation while looking back at map board.
:51:23	While talking, notes another soldier go by.
:31	Turns and gives similar direction to direction to Acting S2. RTOs listen.
:47	Looks to see what's on S3 board, sweeps across arc to left to see what FDO is doing.
:52:00	Listening to S3NCO, rotating gaze to FDO.
:06	Checks watch.
:15	S2NCO says something, S3 turns, listens then gives guidance to RTOs and S3NCO.
:30	ATTENTION IN THE TOC
:45	"Gotta keep the noise down"
:53:02	Keeps rotating to voices then back to map board. Nods acknowledgment to voices.
:12	Keeps rotating to voices then back to map board. Nods acknowledgment to voices.
:25	Picks up handset.
:39	With handset to ear, keeps rotating to voices then back to map board. Nods acknowledgment to voices.
:54	Nods acknowledgment to someone.
:54:00	(Tape ends)
	(New tape)
:55:00	Listening to handset, listening to Acting S2, gives guidance.
:12	Agrees with another voice.
:29	On handset, hears callout in the TOC, leans forward to look at map.
:54	FDO calls out information, S3 looks at map while listening, then puts down handset and asks RTO for additional information.
:56:20	Hears information, tells S2 to act on it.
:29	Hears query from FDO, answers it.
:36	Repeats same information to S2 after hearing them ask about it.
:46	Reads red notebook, looks up at S2, acknowledges voice while reading.
:57:24	S2 asking for information. Conversation with S2. Questions their knowledge.
:59	Educates S2 about enemy equipment. (training/OJT).
:58:29	Reading, looks up to map in response to call out.
:34	Sees location on map board, turns to right to confirm information with FDO.
:59:00	Reading, listening to S2 and FDO and radio. Gives quick acknowledgment to S2, quick confirmatory question to FDO.
:09	Hears something, puts away red book, picks up handset, pulls out yellow book.
:45	While reading, hears FDO say something, responds with "outstanding."
11:00:08	While listening on handset, glances at FDO to see what they're doing.
:24	Looks at soldier leaving TOC on crutches.
:51	While tying boots, listening to Acting S2, nods acknowledgment.
:01:11	Listening to Acting S2, tells him to help, makes face of irritation with Acting S2.
:30	After hearing Acting S2, looking at map, gives evaluation of situation to Battle Captain.
:02:00	Does a visual sweep from Acting S2 to map board to Acting S2, comments on "smelling
:09	Turns right, gets voice input from RTOs, acknowledges, turns forward, picks up handset.
:37	Raises eyes and eyebrows while holding handset and listening to Battle Captain. Then glances left to FDO to confirm what he heard.

:54	Another visual sweep from FDO to Acting S2 and back to map board.
:03:06	Glances up at Battle Captain while on handset.
:23	Glances up at Battle Captain while on handset.
:40	Hears something about “alpha” from an unidentified voice in the area, tells plotter to be sure they have the correct time for “alpha” on the board.
:47	Passes data verbally to S2.
:53	Turns right to tell soldier something about A Battery.
:57	Turns 45 degrees to right to see who just spoke.
:04:11	(Unidentified head in front of camera lens; checked camera 3 and found the view blocked too).
:37	Turns to FDO to ask question, then turns gaze back to map.
:55	Leans back to get a wider view, keeps turning left to listen to FDO.
:05:00	Talks to soldier over his left shoulder, soldier leans in to speak quietly.

970718.2 Coding Sheet

970718.2	Event			Mode																				
18-Jul-97				I/O																				
EventRef	g	l	p	h/n	h/s	h/w	h/l	h/o	s/n	s/s	s/w	s/l	s/o	r/n	r/s	r/w	r/l	r/o	o/n	o/s	o/w	o/l	o/o
12:30:11			x				x					x											
:18		x	x		x			x															
:46		x	x		x																		
:52		x	x					x															
:31:01			x				x																
:08			x				x																
:29		x	x		x					x													
:46			x									x											
:32:28			x									x											
:40			x		x																		
:33:15		x	x					x															
:22		x	x							x													
:32		x	x		x					x													
:40			x					x															
:56			x				x					x											
:34:05			x			x																	
:57			x		x																		
:38:08			x		x																		
:45			x		x		x					x											
:39:00		x	x		x																		
:31		x						x															
:56		x	x		x																		
:40:04		x	x		x		x																
:20		x	x		x																		
:35			x				x					x											
:40			x		x																		
:57		x	x				x					x											
:41:06	x									x													
:40		x	x				x																
:45			x									x											
:54			x									x											
:42:00		x	x		x																		
:29		x	x		x																		
:40		x					x					x											
:43:00		x	x		x																		
:18		x					x					x											
:45		x	x		x			x															
:57		x	x		x																		
:44:35		x	x		x		x																
:58	x	x	x		x		x																

Type												SA			970718.2
															18-Jul-97
a1	a2	a3	B1	b2	b3	c1	c2	c3	d1	d2	d3	ea	dtca	ia	EventRef
												x		x	12:30:11
							x					x	x	x	:18
										x					:46
		x										x		x	:52
												x		x	:31:01
												x		x	:08
				x						x		x	x	x	:29
												x			:46
												x			:32:28
	x											x	x	x	:40
		x										x	x	x	:33:15
					x							x	x	x	:22
					x							x	x	x	:32
		x										x	x	x	:40
												x	x		:56
												x	x		:34:05
		x		x	x							x	x	x	:57
				x								x	x	x	:38:08
		x										x	x	x	:45
			X			x						x	x	x	:39:00
												x	x		:31
						x						x	x	x	:56
					x							x	x	x	:40:04
			X									x	x	x	:20
												x		x	:35
		x										x		x	:40
												x	x		:57
									x			x	x	x	:41:06
												x		x	:40
												x			:45
												x			:54
						x						x	x	x	:42:00
						x						x	x	x	:29
												x		x	:40
x				x										x	:43:00
												x			:18
		x										x	x	x	:45
					x							x	x	x	:57
					x							x	x		:44:35
x		x													:58

970718.2 Observation Notes

970718.2	
Camera 1 / Tape 2	
Time	**Observation**
12:30:00	On handset, listening.
:11	Turns right to look at what S2 is saying.
:18	Nods negative response to what S2 was saying. Leads to exchange with S2.
:46	Waves off someone who is talking to him from 45 degrees front left, concentrating on listening to handset.
:52	Nods acknowledgment to someone 45 degrees front right.
:31:01	Peers closely to RTO to hear what's up.
:08	Glances again to S2.
:16	(soldier blocks view)
:29	Calls out to FDO, with his hand over mouthpiece of handset, "kill that damn battery of
:46	Sitting with chin in hands, looking at map board, listening to environment, glances to see who's moving at 45 degrees front left.
:49	(View blocked)
:32:10	(Open, then blocked again)
:29	Eyes moving from spot to spot on map boards.
:40	Gets face-to-face input from soldier who walks up to his left. Leans in closely to speak face-to-face at about 18 inches. S3 holds hand over mouthpiece of handset. Conversation ends with S3 laughing and soldier smiling.
:33:15	Nods acknowledgment, while looking at board and listening on handset.
:22	Tells plotter something just moved, points to it with handset which he is holding in his right hand.
:32	Tells plotter again that something just moved, points to it with handset, which he is holding in his right hand. Engages in further voice exchange.
:40	Nods acknowledgment.
:56	Does a visual scan from right to left, seems to be curious about FDO.
:34:05	Hears something on handset, sits forward to write in his book.
:17	Gets voice report from soldier who leans down to S3's left side. Soldier responds to S3 voice response by taking notes. Turns into long back and forth conversation with S3 nodding acknowledgements and explaining the situation to the soldier. This exchange seems to be related to the simulation itself, not to the scenario they are playing in the simulation. Computer operator sitting directly behind the S3 listens attentively to conversation. The soldier talking to the S3 could be a superior to the S3 although the S3 does not rise from his seat during the conversation. Conversation lasts until :37:55.
:38:08	Another soldier leans in to talk to S3. Can hear S3 saying "we need to call…" Gives tasking to S2 and to RTOs.
:45	S3 leans back. Getting input form front left quarter and from PC operator to his left rear while simultaneously looking to S2 and to FDO and to map boards with irritated grimace.
:39:00	Talks to FDO.
:31	Sees something peripherally, turns away from FDO to Battle Captain, listening to radio.
:56	After getting information from radio, turns to FDO to query what he did to achieve what he just heard.
:40:04	RTO tells him something which causes smile, looks at RTOs, then to FDO to explain something about the information.
:20	Looking at FDO who is asking him a question, listening to radio. Concurs with FDO suggestion.
:35	Scanning visually from S2 to FDO and back. Notices arrival of pizza to FDO.
:40	Verbally acknowledges input from RTO while continuing to scan.

:57	Hears something on radio and in S2 chatter which causes him to check back to map board and back to the conversations and back again to board then to FDO and back again to board.
:41:01	Calls out to Acting S2 and to general area, “no cokes in the TOC.”
;40	Looks to Acting S2 to see what he’s doing.
:45	Looks at watch.
:54	Looks at soldier moving around.
:42:00	Asks a quick question about radar.
:29	Hears FDO call a fire mission, turns to him, asks question.
:30	Looks to S2 area.
:43:00	A social event. Someone in sweat clothes has come into the TOC. S3 listens to what the new arrival has to say and responds with some information to take away.
:18	Checks out Acting S2 talking to his right and then checks out movement to his left.
:26	Picks up handset. With handset to his ear, he listens to Acting S2 talk to him, nods and speaks acknowledgments.
:37	Relays information to Battle Captain that he hears over handset.
:44:35	Turns from gazing at map to look at S2 and then relays more information to Battle Captain.
:58	Hears FDO call out, nods acknowledgment to Battle Captain, turns to look at FDO, says “good.”
	(simulation ends for the day at about this time)

970723.1 Coding Sheet

970723.1	Event			Mode																					
23-Jul-97				I/O																					
EventRef	g	l	p	h/n	h/s	h/w	h/l	h/o	s/n	s/s	s/w	s/l	s/o	r/n	r/s	r/w	r/l	r/o	o/n	o/s	o/w	o/l	o/o
10:50:13		x			x																		
:22			x		x					x													
:29			x		x																		
:45		x			x																		
:59			x				x					x											
:51:05		x			x					x													
:18		x			x		x																
:35		x					x																
:44		x	x		x		x																
:58		x					x																
:52:20			x									x											
:23		x			x		x																
:50		x					x																
:57		x	x		x																		
:53:10		x	x		x																		
:36	x	x					x																
:51		x					x																
:54:21	x						x	x															
:25	x						x	x															
:32	x	x	x		x		x																
:40		x	x					x															
:47	x	x	x		x		x																
:55		x	x		x																		
:55:15		x										x											
:33		x	x		x					x													
:42		x	x		x																		
:56:10		x			x		x																
:23		x			x		x																
:49		x			x					x													
:57:25		x			x																		
:38			x							x													
:47		x	x		x																		
:59			x							x													
:58:01	x				x																		
:28		x			x																		
:50			x									x											
:59	x				x		x																
:59:16			x		x																		
:25	x						x					x											
11:00:02		x								x													
:15		x								x													
:30		x					x																

970723.1	Event			Mode																					
23-Jul-97				I/O																					
EventRef	g	l	p	h/n	h/s	h/w	h/l	h/o	s/n	s/s	s/w	s/l	s/o	r/n	r/s	r/w	r/l	r/o	o/n	o/s	o/w	o/l	o/o		
11:00:44			x				x																		
:49		x	x		x																				
:58		x	x							x															
:01:00		x	x		x		x																		
:02:17		x	x		x					x															
:48	x	x	x				x																		
:56	x	x	x		x					x															
:03:14		x	x		x																				
:28	x						x																		
:04:12	x				x																				
:34	x	x					x																		
:56		x					x																		

Type												SA			970723.1
															23-Jul-97
a1	a2	a3	b1	b2	b3	c1	c2	c3	d1	d2	d3	ea	dtca	ia	EventRef
			x									x	x	x	10:50:13
	x											x		x	:22
	x											x		x	:29
						x						x	x	x	:45
												x	x	x	:59
						x						x	x	x	:51:05
					x							x	x		:18
												x	x		:35
					x							x	x	x	:44
												x			:58
												x			:52:20
		x										x	x	x	:23
		x										x	x	x	:50
					x							x	x	x	:57
						x						x	x	x	:53:10
												x	x	x	:36
												x			:51
	x											x	x	x	:54:21
	x											x	x	x	:25
				x								x	x	x	:32
		x										x	x	x	:40
				x								x	x	x	:47
			x									x	x	x	:55
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					x							x	x	x	:33
									x			x	x	x	:42
				x								x	x	x	:56:10
												x	x	x	:23
x												x	x	x	:49
			x									x	x	x	:57:25
												x		x	:38
						x						x	x	x	:47
												x	x	x	:59
				x	x							x	x	x	:58:01
					x							x		x	:28
												x		x	:50
				x								x	x	x	:59
					x							x	x	x	:59:16
												x	x		:25
						x						x	x	x	11:00:02
			x	x								x	x	x	:15
												x		x	:30

Type												SA			970723.1
															23-Jul-97
a1	a2	a3	b1	b2	b3	c1	c2	c3	d1	d2	d3	ea	dtca	ia	EventRef
												x			11:00:44
			x									x	x	x	:49
					x							x	x	x	:58
		x										x	x	x	:01:00
				x								x	x	x	:02:17
												x	x	x	:48
				x								x	x	x	:56
				x								x	x	x	:03:14
												x	x		:28
				x								x	x	x	:04:12
												x	x	x	:34
												x	x	x	:56

970723.1 Observation Notes

970723.1	
Camera 3 / Tape 1	
Time	**Observation**
10:50:13	Turns to ask FDO a question “what is it?”
:22	Jokes with FDO.
:29	More banter with FDO.
:45	Shotgun question to area, “we need to know where his recon is, guys”.
:59	Finishes talk with FDO, looks to see what Acting S2is saying on a phone, turns gaze back to map board.
:51:05	Talking to S2, looking at map board, speaking loudly enough for FDO to hear.
:18	Heard RTO say something, while looking at map board tells plotter “we’re good.”
:35	Hears call of shot results, looks at map as plotter shows the position.
:44	FDO gives amplifying data to previous report, S3 looks at him, then rotates back to map with handset in hand. Comments back to FDO with more amplifying information.
:58	Heard someone say “loss of Bradleys,” looks to right to S2 board and to see who’s talking.
:52:20	Checks watch.
:23	Someone gives him a report, acknowledges with a “hooah.”
:50	S2 briefs him at the map, S3 looks at him and map while listening to handset.
:57	Announces “some mortars,” primarily to FDO. This was something he heard through handset.
:53:10	Asks on handset for information about mortars.
:36	Listening to radio call about external activity, looking at map to orient himself.
:51	Looks to right to see who’s speaking.
:54:21	Hears comment about mortars, smiles and looks at FDO.
:25	Does same to S2.
:32	Recognizes situation, turns to S2 to tell him of it, looks at map.
	Almost all events during this period involve the S3’s Interpersonal Awareness because he sees them and can recognize whether they are with it or not, and get a feel for why.
:40	S2 responds, points to map, S3 looks at map, nods acknowledgment.
:47	Relays same conversation to FDO that he just had with S2.
:55	Turns to PC operator (120 degree rotation to his left) to ask for information in visual form. Looks at PC screen.
:55:15	Looks at soldier gesturing, then rotates back to map with handset at his ear.
:33	Tells plotter to put something on the map.
:42	Corrects the S2, “it’s all right, we can crosstalk.”
:56:10	FDO asks question, S3 turns left to look at him. Q: “that’s the recon, right?” A: “that’s his main body.”
:24	Conversation between S2 and FDO amplifying previous exchange between S3 and FDO. S2 adding to the S3’s comment. S3 looking at map.
:49	S2 recognizes something, has soldiers change icon. S3 sees it and likes it, “there you
:57:16	(S2 blocking view of S3)
:25	S3 to FDO. “Shoot it.” Heard radio call, gave guidance.
:43	Listening on handset, glances at S2 to see what he’s doing.
:47	Asks Battle Captain “where’d you get that?”
:59	To relieve pressure from handset on left ear, takes it away and glances at FDO, then back to map.
:58:01	ATTENTION IN THE TOC. S3 announces situation change. Tells plotter to mark icon. Is explicit.
:24	(view blocked)

:28	Someone asks S3 to repeat his “Attention in the TOC” information. He does.
:50	Caught S2 goofing around out of the corner of his eye, flashed a quick glare that way with disapproving look on his face.
:59	Radio call, everyone springs to action. S3: “here we go.” Looking at plots on map.
:59:16	Turns to RTO to clarify input and make clear his intent.
:25	ATTENTION IN THE TOC call out. S3 looks to FDO to confirm. Looks at plotter’s hand on the map.
14:00:02	S3 to plotter: “show me how far Charlie Battery’s moved.”
:15	After looking at plot, turns left to FDO with direction about next few minutes’ activity.
:30	Looks at map board activity to see what S2 is telling soldier to do.
:44	Looks twice at RTOs. Seems slightly irritated with what he’s hearing.
:49	Hears something on handset, tells Battle Captain to plot it.
:01:00	Sees plot on map, turns to S2 and gives details about what’s at plot.
:11	Acting S2 sits down to talk to S3. Captures S3’s focus by pointing to map and explaining some technical detail. S3 acknowledges.
:02:09	Previous conversation terminates.
:17	S3 talking to external party on handset, using map to orient himself as he talks.
:48	Listening to response over handset.
:56	Responds to other person on the line with additional guidance.
:03:14	S2, who has been listening, leans in with suggestion. S3 turns right, leans toward S2. Listens, but then reacts to handset that he has at his ear and responds to voice on handset.
:28	ATTENTION IN THE TOC. S3 is still talking on handset, while listening to “Attention in the TOC” callout and looking at plot on map.
:04:12	Listening to handset causes him to turn to FDO with advice.
:34	Listening to radio and S2 callouts, looking at plots on map.
:56	Hears S2, glances at soldier plotting on S2 map.

970723.2 Coding Sheet

970723.2	Event			Mode																						
23-Jul-97				I/O																						
EventRef	g	l	p	h/n	h/s	h/w	h/l	h/o	s/n	s/s	s/w	s/l	s/o	r/n	r/s	r/w	r/l	r/o	o/n	o/s	o/w	o/l	o/o
12:40:00	x						x																
:08			x		x					x													
:33		x			x																		
:42:01		x					x					x											
:12			x				x																
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:43:09		x	x				x					x											
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:44:12			x		x																		
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:38	x						x					x											
:58	x				x					x													
:47:03		x			x					x													
:34		x			x																		
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:49:20		x	x		x																		
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:56		x	x		x																		
:50:16			x																	x			
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12:51:37		x					x																		
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:53:05		x	x		x																				
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:54:11			x									x													
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Type												SA			970723.2
															23-Jul-97
a1	a2	a3	b1	b2	b3	c1	c2	c3	d1	d2	d3	ea	dtca	ia	EventRef
												x		x	12:40:00
			x								x	x	x	x	:08
		x	x						x			x	x		:33
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			x									x	x	x	:56
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Type												SA			970723.2
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a1	a2	a3	b1	b2	b3	c1	c2	c3	d1	d2	d3	ea	dtca	ia	EventRef
												x	x	x	12:51:37
x			x									x	x	x	:51
x			x									x	x	x	:52:06
														x	:46
			x									x	x	x	:58
	x											x	x	x	:53:05
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x	x											x		x	:38
												x	x	x	:54:11
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970723.2 Observation Notes

970723.2	
Camera 3 / Tape 1	
Time	**Observation**
12:40:00	Listening to radio, looking at FDO.
:08	Asks Acting S2 a question (Acting S2 is currently standing in the FDO area): "hey, are Response: "Yes, I'm getting a confirmation." S3: "No, don't do that." With head shakes.
:33	Face-to-face with the Acting S2. Educating Acting S2 to the difference between a simulation and actual combat operations. Acting S2 explaining his information needs. S3 ends exchange when he turns away to listen to handset.
:41:12	Radio call compels S3 to pay attention to handset. Drops conversation with Acting S2 who eventually gets up and departs unsatisfied.
:42:01	While listening to radio, notices plotter point something out to Battle Captain.
:12	Puts down handset, plays with notebook, looks at Battle Captain, then FDO.
:25	Looks to FDO, says something, then turns to RTO to ask for handset connecting him to a specific unit.
:37	Private radio conversation with Graywolf 6.
:43:09	While talking, looks at FDO as radio call goes out in TOC.
:26	Puts down Graywolf, takes another handset, moves to radio switch, puts down second handset, picks up third.
:37	Asks third handset: "This is (his last name), let me speak to Force Protection."
::44:12	Talking to another unit about combat planning and activities.
:20	Puts down handset, turns to FDO and announces "we're giving up our force protection company to get them into the fight."
:43	Hears something from the FDO which causes him to laugh quickly, then picks up handset.
:52	Glances at S2 to see how he's responding to a callout.
:45:12	Looking at map board as he listens on a handset.
:18	Senses movement to his right, glances over to the right rear.
:26	Puts down handset, turns left to FDO and comments "27 T-80s!" with head shake.
:30	Talking, senses movement to right, looks at S2, then back to board.
:40	FDO and Battle Captain talking to him, responds positively while yawning and turning gaze back to board.
	The map board holds his focus. The map and the status charts are his external reality.
:51	Glances at FDO, checks his watch.
:46:00	ATTENTION IN THE TOC. Battle results announced, S3 looks to speaker, then turns to write in notebook.
:26	While writing, glances up and to left at boards, studies boards.
:38	Picks up handset while listening to radio.
:58	S3: "OK, (someone's name), plot it on the map before you put the yellow dot. Show us where it's at." This came after listening to global radio chatter and seeing the individual he's addressing move toward the map.
	Need better Bales coding descriptions to capture the imperative tone in use.
:47:03	Explains his plan to Acting S2. Acting S2 acknowledges, but attempts to take the lead. S3 takes control back with clear statement of control, "Shoot first, then analyze!"
:34	Telling Acting S2 what he wants and why. Acting S2 doesn't give a positive response, so S3 cuts him off with a curt "Shoot it!" (i.e., "Do it and do it my way!")
:52	While telling Acting S2 what he wants, someone calls to him from his right rear. S3 turns to look, hears, looks to board to confirm with sight what he just heard, then back to look at speaker again.

:48:04	Asks for clarification.
:12	Sees new S2 giving direction to S2's staff after Acting S2 has left the area. New S2 is giving the same message as S3 had given to Acting S2. Smiles and hand gesture from new S2 indicates the Acting S2. S3 responds with half smile and "I know, I know…" Unspoken communication, but clear understanding of meaning between S3 and S2.
:28	S3: "We'll get it straight" to S2 who is now standing in front of S3 desk.
:40	Continues discussion with S2. S3 telling S2 how he wants the job done and why. Both S2 and S3 are working together, talking together because Acting S2 is not in vicinity. S3 is telling S2 how to do the job, that he wants it done in a way the Acting S2 did not want to do. Gestures with hands.
:49:20	While on handset, hears S2 tell soldier/plotter something. S3 interjects again to ensure his message is crystal clear. All soldiers in the area are listening to what S3 is telling (instructing) the S2.
:51	Soldier to S3's left gives him some verbal input, S3 responds with additional information.
:56	S3 turns 120 degrees to his right to speak to someone else behind him. Same subject. Everyone in the vicinity is listening.
:50:16	Turns to S2 and RTOs: "Man, it's hot today."
:30	Hears something, turns back to look at RTO to see who is speaking. No comment.
:43	Takes drink of water, puts down canteen, does visual scan from FDO to S2 and then back to board.
:51	Hears radio call about vehicles somewhere. Asks plotter where they are. Plotter points out location on map.
:56	Tells plotter to "move an icon down there."
:59	Checks watch.
:51:00	Scanning toward S2 and back to board. Looks at S2 to see what S2 and soldier are saying to each other.
:09	Hears an alarm, looks toward RTOs: "somebody's alarm."
:17	Scanning toward S2 and back to board. Looks at S2 to see what S2 and soldier are saying to each other.
:37	Scanning toward S2 and back to board. Looks at S2 to see what S2 and soldier are saying to each other.
:51	Picks up conversation with S2 from where they were at :49:20 above. S3 has been listening to S2 talk to soldier about situation. S3 hears a story that's not to his liking so interjects to restore Acting S2's reputation: "you know, what he's doing is not bad…but only one guy's on the map. You've got to enforce that standard."
:52:06	Moves into instructional mode with S2. S3 is telling him what S2 needs to know in order to be ready for the NTC. At same time, he's restoring the Acting S2's status to the soldiers in the vicinity. All the while, the S3 keeps rotating his head, scanning the map and listening on the handset.
:46	Signals to S2 that the conversation has ended, back to handset.
:58	Hears something form FDO area, turns to RTO to alert him to do something.
:53:05	Chatting with FDO.
:17	Acting S2 returns to area, then leaves again.
:28	FDO says something. S3 responds (smiling), "you can do it."
:38	Talking about the heat and the weather with the Battle Captain and the soldiers standing to his left.
:54:11	Back to looking at board.
:26	Listening to radio, shaking head in resignation at what he hears.
:38	Checking out civilian moving around near the S2 map.