



## **A Platoon-Level Model of Communication Flow and the Effects on Operator Performance**

**by Patricia W. Kilduff, Jennifer C. Swoboda, and Joshua Katz**

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**ARL-MR-0656**

**November 2006**

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**Patricia W. Kilduff and Jennifer C. Swoboda**  
**Human Research and Engineering Directorate, ARL**

**Joshua Katz**  
**MicroAnalysis and Design**

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| <b>13. SUPPLEMENTARY NOTES</b>  |                                    |                                     |  |  |  |
| <b>14. ABSTRACT</b><br><p>The Future Combat System (FCS) initiative is at the center of the Army's Objective Force Vision. The Army Vision (2010) states that U.S. forces must have "information superiority: the capability to collect, process, and disseminate an uninterrupted flow of information while exploiting or denying an adversary's ability to do the same." In other words, the Future Force will be empowered by dominant situational understanding. To predict how proposed systems and displays will impact situational understanding and thereby decision making, the U.S. Army Research Laboratory's Human Research and Engineering Directorate used the tool C3TRACE (command, control, and communication: techniques for reliable assessment of concept execution). C3TRACE is a modeling environment in which one can develop multiple concept models for any size organization, staffed by any number of people, using any type of information technology, performing any number of functions and tasks, and under various communication and information loads. Among the performance measures tracked are Soldier utilization, the number of messages received, dropped, and interrupted, and the degree to which the information is available to support Soldier decision making. C3TRACE was used to develop a platoon-level model of an FCS conceptual configuration in support of the situational understanding as an enabler for the unit of action maneuver team Soldiers Army Technology Objective. The platoon model assumed wrist-mounted displays for the dismounted Soldiers and laptop-type displays for the mounted Soldiers. In general, the Soldiers using the laptop-type display were able to fully process more of their incoming messages and made no decisions with poor information quality. On the other hand, the majority of the Soldiers using the personal digital assistant had high utilization, higher numbers of dropped and interrupted messages, and decisions made with poor information quality. Specifically, the squad leader and team leaders exhibited the highest levels of utilization and decisions made with poor information quality. This was not only because they received more messages than those Soldiers in the mounted phase but also because of the technology being used.</p> |                                    |                                     |  |  |  |
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## 1. Introduction

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The U.S. Army is in the midst of a revolutionary transformation and the Future Combat System (FCS) initiative is at the center. The network-centric concept for the FCS is intended to empower the Soldier by providing accurate, timely, and actionable<sup>1</sup> information. Military missions will be conducted in an intensive information-rich, decision-making, and problem-solving environment, thus making information access and distribution critical to mission success. Technological advances promise a dramatic increase in the pace of information flow. At the same time, this information-rich environment is certain to provide many challenges for the command, control and communication (C3) environment. The potential for information overload, as distinct from information requirements, could negatively affect a Soldier's situation awareness (SA) (Endsley, 1995) and in turn, have an adverse effect on his or her ability to make effective and timely decisions during a battle, ultimately diminishing mission performance rather than improving it. In order to improve the Soldier's ability to filter and select information, an improved understanding of information systems and the interaction of the systems with the organizational structure must be achieved.

A main objective of the Army technology objective (ATO) entitled Situational Understanding (SU) as an Enabler for the Unit of Action Maneuver Team Soldiers is to support and enhance Soldier decision making in the proposed FCS information-saturated environment. Since the various concepts for the FCS organizational, personnel, and technological configurations cannot all be examined in human-in-the-loop simulations or live exercises, constructive simulations and human performance models are used. In particular, C3TRACE (command, control, and communication: techniques for reliable assessment of concept execution) was used to model the communication flow and effects of information processing on Soldier and system performance. The results help to portray the limits in information processing and decision making of the Soldiers, with the intent of affecting system design or implementation.

C3TRACE (Kilduff, Swoboda, & Barnette, 2005) provides an environment for targeted evaluation of the effects of different configurations of Soldiers and information technology on performance: both Soldier performance and overall system performance. This tool has an embedded discrete event simulation engine, Micro Saint Sharp<sup>2</sup> and a graphical user interface. It provides the capability to represent any organizational level, the people assigned to it, the tasks and functions they will perform, and the communications patterns within and outside the organization, all as a function of the frequency, criticality, and quality of incoming information.

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<sup>1</sup>That is, capable of being acted upon

<sup>2</sup>Micro Saint Sharp is a trademark of Micro Analysis & Design.

A key C3TRACE metric is “decision quality” or the degree to which the correct information is available to support a decision-making event. The basis for the decision support metric is an embedded information-driven decision-making architecture (Wojciechowski, Wojcik, Archer, & Dittman, 2001). This decision-making architecture uses 24 possible information elements taken from the U.S. Army’s accelerated decision-making process documentation (Federation of American Scientists, 1996). The information elements are grouped into six categories: (a) enemy force and actions, (b) friendly force and actions, (c) feasibility of the current plan, (d) suitability of the current plan, (e) acceptable risk, and (f) enemy course of action (COA) and potential COAs. C3TRACE uses these elements in three types of tasks: processing, collaborative, and decision making. These elements are attached to the communication events that trigger human tasks. Information is collected in the processing tasks, shared in the collaboration tasks, and used in the decision-making tasks. For example, a processing task would be open/read message; a collaborative task would be discuss; and a decision-making task would be estimate impact. As the messages and the associated information elements move through the task flow, C3TRACE accounts for which Soldier knew what elements of information and how recent that information may be to the Soldier.

The information elements are further adjusted according to two factors: the accumulated “information decay” and the match between available information and the information required to make a decision. As the model runs and messages are generated and sent to personnel to be read, the “age” of each information element is generated, based on when the assigned person first read the message and how much time elapsed before the person used the information in a decision task. It is a basic assumption of C3TRACE that the older the information, the less useful it is. It is also assumed that the rate of decay is not the same for all types of information (figure 1).

Information about the location of the enemy is likely to change frequently and rapidly, and thus, that information element will decay quickly, whereas information about the mission objective of the friendly units is likely to remain stable over a given period of time. C3TRACE provides a decay algorithm to capture this differential decay.

The match between available information and the information required to make a decision occurs whenever a decision task is executed. Just as the information elements carried by each message are identified, the information elements requirements of each decision are identified. Does the decision maker have the correct information, either processed directly from a message or received from a collaborator, to make a decision when the time comes? In the end, the “quality” of a decision, that is, the probability of making a good decision, is based on the match between the information received by the decision maker and the information required to make a decision and also by how much the “value” of the information has decayed over time. This technique can help to identify system and organizational inefficiencies, bottlenecks, or obstacles relevant to the high quality and recent information required for effective decision making.

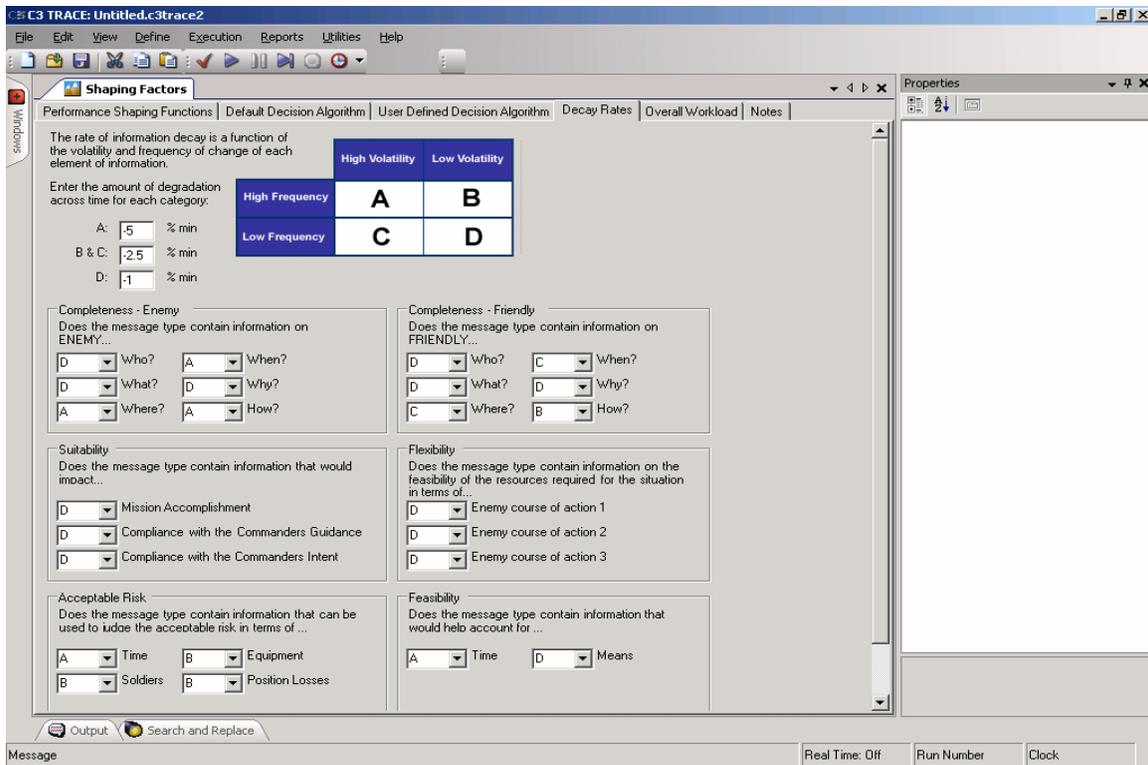


Figure 1. Decay rate matrix.

For this SU ATO-sponsored effort, a C3TRACE platoon-level model was built. This analysis examined the mounted and dismounted phases of a mission where the mounted Soldiers were assumed to be using laptop-type displays and the dismounted Soldiers were assumed to be using wrist-mounted personal digital assistants (PDAs). The principal metrics of interest are (a) Soldier utilization, (b) the number and type of messages received, dropped, and interrupted, and (c) the degree of decision support.

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## 2. Model Development

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The development of the C3TRACE platoon-level model is described in the following subsections.

### 2.1 Organization and Personnel

The proposed FCS infantry company will encompass three platoons and one company headquarters (HQ) section and associated vehicles (see figure 2). Each platoon will consist of 49 personnel in five vehicles (Unit of Action Maneuver Battle Lab [UAMBL], June 2003). In order to control the problem space and still capture the critical information flow, a subset of the total platoon was modeled. The goal was to model the Soldiers who would have the most communication traffic and to simultaneously focus on the dismounted element. The 16 personnel blocked off in figure 2 plus the

company commander (Co CDR) are the personnel modeled. The Co CDR from the infantry company HQ section was added because of the significant communications traffic that he would generate to the platoon leader (PL) and from the PL to the Co CDR.

Thus, a total of 17 Soldiers was modeled and grouped into three vehicles according to the operational and organizational (O&O) plan (UAMBL, June 2003). The Co CDR was in an infantry carrier vehicle (ICV), operating outside the platoon's direct area of operation (AO). In reality, there would be other Soldiers in the vehicle with him but for the purposes of this model, only the Co CDR was modeled. The PL's vehicle was an ICV and consisted of the PL, the vehicle commander (VC), the driver (DRV1), a medic (MED), and a robotics noncommissioned officer (RNCO). The PL was modeled as dismounted while the remainder of the Soldiers in the vehicle were modeled as mounted. The platoon sergeant's (PSG) vehicle was also an ICV and consisted of the PSG, a driver (DVR2), a squad leader (SL), two team leaders (TLA, TLB) and six infantrymen. The SL, two TLs, and the six infantrymen were modeled as dismounted. For purposes of this model and based on Future Force Warrior (FFW) guidance, the platoon model was conceptualized to use wrist-mounted PDAs for the dismounted Soldiers and laptop displays for the mounted Soldiers. These laptop displays were securely mounted in the vehicle.

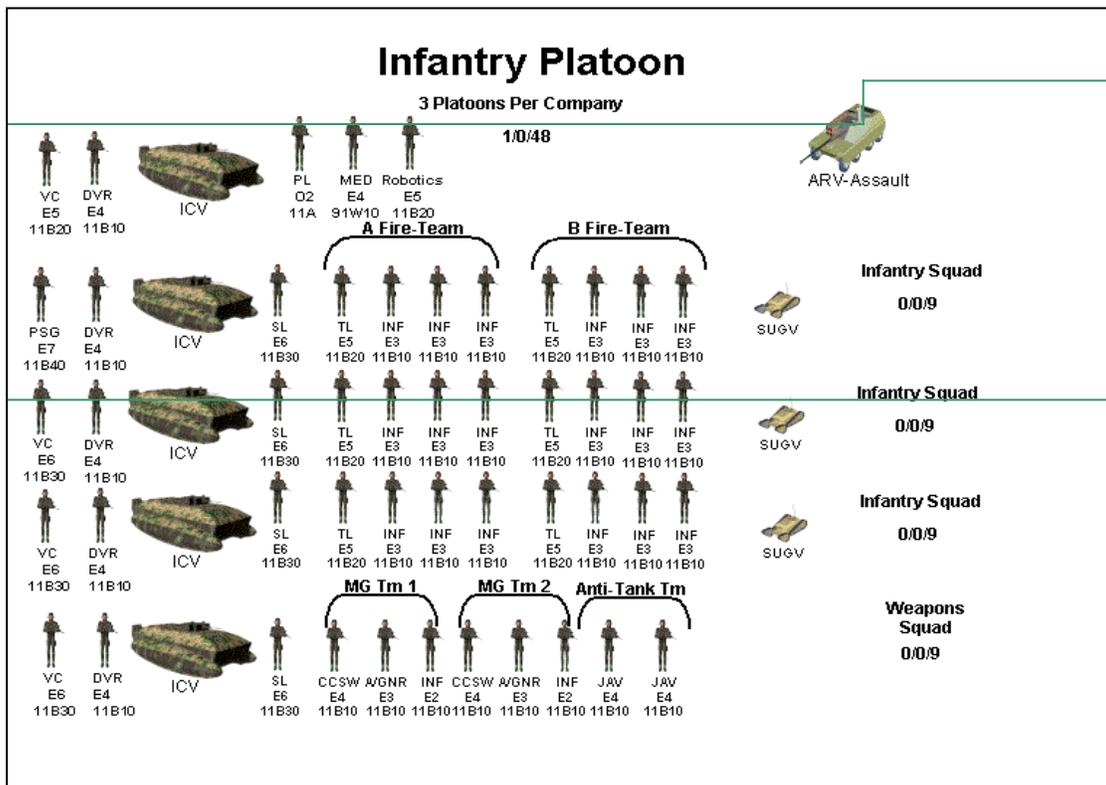


Figure 2. Infantry platoon personnel. (The blocked off personnel and vehicles indicate the Soldiers included in the model, plus the Co CDR.)

Each of the Soldiers in this platoon-level model was described in terms of his or her Soldier attributes or characteristics. The personnel characteristics as modeled here were used for

tracking purposes but do not directly affect the model execution or results. The personnel characteristics for each modeled operator are shown in appendix A. For example, the PL was described as military occupational specialty (MOS)-11A, military training level-officer basic course, length of service-2 years, aptitude level-high, age-22 to 25 years, rank-O2, time in position-4 to 6 months, and highest civilian education-college.

## 2.2 Equipment Assumptions

Although the Army is still developing the FCS and its family of equipment, the authors had to make certain assumptions in order to proceed with model development. Therefore, before building this model, the authors made two assumptions about the equipment that dismounted (see figure 3) and mounted Soldiers (see figure 4) would use, based on the FCS FFW equipment concept at that time (these devices are similar devices and do not represent any equipment undergoing development for FCS or FFW). The first assumption was that the dismounted Soldier would use a wrist-mounted PDA very similar to that of a current PDA, with a diagonal screen size of 3.5 inches. The PDA, it is assumed, would sit on a Soldier's wrist horizontally in fashion unlike its commercial design of a vertical view. Furthermore, it is assumed that the software running on this Soldier's wrist-mounted PDA would support this use. The software running on the PDA is assumed to be a new developmental item that provides a map, direction, and military symbology information.



Figure 3. Wrist-mounted PDA.

The second equipment assumption was based on the mounted Soldier and the current FCS equipment at the time of model development. The screen that the mounted Soldier is assumed to interact with is a tablet-like personal computer (PC) with touch screen capability and approximately a 14.1-inch diagonal screen. It was thought at the time of model development that this could offer portability to the mounted crew when they needed to dismount. The vehicle crew, who is thought not to dismount during operations, would have a similar device mounted on the vehicle (not removable). The software assumed to be used in this device will mirror capabilities similar to Force XXI Battle Command-Brigade and Below.



Figure 4. PC with touch screen capability.

C3TRACE was used to determine the performance effects of these information display devices (laptop versus wrist-mounted PDA) on Soldiers riding in FCS vehicles (mounted positions) and for Soldiers outside the FCS (dismounted). Most of the tasks required for manipulation of these devices are similar. However, the wrist-mounted device requires additional time to process and access needed information. This additional time is illustrated in table 1 specifically open/read message, search for digital information, find digital information, collaborate/discuss. Most of these tasks are reading tasks that require additional processing time. The requirements of the wrist-mounted PDA may create decrements in performance that could affect mission success. Table 1 provides an example of message-processing task times received through e-mail by a mounted Soldier (RNCO) using a laptop display and by a dismounted Soldier (TLA) using a wrist-mounted PDA. Task times were provided by a subject matter expert (SME), who was familiar with the proposed FFW technologies; these times served as input to the model.

Table 1. Example of message processing time for mounted Soldier (using laptop) versus dismounted Soldier (using wrist-mounted PDA).

| <b>Task</b>                           | <b>Mounted Time (sec)</b> | <b>Dismounted Time (sec)</b> |
|---------------------------------------|---------------------------|------------------------------|
| Receive E-mail                        | 0.0                       | 0.0                          |
| Identify environment                  | .5                        | .5                           |
| <b>Identify Sender</b>                | <b>.5</b>                 | <b>2.0</b>                   |
| Identify priority                     | .5                        | 2.0                          |
| Pull up e-mail                        | 2.0                       | 2.0                          |
| <b>Open/Read Message</b>              | <b>1.1</b>                | <b>30.0</b>                  |
| Relevant to me                        | .5                        | .5                           |
| Collect Information                   | 0.0                       | 0.0                          |
| <b>Search for Digital Information</b> | <b>10.0</b>               | <b>60.0</b>                  |
| <b>Find Digital Information</b>       | <b>5.5</b>                | <b>45.0</b>                  |
| Identify Actionable Choices           | 5.5                       | 5.5                          |
| Estimate Impact-Short                 | 2.5                       | 2.5                          |
| <b>Collaborate - Discuss</b>          | <b>5.5</b>                | <b>60.0</b>                  |
| Finalize COA                          | 10.0                      | 10.0                         |
| Take Action – Update COA              | 15.0                      | 15.0                         |
| <b>Average Time</b>                   | <b>3.9</b>                | <b>15.7</b>                  |

## 2.3 Functions and Tasks

According to Field Manual 7-8 (Headquarters, Department of the Army, 1992) and the FCS O&O (June 2003), the infantry platoon's mission is "to close with the enemy by means of fire, maneuver, and tactical assault to destroy, fix, or repel the enemy's assaults by fire, close combat, and counter-attack." Some specific infantry platoon mission-level battle drills include

- Platoon attack
- Squad attack
- React to contact
- Break contact
- React to ambush
- "Knock out" bunkers
- Enter building/clear room
- Enter/clear trench
- Conduct initial breach of a mined wire obstacle

Whether co-located or distributed, each of the infantry tasks requires communication not only between vehicles but also between personnel within the vehicles, between the mounted and dismounted personnel, between the dismounted themselves, and between high echelons, and other platoons/companies. The Co CDR uses his vehicle to provide company command and control (C2) from distributed locations.

In the model, the functions and tasks that each Soldier performed in processing communication events were based on guidance from a military SME who was formerly an Army Ranger with specific squad leader experience and currently works with the FFW program (the third author on this report). The functions are composed of communication tasks consisting of the steps involved in processing each message that comes into the model. When one is considering the complete job of these Soldiers, the communication is, of course, a subset of the mission. The functions and tasks in the models were sequenced to reflect the process that is expected to be followed under FCS missions. Each task was assigned attributes including priority (high, medium, low), SA level (perception, comprehension, prediction), mode (manual, auto, both), decision task (yes/no), collaborative task (yes/no), time to perform (distribution, mean, standard deviation), Soldier assignment (primary Soldier, alternate primary Soldier, supporting Soldier(s)), mental workload levels for Visual, Auditory, Cognitive and Psychomotor (VACP), and decision task information element weighting. A full listing of each task in the model is shown in appendix B. This task listing also includes the mean time, standard deviation, primary operator, and VACP values. Within the 17 model task flows (one per Soldier), there were more than 130 individual "decision

tasks” and included such tasks as “identify actionable choices,” “take action,” or “estimate impact.”

## 2.4 Scenario and Communications

The SME-(third author)-developed scenario used for this model was a 37-minute segment, based on an FFW related application that begins 45 minutes into a mission in which an infantry platoon moving in a mounted posture identifies and begins to clear a danger area. This particular segment was chosen because it had a large volume of message traffic and would represent high communication workload. The scenario segment was divided into 23 phases, ranging from Phase 1 (identifying the danger area and planning where to stop) to Phase 23 (moving to assault at the bridge). It contains both a mounted (Phases 1 through 9) and dismounted segment (Phases 10 through 23). The complete list of phases and the length of the phase is shown in table 2. The terrain in which this scenario is based is an open and rolling terrain environment. This scenario, including the times for each phase, was provided by the SME and was derived from a FFW scenario. A full description of the scenario is provided in appendix C.

Table 2. Phases of the scenario.

| Phase | Description  | Time (in seconds) |
|-------|--|-------------------|
| 1     | Identify the danger area and planning where to stop  | 330               |
| 2     | Update mission profile to reflect danger area  | 48                |
| 3     | Drivers told to stop   | 61                |
| 4     | Move into security halt  | 103               |
| 5     | Launch unmanned aerial vehicle (UAV)   | 83                |
| 6     | Discussing planning for clearing the danger area   | 110               |
| 7     | SL briefs TL about what and how to manage the battle   | 71                |
| 8     | UAV on station and provides feedback   | 44                |
| 9     | PL reports to SL, TLs, and Co CDR  | 8                 |
| 10    | Initial movement of squad (dismounted Soldiers)  | 62                |
| 11    | Medic checks status of Soldiers RNCO searching danger area squad moving                                    | 50                |
| 12    | SL wants his squads to move into cover position  | 59                |
| 13    | SL is talking to RNCO and waiting for intelligence from UAV  | 56                |
| 14    | Handoff of sensor unmanned ground vehicle (SUGV) from TLB to VC so they can fight instead of control robot | 125               |
| 15    | Moving to bridge   | 56                |
| 16    | SL and RNCO talking about what UAV sees RNCO sends video to SL   | 116               |
| 17    | PL and RNCO entering fire missions based on video  | 74                |
| 18    | Squad stopping and pulling security SL explaining to TLs where to go next                                  | 286               |
| 19    | Stopped at last covered and concealed position   | 111               |
| 20    | PL talks to RNCO for update on what he sees  | 20                |
| 21    | Squad stopped  | 101               |
| 22    | SL to RNCO intelligence up PL to RNCO to better position assets  | 119               |
| 23    | Moving to assault at bridge  | 128               |

The communication events or “messages” map onto the scenario “story” and were developed by the SME. Each message is defined by the type of communication (digital (e-mail, whiteboard, maps, sensors), voice, face to face, and written), the time it entered the model, tasks that are triggered as a result of each message, and the priority of the message. A complete list of the

messages entering the model is shown in appendix D. The C3TRACE model works according to a basic “input-throughput-output” scheme. That is, the input to the task model is communication events, which present an information event stream in a time sequence. As these communication events enter the model, tasks are triggered and performed in a pattern that reflects the logic for task branching and interrupt priorities. The logic path (path that each message followed through the organization) for each message was determined on the basis of message content and its timing in the scenario.

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### **3. Results**

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The focus of the model was on information flow and communication, particularly when the information flow led to a decision. Model results included measures of performance such as Soldier use, Soldier performance in terms of received versus interrupted and dropped messages, and “decision quality” as a function of information “goodness” and match to the decision requirements.

#### **3.1 Soldier Utilization**

Table 3 shows the utilization for each Soldier over the duration of the scenario. Utilization is defined as the percentage of time that a particular Soldier was busy during the scenario. For example, the scenario for this model ran for 2,250 seconds or 37 minutes. A Soldier’s utilization is the percent of that 37 minutes that s/he is busy receiving, sending, and thinking about the content of each message and the resulting action required. In other words, during the 37-minute scenario, the SL was busy for 86% of that time. Utilization rates are for communication tasks only and do not include other mission-related tasks that are not included in the model.

The Soldiers are grouped by mounted (7 Soldiers) and dismounted (10 Soldiers) according to their position in the platoon. The dismounted Soldiers were modeled solely performing dismounted tasks and the mounted Soldiers performing mounted tasks. For the mounted Soldiers, only the PSG and RNCO had utilization rates above or approaching 50%. On the other hand, for the dismounted Soldiers, all utilization rates were close to 50% or higher, but squad and team leaders had the highest utilization rates. The authors considered utilization at or above 45% to be high.

Table 3. Utilization by Soldier.

| <b>Soldier</b>    | <b>Utilization (percent)</b> |
|-------------------|------------------------------|
| <b>Mounted</b>    |                              |
| Co Cdr            | 4                            |
| VC                | 23                           |
| DVR1              | 11                           |
| MED               | 22                           |
| PSG               | 49                           |
| RNCO              | 56                           |
| DVR2              | 8                            |
| <b>Dismounted</b> |                              |
| PL                | 71                           |
| SL                | 86                           |
| TLA               | 77                           |
| Rifleman 1A       | 45                           |
| Rifleman 2A       | 54                           |
| Rifleman 3A       | 49                           |
| TLB               | 83                           |
| Rifleman 1B       | 61                           |
| Rifleman 2B       | 62                           |
| Rifleman 3B       | 64                           |

### 3.2 Soldier Performance

Table 4 shows the Soldier performance data in terms of the total number of messages received, number and percent of messages dropped, and number of times messages were interrupted during the scenario. The data in this table represent the Soldiers who were utilized 45% of the time and higher. Although most of the Soldiers had utilization exceeding 50%, several Soldiers were very close to this level (45% or >). Actually, this included all (100%) of the dismounted Soldiers and two (20%) of the mounted Soldiers. The SL received a total of 124 messages and had 286 task interrupts and 88 message drops. A task interrupt is defined as a message for which the processing is interrupted because another message of a higher priority comes into the model causing the Soldier to stop working on the current message (the message is suspended at this point) and start working on the new one. If the Soldier is not able to return to the interrupted message to finish processing it within a predefined 10-minute time limit, that message is dropped and not processed any further. It is important to note that if a message is interrupted and consequently dropped, it may lead to a critical piece of information being lost, thereby having a potentially significant effect on the outcome of the battle. The same could be said for a message that has been interrupted several times and then ultimately processed. In this particular case, the information would most likely be “old”. If a message was dropped during a collaboration task or a decision-making task, this, too, could have a significant effect on the battle outcome. A message can be interrupted more than one time, which was why, in some cases, the number of interrupts was higher than the number of messages received. Among the mounted Soldiers with utilization less than 45%, few messages were dropped. Among the dismounted Soldiers, the squad and team leaders had the highest number (and percentage of) message drops.

Table 4. Number of medium and high priority messages received, interrupted, or dropped by highly utilized (45% or higher) Soldiers.

| <b>Soldier</b>    | <b>Number of Messages Received</b> | <b>Number of Dropped Messages</b> | <b>Percent Dropped Messages</b> | <b>Number of Times Messages Interrupted</b> |
|-------------------|------------------------------------|-----------------------------------|---------------------------------|---|
| <b>Mounted</b>    |                                    |                                   |                                 |   |
| PSG               | 48                                 | 0                                 | 0                               | 4   |
| RNCO              | 65                                 | 3                                 | 5                               | 18  |
| <b>Dismounted</b> |                                    |                                   |                                 |   |
| PL                | 81                                 | 3                                 | 4                               | 146   |
| SL                | 124                                | 88                                | 71                              | 286   |
| TLA               | 98                                 | 47                                | 48                              | 151   |
| Rifleman 1A       | 80                                 | 7                                 | 9                               | 76  |
| Rifleman 2A       | 79                                 | 10                                | 13                              | 129   |
| Rifleman 3A       | 79                                 | 13                                | 16                              | 128   |
| TLB               | 96                                 | 78                                | 81                              | 176   |
| Rifleman 1B       | 82                                 | 19                                | 23                              | 168   |
| Rifleman 2B       | 82                                 | 14                                | 17                              | 154   |
| Rifleman 3B       | 80                                 | 17                                | 21                              | 137   |

It is interesting to identify during which phases of the scenario the majority of messages were dropped. Table 5 shows the number of messages dropped per phase. For most of the phases until Phase 11, there are few drops. There are 10 message drops in Phase 4 because the vehicle is getting ready to stop so the Soldiers can dismount. During Phases 1 through 9, all Soldiers are mounted. Phases 12 through 23 are where the bulk of the mission-related action takes place. Dismounts begin to assume their position on the ground and take action. During these later phases, the majority of messages were dropped by the dismounted Soldiers.

Table 5. Number of dropped messages by phase for highly utilized operators.

| <b>Phase</b>  | <b>Number of Drops</b> |
|---|------------------------|
| 1 – Identify the danger area and planning where to stop                         | 0                      |
| 2 – Update mission profile to reflect danger area                               | 0                      |
| 3 – Drivers told to stop  | 4                      |
| 4 – Move into security halt   | 10                     |
| 5 – Deploy UAV  | 4                      |
| 6 – Discussing planning for clearing the danger area                            | 3                      |
| 7 – SL briefs TLs about what and how to manage the battle                       | 7                      |
| 8 – UAV on station and provides feedback  | 1                      |
| 9 – PL reports to SL, TLs, and Co   | 1                      |
| 10 – Initial movement of squad (dismounted)                                     | 11                     |
| 11 – MED checks status of soldiers RNCO searching danger area squad moving      | 10                     |
| 12 – SL wants his squads to move into cover position                            | 27                     |
| 13 – SL is talking to RNCO and waiting for intelligence from UAV                | 15                     |
| 14 – Handoff of SUGV from TLB to VC so they can fight instead of control robot  | 48                     |
| 15 – Moving to bridge   | 35                     |
| 16 – SL and RNCO talking about what UAV sees RNCO sends video to SL             | 4                      |
| 17 – PL and RNCO entering fire missions based on video                          | 14                     |
| 18 – Squad stopping and pulling security SL explaining to TL’s where to go next | 40                     |
| 19 – Stopped at last covered and concealed position                             | 19                     |
| 20 – PL talks to RNCO for update on what he sees                                | 8                      |
| 21 – Squad stopped  | 5                      |
| 22 – SL to RNCO intelligence to PL to RNCO to better position assets            | 11                     |
| 23 – Moving to assault at bridge  | 19                     |

Dismounts must rely on their wrist-mounted PDA for any communication whether from higher or from other dismounts during this period of high activity.

### 3.3 “Decision Quality”

Table 6 shows the number of decisions made with good or bad quality information for the mounted Soldiers, including the PSG, and RNCO, and the dismounted Soldiers, including the PL, SL, TLA, rifleman 1A, 2A, 3A, TLB, rifleman 1B, 2B, and 3B. It also shows that most decisions were made with good quality information except for the squad leader. Decisions made with good information quality are those in which a Soldier had the most recent information available and was able to process and act upon that information in a timely manner. However, decisions made with poor information quality are those in which a Soldier had only old (out of date) information, possibly as a result of competing tasks and interruptions and was not able to act in a timely manner in making a decision. The assumption in C3TRACE is that decisions are only as good as the information used to make them. The quality of the information and the degree of the match of the information available to the information required equals the “quality” of the decision. If a Soldier is provided with poor information, the likelihood of making a poor decision is high. For the purpose of this model, the probability of making a good decision is defined as any decision with  $\geq 50\%$  good quality information, and conversely, the probability of making a bad decision is defined as any decision with  $< 50\%$  good quality information. The rationale behind this fairly liberal cutoff is that decisions made with poor information quality do not always lead to a negative tactical outcome. Individual personnel characteristics such as experience, training, leadership qualities, and so forth, can all have an impact on decision making as well as recency of the information.

Table 6. Number of decisions based on information quality by Soldier.

| <b>Soldier</b>    | <b>Number of Decisions Made with Good Info Quality</b> | <b>Percent of Decisions Made with Good Info Quality</b> | <b>Number of Decisions Made with Poor Info Quality</b> | <b>Percent of Decisions Made with Poor Info Quality</b> | <b>Total Number of Decisions</b> |
|-------------------|--|---|--|---|----------------------------------|
| <b>Mounted</b>    |  |   |  |   |                                  |
| RNCO              | 92   | 100   | 0  | 0   | 92                               |
| PSG               | 58   | 100   | 0  | 0   | 58                               |
| <b>Dismounted</b> |  |   |  |   |                                  |
| PL                | 94   | 98  | 2  | 2   | 96                               |
| SL                | 52   | 47  | 59   | 53  | 111                              |
| TLA               | 44   | 88  | 6  | 12  | 50                               |
| Rifleman 1A       | 68   | 92  | 6  | 8   | 74                               |
| Rifleman 2A       | 69   | 90  | 8  | 10  | 77                               |
| Rifleman 3A       | 65   | 92  | 6  | 8   | 71                               |
| TLB               | 32   | 82  | 7  | 18  | 39                               |
| Rifleman 1B       | 70   | 91  | 7  | 9   | 77                               |
| Rifleman 2B       | 67   | 91  | 7  | 9   | 74                               |
| Rifleman 3B       | 72   | 92  | 6  | 8   | 78                               |

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## 4. Discussion

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As mentioned earlier in the report, a subset of the total platoon was modeled. This subset included a total of 17 Soldiers, essentially one squad, of 49 Soldiers (50 with the Co Cdr). The results that are presented and discussed are relevant to only the subset. In reality, there would be four squads. As a result of the increased number of personnel that would comprise the other three squads, the Co Cdr's message traffic would increase because of communications from the additional personnel. The SL's message traffic would also increase because of message traffic between SLs.

The Soldiers highlighted in the results were the PSG, the RNCO, the PL, the SL, TLA, TLB, riflemen 1A, 2A, 3A, 1B, 2B, and 3B. Of those 12 Soldiers, all were dismounted except the PSG and the RNCO. As mentioned earlier, the dismounted personnel used a wrist-mounted display while the mounted personnel used a laptop display.

The PL received messages from the Co CDR (higher), from the SL (lower), and from display update messages that are event or system generated. As a result of the volume of messages that he was receiving, he had a high number of interrupts and was 71% utilized. Even though he had a high number of interrupts, he had only three dropped messages, which indicated that he was able to finish processing the most of his received messages, including the interrupted ones. The three messages that were dropped were all high priority. The SL also received messages from higher (PL) and lower (TLs) and had the highest number of interrupts and drops of any of the Soldiers. More than 50% of the SL's decisions were based on poor information quality. The presumed low quality decisions for the SL may have been because he was heavily utilized at 86%, had too many messages to respond or attend to, had additional messages to send to his TLs based on what he was receiving from higher headquarters, and the additional responsibility for the personnel with him in a dismounted status. TLA received messages from higher (SL), TLB, and lower (A team riflemen) during the course of the scenario. He had a high number of interrupts and a high number of drops as well. This is all while leading A Team in a battle on the ground.

The RNCO was not only responding to messages from upper and lower personnel but also dealing with sensor information. This is in addition to his duties in dealing with robot-control-related messages. This model dealt exclusively with communication-related tasks and did not model the RNCO robotic control tasks. Because the non-communication tasks workload was not modeled, the RNCO did not have a high number of interrupts or drops (3) which meant he was able to get his messages fully processed. Since he was able to do this in a timely manner, he did not make any decisions with poor information quality. Note that this particular scenario did not heavily involve the RNCO but focused instead on the dismounts.

The riflemen were only receiving messages from higher headquarters as well as generating messages to higher headquarters. Individually, they received between 79 and 82 messages and were utilized between 45% and 64% over the length of the scenario. In addition to dealing with messages they were also dealing with ground operations and related tasks. This is evidence that the dismounts are required to multi-task because they are moving on the ground and responding to communications simultaneously.

The majority of Soldiers had good quality information that led to an optimum decision. The SL was the only one who had a large number of decisions made with poor information quality (>50%). The fact that this Soldier was interrupted when processing a message, did not receive updated information in a timely manner, or was over utilized to the point of missing information could all contribute to a poor quality decision.

In summary, of the 12 operators focused on in the Results and Discussion sections, two used the vehicle-mounted laptop display while the other 10 used the wrist-mounted PDA display. In general, the operators using the laptop display were able to fully process more of their incoming messages and made no decisions with poor information quality. The majority of the operators using the PDA had high utilization, higher numbers of dropped and interrupted messages, and decisions made with poor information quality.

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## **5. Conclusions and Recommendations**

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This model was designed to investigate operator performance when a laptop display was used in a mounted setting, and a wrist-mounted PDA was used in a dismounted setting. Although not intentional, the model also provided human factors (HF) information that indicated some of the reasons why the wrist-mounted PDA might not be the best device for use by the dismounts as they process communication messages. The insight provided here is based on the results of the modeled use and manipulation of the equipment and the scenario.

The results of this model and scenario showed poor performance by the majority of the dismounted element because they were utilized at a high level. These Soldiers had too many messages to process during dismounted phases and made occasional decisions with poor information quality. The information quality was poor because the information was old. As a result of having too many messages to process, the Soldiers were not able to process them in a timely manner, which resulted in decisions based on poor information quality and messages that were dropped before processing could be completed. It is important to note that this scenario lasted only 37 minutes and involved only planning and maneuver communications events. There was no engagement by the enemy in this scenario. In such a case, it is likely that the number of decisions with poor information quality and dropped and interrupted messages would increase.

In the model, it was assumed that all conditions were perfect. This includes initial information quality at 100%, perfect weather, perfect lighting conditions, no night exercises, no mission-oriented protective posture (MOPP), or cold-weather gear, etc. Some reasons as to why the PDA would not be the optimal technology for the dismounts are (a) the dismounted operators were multitasking by concentrating on their maneuvers while responding to incoming messages, (b) the display area and the individual keys of the keyboard on the PDA were much smaller than with the laptop display, resulting in increased reading and response time, i.e., reference table 1. There was not sufficient time for the manipulation required of wrist-mounted PDA in a dismounted environment. Manipulation of the device included scrolling through messages and use of the stylus to enter and search for desired information. Although not considered as part of this modeling effort, the keyboard, stylus, and the manipulation of the screen when the user was scrolling could be affected by the use of gloves, daylight or night conditions. Too much information on a very small screen and weather can also have an adverse effect. The dismounted personnel should not be taxed to look at a screen that could be difficult to read. Their primary concern should be keeping themselves and other Soldiers alive.

As mentioned earlier, dismounts, by the very nature of their responsibilities, are multi-tasking. As such, they should be provided with equipment that is simple and easy to use and requires the least manipulation from them. They should be provided with a reliable radio system and assistive technologies that are hands free (for example, a haptic belt).

Based on the scenario, the dismounts had too much communication traffic, not always to respond to, but to be aware of. Even these types of communication events sometimes require action. Based on the volume of messages directed to the dismounts, it is impossible for the Soldiers to attend to each one. It would be beneficial for a filtering system to be employed so that only important and necessary information was forwarded to a given dismounted Soldier. Also, limiting the amount of incoming information through filtering should be considered.

The results of this platoon model configuration, including personnel, equipment, and scenario, indicate that those dismounted Soldiers wearing a wrist-mounted display exhibited high levels of utilization and made decisions based on poor information quality. Overall, the (mounted) Soldiers using laptops exhibited low levels of utilization and made all decisions based on good information quality. It is reasonable to assume that the difference in operator performance is attributable to the sheer volume of messages received by mounted Soldiers compared to dismounted Soldiers and the equipment that is being used. It is therefore recommended that a wrist-mounted PDA be designed for ease of reading, rapid processing times, and low manipulation requirements. It would also be feasible to explore alternate technologies requiring less manipulation for use by the dismounted personnel.

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## **6. Future Developments**

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Ensuing work includes modeling the dismounted Soldiers with an alternate display design such as a haptic belt.

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## **7. Summary**

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The use of C3TRACE, in which the capability to easily represent any echelon level, the people assigned to that organization, the tasks and functions they will perform, the equipment they will use, and a communications pattern within and outside the organization, will allow for “what-if” evaluations of numerous concepts without the need for live exercises or experiments. The model in this report represented platoon-level personnel with wrist-mounted PDA technology use for dismounts. Model results showed that this technology had high utilization levels associated with it. Further exploration of alternate technologies is recommended. Because these results were based on a simulation model, the C3TRACE capability saved time and money as well as provided an evaluation of a critical information technology, which if accomplished by “human-in-the-loop” experiments would be extremely time consuming and expensive.

The SU ATO will transition display guidelines to the FFW and FCS programs to enhance the SU of Soldiers in the UA. Ensuing models will be developed to explore the use of alternate technologies that will enhance Soldier SU.

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## Appendix A. Personnel Attributes

| Vehicle      | Soldier Name          | MOS | Military Training level | Length of Service | Aptitude level | Age   | Rank | Time in position | Highest civilian education | Maximum No. of Lead Tasks |
|--------------|-----------------------|-----|-------------------------|-------------------|----------------|-------|------|------------------|----------------------------|---------------------------|
| <b>ICV 1</b> |                       |     |                         |                   |                |       |      |                  |                            |                           |
|              | PL                    | 11A | IOBC*                   | 2yrs              | high           | 22-25 | O2   | 4-6 months       | College                    | 3                         |
|              | Medic                 | 91B | AIT*                    | 2yrs              | high           | 18-21 | E4   | 1-2 years        | High school                | 3                         |
|              | RNCO                  | 11B | PLDC*                   | 3 years           | high           | 22-25 | E-5  | 1-2 years        | High school                | 3                         |
|              | DRV                   | 11B | AIT*                    | 2yrs              | medium         | 18-21 | E-4  | 4-6 months       | High school                | 2                         |
|              | Vehicle Commander     | 11B | PLDC*                   | 3 years           | medium         | 22-25 | E-6  | 10-12 months     | High school                | 1                         |
|              |                       |     |                         |                   |                |       |      |                  |                            |                           |
| <b>ICV 2</b> |                       |     |                         |                   |                |       |      |                  |                            |                           |
|              | PSG                   | 11B | ANCOC*                  | 6-10 years        | high           | 26-30 | E-7  | 10-12 months     | High school                | 3                         |
|              | SL                    | 11B | BNCOC*                  | 5 years           | medium         | 26-30 | E-6  | 1-2 years        | High school                | 3                         |
|              | A Team Leader         | 11B | PLDC*                   | 3yrs              | high           | 22-25 | E-5  | 10-12 months     | High school                | 2                         |
|              | Rifleman 1A           | 11B | AIT*                    | 2 yrs             | medium         | 18-21 | E-2  | 3 months         | High school                | 2                         |
|              | Grenadier 2A          | 11B | AIT*                    | 3yrs              | medium         | 18-21 | E-3  | 10-12 months     | High school                | 2                         |
|              | Automatic Rifleman 3A | 11B | AIT*                    | 2yrs              | medium         | 18-21 | E-3  | 10-12 months     | High school                | 2                         |
|              | B Team Leader         | 11B | PLDC*                   | 3yrs              | high           | 22-25 | E-5  | 1-2 years        | High school                | 2                         |
|              | Rifleman 1B           | 11B | AIT*                    | 2 yrs             | medium         | 18-21 | E-2  | 10-12 months     | High school                | 2                         |
|              | Grenadier 2B          | 11B | AIT*                    | 3yrs              | medium         | 18-21 | E-3  | 10-12 months     | High school                | 2                         |
|              | Automatic Rifleman 3B | 11B | AIT*                    | 2 yrs             | medium         | 18-21 | E-4  | 10-12 months     | High school                | 2                         |
|              | DRV                   | 11B | AIT*                    | 3yrs              | medium         | 18-21 | E-4  | 10-12 months     | High school                | 2                         |
|              |                       |     |                         |                   |                |       |      |                  |                            | 3                         |
| <b>CO HQ</b> | CO                    | 11A | CAS3*                   | 6-10 years        | high           | 26-30 | O3   | 7-9 months       | College                    |                           |

\*IOBC-Infantry Officer Basic Course, AIT-Advanced Individual Training, PLDC-Primary Leadership Development Course, ANCOC-Advanced Non-Commissioned Officer Course, BNCOC-Basic Non-Commissioned Officer Course, CAS3-Combined Arms and Services Staff School.

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## Appendix B. Task List for Each Soldier

| Task Name                               | Time (sec) | SD (sec) | Vehicle | Operator     | Visual | Auditory | Cognitive | Perceptual |
|---|------------|----------|---------|--------------|--------|----------|-----------|------------|
| <b>Team Leader (TLA)</b>                |            |          |         |              |        |          |           |            |
| START                                   | 0          | 0        |         |              | 0      | 0        | 0         | 0          |
| RECEIVE MSG/UPDT                        | 0          | 0        | ICV 2   | TLA          | 0      | 0        | 0         | 0          |
| COLLABORATE                             | 0          | 0        | ICV 2   | TLA          | 0      | 0        | 0         | 0          |
| Listen                                  | 60         | 30       | ICV 2   | TLA          | 3.7    | 4.9      | 4.6       | 0          |
| No action                               | 0          | 0        | ICV 2   | TLA          | 0      | 0        | 0         | 0          |
| Pause                                   | 1          | 30       | ICV 2   | TLA          | 0      | 0        | 0         | 0          |
| No action                               | 0          | 0        | ICV 2   | TLA          | 0      | 0        | 0         | 0          |
| PL Listening                            | 60         | 30       | ICV1    | PL           | 0      | 0        | 0         | 0          |
| MED Listening                           | 60         | 30       | ICV1    | Medic        | 0      | 0        | 0         | 0          |
| VC Listening                            | 60         | 30       | ICV1    | VC           | 0      | 0        | 0         | 0          |
| CO Listening                            | 60         | 30       | Co HQ   | CO           | 0      | 0        | 0         | 0          |
| SL Listening                            | 60         | 30       | ICV 2   | SL           |        |          | 0         | 0          |
| Driver1 Listening                       | 60         | 30       | ICV1    | DVR1         | 0      | 0        | 0         | 0          |
| Radio out for info (RFI)                | 20         | 30       | ICV 2   | TLA          | 3.7    | 2        | 1.2       | 2.2        |
| Driver2 Listening                       | 60         | 30       | ICV 2   | DVR2         | 0      | 0        | 0         | 0          |
| PSG Listening                           | 60         | 30       | ICV 2   | PSG          | 0      | 0        | 0         | 0          |
| TLA Listening                           | 60         | 30       | ICV 2   | TLA          | 0      | 0        | 0         | 0          |
| TLB Listening                           | 60         | 30       | ICV 2   | TLB          | 0      | 0        | 0         | 0          |
| Rifleman1A Listening                    | 60         | 30       | ICV 2   | Rifleman 1A  | 0      | 0        | 0         | 0          |
| Rifleman2A Listening                    | 60         | 30       | ICV 2   | Grenadier 2A | 0      | 0        | 0         | 0          |
| Rifleman3A Listening                    | 60         | 30       | ICV 2   | Auto Rif 3A  | 0      | 0        | 0         | 0          |
| Rifleman1B Listening                    | 60         | 30       | ICV 2   | Rifleman 1B  | 0      | 0        | 0         | 0          |
| Rifleman2B Listening                    | 60         | 30       | ICV 2   | Grenadier 2B | 0      | 0        | 0         | 0          |
| Rifleman3B Listening                    | 60         | 30       | ICV 2   | Auto Rif 3B  | 0      | 0        | 0         | 0          |
| COLLECT INFO                            |            |          | ICV 2   |              |        |          |           |            |
| Branch                                  | 0          | 0        |         | TLA          | 0      | 0        | 0         | 0          |
| Listen                                  | 5.5        | 0.5      | ICV 2   | TLA          | 0      | 4.9      | 4.6       | 0          |
| Relevant to me                          | 0.5        | 0.25     | ICV 2   | TLA          | 0      | 0        | 1.2       | 0          |
| Not relevant to me                      | 0.5        | 0.25     | ICV 2   | TLA          | 0      | 0        | 1.2       | 0          |
| ESTIMATE IMPACT--Short                  | 2.5        | 1.5      | ICV 2   | TLA          | 7      | 0        | 7         | 0          |
| Finalize COA--Short                     | 10         | 5        | ICV 2   | TLA          | 3.7    | 0        | 6.8       | 7          |
| Update mission profile--Short           | 5          | 2.5      | ICV 2   | TLA          | 7      | 0        | 6.8       | 7          |
| Relevant to me                          | 0.5        | 0.25     | ICV 2   | TLA          | 0      | 0        | 1.2       | 0          |
| Search for Digital Info                 | 60         | 30       | ICV 2   | TLA          | 7      | 0        | 5.3       | 7          |
| Not relevant to me                      | 0.5        | 0.25     | ICV 2   | TLA          | 0      | 0        | 1.2       | 0          |
| Relevant to me                          | 0.5        | 0.25     | ICV 2   | TLA          | 0      | 0        | 1.2       | 0          |
| Not relevant to me                      | 0.5        | 0.25     | ICV 2   | TLA          | 0      | 0        | 1.2       | 0          |
| Synchronize with Higher Database--Short | 5          | 2.5      | ICV 2   | TLA          | 4      | 0        | 3.7       | 7          |
| Haptic Message                          | 0          | 0        | ICV 2   | TLA          | 0      | 0        | 0         | 0          |
| Recognize                               | 1.5        | 0.5      | ICV 2   | TLA          | 0      | 1        | 1         | 0          |
| ID Message                              | 2.5        | 0.75     | ICV 2   | TLA          | 0      | 4.2      | 3.7       | 0          |
| Direction                               | 0          | 0        | ICV 2   | TLA          | 0      | 0        | 0         | 0          |
| Reply to voice                          | 60         | 30       | ICV 2   | TLA          | 3.7    | 4.3      | 4.6       | 2.2        |
| Alert                                   | 0          | 0        | ICV 2   | TLA          | 0      | 0        | 0         | 0          |
| Warning                                 | 0          | 0        | ICV 2   | TLA          | 0      | 0        | 0         | 0          |
| Caution                                 | 0          | 0        | ICV 2   | TLA          | 0      | 0        | 0         | 0          |
| ID Direction                            | 0          | 0        | ICV 2   | TLA          | 0      | 0        | 0         | 0          |

|  |     |      |       |              |     |     |     |     |
|--|-----|------|-------|--------------|-----|-----|-----|-----|
| ID Alert                               | 0   | 0    | ICV 2 | TLA          | 0   | 0   | 0   | 0   |
| ID Warning                             | 0   | 0    | ICV 2 | TLA          | 0   | 0   | 0   | 0   |
| ID Caution                             | 0   | 0    | ICV 2 | TLA          | 0   | 0   | 0   | 0   |
| DISCUSS (TL A)                         | 60  | 30   | ICV 2 | TLA          | 3.7 | 4.9 | 3.7 | 2.2 |
| Change recognized                      | 2   | 2    | ICV 2 | TLA          | 3.7 | 0   | 3.7 | 0   |
| Email                                  | 0   | 0    | ICV 2 | TLA          | 0   | 0   | 0   | 0   |
| Synchronize with Higher Database--Long | 60  | 30   | ICV 2 | TLA          | 4   | 0   | 3.7 | 7   |
| Receive radio info                     | 5.5 | 60   | ICV 2 | TLA          | 3.7 | 4.9 | 3.7 | 0   |
| ESTIMATE IMPACT--Long                  | 45  | 30   | ICV 2 | TLA          | 7   | 0   | 7   | 0   |
| Discuss (PL)                           | 60  | 30   | ICV1  | PL           | 3.7 | 4.9 | 3.7 | 2.2 |
| Pull up email                          | 2   | 0.3  | ICV 2 | TLA          | 3.7 | 0   | 1   | 7   |
| Internal Trigger                       | 0   | 0    | ICV 2 | TLA          | 0   | 0   | 0   | 0   |
| ID Current Mission                     | 1   | 0.5  | ICV 2 | TLA          | 3.7 | 0   | 3.7 | 7   |
| ID Environmental Changes               | 0.5 | 0.25 | ICV 2 | TLA          | 3.7 | 0   | 3.7 | 7   |
| ID environment                         | 0.5 | 0.5  | ICV 2 | TLA          | 3.7 | 0   | 3.7 | 0   |
| ID who from                            | 2   | 0.5  | ICV 2 | TLA          | 3.7 | 0   | 3.7 | 7   |
| ID priority                            | 2   | 0.5  | ICV 2 | TLA          | 3.7 | 0   | 3.7 | 0   |
| Find digital info                      | 45  | 15   | ICV 2 | TLA          | 7   | 0   | 4.6 | 7   |
| TAKE ACTION                            | 0   | 0    | ICV 2 | TLA          | 0   | 0   | 0   | 0   |
| Voice Msg                              | 0   | 0    | ICV 2 | TLA          | 0   | 0   | 0   | 0   |
| Verbal request                         | 30  | 20   | ICV 2 | TLA          | 3.7 | 4.9 | 4.6 | 2.2 |
| Receive verbal response                | 60  | 45   | ICV 2 | TLA          | 3.7 | 4.9 | 4.6 | 1   |
| Voice Out                              | 60  | 45   | ICV 2 | TLA          | 3.7 | 2   | 3.7 | 2.2 |
| Send email request                     | 1.5 | 1    | ICV 2 | TLA          | 5.9 | 0   | 4.6 | 7   |
| Receive email response                 | 0.5 | 0.23 | ICV 2 | TLA          | 3.7 | 4.9 | 3.7 | 7   |
| START MONITOR                          | 0   | 0    | ICV 2 | TLA          | 0   | 0   | 0   | 0   |
| See Visual Change                      | 1   | 0.3  | ICV 2 | TLA          | 4   | 0   | 3.7 | 0   |
| Display update                         | 0   | 0    | ICV 2 | TLA          | 0   | 0   | 0   | 0   |
| Pause                                  | 1   | 30   | ICV 2 | TLA          | 0   | 0   | 0   | 0   |
| ID ACTIONABLE CHOICES                  | 5.5 | 4.5  | ICV 2 | TLA          | 5.9 | 0   | 3.7 | 0   |
| START LISTEN                           | 0   | 0    | ICV 2 | TLA          | 0   | 4.9 | 3.7 | 0   |
| Mission Profile Update                 | 10  | 30   | ICV 2 | TLA          | 5.9 | 0   | 1.2 | 2.2 |
| Discuss (TL B)                         | 60  | 30   | ICV 2 | TLB          | 3.7 | 4.9 | 3.7 | 2.2 |
| Open/Read Message                      | 30  | 60   | ICV 2 | TLA          | 5.9 | 0   | 4.6 | 2.2 |
| Discuss (Rifleman A)                   | 60  | 30   | ICV 2 | Rifleman 1A  | 3.7 | 4.9 | 3.7 | 2.2 |
| Discuss (Grenadier A)                  | 60  | 30   | ICV 2 | Grenadier 2A | 3.7 | 4.3 | 3.7 | 2.2 |
| Discuss (Automatic Rifleman)           | 60  | 30   | ICV 2 | Auto Rif 3A  | 3.7 | 4.9 | 3.7 | 2.2 |
| Finalize COA--Long                     | 60  | 30   | ICV 2 | TLA          | 3.7 | 0   | 6.8 | 7   |
| Update COA                             | 15  | 7.5  | ICV 2 | TLA          | 7   | 0   | 6.8 | 7   |
| Perform physical action                | 1   | 0.5  | ICV 2 | TLA          | 5.9 | 0   | 6.8 | 7   |
| Update mission profile--Long           | 120 | 30   | ICV 2 | TLA          | 7   | 0   | 6.8 | 7   |
| ID functionality                       | 0.5 | 0.5  | ICV 2 | TLA          | 4   | 0   | 4.6 | 0   |
| Switch to appropriate I/F              | 1.5 | 1    | ICV 2 | TLA          | 3.7 | 0   | 3.7 | 7   |
| ID channel                             | 0.5 | 0.5  | ICV 2 | TLA          | 4   | 0   | 4.6 | 0   |
| Switch to appropriate channel          | 1   | 0.5  | ICV 2 | TLA          | 3.7 | 0   | 1   | 2.2 |

| Task Name                      | Time (sec) | SD. (sec) | Vehicle | Operator     | Visual | Auditory | Cognitive | Perceptual |
|--------------------------------|------------|-----------|---------|--------------|--------|----------|-----------|------------|
| <b>Rifleman 1A</b>             |            |           |         |              |        |          |           |            |
| START                          | 0          | 0         |         |              | 0      | 0        | 0         | 0          |
| RECEIVE MSG/UPDT               | 0          | 0         | ICV 2   | Rifleman 1A  | 0      | 0        | 0         | 0          |
| COLLABORATE                    | 1          | 1         | ICV 2   | Rifleman 1A  | 0      | 0        | 0         | 0          |
| Listen                         | 5.5        | 1.5       | ICV 2   | Rifleman 1A  | 3.7    | 4.9      | 4.6       | 0          |
| No action                      | 0          | 0         | ICV 2   | Rifleman 1A  | 0      | 0        | 0         | 0          |
| Pause                          | 1          | 30        | ICV 2   | Rifleman 1A  | 0      | 0        | 0         | 0          |
| No action                      | 0          | 0         | ICV 2   | Rifleman 1A  | 0      | 0        | 0         | 0          |
| PL Listening                   | 15         | 45        | ICV1    | PL           | 0      | 0        | 0         | 0          |
| MED Listening                  | 15         | 45        | ICV1    |              | 0      | 0        | 0         | 0          |
| VC Listening                   | 15         | 45        | ICV1    | VC           | 0      | 0        | 0         | 0          |
| CO Listening                   | 15         | 45        | Co HQ   | CO           | 0      | 0        | 0         | 0          |
| SL Listening                   | 15         | 45        | ICV 2   | SL           | 0      | 0        | 0         | 0          |
| Driver1 Listening              | 15         | 45        | ICV1    | DVR1         | 0      | 0        | 0         | 0          |
| Radio out for info (RFI)       | 5.5        | 50        | ICV 2   | Rifleman 1A  | 3.7    | 2        | 1.2       | 2.2        |
| Driver2 Listening              | 15         | 45        | ICV 2   | DVR2         | 0      | 0        | 0         | 0          |
| PSG Listening                  | 15         | 45        | ICV 2   | PSG          | 0      | 0        | 0         | 0          |
| TLA Listening                  | 15         | 45        | ICV 2   | TLA          | 0      | 0        | 0         | 0          |
| TLB Listening                  | 15         | 45        | ICV 2   | TLB          | 0      | 0        | 0         | 0          |
| Rifleman1A Listening           | 15         | 45        | ICV 2   | Rifleman 1A  | 0      | 0        | 0         | 0          |
| Rifleman2A Listening           | 15         | 45        | ICV 2   | Grenadier 2A | 0      | 0        | 0         | 0          |
| Rifleman3A Listening           | 15         | 45        | ICV 2   | Auto Rif 3A  | 0      | 0        | 0         | 0          |
| Rifleman1B Listening           | 15         | 45        | ICV 2   | Rifleman 1B  | 0      | 0        | 0         | 0          |
| Rifleman2B Listening           | 15         | 45        | ICV 2   | Grenadier 2B | 0      | 0        | 0         | 0          |
| Rifleman3B Listening           | 15         | 45        | ICV 2   | Auto Rif 3B  | 0      | 0        | 0         | 0          |
| COLLECT INFO Branch            | 0          | 0         | ICV 2   | Rifleman 1A  | 0      | 0        | 0         | 0          |
| Listen                         | 5.5        | 0.5       | ICV 2   | Rifleman 1A  | 0      | 4.9      | 4.6       | 0          |
| Relevant to me                 | 0.5        | 0.25      | ICV 2   | Rifleman 1A  | 0      | 0        | 1.2       | 0          |
| Not relevant to me             | 0.5        | 0.25      | ICV 2   | Rifleman 1A  | 0      | 0        | 1.2       | 0          |
| ESTIMATE IMPACT--Short         | 2.5        | 1.5       | ICV 2   | Rifleman 1A  | 7      | 0        | 7         | 0          |
| Finalize COA--Short            | 10         | 5         | ICV 2   | TLA          | 3.7    | 0        | 6.8       | 7          |
| Update mission profile--Short  | 5          | 2.5       | ICV 2   | Rifleman 1A  | 7      | 0        | 6.8       | 7          |
| Relevant to me                 | 0.5        | 0.25      | ICV 2   | Rifleman 1A  | 0      | 0        | 1.2       | 0          |
| Not relevant to me             | 0.5        | 0.25      | ICV 2   | Rifleman 1A  | 0      | 0        | 1.2       | 0          |
| Search for Digital Info        | 10         | 4.5       | ICV 2   | Rifleman 1A  | 7      | 0        | 5.3       | 7          |
| Relevant to me                 | 0.5        | 0.25      | ICV 2   | Rifleman 1A  | 0      | 0        | 1.2       | 0          |
| Not relevant to me             | 0.5        | 0.25      | ICV 2   | Rifleman 1A  | 0      | 0        | 1.2       | 0          |
| Synchronize with higher--Short | 5          | 2.5       | ICV 2   | Rifleman 1A  | 4      | 0        | 3.7       | 7          |
| Haptic Message                 | 0          | 0         | ICV 2   | Rifleman 1A  | 0      | 0        | 0         | 0          |
| Recognize                      | 1.5        | 0.5       | ICV 2   | Rifleman 1A  | 0      | 1        | 1         | 0          |
| ID Message                     | 2.5        | 0.75      | ICV 2   | Rifleman 1A  | 0      | 4.2      | 3.7       | 0          |
| Direction                      | 0          | 0         | ICV 2   | Rifleman 1A  | 0      | 0        | 0         | 0          |
| Reply to voice                 | 15         | 45        | ICV 2   | Rifleman 1A  | 3.7    | 4.3      | 4.6       | 2.2        |
| Alert                          | 0          | 0         | ICV 2   | Rifleman 1A  | 0      | 0        | 0         | 0          |
| Warning                        | 0          | 0         | ICV 2   | Rifleman 1A  | 0      | 0        | 0         | 0          |
| Caution                        | 0          | 0         | ICV 2   | Rifleman 1A  | 0      | 0        | 0         | 0          |
| ID Direction                   | 0          | 0         | ICV 2   | Rifleman 1A  | 0      | 0        | 0         | 0          |
| ID Alert                       | 0          | 0         | ICV 2   | Rifleman 1A  | 0      | 0        | 0         | 0          |
| ID Warning                     | 0          | 0         | ICV 2   | Rifleman 1A  | 0      | 0        | 0         | 0          |
| ID Caution                     | 0          | 0         | ICV 2   | Rifleman 1A  | 0      | 0        | 0         | 0          |
| DISCUSS                        | 5.5        | 1.5       | ICV 2   | Rifleman 1A  | 3.7    | 4.9      | 3.7       | 2.2        |
| Change recognized              | 1          | 2.5       | ICV 2   | Rifleman 1A  | 3.7    | 0        | 3.7       | 0          |
| Email                          | 0          | 0         | ICV 2   | Rifleman 1A  | 0      | 0        | 0         | 0          |
| Receive radio info             | 5.5        | 0.5       | ICV 2   | Rifleman 1A  | 3.7    | 4.9      | 3.7       | 0          |
| ESTIMATE IMPACT--Long          | 10         | 15        | ICV 2   | Rifleman 1A  | 7      | 0        | 7         | 0          |

|                               |      |      |       |              |     |     |     |     |
|-------------------------------|------|------|-------|--------------|-----|-----|-----|-----|
| Discuss (PL)                  | 5.5  | 1.5  | ICV1  | PL           | 0   | 0   | 0   | 0   |
| Pull up email                 | 2    | 0.3  | ICV 2 | Rifleman 1A  | 3.7 | 0   | 1   | 7   |
| Internal Trigger              | 0    | 0    | ICV 2 | Rifleman 1A  | 0   | 0   | 0   | 0   |
| ID Current Mission            | 0.5  | 0.5  | ICV 2 | Rifleman 1A  | 3.7 | 0   | 3.7 | 7   |
| ID Environmental Changes      | 0.5  | 0.25 | ICV 2 | Rifleman 1A  | 3.7 | 0   | 3.7 | 7   |
| ID environment                | 0.5  | 0.12 | ICV 2 | Rifleman 1A  | 3.7 | 0   | 3.7 | 0   |
| ID who from                   | 0.5  | 0.5  | ICV 2 | Rifleman 1A  | 3.7 | 0   | 3.7 | 7   |
| ID priority                   | 0.5  | 0.5  | ICV 2 | Rifleman 1A  | 3.7 | 0   | 3.7 | 0   |
| Find digital info             | 5.5  | 4.5  | ICV 2 | Rifleman 1A  | 7   | 0   | 4.6 | 7   |
| TAKE ACTION                   | 0    | 0    | ICV 2 | Rifleman 1A  | 0   | 0   | 0   | 0   |
| Voice Msg                     | 0    | 0    | ICV 2 | Rifleman 1A  | 0   | 0   | 0   | 0   |
| Verbal request                | 6.5  | 5.5  | ICV 2 | Rifleman 1A  | 3.7 | 4.9 | 4.6 | 2.2 |
| Receive verbal response       | 6.5  | 5.5  | ICV 2 | Rifleman 1A  | 3.7 | 4.9 | 4.6 | 1   |
| Voice Out                     | 5.5  | 0.5  | ICV 2 | Rifleman 1A  | 3.7 | 2   | 3.7 | 2.2 |
| Send email request            | 1.5  | 1    | ICV 2 | Rifleman 1A  | 5.9 | 0   | 4.6 | 7   |
| Receive email response        | 0.5  | 0.23 | ICV 2 | Rifleman 1A  | 3.7 | 4.9 | 3.7 | 7   |
| START MONITOR                 | 0    | 0    | ICV 2 | Rifleman 1A  | 0   | 0   | 0   | 0   |
| See Visual Change             | 1.5  | 0.3  | ICV 2 | Rifleman 1A  | 4   | 0   | 3.7 | 0   |
| Display update                | 0    | 0    | ICV 2 | Rifleman 1A  | 0   | 0   | 0   | 0   |
| Pause                         | 1    | 30   | ICV 2 | Rifleman 1A  | 0   | 0   | 0   | 0   |
| ID ACTIONABLE CHOICES         | 5.5  | 4.5  | ICV 2 | Rifleman 1A  | 5.9 | 0   | 7   | 0   |
| START LISTEN                  | 0    | 0    | ICV 2 | Rifleman 1A  | 0   | 4.9 | 3.7 | 0   |
| Mission profile update        | 0    | 0    | ICV 2 | Rifleman 1A  | 0   | 0   | 0   | 0   |
| Open/Read Message             | 1.12 | 1    | ICV 2 | Rifleman 1A  | 5.9 | 0   | 4.6 | 2.2 |
| Discuss (Grenadier)           | 5.5  | 1.5  | ICV 2 | Grenadier 2A | 3.7 | 4.9 | 3.7 | 2.2 |
| Discuss (Automatic Rifleman)  | 5.5  | 1.5  | ICV 2 | Auto Rif 3A  | 3.7 | 4.9 | 3.7 | 2.2 |
| Finalize COA--Long            | 60   | 30   | ICV 2 | TLA          | 3.7 | 0   | 6.8 | 7   |
| Update COA                    | 15   | 7.5  | ICV 2 | Rifleman 1A  | 7   | 0   | 6.8 | 7   |
| Perform physical action       | 1    | 0.5  | ICV 2 | Rifleman 1A  | 5.9 | 0   | 6.8 | 7   |
| Update mission profile--Long  | 60   | 30   | ICV 2 | Rifleman 1A  | 7   | 0   | 6.8 | 7   |
| Synchronize with higher--Long | 60   | 30   | ICV 2 | Rifleman 1A  | 4   | 0   | 3.7 | 7   |
| ID functionality              | 0.5  | 0.5  | ICV 2 | Rifleman 1A  | 4   | 0   | 4.6 | 0   |
| Switch to appropriate I/F     | 1.5  | 1    | ICV 2 | Rifleman 1A  | 3.7 | 0   | 3.7 | 7   |
| ID channel                    | 0.5  | 0.5  | ICV 2 | Rifleman 1A  | 4   | 0   | 4.6 | 0   |
| Switch to appropriate channel | 1    | 0.5  | ICV 2 | Rifleman 1A  | 3.7 | 0   | 1   | 2.2 |

| Task Name                     | Time (sec) | SD (sec) | Vehicle | Operator     | Visual | Auditory | Cognitive | Perceptual |
|-------------------------------|------------|----------|---------|--------------|--------|----------|-----------|------------|
| <b>Team Leader B (TLB)</b>    |            |          |         |              |        |          |           |            |
| START                         | 0          | 0        |         |              | 0      | 0        | 0         | 0          |
| RECEIVE MSG/UPDT              | 0          | 0        | ICV 2   | TLB          | 0      | 0        | 0         | 0          |
| COLLABORATE                   | 0          | 0        | ICV 2   | TLB          | 0      | 0        | 0         | 0          |
| Listen                        | 60         | 30       | ICV 2   | TLB          | 3.7    | 4.9      | 4.6       | 0          |
| No action                     | 0          | 0        | ICV 2   | TLB          | 0      | 0        | 0         | 0          |
| Pause                         | 1          | 30       | ICV 2   | TLB          | 0      | 0        | 0         | 0          |
| No action                     | 0          | 0        | ICV 2   | TLB          | 0      | 0        | 0         | 0          |
| PL Listening                  | 60         | 30       | ICV1    | PL           | 0      | 0        | 0         | 0          |
| MED Listening                 | 60         | 30       | ICV1    | Medic        | 0      | 0        | 0         | 0          |
| VC Listening                  | 60         | 30       | ICV1    | VC           | 0      | 0        | 0         | 0          |
| CO Listening                  | 60         | 30       | Co HQ   | CO           | 0      | 0        | 0         | 0          |
| SL Listening                  | 60         | 30       | ICV 2   | SL           | 0      | 0        | 0         | 0          |
| Driver1 Listening             | 60         | 30       | ICV1    | DVR1         | 0      | 0        | 0         | 0          |
| Radio out for info (RFI)      | 20         | 30       | ICV 2   | TLB          | 3.7    | 2        | 1.2       | 2.2        |
| Driver2 Listening             | 60         | 30       | ICV 2   | DVR2         | 0      | 0        | 0         | 0          |
| PSG Listening                 | 60         | 30       | ICV 2   | PSG          | 0      | 0        | 0         | 0          |
| TLA Listening                 | 60         | 30       | ICV 2   | TLA          | 0      | 0        | 0         | 0          |
| TLB Listening                 | 60         | 30       | ICV 2   | TLB          | 0      | 0        | 0         | 0          |
| Rifleman1A Listening          | 60         | 30       | ICV 2   | Rifleman 1A  | 0      | 0        | 0         | 0          |
| Rifleman2A Listening          | 60         | 30       | ICV 2   | Grenadier 2A | 0      | 0        | 0         | 0          |
| Rifleman3A Listening          | 60         | 30       | ICV 2   | Auto Rif 3A  | 0      | 0        | 0         | 0          |
| Rifleman1B Listening          | 60         | 30       | ICV 2   | Rifleman 1B  | 0      | 0        | 0         | 0          |
| Rifleman2B Listening          | 60         | 30       | ICV 2   | Grenadier 2B | 0      | 0        | 0         | 0          |
| Rifleman3B Listening          | 60         | 30       | ICV 2   | Auto Rif 3B  | 0      | 0        | 0         | 0          |
| COLLECT INFO Branch           | 0          | 0        | ICV 2   | TLB          | 0      | 0        | 0         | 0          |
| Listen                        | 5.5        | 0.5      | ICV 2   | TLB          | 0      | 4.9      | 4.6       | 0          |
| Relevant to me                | 0.5        | 0.25     | ICV 2   | TLB          | 0      | 0        | 1.2       | 0          |
| Not relevant to me            | 0.5        | 0.5      | ICV 2   | TLB          | 0      | 0        | 1.2       | 0          |
| ESTIMATE IMPACT--Short        | 2.5        | 1.5      | ICV 2   | TLB          | 7      | 0        | 7         | 0          |
| Finalize COA--Short           | 10         | 5        | ICV 2   | TLB          | 3.7    | 0        | 6.8       | 7          |
| Update mission profile--Short | 5          | 2.5      | ICV 2   | TLB          | 7      | 0        | 6.8       | 7          |
| Relevant to me                | 0.5        | 0.25     | ICV 2   | TLB          | 0      | 0        | 1.2       | 0          |
| Not relevant to me            | 0.5        | 0.5      | ICV 2   | TLB          | 0      | 0        | 1.2       | 0          |
| Search for Digital Info       | 60         | 30       | ICV 2   | TLB          | 7      | 0        | 5.3       | 7          |
| Relevant to me                | 0.5        | 0.25     | ICV 2   | TLB          | 0      | 0        | 1.2       | 0          |
| Not relevant to me            | 0.5        | 0.5      | ICV 2   | TLB          | 0      | 0        | 1.2       | 0          |
| Synchronize with higher--Long | 60         | 30       | ICV 2   | TLB          | 4      | 0        | 3.7       | 7          |
| Haptic Message                | 0          | 0        | ICV 2   | TLB          | 0      | 0        | 0         | 0          |
| Recognize                     | 1.5        | 0.5      | ICV 2   | TLB          | 0      | 1        | 1         | 0          |
| ID Message                    | 2.5        | 0.75     | ICV 2   | TLB          | 0      | 4.2      | 3.7       | 0          |
| Direction                     | 0          | 0        | ICV 2   | TLB          | 0      | 0        | 0         | 0          |
| Alert                         | 0          | 0        | ICV 2   | TLB          | 0      | 0        | 0         | 0          |
| Reply to voice                | 60         | 30       | ICV 2   | TLB          | 3.7    | 4.3      | 4.6       | 2.2        |
| Warning                       | 0          | 0        | ICV 2   | TLB          | 0      | 0        | 0         | 0          |
| Caution                       | 0          | 0        | ICV 2   | TLB          | 0      | 0        | 0         | 0          |

|                                |     |      |       |              |     |     |     |     |
|--------------------------------|-----|------|-------|--------------|-----|-----|-----|-----|
| ID Direction                   | 0   | 0    | ICV 2 | TLB          | 0   | 0   | 0   | 0   |
| ID Alert                       | 0   | 0    | ICV 2 | TLB          | 0   | 0   | 0   | 0   |
| ID Warning                     | 0   | 0    | ICV 2 | TLB          | 0   | 0   | 0   | 0   |
| ID Caution                     | 0   | 0    | ICV 2 | TLB          | 0   | 0   | 0   | 0   |
| DISCUSS (TL B)                 | 60  | 30   | ICV 2 | TLB          | 3.7 | 4.9 | 3.7 | 2.2 |
| Change recognized              | 2   | 2    | ICV 2 | TLB          | 3.7 | 0   | 3.7 | 0   |
| Email                          | 0   | 0    | ICV 2 | TLB          | 0   | 0   | 0   | 0   |
| Receive radio info             | 5.5 | 60   | ICV 2 | TLB          | 3.7 | 4.9 | 3.7 | 0   |
| ESTIMATE IMPACT--Long          | 45  | 30   | ICV 2 | TLB          | 7   | 0   | 7   | 0   |
| Discuss (PL)                   | 60  | 30   | ICV1  | PL           | 3.7 | 4.9 | 3.7 | 2.2 |
| Pull up email                  | 2   | 0.3  | ICV 2 | TLB          | 3.7 | 0   | 1   | 7   |
| Internal Trigger               | 0   | 0    | ICV 2 | TLB          | 0   | 0   | 0   | 0   |
| ID Current Mission             | 1   | 0.5  | ICV 2 | TLB          | 3.7 | 0   | 3.7 | 7   |
| ID Environment Change          | 0.5 | 0.25 | ICV 2 | TLB          | 3.7 | 0   | 3.7 | 7   |
| ID environment                 | 0.5 | 0.5  | ICV 2 | TLB          | 3.7 | 0   | 3.7 | 0   |
| ID who from                    | 2   | 0.5  | ICV 2 | TLB          | 3.7 | 0   | 3.7 | 7   |
| ID priority                    | 2   | 0.5  | ICV 2 | TLB          | 3.7 | 0   | 3.7 | 0   |
| Find digital info              | 45  | 15   | ICV 2 | TLB          | 7   | 0   | 4.6 | 7   |
| TAKE ACTION                    | 0   | 0    | ICV 2 | TLB          | 0   | 0   | 0   | 0   |
| Voice Msg                      | 0   | 0    | ICV 2 | TLB          | 0   | 0   | 0   | 0   |
| Verbal request                 | 30  | 20   | ICV 2 | TLB          | 3.7 | 4.9 | 4.6 | 2.2 |
| Receive verbal response        | 60  | 45   | ICV 2 | TLB          | 3.7 | 4.9 | 4.6 | 1   |
| Voice Out                      | 60  | 45   | ICV 2 | TLB          | 3.7 | 2   | 3.7 | 2.2 |
| Send email request             | 1.5 | 1    | ICV 2 | TLB          | 5.9 | 0   | 4.6 | 7   |
| Receive email response         | 0.5 | 0.23 | ICV 2 | TLB          | 3.7 | 4.9 | 3.7 | 7   |
| START MONITOR                  | 0   | 0    | ICV 2 | TLB          | 0   | 0   | 0   | 0   |
| See Visual Change              | 1   | 0.3  | ICV 2 | TLB          | 4   | 0   | 3.7 | 0   |
| Display update                 | 0   | 0    | ICV 2 | TLB          | 0   | 0   | 0   | 0   |
| Pause                          | 1   | 30   | ICV 2 | TLB          | 0   | 0   | 0   | 0   |
| ID ACTIONABLE CHOICES          | 5.5 | 4.5  | ICV 2 | TLB          | 5.9 | 0   | 7   | 0   |
| START LISTEN                   | 0   | 0    | ICV 2 | TLB          | 0   | 4.9 | 3.7 | 0   |
| Mission profile update         | 10  | 30   | ICV 2 | TLB          | 5.9 | 0   | 1.2 | 2.2 |
| Discuss with TL A              | 60  | 30   | ICV 2 | TLA          | 0   | 4.9 | 0   | 0   |
| Open/Read Message              | 30  | 60   | ICV 2 | TLB          | 5.9 | 0   | 4.6 | 2.2 |
| Discuss (RiflemanB)            | 60  | 30   | ICV 2 | Rifleman 1B  | 0   | 4.9 | 0   | 0   |
| Discuss (GrenadierB)           | 60  | 30   | ICV 2 | Grenadier 2A | 3.7 | 4.9 | 3.7 | 2.2 |
| Discuss (Automatic RiflemanB)  | 60  | 30   | ICV 2 | Auto Rif 3A  | 3.7 | 4.9 | 3.7 | 2.2 |
| Finalize COA--Long             | 60  | 30   | ICV 2 | TLB          | 3.7 | 0   | 6.8 | 7   |
| Update COA                     | 15  | 7.5  | ICV 2 | TLB          | 7   | 0   | 6.8 | 7   |
| Perform physical action        | 1   | 0.5  | ICV 2 | TLB          | 5.9 | 0   | 6.8 | 7   |
| Update mission profile--Long   | 120 | 30   | ICV 2 | TLB          | 7   | 0   | 6.8 | 7   |
| Synchronize with higher--Short | 5   | 2.5  | ICV 2 | TLB          | 4   | 0   | 3.7 | 7   |
| ID functionality               | 0.5 | 0.5  | ICV 2 | TLB          | 4   | 0   | 4.6 | 0   |
| Switch to appropriate I/F      | 1.5 | 1    | ICV 2 | TLB          | 3.7 | 0   | 3.7 | 7   |
| ID channel                     | 0.5 | 0.5  | ICV 2 | TLB          | 4   | 0   | 4.6 | 0   |
| ID channel                     | 0.5 | 0.5  | ICV 2 | TLB          | 4   | 0   | 4.6 | 0   |
| Switch to appropriate channel  | 1   | 0.5  | ICV 2 | Grenadier 2A | 3.7 | 0   | 1   | 2.2 |

| Task Name                      | Time (sec) | SD (sec) | Vehicle | Operator     | Visual | Auditory | Cognitive | Perceptual |
|--------------------------------|------------|----------|---------|--------------|--------|----------|-----------|------------|
| <b>Grenadier 2A</b>            |            |          |         |              |        |          |           |            |
| START                          | 0          | 0        | ICV 2   | Grenadier 2A | 0      | 0        | 0         | 0          |
| RECEIVE MSG/UPDT               | 0          | 0        | ICV 2   | Grenadier 2A | 0      | 0        | 0         | 0          |
| COLLABORATE                    | 0          | 0        | ICV 2   | Grenadier 2A | 0      | 0        | 0         | 0          |
| START                          | 0          | 0        | ICV 2   | Grenadier 2A | 0      | 0        | 0         | 0          |
| RECEIVE MSG/UPDT               | 0          | 0        | ICV 2   | Grenadier 2A | 0      | 0        | 0         | 0          |
| COLLABORATE                    | 0          | 0        | ICV 2   | Grenadier 2A | 0      | 0        | 0         | 0          |
| Listen                         | 5.5        | 1.5      | ICV 2   | Grenadier 2A | 3.7    | 4.9      | 4.6       | 0          |
| No action                      | 0          | 0        | ICV 2   | Grenadier 2A | 0      | 0        | 0         | 0          |
| Pause                          | 1          | 30       | ICV 2   | Grenadier 2A | 0      | 0        | 0         | 0          |
| No action                      | 0          | 0        | ICV 2   | Grenadier 2A | 0      | 0        | 0         | 0          |
| PL Listening                   | 15         | 45       | ICV1    | PL           | 0      | 0        | 0         | 0          |
| MED Listening                  | 15         | 45       | ICV1    | Medic        | 0      | 0        | 0         | 0          |
| VC Listening                   | 15         | 45       | ICV1    | VC           | 0      | 0        | 0         | 0          |
| CO Listening                   | 15         | 45       | Co HQ   | CO           | 0      | 0        | 0         | 0          |
| SL Listening                   | 15         | 45       | ICV 2   | SL           | 0      | 0        | 0         | 0          |
| Driver1 Listening              | 15         | 45       | ICV1    | DVR1         | 0      | 0        | 0         | 0          |
| Radio out for info (RFI)       | 5.5        | 50       | ICV 2   | Grenadier 2A | 3.7    | 2        | 1.2       | 2.2        |
| Driver2 Listening              | 15         | 45       | ICV 2   | DVR2         | 0      | 0        | 0         | 0          |
| PSG Listening                  | 15         | 45       | ICV 2   | PSG          | 0      | 0        | 0         | 0          |
| TLA Listening                  | 15         | 45       | ICV 2   | TLA          | 0      | 0        | 0         | 0          |
| TLB Listening                  | 15         | 45       | ICV 2   | TLB          | 0      | 0        | 0         | 0          |
| Rifleman1A Listening           | 15         | 45       | ICV 2   | Rifleman 1A  | 0      | 0        | 0         | 0          |
| Rifleman2A Listening           | 15         | 45       | ICV 2   | Grenadier 2A | 0      | 0        | 0         | 0          |
| Rifleman3A Listening           | 15         | 45       | ICV 2   | Auto Rif 3A  | 0      | 0        | 0         | 0          |
| Rifleman1B Listening           | 15         | 45       | ICV 2   | Rifleman 1B  | 0      | 0        | 0         | 0          |
| Rifleman2B Listening           | 15         | 45       | ICV 2   | Grenadier 2B | 0      | 0        | 0         | 0          |
| Rifleman3B Listening           | 15         | 45       | ICV 2   | Auto Rif 3B  | 0      | 0        | 0         | 0          |
| COLLECT INFO Branch            | 0          | 0        | ICV 2   | Grenadier 2A | 0      | 0        | 0         | 0          |
| Listen                         | 5.5        | 0.5      | ICV 2   | Grenadier 2A | 0      | 4.9      | 4.6       | 0          |
| Relevant to me                 | 0.5        | 0.25     | ICV 2   | Grenadier 2A | 0      | 0        | 1.2       | 0          |
| Not relevant to me             | 0.5        | 0.25     | ICV 2   | Grenadier 2A | 0      | 0        | 1.2       | 0          |
| ESTIMATE IMPACT--Short         | 2.5        | 1.5      | ICV 2   | Grenadier 2A | 7      | 0        | 7         | 0          |
| Finalize COA--Short            | 10         | 5        | ICV 2   | Grenadier 2A | 3.7    | 0        | 6.8       | 7          |
| Update mission profile--Long   | 60         | 30       | ICV 2   | Grenadier 2A | 7      | 0        | 6.8       | 7          |
| Update mission profile--Short  | 5          | 2.5      | ICV 2   | Grenadier 2A | 7      | 0        | 6.8       | 7          |
| Relevant to me                 | 0.5        | 0.25     | ICV 2   | Grenadier 2A | 0      | 0        | 1.2       | 0          |
| Search for Digital Info        | 10         | 4.5      | ICV 2   | Grenadier 2A | 7      | 0        | 5.3       | 7          |
| Not relevant to me             | 0.5        | 0.25     | ICV 2   | Grenadier 2A | 0      | 0        | 1.2       | 0          |
| Relevant to me                 | 0.5        | 0.25     | ICV 2   | Grenadier 2A | 0      | 0        | 1.2       | 0          |
| Not relevant to me             | 0.5        | 0.25     | ICV 2   | Grenadier 2A | 0      | 0        | 1.2       | 0          |
| Synchronize with higher--Short | 5          | 2.5      | ICV 2   | Grenadier 2A | 4      | 0        | 3.7       | 7          |
| Haptic Message                 | 0          | 0        | ICV 2   | Grenadier 2A | 0      | 0        | 0         | 0          |
| Reply to voice                 | 15         | 45       | ICV 2   | Grenadier 2A | 3.7    | 4.3      | 4.6       | 2.2        |
| Recognize                      | 1.5        | 0.5      | ICV 2   | Grenadier 2A | 0      | 1        | 1         | 0          |
| ID Message                     | 2.5        | 0.75     | ICV 2   | Grenadier 2A | 0      | 4.2      | 3.7       | 0          |

|                               |      |      |       |              |     |     |     |     |
|-------------------------------|------|------|-------|--------------|-----|-----|-----|-----|
| Direction                     | 0    | 0    | ICV 2 | Grenadier 2A | 0   | 0   | 0   | 0   |
| Caution                       | 0    | 0    | ICV 2 | Grenadier 2A | 0   | 0   | 0   | 0   |
| Alert                         | 0    | 0    | ICV 2 | Grenadier 2A | 0   | 0   | 0   | 0   |
| Warning                       | 0    | 0    | ICV 2 | Grenadier 2A | 0   | 0   | 0   | 0   |
| ID Direction                  | 0    | 0    | ICV 2 | Grenadier 2A | 0   | 0   | 0   | 0   |
| ID Alert                      | 0    | 0    | ICV 2 | Grenadier 2A | 0   | 0   | 0   | 0   |
| ID Warning                    | 0    | 0    | ICV 2 | Grenadier 2A | 0   | 0   | 0   | 0   |
| ID Caution                    | 0    | 0    | ICV 2 | Grenadier 2A | 0   | 0   | 0   | 0   |
| DISCUSS (Rifleman 2A)         | 5.5  | 1.5  | ICV 2 | Grenadier 2A | 3.7 | 4.9 | 3.7 | 2.2 |
| Change recognized             | 1    | 2.5  | ICV 2 | Grenadier 2A | 3.7 | 0   | 3.7 | 0   |
| Email                         | 0    | 0    | ICV 2 | Grenadier 2A | 0   | 0   | 0   | 0   |
| Receive radio info            | 5.5  | 0.5  | ICV 2 | Grenadier 2A | 3.7 | 4.9 | 3.7 | 0   |
| ESTIMATE IMPACT--Long         | 10   | 15   | ICV 2 | Grenadier 2A | 7   | 0   | 7   | 0   |
| Receive verbal response       | 6.5  | 5.5  | ICV 2 | Grenadier 2A | 3.7 | 4.9 | 4.6 | 1   |
| Voice Out                     | 5.5  | 0.5  | ICV 2 | Grenadier 2A | 3.7 | 2   | 3.7 | 2.2 |
| Send email request            | 0    | 0    | ICV 2 | Grenadier 2A | 0   | 0   | 0   | 0   |
| Receive email response        | 0.5  | 0.23 | ICV 2 | Grenadier 2A | 3.7 | 4.9 | 3.7 | 1   |
| START MONITOR                 | 0    | 0    | ICV 2 | Grenadier 2A | 0   | 0   | 0   | 0   |
| See Visual Change             | 1.5  | 0.3  | ICV 2 | Grenadier 2A | 4   | 0   | 3.7 | 0   |
| Display update                | 0    | 0    | ICV 2 | Grenadier 2A | 0   | 0   | 0   | 0   |
| Pause                         | 1    | 30   | ICV 2 | Grenadier 2A | 0   | 0   | 0   | 0   |
| ID ACTIONABLE CHOICES         | 5.5  | 4.5  | ICV 2 | Grenadier 2A | 5.9 | 0   | 3.7 | 0   |
| START LISTEN                  | 0    | 0    | ICV 2 | Grenadier 2A | 0   | 4.9 | 3.7 | 0   |
| Mission profile update        | 0    | 0    | ICV 2 | Grenadier 2A | 0   | 0   | 0   | 0   |
| Open/Read Message             | 1.12 | 1    | ICV 2 | Grenadier 2A | 5.9 | 0   | 4.6 | 2.2 |
| Discuss (Rifleman)            | 5.5  | 1.5  | ICV 2 | Rifleman 1A  | 3.7 | 4.9 | 3.7 | 2.2 |
| Discuss (Automatic Rifleman)  | 5.5  | 1.5  | ICV 2 | Auto Rif 3B  | 3.7 | 4.9 | 3.7 | 2.2 |
| Finalize COA--Long            | 60   | 30   | ICV 2 | Grenadier 2A | 3.7 | 0   | 6.8 | 7   |
| Update COA                    | 15   | 7.5  | ICV 2 | Grenadier 2A | 7   | 0   | 6.8 | 7   |
| Perform physical action       | 1    | 0.5  | ICV 2 | Grenadier 2A | 5.9 | 0   | 6.8 | 7   |
| Synchronize with higher--Long | 60   | 30   | ICV 2 | Grenadier 2A | 4   | 0   | 3.7 | 7   |
| ID functionality              | 0.5  | 0.5  | ICV 2 | Grenadier 2A | 4   | 0   | 4.6 | 0   |
| Switch to appropriate I/F     | 1    | 0.5  | ICV 2 | Grenadier 2A | 3.7 | 0   | 1   | 2.2 |
| ID channel                    | 1    | 1    | ICV 2 | Grenadier 2A | 0   | 0   | 0   | 0   |
| Switch to appropriate channel | 1    | 0.5  | ICV 2 | Grenadier 2A | 3.7 | 0   | 1   | 2.2 |

| Task Name                      | Time (sec) | SD (sec) | Vehicle | Operator     | Visual | Auditory | Cognitive | Perceptual |
|--------------------------------|------------|----------|---------|--------------|--------|----------|-----------|------------|
| <b>Rifleman 1B</b>             |            |          |         |              |        |          |           |            |
| START                          | 0          | 0        | ICV 2   | Rifleman 1B  | 0      | 0        | 0         | 0          |
| RECEIVE MSG/UPDT               | 0          | 0        | ICV 2   | Rifleman 1B  | 0      | 0        | 0         | 0          |
| COLLABORATE                    | 0          | 0        | ICV 2   | Rifleman 1B  | 0      | 0        | 0         | 0          |
| Listen                         | 5.5        | 1.5      | ICV 2   | Rifleman 1B  | 3.7    | 4.9      | 4.6       | 0          |
| No action                      | 0          | 0        | ICV 2   | Rifleman 1B  | 0      | 0        | 0         | 0          |
| Pause                          | 1          | 30       | ICV 2   | Rifleman 1B  | 0      | 0        | 0         | 0          |
| No action                      | 0          | 0        | ICV 2   | Rifleman 1B  | 0      | 0        | 0         | 0          |
| PL Listening                   | 15         | 45       | ICV1    | PL           | 0      | 0        | 0         | 0          |
| MED Listening                  | 15         | 45       | ICV1    | Medic        | 0      | 0        | 0         | 0          |
| VC Listening                   | 15         | 45       | ICV1    | VC           | 0      | 0        | 0         | 0          |
| CO Listening                   | 15         | 45       | Co HQ   | CO           | 0      | 0        | 0         | 0          |
| SL Listening                   | 15         | 45       | ICV 2   | SL           | 0      | 0        | 0         | 0          |
| Driver1 Listening              | 15         | 45       | ICV1    | DVR1         | 0      | 0        | 0         | 0          |
| Radio out for info (RFI)       | 5.5        | 50       | ICV 2   | Rifleman 1B  | 3.7    | 2        | 1.2       | 2.2        |
| Driver2 Listening              | 15         | 45       | ICV 2   | DVR2         | 0      | 0        | 0         | 0          |
| PSG Listening                  | 15         | 45       | ICV 2   | PSG          | 0      | 0        | 0         | 0          |
| TLA Listening                  | 15         | 45       | ICV 2   | TLA          | 0      | 0        | 0         | 0          |
| TLB Listening                  | 15         | 45       | ICV 2   | TLB          | 0      | 0        | 0         | 0          |
| Rifleman1A Listening           | 15         | 45       | ICV 2   | Rifleman 1A  | 0      | 0        | 0         | 0          |
| Rifleman2A Listening           | 15         | 45       | ICV 2   | Grenadier 2A | 0      | 0        | 0         | 0          |
| Rifleman3A Listening           | 15         | 45       | ICV 2   | Auto Rif 3A  | 0      | 0        | 0         | 0          |
| Rifleman1B Listening           | 15         | 45       | ICV 2   | Rifleman 1B  | 0      | 0        | 0         | 0          |
| Rifleman2B Listening           | 15         | 45       | ICV 2   | Grenadier 2B | 0      | 0        | 0         | 0          |
| Rifleman3B Listening           | 15         | 45       | ICV 2   | Auto Rif 3B  | 0      | 0        | 0         | 0          |
| COLLECT INFO Branch            | 0          | 0        | ICV 2   | Rifleman 1B  | 0      | 0        | 0         | 0          |
| Listen                         | 5.5        | 0.5      | ICV 2   | Rifleman 1B  | 0      | 4.9      | 4.6       | 0          |
| Relevant to me                 | 0.5        | 0.25     | ICV 2   | Rifleman 1B  | 0      | 0        | 1.2       | 0          |
| Not relevant to me             | 0.5        | 0.25     | ICV 2   | Rifleman 1B  | 0      | 0        | 1.2       | 0          |
| ESTIMATE IMPACT--Short         | 2.5        | 1.5      | ICV 2   | Rifleman 1B  | 7      | 0        | 7         | 0          |
| Finalize COA--Short            | 10         | 5        | ICV 2   | Rifleman 1B  | 3.7    | 0        | 6.8       | 7          |
| Update mission profile--Long   | 60         | 30       | ICV 2   | Rifleman 1B  | 7      | 0        | 6.8       | 7          |
| Relevant to me                 | 0.5        | 0.25     | ICV 2   | Rifleman 1B  | 0      | 0        | 1.2       | 0          |
| Not relevant to me             | 0.5        | 0.25     | ICV 2   | Rifleman 1B  | 0      | 0        | 1.2       | 0          |
| Search for Digital Info        | 10         | 4.5      | ICV 2   | Rifleman 1B  | 7      | 0        | 5.3       | 7          |
| Relevant to me                 | 0.5        | 0.25     | ICV 2   | Rifleman 1B  | 0      | 0        | 1.2       | 0          |
| Not relevant to me             | 0.5        | 0.25     | ICV 2   | Rifleman 1B  | 0      | 0        | 1.2       | 0          |
| Synchronize with higher--Short | 5          | 2.5      | ICV 2   | Rifleman 1B  | 4      | 0        | 3.7       | 7          |
| Haptic Message                 | 0          | 0        | ICV 2   | Rifleman 1B  | 0      | 0        | 0         | 0          |
| Recognize                      | 1.5        | 0.5      | ICV 2   | Rifleman 1B  | 0      | 1        | 1         | 0          |
| ID Message                     | 2.5        | 0.75     | ICV 2   | Rifleman 1B  | 0      | 4.2      | 3.7       | 0          |
| Direction                      | 0          | 0        | ICV 2   | Rifleman 1B  | 0      | 0        | 0         | 0          |
| Alert                          | 0          | 0        | ICV 2   | Rifleman 1B  | 0      | 0        | 0         | 0          |
| Reply to voice                 | 15         | 45       | ICV 2   | Rifleman 1B  | 3.7    | 4.3      | 4.6       | 2.2        |
| Warning                        | 0          | 0        | ICV 2   | Rifleman 1B  | 0      | 0        | 0         | 0          |
| Caution                        | 0          | 0        | ICV 2   | Rifleman 1B  | 0      | 0        | 0         | 0          |

|                               |      |      |       |              |     |     |     |     |
|-------------------------------|------|------|-------|--------------|-----|-----|-----|-----|
| ID Direction                  | 0    | 0    | ICV 2 | Rifleman 1B  | 0   | 0   | 0   | 0   |
| ID Alert                      | 0    | 0    | ICV 2 | Rifleman 1B  | 0   | 0   | 0   | 0   |
| ID Warning                    | 0    | 0    | ICV 2 | Rifleman 1B  | 0   | 0   | 0   | 0   |
| ID Caution                    | 0    | 0    | ICV 2 | Rifleman 1B  | 0   | 0   | 0   | 0   |
| DISCUSS (Rifleman 1B)         | 5.5  | 1.5  | ICV 2 | Rifleman 1B  | 3.7 | 4.9 | 3.7 | 2.2 |
| Change recognized             | 1    | 2.5  | ICV 2 | Rifleman 1B  | 3.7 | 0   | 3.7 | 0   |
| Email                         | 0    | 0    | ICV 2 | Rifleman 1B  | 0   | 0   | 0   | 0   |
| Receive radio info            | 5.5  | 0.5  | ICV 2 | Rifleman 1B  | 3.7 | 4.9 | 3.7 | 0   |
| ESTIMATE IMPACT--Long         | 10   | 15   | ICV 2 | Rifleman 1B  | 7   | 0   | 7   | 0   |
| Discuss (PL)                  | 5.5  | 1.5  | ICV1  | PL           | 3.7 | 4.9 | 3.7 | 2.2 |
| Pull up email                 | 2    | 0.3  | ICV 2 | Rifleman 1B  | 3.7 | 0   | 1   | 7   |
| Internal Trigger              | 0    | 0    | ICV 2 | Rifleman 1B  | 0   | 0   | 0   | 0   |
| ID Current Mission            | 0.5  | 0.5  | ICV 2 | Rifleman 1B  | 3.7 | 0   | 3.7 | 7   |
| ID Environment Change         | 0.5  | 0.25 | ICV 2 | Rifleman 1B  | 3.7 | 0   | 3.7 | 7   |
| ID environment                | 0.5  | 0.12 | ICV 2 | Rifleman 1B  | 3.7 | 0   | 3.7 | 0   |
| ID who from                   | 0.5  | 0.5  | ICV 2 | Rifleman 1B  | 3.7 | 0   | 3.7 | 7   |
| ID priority                   | 0.5  | 0.5  | ICV 2 | Rifleman 1B  | 3.7 | 0   | 3.7 | 0   |
| Find digital info             | 5.5  | 4.5  | ICV 2 | Rifleman 1B  | 7   | 0   | 4.6 | 7   |
| TAKE ACTION                   | 0    | 0    | ICV 2 | Rifleman 1B  | 0   | 0   | 0   | 0   |
| Voice Msg                     | 0    | 0    | ICV 2 | Rifleman 1B  | 0   | 0   | 0   | 0   |
| Verbal request                | 6.5  | 5.5  | ICV 2 | Rifleman 1B  | 3.7 | 4.9 | 4.6 | 2.2 |
| Receive verbal response       | 6.5  | 5.5  | ICV 2 | Rifleman 1B  | 3.7 | 4.9 | 4.6 | 1   |
| Voice Out                     | 5.5  | 0.5  | ICV 2 | Rifleman 1B  | 3.7 | 2   | 3.7 | 2.2 |
| Send email request            | 1    | 1    | ICV 2 | Rifleman 1B  | 0   | 0   | 0   | 0   |
| Receive email response        | 0.5  | 0.23 | ICV 2 | Rifleman 1B  | 3.7 | 4.9 | 3.7 | 7   |
| START MONITOR                 | 0    | 0    | ICV 2 | Rifleman 1B  | 0   | 0   | 0   | 0   |
| See Visual Change             | 1.5  | 0.3  | ICV 2 | Rifleman 1B  | 4   | 0   | 3.7 | 0   |
| Display update                | 0    | 0    | ICV 2 | Rifleman 1B  | 0   | 0   | 0   | 0   |
| Pause                         | 1    | 30   | ICV 2 | Rifleman 1B  | 0   | 0   | 0   | 0   |
| ID ACTIONABLE CHOICES         | 5.5  | 4.5  | ICV 2 | Rifleman 1B  | 5.9 | 0   | 3.7 | 0   |
| START LISTEN                  | 0    | 0    | ICV 2 | Rifleman 1B  | 0   | 4.9 | 3.7 | 0   |
| Mission profile update        | 0    | 0    | ICV 2 | Rifleman 1B  | 0   | 0   | 0   | 0   |
| Open/Read Message             | 1.12 | 1    | ICV 2 | Rifleman 1B  | 5.9 | 0   | 4.6 | 2.2 |
| Discuss (Grenadier)           | 5.5  | 1.5  | ICV 2 | Grenadier 2A | 3.7 | 4.9 | 3.7 | 2.2 |
| Discuss (Automatic Rifleman)  | 5.5  | 1.5  | ICV 2 | Auto Rif 3A  | 3.7 | 4.9 | 3.7 | 2.2 |
| Finalize COA--Long            | 60   | 30   | ICV 2 | Rifleman 1B  | 3.7 | 0   | 6.8 | 7   |
| Update COA                    | 15   | 7.5  | ICV 2 | Rifleman 1B  | 7   | 0   | 6.8 | 7   |
| Perform physical action       | 1    | 0.5  | ICV 2 | Rifleman 1B  | 5.9 | 0   | 6.8 | 7   |
| Update mission profile--Short | 5    | 2.5  | ICV 2 | Rifleman 1B  | 7   | 0   | 6.8 | 7   |
| Synchronize with higher--Long | 60   | 30   | ICV 2 | Rifleman 1B  | 4   | 0   | 3.7 | 7   |
| ID functionality              | 0.5  | 0.5  | ICV 2 | Rifleman 1B  | 4   | 0   | 4.6 | 0   |
| Switch to appropriate I/F     | 1.5  | 1    | ICV 2 | Rifleman 1B  | 3.7 | 0   | 3.7 | 7   |
| ID channel                    | 0.5  | 0.5  | ICV 2 | Rifleman 1B  | 4   | 0   | 4.6 | 0   |
| Switch to appropriate channel | 1.5  | 1    | ICV 2 | Rifleman 1B  | 3.7 | 0   | 1   | 2.2 |

| Task Name                      | Time (sec) | SD (sec) | Vehicle | Operator     | Visual | Auditory | Cognitive | Perceptual |
|--------------------------------|------------|----------|---------|--------------|--------|----------|-----------|------------|
| <b>Grenadier 2B</b>            |            |          |         |              |        |          |           |            |
| START                          | 0          | 0        | ICV 2   | Grenadier 2B | 0      | 0        | 0         | 0          |
| RECEIVE MSG/UPDT               | 0          | 0        | ICV 2   | Grenadier 2B | 0      | 0        | 0         | 0          |
| COLLABORATE                    | 0          | 0        | ICV 2   | Grenadier 2B | 0      | 0        | 0         | 0          |
| Listen                         | 5.5        | 1.5      | ICV 2   | Grenadier 2B | 3.7    | 4.9      | 4.6       | 0          |
| Discuss (Rifleman 2B)          | 5.5        | 1.5      | ICV 2   | Grenadier 2B | 3.7    | 4.9      | 3.7       | 2.2        |
| PL Listening                   | 15         | 45       | ICV1    | PL           | 0      | 0        | 0         | 0          |
| MED Listening                  | 15         | 45       | ICV1    | Medic        | 0      | 0        | 0         | 0          |
| VC Listening                   | 15         | 45       | ICV1    | VC           | 0      | 0        | 0         | 0          |
| CO Listening                   | 15         | 45       | Co HQ   | CO           | 0      | 0        | 0         | 0          |
| SL Listening                   | 15         | 45       | ICV 2   | SL           | 0      | 0        | 0         | 0          |
| Driver1 Listening              | 15         | 45       | ICV1    | DVR1         | 0      | 0        | 0         | 0          |
| Driver2 Listening              | 15         | 45       | ICV 2   | DVR2         | 0      | 0        | 0         | 0          |
| PSG Listening                  | 15         | 45       | ICV 2   | PSG          | 0      | 0        | 0         | 0          |
| TLA Listening                  | 15         | 45       | ICV 2   | TLA          | 0      | 0        | 0         | 0          |
| No action                      | 0          | 0        | ICV 2   | Grenadier 2B | 0      | 0        | 0         | 0          |
| TLB Listening                  | 15         | 45       | ICV 2   | TLB          | 0      | 0        | 0         | 0          |
| Rifleman1A Listening           | 15         | 45       | ICV 2   | Rifleman 1A  | 0      | 0        | 0         | 0          |
| Rifleman2A Listening           | 15         | 45       | ICV 2   | Grenadier 2A | 0      | 0        | 0         | 0          |
| Rifleman3A Listening           | 15         | 45       | ICV 2   | Auto Rif 3A  | 0      | 0        | 0         | 0          |
| Rifleman1B Listening           | 15         | 45       | ICV 2   | Rifleman 1B  | 0      | 0        | 0         | 0          |
| Rifleman2B Listening           | 15         | 45       | ICV 2   | Grenadier 2B | 0      | 0        | 0         | 0          |
| Rifleman3B Listening           | 15         | 45       | ICV 2   | Auto Rif 3B  | 0      | 0        | 0         | 0          |
| Listen                         | 5.5        | 0.5      | ICV 2   | Grenadier 2B | 0      | 4.9      | 4.6       | 0          |
| Relevant to me                 | 0.5        | 0        | ICV 2   | Grenadier 2B | 0      | 0        | 1.2       | 0          |
| Not relevant to me             | 0.5        | 0.25     | ICV 2   | Grenadier 2B | 0      | 0        | 1.2       | 0          |
| Pause                          | 1          | 30       | ICV 2   | Grenadier 2B | 0      | 0        | 0         | 0          |
| ESTIMATE IMPACT--Short         | 2.5        | 1.5      | ICV 2   | Grenadier 2B | 7      | 0        | 7         | 0          |
| Finalize COA--Short            | 10         | 5        | ICV 2   | Grenadier 2B | 3.7    | 0        | 6.8       | 7          |
| Update mission profile--Short  | 5          | 2.5      | ICV 2   | Grenadier 2B | 7      | 0        | 6.8       | 7          |
| Relevant to me                 | 0.5        | 0        | ICV 2   | Grenadier 2B | 0      | 0        | 1.2       | 0          |
| Not relevant to me             | 0.5        | 0.25     | ICV 2   | Grenadier 2B | 0      | 0        | 1.2       | 0          |
| Relevant to me                 | 0.5        | 0        | ICV 2   | Grenadier 2B | 0      | 0        | 1.2       | 0          |
| Not relevant to me             | 0.5        | 0.25     | ICV 2   | Grenadier 2B | 0      | 0        | 1.2       | 0          |
| No action                      | 0          | 0        | ICV 2   | Grenadier 2B | 0      | 0        | 0         | 0          |
| Synchronize with higher--Short | 5          | 2.5      | ICV 2   | Grenadier 2B | 4      | 0        | 3.7       | 7          |
| Haptic Message                 | 0          | 0        | ICV 2   | Grenadier 2B | 0      | 0        | 0         | 0          |
| Recognize                      | 1.5        | 0.5      | ICV 2   | Grenadier 2B | 0      | 1        | 1         | 0          |
| ID Message                     | 2.5        | 0.75     | ICV 2   | Grenadier 2B | 0      | 4.2      | 3.7       | 0          |
| Direction                      | 0          | 0        | ICV 2   | Grenadier 2B | 0      | 0        | 0         | 0          |
| Alert                          | 0          | 0        | ICV 2   | Grenadier 2B | 0      | 0        | 0         | 0          |
| Warning                        | 0          | 0        | ICV 2   | Grenadier 2B | 0      | 0        | 0         | 0          |
| Caution                        | 0          | 0        | ICV 2   | Grenadier 2B | 0      | 0        | 0         | 0          |
| ID Direction                   | 0          | 0        | ICV 2   | Grenadier 2B | 0      | 0        | 0         | 0          |
| ID Alert                       | 0          | 0        | ICV 2   | Grenadier 2B | 0      | 0        | 0         | 0          |
| ID Warning                     | 0          | 0        | ICV 2   | Grenadier 2B | 0      | 0        | 0         | 0          |

|                               |      |      |       |              |     |     |     |     |
|-------------------------------|------|------|-------|--------------|-----|-----|-----|-----|
| ID Caution                    | 0    | 0    | ICV 2 | Grenadier 2B | 0   | 0   | 0   | 0   |
| Radio out for info (RFI)      | 5.5  | 50   | ICV 2 | Grenadier 2B | 3.7 | 2   | 1.2 | 2.2 |
| COLLECT INFO                  | 0    | 0    | ICV 2 | Grenadier 2B | 0   | 0   | 0   | 0   |
| Search for Digital Info       | 10   | 4.5  | ICV 2 | Grenadier 2B | 7   | 0   | 5.3 | 7   |
| Reply to voice                | 15   | 45   | ICV 2 | Grenadier 2B | 3.7 | 4.3 | 4.6 | 2.2 |
| Change recognized             | 1    | 2.5  | ICV 2 | Grenadier 2B | 3.7 | 0   | 3.7 | 0   |
| Email                         | 0    | 0    | ICV 2 | Grenadier 2B | 0   | 0   | 0   | 0   |
| Receive radio info            | 5.5  | 0.5  | ICV 2 | Grenadier 2B | 3.7 | 4.9 | 3.7 | 0   |
| ESTIMATE IMPACT--Long         | 10   | 15   | ICV 2 | Grenadier 2B | 7   | 0   | 7   | 0   |
| Discuss (PL)                  | 5.5  | 1.5  | ICV1  | PL           | 3.7 | 4.9 | 3.7 | 2.2 |
| Pull up email                 | 2    | 0.3  | ICV 2 | Grenadier 2B | 3.7 | 0   | 1   | 7   |
| Internal Trigger              | 0    | 0    | ICV 2 | Grenadier 2B | 0   | 0   | 0   | 0   |
| ID Current Mission            | 0.5  | 0.5  | ICV 2 | Grenadier 2B | 3.7 | 0   | 3.7 | 7   |
| ID Environment Change         | 0.5  | 0.25 | ICV 2 | Grenadier 2B | 3.7 | 0   | 3.7 | 7   |
| ID environment                | 0.5  | 0.12 | ICV 2 | Grenadier 2B | 3.7 | 0   | 3.7 | 0   |
| ID who from                   | 0.5  | 0.5  | ICV 2 | Grenadier 2B | 3.7 | 0   | 3.7 | 7   |
| ID priority                   | 0.5  | 0.5  | ICV 2 | Grenadier 2B | 3.7 | 0   | 3.7 | 0   |
| Find digital info             | 5.5  | 4.5  | ICV 2 | Grenadier 2B | 7   | 0   | 4.6 | 7   |
| TAKE ACTION                   | 0    | 0    | ICV 2 | Grenadier 2B | 0   | 0   | 0   | 0   |
| Voice Msg                     | 0    | 0    | ICV 2 | Grenadier 2B | 0   | 0   | 0   | 0   |
| Verbal request                | 6.5  | 5.5  | ICV 2 | Grenadier 2B | 3.7 | 4.9 | 4.6 | 2.2 |
| Receive verbal response       | 6.5  | 5.5  | ICV 2 | Grenadier 2B | 3.7 | 4.9 | 4.6 | 1   |
| Voice Out                     | 5.5  | 0.5  | ICV 2 | Grenadier 2B | 3.7 | 2   | 3.7 | 2.2 |
| Send email request            | 1    | 1    | ICV 2 | Grenadier 2B | 0   | 0   | 0   | 0   |
| Receive email response        | 0.5  | 0.23 | ICV 2 | Grenadier 2B | 3.7 | 4.9 | 3.7 | 7   |
| START MONITOR                 | 0    | 0    | ICV 2 | Grenadier 2B | 0   | 0   | 0   | 0   |
| See Visual Change             | 1.5  | 0.3  | ICV 2 | Grenadier 2B | 4   | 0   | 3.7 | 0   |
| Display update                | 0    | 0    | ICV 2 | Grenadier 2B | 0   | 0   | 0   | 0   |
| Pause                         | 1    | 30   | ICV 2 | Grenadier 2B | 0   | 0   | 0   | 0   |
| ID ACTIONABLE CHOICES         | 5.5  | 4.5  | ICV 2 | Grenadier 2B | 5.9 | 0   | 7   | 0   |
| START LISTEN                  | 0    | 0    | ICV 2 | Grenadier 2B | 0   | 4.9 | 3.7 | 0   |
| Mission profile update        | 0    | 0    | ICV 2 | Grenadier 2B | 0   | 0   | 0   | 0   |
| Open/Read Message             | 1.12 | 1    | ICV 2 | Grenadier 2B | 5.9 | 0   | 4.6 | 2.2 |
| Discuss (Rifleman)            | 5.5  | 1.5  | ICV 2 | Rifleman 1B  | 3.7 | 4.9 | 3.7 | 2.2 |
| Discuss (Automatic Rifleman)  | 5.5  | 1.5  | ICV 2 | Auto Rif 3B  | 3.7 | 4.9 | 3.7 | 2.2 |
| Finalize COA--Long            | 60   | 30   | ICV 2 | Grenadier 2B | 3.7 | 0   | 6.8 | 7   |
| Update COA                    | 15   | 7.5  | ICV 2 | Grenadier 2B | 7   | 0   | 6.8 | 7   |
| Perform physical action       | 1    | 0.5  | ICV 2 | Grenadier 2B | 5.9 | 0   | 6.8 | 7   |
| Update mission profile--Long  | 60   | 30   | ICV 2 | Grenadier 2B | 7   | 0   | 6.8 | 7   |
| Synchronize with higher--Long | 60   | 30   | ICV 2 | Grenadier 2B | 4   | 0   | 3.7 | 7   |
| ID functionality              | 0.5  | 0.5  | ICV 2 | Grenadier 2B | 4   | 0   | 4.6 | 0   |
| Switch to appropriate I/F     | 1.5  | 1    | ICV 2 | Grenadier 2B | 3.7 | 0   | 3.7 | 7   |
| ID channel                    | 0.5  | 0.5  | ICV 2 | Grenadier 2B | 4   | 0   | 4.6 | 0   |
| Switch to appropriate channel | 1    | 0.5  | ICV 2 | Grenadier 2B | 3.7 | 0   | 1   | 2.2 |

| Task Name                      | Time (sec) | SD (sec) | Vehicle | Operator     | Visual | Auditory | Cognitive | Perceptual |
|--------------------------------|------------|----------|---------|--------------|--------|----------|-----------|------------|
| <b>Auto Rifleman 3B</b>        |            |          |         |              |        |          |           |            |
| START                          | 0          | 0        | ICV 2   | Auto Rif 3B  | 0      | 0        | 0         | 0          |
| RECEIVE MSG/UPDT               | 0          | 0        | ICV 2   | Auto Rif 3B  | 0      | 0        | 0         | 0          |
| COLLABORATE                    | 0          | 0        | ICV 2   | Auto Rif 3B  | 0      | 0        | 0         | 0          |
| Listen                         | 5.5        | 1.5      | ICV 2   | Auto Rif 3B  | 3.7    | 4.9      | 4.6       | 0          |
| No action                      | 0          | 0        | ICV 2   | Auto Rif 3B  | 0      | 0        | 0         | 0          |
| Pause                          | 1          | 30       | ICV 2   | Auto Rif 3B  | 0      | 0        | 0         | 0          |
| No action                      | 0          | 0        | ICV 2   | Auto Rif 3B  | 0      | 0        | 0         | 0          |
| PL Listening                   | 15         | 45       | ICV1    | PL           | 0      | 0        | 0         | 0          |
| MED Listening                  | 15         | 45       | ICV1    | Medic        | 0      | 0        | 0         | 0          |
| VC Listening                   | 15         | 45       | ICV1    | VC           | 0      | 0        | 0         | 0          |
| CO Listening                   | 15         | 45       | Co HQ   | CO           | 0      | 0        | 0         | 0          |
| SL Listening                   | 15         | 45       | ICV 2   | SL           | 0      | 0        | 0         | 0          |
| Driver1 Listening              | 15         | 45       | ICV1    | DVR1         | 0      | 0        | 0         | 0          |
| Radio out for info (RFI)       | 5.5        | 50       | ICV 2   | Auto Rif 3B  | 3.7    | 2        | 1.2       | 2.2        |
| Driver2 Listening              | 15         | 45       | ICV 2   | DVR2         | 0      | 0        | 0         | 0          |
| PSG Listening                  | 15         | 45       | ICV 2   | PSG          | 0      | 0        | 0         | 0          |
| TLA Listening                  | 15         | 45       | ICV 2   | TLA          | 0      | 0        | 0         | 0          |
| TLB Listening                  | 15         | 45       | ICV 2   | TLB          | 0      | 0        | 0         | 0          |
| Rifleman1A Listening           | 15         | 45       | ICV 2   | Rifleman 1A  | 0      | 0        | 0         | 0          |
| Rifleman2A Listening           | 15         | 45       | ICV 2   | Grenadier 2A | 0      | 0        | 0         | 0          |
| Rifleman3A Listening           | 15         | 45       | ICV 2   | Auto Rif 3A  | 0      | 0        | 0         | 0          |
| Rifleman1B Listening           | 15         | 45       | ICV 2   | Rifleman 1B  | 0      | 0        | 0         | 0          |
| Rifleman2B Listening           | 15         | 45       | ICV 2   | Grenadier 2B | 0      | 0        | 0         | 0          |
| Rifleman3B Listening           | 15         | 45       | ICV 2   | Auto Rif 3B  | 0      | 0        | 0         | 0          |
| COLLECT INFO                   | 0          | 0        | ICV 2   | Auto Rif 3B  | 0      | 0        | 0         | 0          |
| Listen                         | 5.5        | 0.5      | ICV 2   | Auto Rif 3B  | 0      | 4.9      | 4.6       | 0          |
| Relevant to me                 | 0.5        | 0.25     | ICV 2   | Auto Rif 3B  | 0      | 0        | 1.2       | 0          |
| Not relevant to me             | 0.5        | 0.25     | ICV 2   | Auto Rif 3B  | 0      | 0        | 1.2       | 0          |
| ESTIMATE IMPACT--Short         | 2.5        | 1.5      | ICV 2   | Auto Rif 3B  | 7      | 0        | 7         | 0          |
| Finalize COA--Short            | 10         | 5        | ICV 2   | Auto Rif 3B  | 3.7    | 0        | 6.8       | 7          |
| Update mission profile--Long   | 60         | 30       | ICV 2   | Auto Rif 3B  | 7      | 0        | 6.8       | 7          |
| Relevant to me                 | 0.5        | 0.25     | ICV 2   | Auto Rif 3B  | 0      | 0        | 1.2       | 0          |
| Not relevant to me             | 0.5        | 0.25     | ICV 2   | Auto Rif 3B  | 0      | 0        | 1.2       | 0          |
| Search for Digital Info        | 10         | 4.5      | ICV 2   | Auto Rif 3B  | 7      | 0        | 5.3       | 7          |
| Relevant to me                 | 0.5        | 0.25     | ICV 2   | Auto Rif 3B  | 0      | 0        | 1.2       | 0          |
| Not relevant to me             | 0.5        | 0.25     | ICV 2   | Auto Rif 3B  | 0      | 0        | 1.2       | 0          |
| Synchronize with higher--Short | 5          | 2.5      | ICV 2   | Auto Rif 3B  | 4      | 0        | 3.7       | 7          |
| Haptic Message                 | 0          | 0        | ICV 2   | Auto Rif 3B  | 0      | 0        | 0         | 0          |
| Recognize                      | 1.5        | 0.5      | ICV 2   | Auto Rif 3B  | 0      | 1        | 1         | 0          |
| ID Message                     | 2.5        | 0.75     | ICV 2   | Auto Rif 3B  | 0      | 4.2      | 3.7       | 0          |
| Direction                      | 0          | 0        | ICV 2   | Auto Rif 3B  | 0      | 0        | 0         | 0          |
| Reply to voice                 | 15         | 45       | ICV 2   | Auto Rif 3B  | 3.7    | 4.3      | 4.6       | 2.2        |
| Alert                          | 0          | 0        | ICV 2   | Auto Rif 3B  | 0      | 0        | 0         | 0          |

|                               |      |      |       |              |     |     |     |     |
|-------------------------------|------|------|-------|--------------|-----|-----|-----|-----|
| Warning                       | 0    | 0    | ICV 2 | Auto Rif 3B  | 0   | 0   | 0   | 0   |
| Caution                       | 0    | 0    | ICV 2 | Auto Rif 3B  | 0   | 0   | 0   | 0   |
| ID Direction                  | 0    | 0    | ICV 2 | Auto Rif 3B  | 0   | 0   | 0   | 0   |
| ID Alert                      | 0    | 0    | ICV 2 | Auto Rif 3B  | 0   | 0   | 0   | 0   |
| ID Warning                    | 0    | 0    | ICV 2 | Auto Rif 3B  | 0   | 0   | 0   | 0   |
| ID Caution                    | 0    | 0    | ICV 2 | Auto Rif 3B  | 0   | 0   | 0   | 0   |
| DISCUSS (Rifleman 3B)         | 5.5  | 1.5  | ICV 2 | Auto Rif 3B  | 3.7 | 4.9 | 3.7 | 2.2 |
| Change recognized             | 1    | 2.5  | ICV 2 | Auto Rif 3B  | 3.7 | 0   | 3.7 | 0   |
| Email                         | 0    | 0    | ICV 2 | Auto Rif 3B  | 0   | 0   | 0   | 0   |
| Receive radio info            | 5.5  | 0.5  | ICV 2 | Auto Rif 3B  | 3.7 | 4.9 | 3.7 | 0   |
| ESTIMATE IMPACT--Long         | 10   | 15   | ICV 2 | Auto Rif 3B  | 7   | 0   | 7   | 0   |
| Discuss (PL)                  | 5.5  | 1.5  | ICV1  | PL           | 3.7 | 4.9 | 3.7 | 2.2 |
| Pull up email                 | 2    | 0.3  | ICV 2 | Auto Rif 3B  | 3.7 | 0   | 1   | 7   |
| Internal Trigger              | 0    | 0    | ICV 2 | Auto Rif 3B  | 0   | 0   | 0   | 0   |
| ID Current Mission            | 0.5  | 0.5  | ICV 2 | Auto Rif 3B  | 3.7 | 0   | 3.7 | 7   |
| ID Environment Change         | 0.5  | 0.25 | ICV 2 | Auto Rif 3B  | 3.7 | 0   | 3.7 | 7   |
| ID environment                | 0.5  | 0.12 | ICV 2 | Auto Rif 3B  | 3.7 | 0   | 3.7 | 0   |
| ID who from                   | 0.5  | 0.5  | ICV 2 | Auto Rif 3B  | 3.7 | 0   | 3.7 | 7   |
| ID priority                   | 0.5  | 0.5  | ICV 2 | Auto Rif 3B  | 3.7 | 0   | 3.7 | 0   |
| Find digital info             | 5.5  | 4.5  | ICV 2 | Auto Rif 3B  | 7   | 0   | 4.6 | 7   |
| TAKE ACTION                   | 0    | 0    | ICV 2 | Auto Rif 3B  | 0   | 0   | 0   | 0   |
| Voice Msg                     | 0    | 0    | ICV 2 | Auto Rif 3B  | 0   | 0   | 0   | 0   |
| Verbal request                | 6.5  | 5.5  | ICV 2 | Auto Rif 3B  | 3.7 | 4.9 | 4.6 | 2.2 |
| Receive verbal response       | 6.5  | 5.5  | ICV 2 | Auto Rif 3B  | 3.7 | 4.9 | 4.6 | 1   |
| Voice Out                     | 5.5  | 0.5  | ICV 2 | Auto Rif 3B  | 3.7 | 2   | 3.7 | 2.2 |
| Send email request            | 1    | 1    | ICV 2 | Auto Rif 3B  | 0   | 0   | 0   | 0   |
| Receive email response        | 0.5  | 0.23 | ICV 2 | Auto Rif 3B  | 3.7 | 4.9 | 3.7 | 7   |
| START MONITOR                 | 0    | 0    | ICV 2 | Auto Rif 3B  | 0   | 0   | 0   | 0   |
| See Visual Change             | 1.5  | 0.3  | ICV 2 | Auto Rif 3B  | 4   | 0   | 3.7 | 0   |
| Display update                | 0    | 0    | ICV 2 | Auto Rif 3B  | 0   | 0   | 0   | 0   |
| Pause                         | 1    | 30   | ICV 2 | Auto Rif 3B  | 0   | 0   | 0   | 0   |
| ID ACTIONABLE CHOICES         | 5.5  | 4.5  | ICV 2 | Auto Rif 3B  | 5.9 | 0   | 7   | 0   |
| START LISTEN                  | 0    | 0    | ICV 2 | Auto Rif 3B  | 0   | 4.9 | 3.7 | 0   |
| Mission profile update        | 0    | 0    | ICV 2 | Auto Rif 3B  | 0   | 0   | 0   | 0   |
| Open/Read Message             | 1.12 | 1    | ICV 2 | Auto Rif 3B  | 5.9 | 0   | 4.6 | 2.2 |
| Discuss (Grenadier)           | 5.5  | 1.5  | ICV 2 | Grenadier 2B | 3.7 | 4.9 | 3.7 | 2.2 |
| Discuss with Rifleman         | 5.5  | 1.5  | ICV 2 | Rifleman 1B  | 3.7 | 4.9 | 3.7 | 2.2 |
| Finalize COA--Long            | 60   | 30   | ICV 2 | Auto Rif 3B  | 3.7 | 0   | 6.8 | 7   |
| Update COA                    | 15   | 7.5  | ICV 2 | Auto Rif 3B  | 7   | 0   | 6.8 | 7   |
| Perform physical action       | 1    | 0.5  | ICV 2 | Auto Rif 3B  | 5.9 | 0   | 6.8 | 7   |
| Update mission profile--Short | 5    | 2.5  | ICV 2 | Auto Rif 3B  | 7   | 0   | 6.8 | 7   |
| Synchronize with higher--Long | 60   | 30   | ICV 2 | Auto Rif 3B  | 4   | 0   | 3.7 | 7   |
| ID functionality              | 0.5  | 0.5  | ICV 2 | Auto Rif 3B  | 4   | 0   | 4.6 | 0   |
| Switch to appropriate I/F     | 1.5  | 1    | ICV 2 | Auto Rif 3B  | 3.7 | 0   | 3.7 | 7   |
| ID channel                    | 0.5  | 0.5  | ICV 2 | Auto Rif 3B  | 4   | 0   | 4.6 | 0   |
| Switch to appropriate channel | 1    | 0.5  | ICV 2 | Auto Rif 3B  | 3.7 | 0   | 1   | 2.2 |

| Task Name                               | Time (sec) | SD (sec) | Vehicle | Operator     | Visual | Auditory | Cognitive | Perceptual |
|---|------------|----------|---------|--------------|--------|----------|-----------|------------|
| <b>Medic</b>                            |            |          |         |              |        |          |           |            |
| START                                   | 0          | 0        | ICV1    | Medic        | 0      | 0        | 0         | 0          |
| RECEIVE MSG/UPDT Branch                 | 0          | 0        | ICV1    | Medic        | 0      | 0        | 0         | 0          |
| Switch to Appropriate Channel           | 1          | 0.5      | ICV1    | Medic        |        | 0        | 1         | 2.2        |
| Update COA                              | 15         | 7.5      | ICV1    | Medic        | 7      | 0        | 6.8       | 7          |
| PL Listening                            | 30         | 10       | ICV1    | PL           | 0      | 0        | 0         | 0          |
| MED Listening                           | 30         | 10       | ICV1    | Medic        | 0      | 0        | 0         | 0          |
| VC Listening                            | 30         | 10       | ICV1    | VC           | 0      | 0        | 0         | 0          |
| CO Listening                            | 30         | 10       | Co HQ   | CO           | 0      | 0        | 0         | 0          |
| SL Listening                            | 30         | 10       | ICV 2   | SL           | 0      | 0        | 0         | 0          |
| No Action                               | 0          | 0        | ICV1    | Medic        | 0      | 0        | 0         | 0          |
| Driver1 Listening                       | 30         | 10       | ICV1    | DVR1         | 0      | 0        | 0         | 0          |
| Driver2 Listening                       | 30         | 10       | ICV 2   | DVR2         | 0      | 0        | 0         | 0          |
| PSG Listening                           | 30         | 10       | ICV 2   | PSG          | 0      | 0        | 0         | 0          |
| TLA Listening                           | 30         | 10       | ICV 2   | TLA          | 0      | 0        | 0         | 0          |
| TLB Listening                           | 30         | 10       | ICV 2   | TLB          | 0      | 0        | 0         | 0          |
| Rifleman1A Listening                    | 30         | 10       | ICV 2   | Rifleman 1A  | 0      | 0        | 0         | 0          |
| Rifleman2A Listening                    | 30         | 10       | ICV 2   | Grenadier 2A | 0      | 0        | 0         | 0          |
| Rifleman3A Listening                    | 30         | 10       | ICV 2   | Auto Rif 3A  | 0      | 0        | 0         | 0          |
| Rifleman1B Listening                    | 30         | 10       | ICV 2   | Rifleman 1B  | 0      | 0        | 0         | 0          |
| Rifleman2B Listening                    | 30         | 10       | ICV 2   | Grenadier 2B | 0      | 0        | 0         | 0          |
| Rifleman3B Listening                    | 30         | 10       | ICV 2   | Auto Rif 3B  | 0      | 0        | 0         | 0          |
| Listen                                  | 5.5        | 0.5      | ICV1    | Medic        | 0      | 4.9      | 4.6       | 0          |
| Relevant to me                          | 0.5        | 0.25     | ICV1    | Medic        | 0      | 0        | 1.2       | 0          |
| Not relevant to me                      | 0.5        | 0.25     | ICV1    | Medic        | 0      | 0        | 1.2       | 0          |
| ESTIMATE IMPACT--Short                  | 2.5        | 1.5      | ICV1    | Medic        | 7      | 0        | 7         | 0          |
| FINALIZE COA--Short                     | 10         | 5        | ICV1    | Medic        | 7      | 0        | 7         | 0          |
| Update Mission Profile--Short           | 5          | 2.5      | ICV1    | DVR1         | 7      | 0        | 6.8       | 7          |
| Relevant to me                          | 0.5        | 0.25     | ICV1    | Medic        | 0      | 0        | 1.2       | 0          |
| Not relevant to me                      | 0.5        | 0.25     | ICV1    | Medic        | 0      | 0        | 1.2       | 0          |
| Relevant to me                          | 0.5        | 0.25     | ICV1    | Medic        | 0      | 0        | 1.2       | 0          |
| Not relevant to me                      | 0.5        | 0.25     | ICV1    | Medic        | 0      | 0        | 1.2       | 0          |
| Synchronize with higher database--short | 5          | 2.5      | ICV1    | Medic        | 4      | 0        | 3.7       | 7          |
| Radio out for info (RFI)                | 5.5        | 0.5      | ICV1    | Medic        | 3.7    | 2        | 1.2       | 2.2        |
| LOOK UP INFO Branch                     | 0          | 0        | ICV1    | Medic        | 0      | 0        | 0         | 0          |
| Search for Digital Info                 | 10         | 4.5      | ICV1    | Medic        | 7      | 0        | 5.3       | 7          |
| Reply to voice                          | 30         | 10       | ICV1    | Medic        | 3.7    | 4.3      | 4.6       | 2.2        |
| Display Change Recognition              | 0.1        | 0.2      | ICV1    | Medic        | 3.7    | 0        | 3.7       | 0          |
| Email                                   | 0          | 0        | ICV1    | Medic        | 0      | 0        | 0         | 0          |
| Receive radio info                      | 5.5        | 0.5      | ICV1    | Medic        | 3.7    | 4.9      | 3.7       | 0          |
| ESTIMATE IMPACT--Long                   | 45         | 0.15     | ICV1    | Medic        | 7      | 0        | 7         | 0          |
| ID Current Mission                      | 0.5        | 0.5      | ICV1    | Medic        | 3.7    | 0        | 3.7       | 7          |
| COLLABORATE                             | 0          | 0        | ICV1    | Medic        | 0      | 0        | 0         | 0          |
| ID Environmental Changes                | 0.5        | 0.25     | ICV1    | Medic        | 3.7    | 0        | 3.7       | 7          |
| Internal Trigger                        | 0          | 0        | ICV1    | Medic        | 0      | 0        | 0         | 0          |

|  |      |      |       |       |     |     |     |     |
|--|------|------|-------|-------|-----|-----|-----|-----|
| Pull up email                          | 2    | 0.3  | ICV1  | Medic | 3.7 | 0   | 1   | 7   |
| Discuss (1SGT)                         | 5.5  | 1.5  |       |       | 0   | 0   | 0   | 0   |
| DISCUSS (MED)                          | 5.5  | 1.5  | ICV1  | Medic | 3.7 | 4.9 | 3.7 | 2.2 |
| Discuss (VC1)                          | 5.5  | 1.5  | ICV1  | VC    | 0   | 0   | 0   | 0   |
| Find digital info                      | 5.5  | 4.5  | ICV1  | Medic | 7   | 0   | 4.6 | 7   |
| TAKE ACTION Branch                     | 0    | 0    | ICV1  | Medic | 0   | 0   | 0   | 0   |
| Voice Msg                              | 0    | 0    | ICV1  | Medic | 0   | 0   | 0   | 0   |
| Voice Out                              | 5.5  | 0.5  | ICV1  | Medic | 3.7 | 2   | 3.7 | 2.2 |
| End                                    | 0    | 0    | ICV1  | Medic | 0   | 0   | 0   | 0   |
| START MONITOR                          | 0    | 0    | ICV1  | Medic |     | 0   | 0   | 0   |
| See Visual Change                      | 1.5  | 0.3  | ICV1  | Medic |     | 0   | 3.7 | 0   |
| Display Update                         | 0    | 0    | ICV1  | Medic | 0   | 0   | 0   | 0   |
| pause                                  | 1    | 30   | ICV1  | Medic | 0   | 0   | 0   | 0   |
| Discuss (SL2)                          | 5.5  | 1.5  | ICV1  |       | 0   | 0   | 0   | 0   |
| Listen                                 | 5.5  | 1.5  | ICV1  | Medic | 3.7 | 4.9 | 4.6 | 0   |
| pause                                  | 1    | 30   | ICV1  | Medic | 0   | 0   | 0   | 0   |
| Discuss (SL3)                          | 5.5  | 1.5  | ICV1  |       | 0   | 0   | 0   | 0   |
| Update Mission Profile                 | 0    | 0    | ICV1  | Medic | 0   | 0   | 0   | 0   |
| Discuss (SL4)                          | 5.5  | 1.5  | ICV1  |       | 0   | 0   | 0   | 0   |
| Discuss (SL5)                          | 5.5  | 1.5  | ICV1  |       | 0   | 0   | 0   | 0   |
| Perform Physical Action                | 1    | 0.5  | ICV1  | Medic | 5.9 | 0   | 6.8 | 7   |
| Environmental ID                       | 0.5  | 0.1  | ICV1  | Medic | 3.7 | 0   | 3.7 | 0   |
| ID Who From                            | 0.5  | 0.5  | ICV1  | Medic | 3.7 | 0   | 3.7 | 7   |
| DISCUSS (PL)                           | 5.5  | 1.5  | ICV1  | PL    | 0   | 0   | 0   | 0   |
| ID Priority                            | 0.5  | 0.5  | ICV1  | Medic | 3.7 | 0   | 3.7 | 0   |
| Synchronize with higher database--long | 60   | 30   | ICV1  | Medic | 4   | 0   | 3.7 | 7   |
| Verbal Request                         | 6.5  | 5.5  | ICV1  | Medic | 3.7 | 4.9 | 4.6 | 2.2 |
| Receive Verbal Response                | 6.5  | 5.5  | ICV1  | Medic | 3.7 | 4.9 | 4.6 | 1   |
| E-mail Request                         | 1    | 1    | ICV1  | Medic | 0   | 0   | 0   | 0   |
| Receive E-mail Response                | 0.5  | 0.23 | ICV1  | Medic | 3.7 | 4.9 | 3.7 | 7   |
| Identify Actionable Choices            | 5.5  | 4.5  | ICV1  | Medic | 5.9 | 0   | 7   | 0   |
| Discuss (PSG)                          | 5.5  | 1.5  | ICV 2 | PSG   | 0   | 0   | 0   | 0   |
| Open/Read Message                      | 1.12 | 1    | ICV1  | Medic | 5.9 | 0   | 4.6 | 2.2 |
| Discuss (Bn MED)                       | 5.5  | 1.5  |       |       | 0   | 0   | 0   | 0   |
| Discuss (Plt2MED)                      | 5.5  | 1.5  |       |       | 0   | 0   | 0   | 0   |
| Discuss (Plt3MED)                      | 5.5  | 1.5  |       |       | 0   | 0   | 0   | 0   |
| Finalize COA--Long                     | 60   | 30   | ICV1  | Medic | 3.7 | 0   | 6.8 | 7   |
| Update Mission Profile--Long           | 60   | 30   | ICV1  | Medic | 7   | 0   | 6.8 | 7   |
| ID Functionality                       | 0.5  | 0.5  | ICV1  | Medic |     | 0   | 4.6 | 0   |
| Switch to Appropriate Interface        | 1.5  | 1    | ICV1  | Medic |     | 0   | 3.7 | 7   |
| No Action                              | 0    | 0    | ICV1  | Medic | 0   | 0   | 0   | 0   |
| START LISTEN                           | 0    | 0    | ICV1  | Medic | 0   | 4.9 | 3.7 | 0   |

| Task Name                               | Time (sec) | SD (sec) | Vehicle | Operator     | Visual | Auditory | Cognitive | Perceptual |
|---|------------|----------|---------|--------------|--------|----------|-----------|------------|
| <b>Driver 1 (DRVR 1)</b>                |            |          |         |              |        |          |           |            |
| START                                   | 0          | 0        | ICV1    | DVR1         | 0      | 0        | 0         | 0          |
| RECEIVE MSG/UPDT Branch                 | 0          | 0        | ICV1    | DVR1         | 0      | 0        | 0         | 0          |
| Update COA                              | 15         | 7.5      | ICV1    | DVR1         | 7      | 0        | 6.8       | 7          |
| PL Listening                            | 9          | 27       | ICV1    | PL           | 0      | 0        | 0         | 0          |
| MED Listening                           | 9          | 27       | ICV1    | Medic        | 0      | 0        | 0         | 0          |
| VC Listening                            | 9          | 27       | ICV1    | VC           | 0      | 0        | 0         | 0          |
| CO Listening                            | 9          | 27       | Co HQ   | CO           | 0      | 0        | 0         | 0          |
| SL Listening                            | 9          | 27       | ICV 2   | SL           | 0      | 0        | 0         | 0          |
| Driver1 Listening                       | 9          | 27       | ICV1    | DVR1         | 0      | 0        | 0         | 0          |
| Driver2 Listening                       | 9          | 27       | ICV 2   | DVR2         | 0      | 0        | 0         | 0          |
| PSG Listening                           | 9          | 27       | ICV 2   | PSG          | 0      | 0        | 0         | 0          |
| TLA Listening                           | 9          | 27       | ICV 2   | TLA          | 0      | 0        | 0         | 0          |
| TLB Listening                           | 9          | 27       | ICV 2   | TLB          | 0      | 0        | 0         | 0          |
| Rifleman1A Listening                    | 9          | 27       | ICV 2   | Rifleman 1A  | 0      | 0        | 0         | 0          |
| Rifleman2A Listening                    | 9          | 27       | ICV 2   | Grenadier 2A | 0      | 0        | 0         | 0          |
| Rifleman3A Listening                    | 9          | 27       | ICV 2   | Auto Rif 3A  | 0      | 0        | 0         | 0          |
| Rifleman1B Listening                    | 9          | 27       | ICV 2   | Rifleman 1B  | 0      | 0        | 0         | 0          |
| Rifleman2B Listening                    | 9          | 27       | ICV 2   | Grenadier 2B | 0      | 0        | 0         | 0          |
| Rifleman3B Listening                    | 9          | 27       | ICV 2   | Auto Rif 3B  | 0      | 0        | 0         | 0          |
| Listen                                  | 5.5        | 0.5      | ICV1    | DVR1         | 0      | 4.9      | 4.6       | 0          |
| Relevant to me                          | 0.5        | 0.25     | ICV1    | DVR1         | 0      | 0        | 1.2       | 0          |
| Not relevant to me                      | 0.5        | 0.25     | ICV1    | DVR1         | 0      | 0        | 1.2       | 0          |
| ESTIMATE IMPACT--Short                  | 2.5        | 1.5      | ICV1    | DVR1         | 7      | 0        | 7         | 0          |
| Update mission profile--short           | 5          | 2.5      | ICV1    | DVR1         | 7      | 0        | 6.8       | 7          |
| Relevant to me                          | 0.5        | 0.25     | ICV1    | DVR1         | 0      | 0        | 1.2       | 0          |
| Not relevant to me                      | 0.5        | 0.25     | ICV1    | DVR1         | 0      | 0        | 1.2       | 0          |
| Relevant to me                          | 0.5        | 0.25     | ICV1    | DVR1         | 0      | 0        | 1.2       | 0          |
| Not relevant to me                      | 0.5        | 0.25     | ICV1    | DVR1         | 0      | 0        | 1.2       | 0          |
| Synchronize with higher database--short | 5          | 2.5      | ICV1    | DVR1         | 4      | 0        | 3.7       | 7          |
| Radio out for info (RFI)                | 5.5        | 50       | ICV1    | DVR1         | 3.7    | 2        | 1.2       | 2.2        |
| LOOK UP INFO Branch                     | 0          | 0        | ICV1    | DVR1         | 0      | 0        | 0         | 0          |
| Search for Digital Info                 | 10         | 4.5      | ICV1    | DVR1         | 7      | 0        | 5.3       | 7          |
| Reply to voice                          | 9          | 27       | ICV1    | DVR1         | 3.7    | 4.3      | 4.6       | 2.2        |
| ID Who From                             | 0.5        | 0.5      | ICV1    | DVR1         | 3.7    | 0        | 3.7       | 7          |
| Display Change Recognition              | 1          | 2.5      | ICV1    | DVR1         | 3.7    | 0        | 3.7       | 0          |
| Email                                   | 0          | 0        | ICV1    | DVR1         | 0      | 0        | 0         | 0          |
| Receive radio info                      | 5.5        | 0.5      | ICV1    | DVR1         | 3.7    | 4.9      | 3.7       | 1          |
| Perform Physical Action                 | 1          | 0.5      | ICV1    | DVR1         | 5.9    | 0        | 6.8       | 7          |
| ESTIMATE IMPACT--Long                   | 10         | 15       | ICV1    | DVR1         | 7      | 0        | 7         | 0          |
| Determine Priority                      | 0.5        | 0.5      | ICV1    | DVR1         | 3.7    | 0        | 3.7       | 0          |
| Verbal Request                          | 6.5        | 5.5      | ICV1    | DVR1         | 3.7    | 4.9      | 4.6       | 2.2        |
| Receive Verbal Response                 | 6.5        | 5.5      | ICV1    | DVR1         | 3.7    | 4.9      | 4.6       | 1          |
| E-Mail Request                          | 1          | 1        | ICV1    | DVR1         | 0      | 0        | 0         | 0          |
| Receive e-mail response                 | 1          | 1        | ICV1    | DVR1         | 0      | 0        | 0         | 0          |

|  |      |      |      |      |     |     |     |     |
|--|------|------|------|------|-----|-----|-----|-----|
| Internal Trigger                       | 0    | 0    | ICV1 | DVR1 | 0   | 0   | 0   | 0   |
| Pull up email                          | 2    | 0.3  | ICV1 | DVR1 | 3.7 | 0   | 1   | 7   |
| Identify Actionable Choices            | 5.5  | 4.5  | ICV1 | DVR1 | 5.9 | 0   | 7   | 0   |
| Update Mission Profile--Long           | 60   | 30   | ICV1 | DVR1 | 7   | 0   | 6.8 | 7   |
| Synchronize with higher database--long | 60   | 30   | ICV1 | DVR1 | 4   | 0   | 3.7 | 7   |
| ID Functionality                       | 0.5  | 0.5  | ICV1 | DVR1 | 4   | 0   | 4.6 | 0   |
| Switch to Appropriate Interface        | 1.5  | 1    | ICV1 | DVR1 | 3.7 | 0   | 3.7 | 7   |
| No Action                              | 0    | 0    | ICV1 | DVR1 | 0   | 0   | 0   | 0   |
| START LISTEN                           | 0    | 0    | ICV1 | DVR1 | 0   | 4.9 | 3.7 | 0   |
| Find digital info                      | 5.5  | 4.5  | ICV1 | DVR1 | 7   | 0   | 4.6 | 7   |
| TAKE ACTION Branch                     | 0    | 0    | ICV1 | DVR1 | 0   | 0   | 0   | 0   |
| Voice Msg                              | 0    | 0    | ICV1 | DVR1 | 0   | 0   | 0   | 0   |
| ID Appropriate Channel                 | 0.5  | 0.5  | ICV1 | DVR1 | 4   | 0   | 4.6 | 0   |
| Voice Out                              | 5.5  | 0.5  | ICV1 | DVR1 | 3.7 | 2   | 3.7 | 2.2 |
| Switch to Appropriate Channel          | 1    | 0.5  | ICV1 | DVR1 | 3.7 | 0   | 1   | 2.2 |
| No Action                              | 0    | 0    | ICV1 | DVR1 | 0   | 0   | 0   | 0   |
| START MONITOR                          | 0    | 0    | ICV1 | DVR1 | 0   | 0   | 0   | 0   |
| See Visual Change                      | 1.5  | 0.3  | ICV1 | DVR1 | 4   | 0   | 3.7 | 0   |
| Display Update                         | 0    | 0    | ICV1 | DVR1 | 0   | 0   | 0   | 0   |
| pause                                  | 1    | 0.1  | ICV1 | DVR1 | 0   | 0   | 0   | 0   |
| ID Current Mission                     | 0.5  | 0.5  | ICV1 | DVR1 | 3.7 | 0   | 3.7 | 7   |
| Listen                                 | 5.5  | 1.5  | ICV1 | DVR1 | 3.7 | 4.9 | 4.6 | 0   |
| pause                                  | 1    | 0.1  | ICV1 | DVR1 | 0   | 0   | 0   | 0   |
| ID Environmental Changes               | 0.5  | 0.25 | ICV1 | DVR1 | 3.7 | 0   | 3.7 | 7   |
| Update Mission Profile                 | 0    | 0    | ICV1 | DVR1 | 0   | 0   | 0   | 0   |
| Environmental ID                       | 0.5  | 0.1  | ICV1 | DVR1 | 3.7 | 0   | 3.7 | 0   |
| Open/Read Message                      | 1.12 | 1    | ICV1 | DVR1 | 5.9 | 0   | 4.6 | 2.2 |

| Task Name                               | Time (sec) | SD (sec) | Vehicle | Operator     | Visual | Auditory | Cognitive | Perceptual |
|---|------------|----------|---------|--------------|--------|----------|-----------|------------|
| <b>Platoon Leader (PL)</b>              |            |          |         |              |        |          |           |            |
| START                                   | 0          | 0        | ICV1    | VC           | 0      | 0        | 0         | 0          |
| RECEIVE MSG/UPDT Branch                 | 0          | 0        | ICV1    | VC           | 0      | 0        | 0         | 0          |
| DISCUSS (VC)                            | 5.5        | 1.5      | ICV1    | VC           | 0      | 0        | 0         | 0          |
| Update COA                              | 15         | 7.5      | ICV1    | PL           | 7      | 0        | 6.8       | 7          |
| PL Listening                            | 30         | 10       | ICV1    | PL           | 0      | 0        | 0         | 0          |
| MED Listening                           | 30         | 10       | ICV1    | Medic        | 0      | 0        | 0         | 0          |
| VC Listening                            | 30         | 10       | ICV1    | VC           | 0      | 0        | 0         | 0          |
| CO Listening                            | 30         | 10       | Co HQ   | CO           | 0      | 0        | 0         | 0          |
| SL Listening                            | 30         | 10       | ICV 2   | SL           | 0      | 0        | 0         | 0          |
| Driver1 Listening                       | 30         | 10       | ICV1    | DVR1         | 0      | 0        | 0         | 0          |
| Driver2 Listening                       | 30         | 10       | ICV 2   | DVR2         | 0      | 0        | 0         | 0          |
| PSG Listening                           | 30         | 10       | ICV 2   | PSG          | 0      | 0        | 0         | 0          |
| TLA Listening                           | 30         | 10       | ICV 2   | TLA          | 0      | 0        | 0         | 0          |
| TLB Listening                           | 30         | 10       | ICV 2   | TLB          | 0      | 0        | 0         | 0          |
| Rifleman1A Listening                    | 30         | 10       | ICV 2   | Rifleman 1A  | 0      | 0        | 0         | 0          |
| Rifleman2A Listening                    | 30         | 10       | ICV 2   | Grenadier 2A | 0      | 0        | 0         | 0          |
| Rifleman3A Listening                    | 30         | 10       | ICV 2   | Auto Rif 3A  | 0      | 0        | 0         | 0          |
| Rifleman1B Listening                    | 30         | 10       | ICV 2   | Rifleman 1B  | 0      | 0        | 0         | 0          |
| Rifleman2B Listening                    | 30         | 10       | ICV 2   | Grenadier 2B | 0      | 0        | 0         | 0          |
| Rifleman3B Listening                    | 30         | 10       | ICV 2   | Auto Rif 3B  | 0      | 0        | 0         | 0          |
| Listen                                  | 5.5        | 0.5      | ICV1    | PL           | 0      | 4.9      | 4.6       | 0          |
| Relevant to me                          | 0.5        | 0.25     | ICV1    | PL           | 0      | 0        | 1.2       | 0          |
| Not relevant to me                      | 0.5        | 0.25     | ICV1    | PL           | 0      | 0        | 1.2       | 0          |
| ESTIMATE IMPACT--Short                  | 2.5        | 2.5      | ICV1    | PL           | 7      | 0        | 7         | 0          |
| Finalize COA--Short                     | 10         | 5        | ICV1    | PL           | 3.7    | 0        | 6.8       | 7          |
| Update Mission Profile--Short           | 5          | 2.5      | ICV1    | PL           | 7      | 0        | 6.8       | 7          |
| Relevant to me                          | 0.5        | 0.25     | ICV1    | PL           | 0      | 0        | 1.2       | 0          |
| Not relevant to me                      | 0.5        | 0.25     | ICV1    | PL           | 0      | 0        | 1.2       | 0          |
| Relevant to me                          | 0.5        | 0.25     | ICV1    | PL           | 0      | 0        | 1.2       | 0          |
| Not relevant to me                      | 0.5        | 0.25     | ICV1    | PL           | 0      | 0        | 1.2       | 0          |
| Synchronize with Higher Database--Short | 5          | 2.5      | ICV1    | PL           | 4      | 0        | 3.7       | 7          |
| Haptic message                          | 0          | 0        | ICV1    | PL           | 0      | 0        | 0         | 0          |
| Recognize                               | 1.5        | 0.5      | ICV1    | PL           | 0      | 1        | 1         | 0          |
| ID Message                              | 2.5        | 0.75     | ICV1    | PL           | 0      | 4.2      | 3.7       | 0          |
| Direction                               | 0          | 0        | ICV1    | PL           | 0      | 0        | 0         | 0          |
| Alert                                   | 0          | 0        | ICV1    | PL           | 0      | 0        | 0         | 0          |
| Warning                                 | 0          | 0        | ICV1    | PL           | 0      | 0        | 0         | 0          |
| Caution                                 | 0          | 0        | ICV1    | PL           | 0      | 0        | 0         | 0          |
| ID Direction                            | 0          | 0        | ICV1    | PL           | 0      | 0        | 0         | 0          |
| ID Alert                                | 0          | 0        | ICV1    | PL           | 0      | 0        | 0         | 0          |
| ID Warning                              | 0          | 0        | ICV1    | PL           | 0      | 0        | 0         | 0          |
| ID Caution                              | 0          | 0        | ICV1    | PL           | 0      | 0        | 0         | 0          |
| Radio out for info (RFI)                | 5.5        | 0.5      | ICV1    | PL           | 3.7    | 2        | 1.2       | 2.2        |
| COLLECT INFO Branch                     | 0          | 0        | ICV1    | VC           | 0      | 0        | 0         | 0          |
| Search for Digital Info                 | 10         | 4.5      | ICV1    | PL           | 7      | 0        | 5.3       | 7          |

|  |      |      |       |    |     |     |     |     |
|--|------|------|-------|----|-----|-----|-----|-----|
| Reply to voice                         | 30   | 10   | ICV1  | PL | 3.7 | 4.3 | 4.6 | 2.2 |
| Display Change Recognition             | 0.1  | 0.2  | ICV1  | VC | 3.7 | 0   | 3.7 | 0   |
| Synchronize with Higher Database--Long | 60   | 30   | ICV1  | PL | 4   | 0   | 3.7 | 7   |
| Email                                  | 0    | 0    | ICV1  | VC | 0   | 0   | 0   | 0   |
| Receive radio info                     | 5.5  | 0.5  | ICV1  | PL | 3.7 | 4.9 | 3.7 | 0   |
| Perform Physical Action                | 1    | 0.5  | ICV1  | PL | 5.9 | 0   | 6.8 | 7   |
| ESTIMATE IMPACT--Long                  | 45   | 0.15 | ICV1  | PL | 7   | 0   | 7   | 0   |
| ID Current Mission                     | 0.5  | 0.5  | ICV1  | PL | 3.7 | 0   | 3.7 | 7   |
| COLLABORATE                            | 0    | 0    | ICV1  | VC | 0   | 0   | 0   | 0   |
| ID Environmental Changes               | 0.5  | 0.25 | ICV1  | PL | 3.7 | 0   | 3.7 | 7   |
| Internal Trigger                       | 0    | 0    | ICV1  | VC | 0   | 0   | 0   | 0   |
| Pull up email                          | 2    | 0.3  | ICV1  | PL | 3.7 | 0   | 1   | 7   |
| DISCUSS (PL)                           | 5.5  | 1.5  | ICV1  | PL | 3.7 | 4.9 | 3.7 | 2.2 |
| DISCUSS (SL2)                          | 5.5  | 1.5  | ICV1  |    | 0   | 0   | 0   | 0   |
| Find digital info                      | 5.5  | 4.5  | ICV1  | PL | 7   | 0   | 4.6 | 7   |
| TAKE ACTION Branch                     | 0    | 0    | ICV1  | PL | 0   | 0   | 0   | 0   |
| Voice Msg                              | 0    | 0    | ICV1  | PL | 0   | 0   | 0   | 0   |
| Voice Out                              | 5.5  | 0.5  | ICV1  | PL | 3.7 | 2   | 3.7 | 2.2 |
| Environmental ID                       | 0.5  | 0.1  | ICV1  | PL | 3.7 | 0   | 3.7 | 0   |
| START MONITOR                          | 0    | 0    | ICV1  | PL | 0   | 0   | 0   | 0   |
| See Visual Change                      | 1.5  | 0.3  | ICV1  | PL | 4   | 0   | 3.7 | 0   |
| Display Update                         | 0    | 0    | ICV1  | PL | 0   | 0   | 0   | 0   |
| pause                                  | 1    | 30   | ICV1  | PL | 0   | 0   | 0   | 0   |
| Start Listen                           | 0    | 0    | ICV1  | PL | 0   | 4.9 | 3.7 | 0   |
| pause                                  | 1    | 30   | ICV1  | PL | 0   | 0   | 0   | 0   |
| DISCUSS (SL3)                          | 5.5  | 1.5  |       |    | 0   | 0   | 0   | 0   |
| DISCUSS (SL4)                          | 5.5  | 1.5  |       |    | 0   | 0   | 0   | 0   |
| Update Mission Profile                 | 0    | 0    | ICV1  | PL | 0   | 0   | 0   | 0   |
| DISCUSS (SL5)                          | 5.5  | 1.5  |       |    | 0   | 0   | 0   | 0   |
| ID Who From                            | 0.5  | 0.5  | ICV1  | PL | 3.7 | 0   | 3.7 | 7   |
| ID Priority                            | 0.5  | 0.5  | ICV1  | PL | 3.7 | 0   | 3.7 | 0   |
| Verbal Request                         | 6.5  | 5.5  | ICV1  | PL | 3.7 | 4.9 | 4.6 | 2.2 |
| Receive Verbal Response                | 6.5  | 5.5  | ICV1  | PL | 3.7 | 4.9 | 4.6 | 1   |
| E-mail Request                         | 1.5  | 1    | ICV1  | PL | 5.9 | 0   | 4.6 | 7   |
| Receive E-mail Response                | 0.5  | 0.23 | ICV1  | PL | 3.7 | 4.9 | 3.7 | 7   |
| DISCUSS (CO)                           | 5.5  | 1.5  | Co HQ | CO | 0   | 0   | 0   | 0   |
| ID Actionable Choices                  | 5.5  | 4.5  | ICV1  | PL | 5.9 | 0   | 7   | 0   |
| Finalize COA--Long                     | 60   | 30   | ICV1  | PL | 3.7 | 0   | 6.8 | 7   |
| Update Mission Profile--Long           | 60   | 30   | ICV1  | PL | 7   | 0   | 6.8 | 7   |
| Open/Read Message                      | 1.12 | 1    | ICV1  | PL | 5.9 | 0   | 4.6 | 2.2 |
| ID Functionality                       | 0.5  | 0.5  | ICV1  | PL | 4   | 0   | 4.6 | 0   |
| No Action                              | 0    | 0    | ICV1  | PL | 0   | 0   | 0   | 0   |
| Switch to Appropriate Interface        | 1.5  | 1    | ICV1  | PL | 3.7 | 0   | 3.7 | 0   |
| ID Appropriate Channel                 | 0.5  | 0.5  | ICV1  | PL | 4   | 0   | 4.6 | 0   |
| Switch to Appropriate Channel          | 1    | 0.5  | ICV1  | PL | 3.7 | 0   | 1   | 2.2 |
| Listen                                 | 5.5  | 1.5  | ICV1  | PL | 3.7 | 4.9 | 4.6 | 0   |
| No Action                              | 0    | 0    | ICV1  | PL | 0   | 0   | 0   | 0   |
| DISCUSS (Plt 2)                        | 5.5  | 1.5  |       |    | 0   | 0   | 0   | 0   |

| Task Name                      | Time (sec) | SD (sec) | Vehicle | Operator     | Visual | Auditory | Cognitive | Perceptual |
|--------------------------------|------------|----------|---------|--------------|--------|----------|-----------|------------|
| <b>Auto Rifleman 3A</b>        |            |          |         |              |        |          |           |            |
| START                          | 0          | 0        | ICV 2   | Auto Rif 3A  | 0      | 0        | 0         | 0          |
| RECEIVE MSG/UPDT               | 0          | 0        | ICV 2   | Auto Rif 3A  | 0      | 0        | 0         | 0          |
| COLLABORATE                    | 0          | 0        | ICV 2   | Auto Rif 3A  | 0      | 0        | 0         | 0          |
| Listen                         | 5.5        | 1.5      | ICV 2   | Auto Rif 3A  | 3.7    | 4.9      | 4.6       | 0          |
| No action                      | 0          | 0        | ICV 2   | Auto Rif 3A  | 0      | 0        | 0         | 0          |
| Pause                          | 1          | 30       | ICV 2   | Auto Rif 3A  | 0      | 0        | 0         | 0          |
| No action                      | 0          | 0        | ICV 2   | Auto Rif 3A  | 0      | 0        | 0         | 0          |
| PL Listening                   | 15         | 45       | ICV1    | PL           | 0      | 0        | 0         | 0          |
| MED Listening                  | 15         | 45       | ICV1    | Medic        | 0      | 0        | 0         | 0          |
| VC Listening                   | 15         | 45       | ICV1    | VC           | 0      | 0        | 0         | 0          |
| CO Listening                   | 15         | 45       | Co HQ   | CO           | 0      | 0        | 0         | 0          |
| SL Listening                   | 15         | 45       | ICV 2   | SL           | 0      | 0        | 0         | 0          |
| Driver1 Listening              | 15         | 45       | ICV1    | DVR1         | 0      | 0        | 0         | 0          |
| Radio out for info (RFI)       | 5.5        | 50       | ICV 2   | Auto Rif 3A  | 3.7    | 2        | 1.2       | 2.2        |
| Driver2 Listening              | 15         | 45       | ICV 2   | DVR2         | 0      | 0        | 0         | 0          |
| PSG Listening                  | 15         | 45       | ICV 2   | PSG          | 0      | 0        | 0         | 0          |
| TLA Listening                  | 15         | 45       | ICV 2   | TLA          | 0      | 0        | 0         | 0          |
| TLB Listening                  | 15         | 45       | ICV 2   | TLB          | 0      | 0        | 0         | 0          |
| Rifleman1A Listening           | 15         | 45       | ICV 2   | Rifleman 1A  | 0      | 0        | 0         | 0          |
| Rifleman2A Listening           | 15         | 45       | ICV 2   | Grenadier 2A | 0      | 0        | 0         | 0          |
| Rifleman3A Listening           | 15         | 45       | ICV 2   | Auto Rif 3A  | 0      | 0        | 0         | 0          |
| Rifleman1B Listening           | 15         | 45       | ICV 2   | Rifleman 1B  | 0      | 0        | 0         | 0          |
| Rifleman2B Listening           | 15         | 45       | ICV 2   | Grenadier 2B | 0      | 0        | 0         | 0          |
| Rifleman3B Listening           | 15         | 45       | ICV 2   | Auto Rif 3B  | 0      | 0        | 0         | 0          |
| COLLECT INFO Branch            | 0          | 0        | ICV 2   | Auto Rif 3A  | 0      | 0        | 0         | 0          |
| Listen                         | 5.5        | 0.5      | ICV 2   | Auto Rif 3A  | 0      | 4.9      | 4.6       | 0          |
| Relevant to me                 | 0.5        | 0.25     | ICV 2   | Auto Rif 3A  | 0      | 0        | 1.2       | 0          |
| Not relevant to me             | 0.5        | 0.25     | ICV 2   | Auto Rif 3A  | 0      | 0        | 1.2       | 0          |
| ESTIMATE IMPACT--Short         | 2.5        | 1.5      | ICV 2   | Auto Rif 3A  | 7      | 0        | 7         | 0          |
| Finalize COA--Short            | 10         | 5        | ICV 2   | Auto Rif 3A  | 3.7    | 0        | 6.8       | 7          |
| Update mission profile--Short  | 60         | 30       | ICV 2   | Auto Rif 3A  | 7      | 0        | 6.8       | 7          |
| Relevant to me                 | 0.5        | 0.25     | ICV 2   | Auto Rif 3A  | 0      | 0        | 1.2       | 0          |
| Not relevant to me             | 0.5        | 0.25     | ICV 2   | Auto Rif 3A  | 0      | 0        | 1.2       | 0          |
| Search for Digital Info        | 10         | 4.5      | ICV 2   | Auto Rif 3A  | 7      | 0        | 5.3       | 7          |
| Relevant to me                 | 0.5        | 0.25     | ICV 2   | Auto Rif 3A  | 0      | 0        | 1.2       | 0          |
| Not relevant to me             | 0.5        | 0.25     | ICV 2   | Auto Rif 3A  | 0      | 0        | 1.2       | 0          |
| Synchronize with higher--Short | 60         | 30       | ICV 2   | Auto Rif 3A  | 4      | 0        | 3.7       | 7          |
| Haptic Message                 | 0          | 0        | ICV 2   | Auto Rif 3A  | 0      | 0        | 0         | 0          |
| Recognize                      | 1.5        | 0.5      | ICV 2   | Auto Rif 3A  | 0      | 1        | 1         | 0          |
| ID Message                     | 2.5        | 0.75     | ICV 2   | Auto Rif 3A  | 0      | 4.2      | 3.7       | 0          |
| Direction                      | 0          | 0        | ICV 2   | Auto Rif 3A  | 0      | 0        | 0         | 0          |
| Alert                          | 0          | 0        | ICV 2   | Auto Rif 3A  | 0      | 0        | 0         | 0          |
| Reply to voice                 | 15         | 45       | ICV 2   | Auto Rif 3A  | 3.7    | 4.3      | 4.6       | 2.2        |
| Warning                        | 0          | 0        | ICV 2   | Auto Rif 3A  | 0      | 0        | 0         | 0          |

|                               |      |      |       |              |     |     |     |     |
|-------------------------------|------|------|-------|--------------|-----|-----|-----|-----|
| Caution                       | 0    | 0    | ICV 2 | Auto Rif 3A  | 0   | 0   | 0   | 0   |
| ID Direction                  | 0    | 0    | ICV 2 | Auto Rif 3A  | 0   | 0   | 0   | 0   |
| ID Alert                      | 0    | 0    | ICV 2 | Auto Rif 3A  | 0   | 0   | 0   | 0   |
| ID Warning                    | 0    | 0    | ICV 2 | Auto Rif 3A  | 0   | 0   | 0   | 0   |
| ID Caution                    | 0    | 0    | ICV 2 | Auto Rif 3A  | 0   | 0   | 0   | 0   |
| DISCUSS (Rifleman 3A)         | 5.5  | 1.5  | ICV 2 | Auto Rif 3A  | 3.7 | 4.9 | 3.7 | 2.2 |
| Change recognized             | 1    | 2.5  | ICV 2 | Auto Rif 3A  | 3.7 | 0   | 3.7 | 0   |
| Email                         | 0    | 0    | ICV 2 | Auto Rif 3A  | 0   | 0   | 0   | 0   |
| Receive radio info            | 5.5  | 0.5  | ICV 2 | Auto Rif 3A  | 3.7 | 4.9 | 3.7 | 0   |
| ESTIMATE IMPACT--Long         | 10   | 15   | ICV 2 | Auto Rif 3A  | 7   | 0   | 7   | 0   |
| Discuss (PL)                  | 5.5  | 1.5  | ICV1  | PL           | 3.7 | 4.9 | 3.7 | 2.2 |
| Pull up email                 | 2    | 0.3  | ICV 2 | Auto Rif 3A  | 3.7 | 0   | 1   | 7   |
| Internal Trigger              | 0    | 0    | ICV 2 | Auto Rif 3A  | 0   | 0   | 0   | 0   |
| ID Current Mission            | 0.5  | 0.5  | ICV 2 | Auto Rif 3A  | 3.7 | 0   | 3.7 | 7   |
| ID Environment Change         | 0.5  | 0.25 | ICV 2 | Auto Rif 3A  | 3.7 | 0   | 3.7 | 7   |
| ID environment                | 0.5  | 0.12 | ICV 2 | Auto Rif 3A  | 3.7 | 0   | 3.7 | 0   |
| ID who from                   | 0.5  | 0.5  | ICV 2 | Auto Rif 3A  | 3.7 | 0   | 3.7 | 7   |
| ID priority                   | 0.5  | 0.5  | ICV 2 | Auto Rif 3A  | 3.7 | 0   | 3.7 | 0   |
| Find digital info             | 5.5  | 4.5  | ICV 2 | Auto Rif 3A  | 7   | 0   | 4.6 | 7   |
| TAKE ACTION                   | 0    | 0    | ICV 2 | Auto Rif 3A  | 0   | 0   | 0   | 0   |
| Voice Msg                     | 0    | 0    | ICV 2 | Auto Rif 3A  | 0   | 0   | 0   | 0   |
| Verbal request                | 6.5  | 5.5  | ICV 2 | Auto Rif 3A  | 3.7 | 4.9 | 4.6 | 2.2 |
| Receive verbal response       | 6.5  | 5.5  | ICV 2 | Auto Rif 3A  | 3.7 | 4.9 | 4.6 | 1   |
| Voice Out                     | 5.5  | 0.5  | ICV 2 | Auto Rif 3A  | 3.7 | 2   | 3.7 | 2.2 |
| Send email request            | 0    | 0    | ICV 2 | Auto Rif 3A  | 0   | 0   | 0   | 0   |
| Receive email response        | 0.5  | 0.23 | ICV 2 | Auto Rif 3A  | 3.7 | 4.9 | 3.7 | 7   |
| START MONITOR                 | 0    | 0    | ICV 2 | Auto Rif 3A  | 0   | 0   | 0   | 0   |
| See Visual Change             | 1.5  | 0.3  | ICV 2 | Auto Rif 3A  | 4   | 0   | 3.7 | 0   |
| Display update                | 0    | 0    | ICV 2 | Auto Rif 3A  | 0   | 0   | 0   | 0   |
| Pause                         | 1    | 30   | ICV 2 | Auto Rif 3A  | 0   | 0   | 0   | 0   |
| ID ACTIONABLE CHOICES         | 5.5  | 4.5  | ICV 2 | Auto Rif 3A  | 5.9 | 0   | 7   | 0   |
| START LISTEN                  | 0    | 0    | ICV 2 | Auto Rif 3A  | 0   | 4.9 | 3.7 | 0   |
| Mission profile update        | 0    | 0    | ICV 2 | Auto Rif 3A  | 0   | 0   | 0   | 0   |
| Open/Read Message             | 1.12 | 1    | ICV 2 | Auto Rif 3A  | 5.9 | 0   | 4.6 | 2.2 |
| Discuss (Grenadier)           | 5.5  | 1.5  | ICV 2 | Grenadier 2A | 3.7 | 4.9 | 3.7 | 2.2 |
| Discuss (Rifleman)            | 5.5  | 1.5  | ICV 2 | Rifleman 1A  | 3.7 | 4.9 | 3.7 | 2.2 |
| Finalize COA--Long            | 60   | 30   | ICV 2 | Auto Rif 3A  | 3.7 | 0   | 6.8 | 7   |
| Update COA                    | 15   | 7.5  | ICV 2 | Auto Rif 3A  | 7   | 0   | 6.8 | 7   |
| Perform physical action       | 10   | 5    | ICV 2 | Auto Rif 3A  | 5.9 | 0   | 6.8 | 7   |
| Update mission profile--Long  | 60   | 30   | ICV 2 | Auto Rif 3A  | 7   | 0   | 6.8 | 7   |
| Synchronize with higher--Long | 60   | 30   | ICV 2 | Auto Rif 3A  | 4   | 0   | 3.7 | 7   |
| ID functionality              | 0.5  | 0.5  | ICV 2 | Auto Rif 3A  | 4   | 0   | 4.6 | 0   |
| Switch to appropriate I/F     | 1.5  | 1    | ICV 2 | Auto Rif 3A  | 3.7 | 0   | 3.7 | 7   |
| ID channel                    | 0.5  | 0.5  | ICV 2 | Auto Rif 3A  | 4   | 0   | 4.6 | 0   |
| Switch to appropriate channel | 1    | 0.5  | ICV 2 | Auto Rif 3A  | 3.7 | 0   | 1   | 2.2 |

| Task Name                               | Time (sec) | SD (sec) | Vehicle | Operator     | Visual | Auditory | Cognitive | Perceptual |
|---|------------|----------|---------|--------------|--------|----------|-----------|------------|
| <b>Driver 2 (DVR2)</b>                  |            |          |         |              |        |          |           |            |
| START                                   | 0          | 0        | ICV 2   | DVR2         | 0      | 0        | 0         | 0          |
| RECEIVE MSG/UPDT Branch                 | 0          | 0        | ICV 2   | DVR2         | 0      | 0        | 0         | 0          |
| Update COA                              | 15         | 7.5      | ICV 2   | DVR2         | 7      | 0        | 6.8       | 7          |
| PL Listening                            | 30         | 10       | ICV1    | PL           | 0      | 0        | 0         | 0          |
| MED Listening                           | 30         | 10       | ICV1    | Medic        | 0      | 0        | 0         | 0          |
| VC Listening                            | 30         | 10       | ICV1    | VC           | 0      | 0        | 0         | 0          |
| CO Listening                            | 30         | 10       | Co HQ   | CO           | 0      | 0        | 0         | 0          |
| SL Listening                            | 30         | 10       | ICV 2   | SL           | 0      | 0        | 0         | 0          |
| Driver1 Listening                       | 30         | 10       | ICV1    | DVR1         | 0      | 0        | 0         | 0          |
| Driver2 Listening                       | 30         | 10       | ICV 2   | DVR2         | 0      | 0        | 0         | 0          |
| PSG Listening                           | 30         | 10       | ICV 2   | PSG          | 0      | 0        | 0         | 0          |
| TLA Listening                           | 30         | 10       | ICV 2   | TLA          | 0      | 0        | 0         | 0          |
| TLB Listening                           | 30         | 10       | ICV 2   | TLB          | 0      | 0        | 0         | 0          |
| Rifleman1A Listening                    | 30         | 10       | ICV 2   | Rifleman 1A  | 0      | 0        | 0         | 0          |
| Rifleman2A Listening                    | 30         | 10       | ICV 2   | Grenadier 2A | 0      | 0        | 0         | 0          |
| Rifleman3A Listening                    | 30         | 10       | ICV 2   | Auto Rif 3A  | 0      | 0        | 0         | 0          |
| Rifleman1B Listening                    | 30         | 10       | ICV 2   | Rifleman 1B  | 0      | 0        | 0         | 0          |
| Rifleman2B Listening                    | 30         | 10       | ICV 2   | Grenadier 2B | 0      | 0        | 0         | 0          |
| Rifleman3B Listening                    | 30         | 10       | ICV 2   | Auto Rif 3B  | 0      | 0        | 0         | 0          |
| Listen                                  | 5.5        | 0.5      | ICV 2   | DVR2         | 0      | 4.9      | 4.6       | 0          |
| Not relevant to me                      | 0.5        | 0.25     | ICV 2   | DVR2         | 0      | 0        | 0         | 0          |
| ESTIMATE IMPACT--Short                  | 2.5        | 1.5      | ICV 2   | DVR2         | 0      | 0        | 7         | 0          |
| Update Mission Profile--Short           | 5          | 2.5      | ICV 2   | DVR2         | 5.9    | 0        | 6.8       | 7          |
| Relevant to me                          | 0.5        | 0.25     | ICV 2   | DVR2         | 0      | 0        | 0         | 0          |
| Not relevant to me                      | 0.5        | 0.25     | ICV 2   | DVR2         | 0      | 0        | 0         | 0          |
| Not relevant to me                      | 0.5        | 0.25     | ICV 2   | DVR2         | 0      | 0        | 0         | 0          |
| Relevant to me                          | 0.5        | 0.25     | ICV 2   | DVR2         | 0      | 0        | 0         | 0          |
| Synchronize with higher database--Short | 5          | 2.5      | ICV 2   | DVR2         | 0      | 0        | 0         | 0          |
| Relevant to me                          | 0.5        | 0.25     | ICV 2   | DVR2         | 0      | 0        | 0         | 0          |
| Radio out for info (RFI)                | 0.2        | 0.02     | ICV 2   | DVR2         | 0      | 2        | 0         | 1          |
| LOOK UP INFO Branch                     | 0          | 0        | ICV 2   | DVR2         | 0      | 0        | 0         | 0          |
| Search for Digital Info                 | 0.404      | 0.041    | ICV 2   | DVR2         | 7      | 0        | 4.6       | 0          |
| Reply to voice                          | 30         | 10       | ICV 2   | DVR2         | 0      | 2        | 1         | 1          |
| ID Who From                             | 2          | 0.5      | ICV 2   | DVR2         | 0      | 0        | 0         | 0          |
| Display Change Recognition              | 1          | 2.5      | ICV 2   | DVR2         | 3.7    | 0        | 3.7       | 0          |
| Email                                   | 0          | 0        | ICV 2   | DVR2         | 0      | 0        | 0         | 0          |
| Receive radio info                      | 0.363      | 0.036    | ICV 2   | DVR2         | 0      | 2        | 0         | 1          |
| Perform Physical Action                 | 1          | 0.5      | ICV 2   | DVR2         | 0      | 0        | 0         | 0          |
| ESTIMATE IMPACT--Long                   | 10         | 15       | ICV 2   | DVR2         | 0      | 0        | 7         | 0          |
| Determine Priority                      | 2          | 0.5      | ICV 2   | DVR2         | 0      | 0        | 0         | 0          |

|  |       |       |       |      |     |     |     |     |
|--|-------|-------|-------|------|-----|-----|-----|-----|
| Verbal Request                         | 1     | 1     | ICV 2 | DVR2 | 0   | 0   | 0   | 0   |
| Receive Verbal Response                | 1     | 1     | ICV 2 | DVR2 | 0   | 0   | 0   | 0   |
| E-Mail Request                         | 1     | 1     | ICV 2 | DVR2 | 0   | 0   | 0   | 0   |
| Receive e-mail response                | 1     | 1     | ICV 2 | DVR2 | 0   | 0   | 0   | 0   |
| Internal Trigger                       | 0     | 0     | ICV 2 | DVR2 | 0   | 0   | 0   | 0   |
| Pull up email                          | 2     | 0.3   | ICV 2 | DVR2 | 1   | 0   | 0   | 4.6 |
| Identify Actionable Choices            | 1     | 1     | ICV 2 | DVR2 | 0   | 0   | 0   | 0   |
| Update Mission Profile--Long           | 60    | 30    | ICV 2 | DVR2 | 5.9 | 0   | 6.8 | 7   |
| Synchronize with higher database--Long | 1     | 1     | ICV 2 | DVR2 | 0   | 0   | 0   | 0   |
| ID Functionality                       | 1     | 0.1   | ICV 2 | DVR2 | 0   | 0   | 0   | 0   |
| Switch to Appropriate Interface        | 1     | 0.1   | ICV 2 | DVR2 | 0   | 0   | 0   | 0   |
| No Action                              | 0     | 0     | ICV 2 | DVR2 | 0   | 0   | 0   | 0   |
| START LISTEN                           | 0     | 0     | ICV 2 | DVR2 | 0   | 0   | 0   | 0   |
| Find digital info                      | 0.202 | 0.021 | ICV 2 | DVR2 | 7   | 0   | 4.6 | 0   |
| TAKE ACTION Branch                     | 0     | 0     | ICV 2 | DVR2 | 0   | 0   | 0   | 0   |
| Voice Msg                              | 0     | 0     | ICV 2 | DVR2 | 0   | 0   | 0   | 0   |
| ID Appropriate Channel                 | 1     | 0.1   | ICV 2 | DVR2 | 0   | 0   | 0   | 0   |
| Voice Out                              | 0.363 | 0     | ICV 2 | DVR2 | 0   | 2   | 1   | 1   |
| Switch to Appropriate Channel          | 1     | 0.1   | ICV 2 | DVR2 | 0   | 0   | 0   | 0   |
| No Action                              | 0     | 0     | ICV 2 | DVR2 | 0   | 0   | 0   | 0   |
| START MONITOR                          | 0     | 0     | ICV 2 | DVR2 | 0   | 0   | 0   | 0   |
| See Visual Change                      | 3     | 0.3   | ICV 2 | DVR2 | 3.7 | 0   | 3.7 | 0   |
| Display Update                         | 0     | 0     | ICV 2 | DVR2 | 0   | 0   | 0   | 0   |
| pause                                  | 1     | 0.1   | ICV 2 | DVR2 | 0   | 0   | 0   | 0   |
| ID Current Mission                     | 1     | 1     | ICV 2 | DVR2 | 0   | 0   | 0   | 0   |
| Listen                                 | 30    | 10    | ICV 2 | DVR2 | 0   | 4.9 | 3.7 | 0   |
| pause                                  | 1     | 30    | ICV 2 | DVR2 | 0   | 0   | 0   | 0   |
| ID Environmental Changes               | 0.5   | 0.25  | ICV 2 | DVR2 | 0   | 0   | 0   | 0   |
| Update Mission Profile                 | 0     | 0     | ICV 2 | DVR2 | 0   | 0   | 0   | 0   |
| Environmental ID                       | 0.5   | 0.5   | ICV 2 | DVR2 | 0   | 0   | 0   | 0   |
| Open/Read Message                      | 1.12  | 0.1   | ICV 2 | DVR2 | 5.9 | 0   | 3.7 | 2.2 |

| Task Name                               | Time (sec) | SD (sec) | Vehicle | Operator     | Visual | Auditory | Cognitive | Perceptual |
|---|------------|----------|---------|--------------|--------|----------|-----------|------------|
| <b>Platoon Sergeant (PSG)</b>           |            |          |         |              |        |          |           |            |
| START                                   | 0          | 0        | ICV 2   | PSG          | 0      | 0        | 0         | 0          |
| RECEIVE MSG/UPDT Branch                 | 0          | 0        | ICV 2   | PSG          | 0      | 0        | 0         | 0          |
| DISCUSS (VC)                            | 5          | 1.5      | ICV 2   | DVR2         | 0      | 0        | 0         | 0          |
| CO Listening                            | 30         | 10       | Co HQ   | CO           | 0      | 0        | 0         | 0          |
| SL Listening                            | 30         | 10       | ICV 2   | SL           | 0      | 0        | 0         | 0          |
| Driver1 Listening                       | 30         | 10       | ICV1    | DVR1         | 0      | 0        | 0         | 0          |
| Driver2 Listening                       | 30         | 10       | ICV 2   | DVR2         | 0      | 0        | 0         | 0          |
| PSG Listening                           | 30         | 10       | ICV 2   | PSG          | 0      | 0        | 0         | 0          |
| TLA Listening                           | 30         | 10       | ICV 2   | TLA          | 0      | 0        | 0         | 0          |
| TLB Listening                           | 30         | 10       | ICV 2   | TLB          | 0      | 0        | 0         | 0          |
| Rifleman1A Listening                    | 30         | 10       | ICV 2   | Rifleman 1A  | 0      | 0        | 0         | 0          |
| Rifleman2A Listening                    | 30         | 10       | ICV 2   | Grenadier 2A | 0      | 0        | 0         | 0          |
| Rifleman3A Listening                    | 30         | 10       | ICV 2   | Auto Rif 3A  | 0      | 0        | 0         | 0          |
| Radio out for info (RFI)                | 5.5        | 0.5      | ICV 2   | PSG          | 3.7    | 2        | 1.2       | 2.2        |
| Rifleman1B Listening                    | 30         | 10       | ICV 2   | Rifleman 1B  | 0      | 0        | 0         | 0          |
| Rifleman2B Listening                    | 30         | 10       | ICV 2   | Grenadier 2B | 0      | 0        | 0         | 0          |
| Rifleman3B Listening                    | 30         | 10       | ICV 2   | Auto Rif 3B  | 0      | 0        | 0         | 0          |
| Listen                                  | 5.5        | 0.5      | ICV 2   | PSG          | 0      | 4.9      | 4.6       | 0          |
| Relevant to me                          | 0.5        | 0        | ICV 2   | PSG          | 0      | 0        | 1.2       | 0          |
| Not relevant to me                      | 0.5        | 0.25     | ICV 2   | PSG          | 0      | 0        | 1.2       | 0          |
| ESTIMATE IMPACT--Short                  | 2.5        | 1.5      | ICV 2   | PSG          | 7      | 0        | 7         | 0          |
| Finalize COA--Short                     | 10         | 5        | ICV 2   | PSG          | 3.7    | 0        | 6.8       | 7          |
| Update Mission Profile--Short           | 5          | 2.5      | ICV 2   | PSG          | 7      | 0        | 6.8       | 7          |
| LOOK UP INFO Branch                     | 0          | 0        | ICV 2   | PSG          | 0      | 0        | 0         | 0          |
| Relevant to me                          | 0.5        | 0        | ICV 2   | PSG          | 0      | 0        | 1.2       | 0          |
| Not relevant to me                      | 0.5        | 0.25     | ICV 2   | PSG          | 0      | 0        | 1.2       | 0          |
| Relevant to me                          | 0.5        | 0        | ICV 2   | PSG          | 0      | 0        | 1.2       | 0          |
| Not relevant to me                      | 0.5        | 0.25     | ICV 2   | PSG          | 0      | 0        | 1.2       | 0          |
| Synchronize with Higher Database--Short | 5          | 2.5      | ICV 2   | PSG          | 4      | 0        | 3.7       | 7          |
| Search for Digital Info                 | 10         | 4.5      | ICV 2   | PSG          | 7      | 0        | 5.3       | 7          |
| Reply to voice                          | 30         | 10       | ICV 2   | PSG          | 3.7    | 4.3      | 4.6       | 2.2        |
| Display Change Recognition              | 0.1        | 0.2      | ICV 2   | PSG          | 3.7    | 0        | 3.7       | 0          |
| Synchronize with Higher Database--Long  | 60         | 30       | ICV 2   | PSG          | 4      | 0        | 3.7       | 7          |
| Email                                   | 0          | 0        | ICV 2   | PSG          | 0      | 0        | 0         | 0          |
| Receive radio info                      | 5.5        | 0.5      | ICV 2   | PSG          | 3.7    | 4.9      | 3.7       | 0          |
| Perform Physical Action                 | 1          | 0.5      | ICV 2   | PSG          | 5.9    | 0        | 6.8       | 6.5        |
| ESTIMATE IMPACT--Long                   | 45         | 15       | ICV 2   | PSG          | 7      | 0        | 7         | 0          |
| ID Current Mission                      | 0.5        | 0.5      | ICV 2   | PSG          | 3.7    | 0        | 3.7       | 7          |

|                                 |      |      |       |       |     |     |     |     |
|---------------------------------|------|------|-------|-------|-----|-----|-----|-----|
| COLLABORATE                     | 0    | 0    | ICV 2 | PSG   | 0   | 0   | 0   | 0   |
| ID Environmental Changes        | 0.5  | 0.25 | ICV 2 | PSG   | 3.7 | 0   | 3.7 | 7   |
| Internal Trigger                | 0    | 0    | ICV 2 | PSG   | 0   | 0   | 0   | 0   |
| Pull up email                   | 2    | 0.3  | ICV 2 | PSG   | 1   | 0   | 0   | 4.6 |
| DISCUSS (PSG)                   | 5.5  | 1.5  | ICV 2 | PSG   | 3.7 | 4.9 | 3.7 | 2.2 |
| DISCUSS (SL2)                   | 5    | 1.5  | ICV 2 | SL    | 0   | 0   | 0   | 0   |
| Find digital info               | 5.5  | 4.5  | ICV 2 | PSG   | 7   | 0   | 4.6 | 7   |
| TAKE ACTION Branch              | 0    | 0    | ICV 2 | PSG   | 0   | 0   | 0   | 0   |
| Voice Msg                       | 0    | 0    | ICV 2 | PSG   | 0   | 0   | 0   | 0   |
| Update COA                      | 15   | 7.5  | ICV 2 | PSG   | 7   | 0   | 6.8 | 7   |
| Voice Out                       | 5.5  | 0.5  | ICV 2 | PSG   | 3.7 | 2   | 3.7 | 2.2 |
| Environmental ID                | 0.5  | 0.1  | ICV 2 | PSG   | 3.7 | 0   | 3.7 | 0   |
| START MONITOR                   | 0    | 0    | ICV 2 | PSG   | 0   | 0   | 0   | 0   |
| See Visual Change               | 1.5  | 0.3  | ICV 2 | PSG   | 4   | 0   | 3.7 | 0   |
| Display Update                  | 0    | 0    | ICV 2 | PSG   | 0   | 0   | 0   | 0   |
| pause                           | 1    | 30   | ICV 2 | PSG   | 0   | 0   | 0   | 0   |
| Start Listen                    | 0    | 0    | ICV 2 | PSG   | 0   | 4.9 | 3.7 | 0   |
| pause                           | 1    | 30   | ICV 2 | PSG   | 0   | 0   | 0   | 0   |
| DISCUSS (SL3)                   | 5    | 1.5  |       |       | 0   | 0   | 0   | 0   |
| DISCUSS (SL4)                   | 5    | 1.5  |       |       | 0   | 0   | 0   | 0   |
| Update Mission Profile          | 0    | 0    | ICV 2 | PSG   | 0   | 0   | 0   | 0   |
| DISCUSS (SL5)                   | 5    | 1.5  |       |       | 0   | 0   | 0   | 0   |
| ID Who From                     | 0.5  | 0.5  | ICV 2 | PSG   | 3.7 | 0   | 3.7 | 7   |
| ID Priority                     | 0.5  | 0.5  | ICV 2 | PSG   | 3.7 | 0   | 3.7 | 0   |
| Verbal Request                  | 6.5  | 5.5  | ICV 2 | PSG   | 3.7 | 4.9 | 4.6 | 2.2 |
| Receive Verbal Response         | 6.5  | 5.5  | ICV 2 | PSG   | 3.7 | 4.9 | 4.6 | 1   |
| E-mail Request                  | 1    | 1    | ICV 2 | PSG   | 0   | 0   | 0   | 0   |
| Receive E-mail Response         | 0.5  | 0.23 | ICV 2 | PSG   | 3.7 | 4.9 | 3.7 | 7   |
| DISCUSS (PL)                    | 5    | 1.5  | ICV1  | PL    | 0   | 0   | 0   | 0   |
| ID Actionable Choices           | 5.5  | 4.5  | ICV 2 | PSG   | 5.9 | 0   | 7   | 0   |
| Finalize COA--Long              | 60   | 30   | ICV 2 | PSG   | 3.7 | 0   | 6.8 | 7   |
| Update Mission Profile--Long    | 60   | 30   | ICV 2 | PSG   | 7   | 0   | 6.8 | 7   |
| Open/Read Message               | 1.12 | 1    | ICV 2 | PSG   | 5.9 | 0   | 4.6 | 2.2 |
| ID Functionality                | 0.5  | 0.5  | ICV 2 | PSG   | 4   | 0   | 4.6 | 0   |
| No Action                       | 0    | 0    | ICV 2 | PSG   | 0   | 0   | 0   | 0   |
| Switch to Appropriate Interface | 1.5  | 1    | ICV 2 | PSG   | 3.7 | 0   | 3.7 | 0   |
| ID Appropriate Channel          | 0.5  | 0.5  | ICV 2 | PSG   | 4   | 0   | 4.6 | 0   |
| Switch to Appropriate Channel   | 1    | 1    | ICV 2 | PSG   | 0   | 0   | 0   | 0   |
| Listen                          | 5.5  | 1.5  | ICV 2 | PSG   | 3.7 | 4.9 | 4.6 | 0   |
| No Action                       | 0    | 0    | ICV 2 | PSG   | 0   | 0   | 0   | 0   |
| DISCUSS (Plt 2)                 | 5    | 1.5  |       |       | 0   | 0   | 0   | 0   |
| DISCUSS (Plt 3)                 | 5    | 1.5  |       |       | 0   | 0   | 0   | 0   |
| PL Listening                    | 30   | 10   | ICV1  | PL    | 0   | 0   | 0   | 0   |
| MED Listening                   | 30   | 10   | ICV1  | Medic | 0   | 0   | 0   | 0   |
| VC Listening                    | 30   | 10   | ICV1  | VC    | 0   | 0   | 0   | 0   |

| Task Name                      | Time (sec) | SD (sec) | Vehicle | Operator     | Visual | Auditory | Cognitive | Perceptual |
|--------------------------------|------------|----------|---------|--------------|--------|----------|-----------|------------|
| <b>Commanding Officer (CO)</b> |            |          |         |              |        |          |           |            |
| START                          | 0          | 0        | Co HQ   | CO           | 0      | 0        | 0         | 0          |
| RECEIVE MSG/UPDT Branch        | 0          | 0        | Co HQ   | CO           | 0      | 0        | 0         | 0          |
| Discuss with Medic             | 5.5        | 1.5      | ICV1    | Medic        | 0      | 0        | 0         | 0          |
| PL Listening                   | 30         | 10       | ICV1    | PL           | 0      | 0        | 0         | 0          |
| MED Listening                  | 30         | 10       | ICV1    | Medic        | 0      | 0        | 0         | 0          |
| VC Listening                   | 30         | 10       | ICV1    | VC           | 0      | 0        | 0         | 0          |
| CO Listening                   | 30         | 10       | Co HQ   | CO           | 0      | 0        | 0         | 0          |
| SL Listening                   | 30         | 10       | ICV 2   | SL           | 0      | 0        | 0         | 0          |
| Driver1 Listening              | 30         | 10       | ICV1    | DVR1         | 0      | 0        | 0         | 0          |
| Driver2 Listening              | 30         | 10       | ICV 2   | DVR2         | 0      | 0        | 0         | 0          |
| PSG Listening                  | 30         | 10       | ICV 2   | PSG          | 0      | 0        | 0         | 0          |
| TLA Listening                  | 30         | 10       | ICV 2   | TLA          | 0      | 0        | 0         | 0          |
| TLB Listening                  | 30         | 10       | ICV 2   | TLB          | 0      | 0        | 0         | 0          |
| Rifleman1A Listening           | 30         | 10       | ICV 2   | Rifleman 1A  | 0      | 0        | 0         | 0          |
| Rifleman2A Listening           | 30         | 10       | ICV 2   | Grenadier 2A | 0      | 0        | 0         | 0          |
| Rifleman3A Listening           | 30         | 10       | ICV 2   | Auto Rif 3A  | 0      | 0        | 0         | 0          |
| Rifleman1B Listening           | 30         | 10       | ICV 2   | Rifleman 1B  | 0      | 0        | 0         | 0          |
| Rifleman2B Listening           | 30         | 10       | ICV 2   | Grenadier 2B | 0      | 0        | 0         | 0          |
| Rifleman3B Listening           | 30         | 10       | ICV 2   | Auto Rif 3B  | 0      | 0        | 0         | 0          |
| Not relevant to me             | 0.5        | 0.25     | Co HQ   | CO           | 0      | 0        | 1.2       | 0          |
| Relevant to me                 | 0.5        | 0.25     | Co HQ   | CO           | 0      | 0        | 1.2       | 0          |
| Relevant to me                 | 0.5        | 0.25     | Co HQ   | CO           | 0      | 0        | 1.2       | 0          |
| Not relevant to me             | 0.5        | 0.25     | Co HQ   | CO           | 0      | 0        | 1.2       | 0          |
| ESTIMATE IMPACT--Short         | 2.5        | 15       | Co HQ   | CO           | CO     |          | 0         | 7          |
| FINALIZE COA--Short            | 10         | 5        | Co HQ   | CO           | 3.7    | 0        | 6.8       | 7          |
| Update mission profile--short  | 5          | 2.5      | Co HQ   | CO           | 7      | 0        | 6.8       | 7          |
| Relevant to me                 | 0.5        | 0.25     | Co HQ   | CO           | 0      | 0        | 1.2       | 0          |
| Not relevant to me             | 0.5        | 0.25     | Co HQ   | CO           | 0      | 0        | 1.2       | 0          |
| End                            | 0          | 0        | Co HQ   | CO           | 0      | 0        | 0         | 0          |
| Synchronize with higher--short | 5          | 2.5      | Co HQ   | CO           | 4      | 0        | 3.7       | 7          |
| Radio out for info (RFI)       | 5.5        | 0.5      | Co HQ   | CO           |        | 2        | 1.2       | 2.2        |
| Discuss with XO for Inf Co-    | 5.5        | 1.5      |         |              | 0      | 0        | 0         | 0          |
| COLLECT INFO                   | 0          | 0        | Co HQ   | CO           | 0      | 0        | 0         | 0          |
| Discuss with 1SG of Inf Co     | 5.5        | 1.5      |         |              | 0      | 0        | 0         | 0          |
| Discuss with 1SG of Inf Co     | 5.5        | 1.5      |         |              | 0      | 0        | 0         | 0          |
| Search for digital info        | 10         | 4.5      | Co HQ   | CO           |        | 0        | 5.3       | 7          |
| Reply to voice                 | 30         | 10       | Co HQ   | CO           | 3.7    | 4.3      | 4.6       | 2.2        |
| Display change recognition     | 0.1        | 0.2      | Co HQ   | CO           | 3.7    | 0        | 3.7       | 0          |

|                                |     |      |       |      |     |     |     |     |
|--------------------------------|-----|------|-------|------|-----|-----|-----|-----|
| Email (Free text or IM)        | 0   | 0    | Co HQ | CO   | 0   | 0   | 0   | 0   |
| Receive radio info             | 5.5 | 0.5  | Co HQ | CO   |     | 4.9 | 3.7 | 1   |
| Discuss with 3rd PL            | 5.5 | 1.5  |       |      | 0   | 0   | 0   | 0   |
| Listen                         | 5.5 | 0.5  | Co HQ | CO   | 0   | 4.9 | 4.6 | 0   |
| ESTIMATE IMPACT--<br>Long      | 45  | 0.15 | Co HQ | CO   |     | 0   | 7   | 0   |
| Discuss with Bn<br>CMDR/Staff  | 5.5 | 1.5  |       |      | 0   | 0   | 0   | 0   |
| COLLABORATE                    | 0   | 0    | Co HQ | CO   |     | 0   | 0   | 0   |
|                                |     |      |       |      |     |     |     |     |
| Discuss with Recon CO<br>CDR   | 5.5 | 1.5  |       |      | 0   | 0   | 0   | 0   |
| Discuss with 2nd PL            | 5.5 | 1.5  |       |      | 0   | 0   | 0   | 0   |
| Pull up email                  | 2   | 0.3  | Co HQ | CO   | 3.7 | 0   | 1   | 7   |
| DISCUSS (CO)                   | 5.5 | 1.5  | Co HQ | CO   | 3.7 | 4.9 | 3.7 | 2.2 |
| Find digital info              | 5.5 | 4.5  | Co HQ | CO   |     | 0   | 4.6 | 7   |
| TAKE ACTION Branch             | 0   | 0    | Co HQ | CO   | 0   | 0   | 0   | 0   |
| Voice Msg                      | 0   | 0    | Co HQ | CO   | 0   | 0   | 0   | 0   |
| Discuss with MCS CO<br>CDR     | 5.5 | 1.5  |       |      | 0   | 0   | 0   | 0   |
| Voice Out                      | 5.5 | 0.5  | Co HQ | CO   | 3.7 | 2   | 3.7 | 2.2 |
| Discuss with Effects CO<br>CDR | 5.5 | 1.5  |       |      | 0   | 0   | 0   | 0   |
| START MONITOR                  | 0   | 0    | Co HQ | CO   |     | 0   | 0   | 0   |
| See Visual Change              | 1.5 | 0.3  | Co HQ | CO   | 4   | 0   | 3.7 | 0   |
| Display Update                 | 0   | 0    | Co HQ | CO   | 0   | 0   | 0   | 0   |
| pause                          | 1   | 30   | Co HQ | CO   | 0   | 0   | 0   | 0   |
| Start Listen                   | 0   | 0    | Co HQ | CO   | 0   | 4.9 | 3.7 | 0   |
| Pause                          | 1   | 30   | Co HQ | CO   | 0   | 0   | 0   | 0   |
| Discuss with Robotics          | 5.5 | 1.5  | ICV1  | RNCO | 0   | 0   | 0   | 0   |
| Discuss with VC                | 5.5 | 1.5  | ICV1  | VC   | 0   | 0   | 0   | 0   |
| Internal Trigger               | 0   | 0    | Co HQ | CO   | 0   | 0   | 0   | 0   |
| Mission Profile Update         | 0   | 0    | Co HQ | CO   | 0   | 0   | 0   | 0   |
| ID Current Mission             | 0.5 | 0.5  | Co HQ | CO   | 3.7 | 0   | 3.7 | 7   |
| ID Environmental<br>Changes    | 0.5 | 0.25 | Co HQ | CO   | 3.7 | 0   | 3.7 | 7   |
| ID environment                 | 0.5 | 0.1  | Co HQ | CO   | 3.7 | 0   | 3.7 | 0   |
| ID who from                    | 0.5 | 0.5  | Co HQ | CO   | 3.7 | 0   | 3.7 | 7   |
| ID priority                    | 0.5 | 0.5  | Co HQ | CO   | 3.7 | 0   | 3.7 | 0   |
| Verbal request                 | 6.5 | 5.5  | Co HQ | CO   | 3.7 | 4.9 | 4.6 | 2.2 |
| Receive verbal<br>response     | 6.5 | 5.5  | Co HQ | CO   |     | 4.9 | 4.6 | 1   |
| Email request                  | 1   | 1    | Co HQ | CO   | 0   | 0   | 0   | 0   |
| Receive email response         | 0.5 | 0.23 | Co HQ | CO   |     | 4.9 | 3.7 | 7   |
| ID ACTIONABLE<br>CHOICES       | 5.5 | 4.5  | Co HQ | CO   |     | 0   | 7   | 0   |
| Discuss with PL                | 5.5 | 1.5  | ICV1  | PL   | 0   | 0   | 0   | 0   |
| FINALIZE COA--Long             | 60  | 30   | Co HQ | CO   | 3.7 | 0   | 6.8 | 7   |
| Update COA                     | 15  | 7.5  | Co HQ | CO   | 7   | 0   | 6.8 | 7   |
| Perform physical action        | 1   | 0.5  | Co HQ | CO   | 5.9 | 0   | 6.8 | 7   |
| Update mission profile--       | 60  | 30   | Co HQ | CO   | 7   | 0   | 6.8 | 7   |

|                               |      |     |       |    |     |     |     |     |
|-------------------------------|------|-----|-------|----|-----|-----|-----|-----|
| long                          |      |     |       |    |     |     |     |     |
| ID functionality              | 0.5  | 0.5 | Co HQ | CO |     | 0   | 4.6 | 0   |
| No action                     | 0    | 0   | Co HQ | CO |     | 0   | 0   | 0   |
| Open/Read Message             | 1.12 | 1   | Co HQ | CO | 5.9 | 0   | 4.6 | 2.2 |
| Switch to appropriate I/F     | 1.5  | 1   | Co HQ | CO |     | 0   | 3.7 | 7   |
| ID channel                    | 1    | 0.5 | Co HQ | CO | 3.7 | 0   | 1   | 2.2 |
| Switch to appropriate channel | 1    | 1   | Co HQ | CO |     | 0   | 0   | 0   |
| No action                     | 0    | 0   | Co HQ | CO |     | 0   | 0   | 0   |
| Listen                        | 5.5  | 1.5 | Co HQ | CO | 3.7 | 4.9 | 4.6 | 0   |
| Synchronize with higher-long  | 60   | 30  | Co HQ | CO | 4   | 0   | 3.7 | 7   |

| Task Name                       | Time (sec) | SD (sec) | Vehicle | Operator | Visual | Auditory | Cognitive | Perceptual |
|---------------------------------|------------|----------|---------|----------|--------|----------|-----------|------------|
| <b>Vehicle Commander (VC)</b>   |            |          |         |          |        |          |           |            |
| START                           | 0          | 0        | ICV1    | VC       | 0      | 0        | 0         | 0          |
| RECEIVE MSG/UPDT                | 0          | 0        | ICV1    | VC       | 0      | 0        | 0         | 0          |
| Relevant to me                  | 0.5        | 0        | ICV1    | VC       | 0      | 0        | 1.2       | 0          |
| Synchronize with higher--Long   | 60         | 30       | ICV1    | VC       | 4      | 0        | 3.7       | 7          |
| Radio out for info (RFI)        | 5.5        | 0.5      | ICV1    | VC       | 3.7    | 2        | 1.2       | 2.2        |
| COLLECT INFO                    | 0          | 0        | ICV1    | VC       | 0      | 0        | 0         | 0          |
| Search for digital info         | 10         | 4.5      | ICV1    | VC       | 7      | 0        | 5.3       | 7          |
| Reply to voice                  | 30         | 10       | ICV1    | VC       | 3.7    | 4.3      | 4.6       | 2.2        |
| ID Functionality                | 0.5        | 0.5      | ICV1    | VC       | 4      | 0        | 4.6       | 0          |
| Display change recognition      | 0.1        | 0.2      | ICV1    | VC       | 3.7    | 0        | 3.7       | 0          |
| Email                           | 0          | 0        | ICV1    | VC       | 0      | 0        | 0         | 0          |
| Receive radio info              | 5.5        | 0.5      | ICV1    | VC       | 3.7    | 4.9      | 3.7       | 0          |
| COLLABORATE                     | 0          | 0        | ICV1    | VC       | 0      | 0        | 0         | 0          |
| ESTIMATE IMPACT--Long           | 45         | 15       | ICV1    | VC       | 7      | 0        | 7         | 0          |
| No action                       | 0          | 0        | ICV1    | VC       | 0      | 0        | 0         | 0          |
| Switch to appropriate interface | 1.5        | 1        | ICV1    | VC       | 3.7    | 0        | 3.7       | 7          |
| ID Channel                      | 0.5        | 0.5      | ICV1    | VC       | 4      | 0        | 4.6       | 0          |
| Internal Trigger                | 0          | 0        | ICV1    | VC       | 0      | 0        | 0         | 0          |
| Pull up email                   | 2          | 0.3      | ICV1    | VC       | 3.7    | 0        | 1         | 7          |
| DISCUSS                         | 5.5        | 1.5      | ICV1    | VC       | 3.7    | 4.9      | 3.7       | 2.2        |
| Switch to appropriate channel   | 1          | 0.5      | ICV1    | VC       | 3.7    | 0        | 1         | 2.2        |
| Discuss with PL                 | 5.5        | 1.5      | ICV1    | PL       | 0      | 0        | 0         | 0          |
| Listen                          | 5.5        | 1.5      | ICV1    | VC       | 3.7    | 4.9      | 4.6       | 0          |
| ID Current Mission              | 0.5        | 0.5      | ICV1    | VC       | 3.7    | 0        | 3.7       | 7          |
| ID Environmental Changes        | 0.5        | 0.25     | ICV1    | VC       | 3.7    | 0        | 3.7       | 7          |
| Find digital info               | 5.5        | 4.5      | ICV1    | VC       | 7      | 0        | 4.6       | 7          |
| TAKE ACTION                     | 0          | 0        | ICV1    | VC       | 0      | 0        | 0         | 0          |
| Voice msg                       | 0          | 0        | ICV1    | VC       | 0      | 0        | 0         | 0          |
| ID environment                  | 0.5        | 0.1      | ICV1    | VC       | 0      | 0        | 0         | 0          |
| Voice out                       | 0.363      | 0        | ICV1    | VC       | 0      | 2        | 1         | 1          |
| ID who from                     | 0.5        | 0.5      | ICV1    | VC       | 0      | 0        | 0         | 0          |
| ID priority                     | 0.5        | 0.5      | ICV1    | VC       | 0      | 0        | 0         | 0          |
| No action                       | 0          | 0        | ICV1    | VC       | 0      | 0        | 0         | 0          |
| START MONITOR                   | 0          | 0        | ICV1    | VC       | 0      | 0        | 0         | 0          |
| See visual change               | 3          | 0.3      | ICV1    | VC       | 4      | 0        | 3.7       | 0          |
| Display update                  | 0          | 0        | ICV1    | VC       | 0      | 0        | 0         | 0          |
| Pause                           | 30         | 60       | ICV1    | VC       | 0      | 0        | 0         | 0          |
| START LISTEN                    | 0          | 0        | ICV1    | VC       | 0      | 4.9      | 4.6       | 0          |
| pause                           | 1          | 30       | ICV1    | VC       | 0      | 0        | 0         | 0          |
| Verbal (ask someone in vehicle) | 1          | 1        | ICV1    | VC       | 0      | 0        | 0         | 0          |

|                                |      |      |       |              |     |     |     |     |
|--------------------------------|------|------|-------|--------------|-----|-----|-----|-----|
| Receive verbal information     | 1    | 1    | ICV1  | VC           | 0   | 0   | 0   | 0   |
| Email                          | 1    | 1    | ICV1  | VC           | 0   | 0   | 0   | 0   |
| Receive email                  | 1    | 1    | ICV1  | VC           | 0   | 0   | 0   | 0   |
| ID ACTIONABLE CHOICES          | 5.5  | 4.5  | ICV1  | VC           | 5.9 | 0   | 7   | 0   |
| Mission profile update         | 0    | 0    | ICV1  | VC           | 0   | 0   | 0   | 0   |
| FINALIZE COA--Long             | 60   | 30   | ICV1  | VC           | 3.7 | 0   | 6.8 | 7   |
| Update COA                     | 15   | 7.5  | ICV1  | VC           | 7   | 0   | 6.8 | 7   |
| Perform physical action        | 1    | 0.5  | ICV1  | VC           | 5.9 | 0   | 6.8 | 7   |
| Update mission profile--Long   | 60   | 30   | ICV1  | VC           | 7   | 0   | 6.8 | 7   |
| Synchronize with higher--Short | 5    | 2.5  | ICV1  | VC           | 4   | 0   | 3.7 | 7   |
| PL Listening                   | 30   | 10   | ICV1  | PL           | 0   | 0   | 0   | 0   |
| MED Listening                  | 30   | 10   | ICV1  | Medic        | 0   | 0   | 0   | 0   |
| VC Listening                   | 30   | 10   | ICV1  | VC           | 0   | 0   | 0   | 0   |
| CO Listening                   | 30   | 10   | Co HQ | CO           | 0   | 0   | 0   | 0   |
| SL Listening                   | 30   | 10   | ICV 2 | SL           | 0   | 0   | 0   | 0   |
| Driver1 Listening              | 30   | 10   | ICV1  | DVR1         | 0   | 0   | 0   | 0   |
| Driver2 Listening              | 30   | 10   | ICV 2 | DVR2         | 0   | 0   | 0   | 0   |
| PSG Listening                  | 30   | 10   | ICV 2 | PSG          | 0   | 0   | 0   | 0   |
| TLA Listening                  | 30   | 10   | ICV 2 | TLA          | 0   | 0   | 0   | 0   |
| TLB Listening                  | 30   | 10   | ICV 2 | TLB          | 0   | 0   | 0   | 0   |
| Rifleman1A Listening           | 30   | 10   | ICV 2 | Rifleman 1A  | 0   | 0   | 0   | 0   |
| Rifleman2A Listening           | 30   | 10   | ICV 2 | Grenadier 2A | 0   | 0   | 0   | 0   |
| Rifleman3A Listening           | 30   | 10   | ICV 2 | Auto Rif 3A  | 0   | 0   | 0   | 0   |
| Rifleman1B Listening           | 30   | 10   | ICV 2 | Rifleman 1B  | 0   | 0   | 0   | 0   |
| Open/read message              | 1.12 | 1    | ICV1  | VC           | 5.9 | 0   | 4.6 | 2.2 |
| Rifleman2B Listening           | 30   | 10   | ICV 2 | Grenadier 2B | 0   | 0   | 0   | 0   |
| Rifleman3B Listening           | 30   | 10   | ICV 2 | Auto Rif 3B  | 0   | 0   | 0   | 0   |
| Listen                         | 5.5  | 0.5  | ICV1  | VC           | 0   | 4.9 | 4.6 | 0   |
| Relevant to me                 | 0.5  | 0    | ICV1  | VC           | 0   | 0   | 1.2 | 0   |
| Not relevant to me             | 0.5  | 0.25 | ICV1  | VC           | 0   | 0   | 1.2 | 0   |
| ESTIMATE IMPACT--Short         | 2.5  | 1.5  | ICV1  | VC           | 7   | 0   | 7   | 0   |
| FINALIZE COA--Short            | 10   | 5    | ICV1  | VC           | 3.7 | 0   | 6.8 | 7   |
| Update mission profile--short  | 5    | 2.5  | ICV1  | VC           | 7   | 0   | 6.8 | 7   |
| Relevant to me                 | 0.5  | 0    | ICV1  | VC           | 0   | 0   | 1.2 | 0   |
| Not relevant to me             | 0.5  | 0.25 | ICV1  | VC           | 0   | 0   | 1.2 | 0   |
| Not relevant to me             | 0.5  | 0.25 | ICV1  | VC           | 0   | 0   | 1.2 | 0   |

| Task Name                     | Time (sec) | SD (sec) | Vehicle | Operator     | Visual | Auditory | Cognitive | Perceptual |
|-------------------------------|------------|----------|---------|--------------|--------|----------|-----------|------------|
| <b>Squad Leader (SL)</b>      |            |          |         |              |        |          |           |            |
| START                         | 0          | 0        | ICV 2   | SL           | 0      | 0        | 0         | 0          |
| RECEIVE MSG/UPDT              | 0          | 0        | ICV 2   | SL           | 0      | 0        | 0         | 0          |
| COLLABORATE                   | 1          | 1        | ICV 2   | SL           | 0      | 0        | 0         | 0          |
| Listen                        | 60         | 60       | ICV 2   | SL           | 3.7    | 4.9      | 4.6       | 0          |
| No action                     | 0          | 0        | ICV 2   | SL           | 0      | 0        | 0         | 0          |
| Pause                         | 1          | 30       | ICV 2   | SL           | 0      | 0        | 0         | 0          |
| No action                     | 0          | 0        | ICV 2   | SL           | 0      | 0        | 0         | 0          |
| PL Listening                  | 60         | 30       | ICV1    | PL           | 0      | 0        | 0         | 0          |
| MED Listening                 | 60         | 30       | ICV1    | Medic        | 0      | 0        | 0         | 0          |
| VC Listening                  | 60         | 30       | ICV1    | VC           | 0      | 0        | 0         | 0          |
| CO Listening                  | 60         | 30       | Co HQ   | CO           | 0      | 0        | 0         | 0          |
| SL Listening                  | 60         | 30       | ICV 2   | SL           | 0      | 0        | 0         | 0          |
| Driver1 Listening             | 60         | 30       | ICV1    | DVR1         | 0      | 0        | 0         | 0          |
| Radio out for info (RFI)      | 20         | 30       | ICV 2   | SL           | 3.7    | 2        | 1.2       | 2.2        |
| Driver2 Listening             | 60         | 30       | ICV 2   | DVR2         | 0      | 0        | 0         | 0          |
| PSG Listening                 | 60         | 30       | ICV 2   | PSG          | 0      | 0        | 0         | 0          |
| TLA Listening                 | 60         | 30       | ICV 2   | TLA          | 0      | 0        | 0         | 0          |
| TLB Listening                 | 60         | 30       | ICV 2   | TLB          | 0      | 0        | 0         | 0          |
| Rifleman1A Listening          | 60         | 30       | ICV 2   | Rifleman 1A  | 0      | 0        | 0         | 0          |
| Rifleman2A Listening          | 60         | 30       | ICV 2   | Grenadier 2A | 0      | 0        | 0         | 0          |
| Rifleman3A Listening          | 60         | 30       | ICV 2   | Auto Rif 3A  | 0      | 0        | 0         | 0          |
| Rifleman1B Listening          | 60         | 30       | ICV 2   | Rifleman 1B  | 0      | 0        | 0         | 0          |
| Rifleman2B Listening          | 60         | 30       | ICV 2   | Grenadier 2B | 0      | 0        | 0         | 0          |
| Rifleman3B Listening          | 60         | 30       | ICV 2   | Auto Rif 3B  | 0      | 0        | 0         | 0          |
| COLLECT INFO                  | 0          | 0        | ICV 2   | SL           | 0      | 0        | 0         | 0          |
| Listen                        | 5.5        | 0.5      | ICV 2   | SL           | 0      | 4.9      | 4.6       | 0          |
| Relevant to me                | 0.5        | 0.25     | ICV 2   | SL           | 0      | 0        | 1.2       | 0          |
| Not relevant to me            | 0.5        | 0.25     | ICV 2   | SL           | 0      | 0        | 1.2       | 0          |
| ESTIMATE IMPACT--Short        | 2.5        | 1.5      | ICV 2   | SL           | 7      | 0        | 7         | 0          |
| Finalize COA--Short           | 10         | 5        | ICV 2   | SL           | 3.7    | 0        | 6.8       | 7          |
| Update mission profile--Short | 5          | 2.5      | ICV 2   | SL           | 7      | 0        | 6.8       | 7          |
| Relevant to me                | 0.5        | 0.25     | ICV 2   | SL           | 0      | 0        | 1.2       | 0          |
| Not relevant to me            | 0.5        | 0.25     | ICV 2   | SL           | 0      | 0        | 1.2       | 0          |
| Search for Digital Info       | 60         | 30       | ICV 2   | SL           | 7      | 0        | 5.3       | 7          |
| Relevant to me                | 0.5        | 0.25     | ICV 2   | SL           | 0      | 0        | 1.2       | 0          |
| Not relevant to me            | 0.5        | 0.25     | ICV 2   | SL           | 0      | 0        | 1.2       | 0          |
| Synchronize with higher--Long | 60         | 30       | ICV 2   | SL           | 4      | 0        | 3.7       | 7          |
| Haptic Message                | 0          | 0        | ICV 2   | SL           | 0      | 0        | 0         | 0          |
| Recognize                     | 1.5        | 0.5      | ICV 2   | SL           | 0      | 1        | 1         | 0          |
| ID Message                    | 2.5        | 0.75     | ICV 2   | SL           | 0      | 4.2      | 3.7       | 0          |
| Direction                     | 0          | 0        | ICV 2   | SL           | 0      | 0        | 0         | 0          |
| Alert                         | 0          | 0        | ICV 2   | SL           | 0      | 0        | 0         | 0          |
| Reply to voice                | 60         | 30       | ICV 2   | SL           | 3.7    | 4.3      | 4.6       | 2.2        |
| Warning                       | 0          | 0        | ICV 2   | SL           | 0      | 0        | 0         | 0          |
| Caution                       | 0          | 0        | ICV 2   | SL           | 0      | 0        | 0         | 0          |

|                                |     |      |       |    |     |     |     |     |
|--------------------------------|-----|------|-------|----|-----|-----|-----|-----|
| ID Direction                   | 0   | 0    | ICV 2 | SL | 0   | 0   | 0   | 0   |
| ID Alert                       | 0   | 0    | ICV 2 | SL | 0   | 0   | 0   | 0   |
| ID Warning                     | 0   | 0    | ICV 2 | SL | 0   | 0   | 0   | 0   |
| ID Caution                     | 0   | 0    | ICV 2 | SL | 0   | 0   | 0   | 0   |
| DISCUSS                        | 60  | 30   | ICV 2 | SL | 3.7 | 4.9 | 3.7 | 2.2 |
| Change recognized              | 2   | 2    | ICV 2 | SL | 3.7 | 0   | 3.7 | 0   |
| Email                          | 0   | 0    | ICV 2 | SL | 0   | 0   | 0   | 0   |
| Receive radio info             | 5.5 | 60   | ICV 2 | SL | 3.7 | 4.9 | 3.7 | 1   |
| ESTIMATE IMPACT--Long          | 45  | 30   | ICV 2 | SL | 7   | 0   | 7   | 0   |
| Discuss with PL                | 60  | 30   | ICV1  | PL | 0   | 0   | 0   | 0   |
| Pull up email                  | 2   | 0.3  | ICV 2 | SL | 3.7 | 0   | 1   | 7   |
| Internal Trigger               | 0   | 0    | ICV 2 | SL | 0   | 0   | 0   | 0   |
| ID Current Mission             | 1   | 0.5  | ICV 2 | SL | 3.7 | 0   | 3.7 | 7   |
| ID Environment Change          | 0.5 | 0.25 | ICV 2 | SL | 3.7 | 0   | 3.7 | 7   |
| ID Actionable Choices          | 10  | 10   | ICV 2 | SL | 5.9 | 0   | 7   | 0   |
| ID environment                 | 0.5 | 0.5  | ICV 2 | SL | 3.7 | 0   | 3.7 | 0   |
| ID who from                    | 2   | 0.5  | ICV 2 | SL | 3.7 | 0   | 3.7 | 7   |
| ID priority                    | 2   | 0.5  | ICV 2 | SL | 3.7 | 0   | 3.7 | 0   |
| Find digital info              | 45  | 15   | ICV 2 | SL | 7   | 0   | 4.6 | 7   |
| TAKE ACTION                    | 0   | 0    | ICV 2 | SL | 0   | 0   | 0   | 0   |
| Voice Msg                      | 0   | 0    | ICV 2 | SL | 0   | 0   | 0   | 0   |
| Verbal request                 | 30  | 20   | ICV 2 | SL | 3.7 | 4.9 | 4.6 | 2.2 |
| Receive verbal response        | 60  | 45   | ICV 2 | SL | 3.7 | 4.9 | 4.6 | 1   |
| Voice Out                      | 60  | 45   | ICV 2 | SL | 3.7 | 2   | 3.7 | 2.2 |
| Send email request             | 1.5 | 1    | ICV 2 | SL | 5.9 | 0   | 4.6 | 7   |
| Receive email response         | 0.5 | 0.23 | ICV 2 | SL | 3.7 | 4.9 | 3.7 | 7   |
| START MONITOR                  | 0   | 0    | ICV 2 | SL | 0   | 0   | 0   | 0   |
| See Visual Change              | 1   | 0.3  | ICV 2 | SL | 4   | 0   | 3.7 | 0   |
| Display update                 | 0   | 0    | ICV 2 | SL | 0   | 0   | 0   | 0   |
| Pause                          | 1   | 30   | ICV 2 | SL | 0   | 0   | 0   | 0   |
| ID ACTIONABLE CHOICES          | 5.5 | 4.5  | ICV 2 | SL | 5.9 | 0   | 3.7 | 0   |
| START LISTEN                   | 0   | 0    | ICV 2 | SL | 0   | 4.9 | 3.7 | 0   |
| Mission profile update         | 10  | 30   | ICV 2 | SL | 5.9 | 0   | 1.2 | 2.2 |
| Discuss with SL2               | 60  | 30   |       |    | 0   | 0   | 0   | 0   |
| Open/Read Message              | 30  | 60   | ICV 2 | SL | 5.9 | 0   | 4.6 | 2.2 |
| Discuss with SL3               | 60  | 30   |       |    | 0   | 0   | 0   | 0   |
| Discuss with SL4               | 60  | 30   |       |    | 0   | 0   | 0   | 0   |
| Finalize COA--Long             | 60  | 30   | ICV 2 | SL | 3.7 | 0   | 6.8 | 7   |
| Update COA                     | 15  | 7.5  | ICV 2 | SL | 7   | 0   | 6.8 | 7   |
| Perform action                 | 1   | 0.5  | ICV 2 | SL | 5.9 | 0   | 6.8 | 7   |
| Update mission profile--Long   | 120 | 30   | ICV 2 | SL | 7   | 0   | 6.8 | 7   |
| Synchronize with higher--Short | 5   | 2.5  | ICV 2 | SL | 4   | 0   | 3.7 | 7   |
| ID functionality               | 0.5 | 0.5  | ICV 2 | SL | 4   | 0   | 4.6 | 0   |
| Switch to appropriate I/F      | 1.5 | 1    | ICV 2 | SL | 3.7 | 0   | 3.7 | 7   |
| ID channel                     | 0.5 | 0.5  | ICV 2 | SL | 4   | 0   | 4.6 | 0   |
| Switch to appropriate channel  | 1   | 0.5  | ICV 2 | SL | 3.7 | 0   | 1   | 2.2 |

| Task Name                                       | Time (sec) | SD (sec) | Vehicle | Operator     | Visual | Auditory | Cognitive | Perceptual |
|---|------------|----------|---------|--------------|--------|----------|-----------|------------|
| <b>Robotics Non-Commissioned Officer (RNCO)</b> |            |          |         |              |        |          |           |            |
| START   | 0          | 0        | ICV1    | RNCO         | 0      | 0        | 0         | 0          |
| RECEIVE MSG/UPDT                                | 0          | 0        | ICV1    | RNCO         | 0      | 0        | 0         | 0          |
| COLLABORATE                                     | 1          | 1        | ICV1    | RNCO         | 0      | 0        | 0         | 0          |
| Update Mission Profile--Long                    | 60         | 30       | ICV1    | RNCO         | 7      | 0        | 6.8       | 7          |
| Perform Physical Action                         | 1          | 0.5      | ICV1    | RNCO         | 5.9    | 0        | 6.8       | 7          |
| PL Listening                                    | 30         | 10       | ICV1    | PL           | 0      | 0        | 0         | 0          |
| MED Listening                                   | 30         | 10       | ICV1    | Medic        | 0      | 0        | 0         | 0          |
| VC Listening                                    | 30         | 10       | ICV1    | VC           | 0      | 0        | 0         | 0          |
| CO Listening                                    | 30         | 10       | Co HQ   | CO           | 0      | 0        | 0         | 0          |
| SL Listening                                    | 30         | 10       | ICV 2   | SL           | 0      | 0        | 0         | 0          |
| Driver1 Listening                               | 30         | 10       | ICV1    | DVR1         | 0      | 0        | 0         | 0          |
| Driver2 Listening                               | 30         | 10       | ICV 2   | DVR2         | 0      | 0        | 0         | 0          |
| PSG Listening                                   | 30         | 10       | ICV 2   | PSG          | 0      | 0        | 0         | 0          |
| TLA Listening                                   | 30         | 10       | ICV 2   | TLA          | 0      | 0        | 0         | 0          |
| TLB Listening                                   | 30         | 10       | ICV 2   | TLB          | 0      | 0        | 0         | 0          |
| Rifleman1A Listening                            | 30         | 10       | ICV 2   | Rifleman 1A  | 0      | 0        | 0         | 0          |
| Rifleman2A Listening                            | 30         | 10       | ICV 2   | Grenadier 2A | 0      | 0        | 0         | 0          |
| Rifleman3A Listening                            | 30         | 10       | ICV 2   | Auto Rif 3A  | 0      | 0        | 0         | 0          |
| Rifleman1B Listening                            | 30         | 10       | ICV 2   | Rifleman 1B  | 0      | 0        | 0         | 0          |
| Rifleman2B Listening                            | 30         | 10       | ICV 2   | Grenadier 2B | 0      | 0        | 0         | 0          |
| Rifleman3B Listening                            | 30         | 10       | ICV 2   | Auto Rif 3B  | 0      | 0        | 0         | 0          |
| Listen  | 5.5        | 0.5      | ICV1    | RNCO         | 0      | 4.9      | 4.6       | 0          |
| Relevant to me                                  | 0.5        | 0.25     | ICV1    | RNCO         | 0      | 0        | 1.2       | 0          |
| Not relevant to me                              | 0.5        | 2.5      | ICV1    | RNCO         | 0      | 0        | 1.2       | 0          |
| ESTIMATE IMPACT--Short                          | 2.5        | 1.5      | ICV1    | RNCO         | 7      | 0        | 7         | 0          |
| Finalize COA--Short                             | 10         | 5        | ICV1    | RNCO         | 3.7    | 0        | 6.8       | 7          |
| Update Mission Profile--Short                   | 5          | 2.5      | ICV1    | RNCO         | 7      | 0        | 6.8       | 7          |
| Relevant to me                                  | 0.5        | 0.25     | ICV1    | RNCO         | 0      | 0        | 1.2       | 0          |
| Not relevant to me                              | 0.5        | 2.5      | ICV1    | RNCO         | 0      | 0        | 1.2       | 0          |
| Relevant to me                                  | 0.5        | 0.25     | ICV1    | RNCO         | 0      | 0        | 1.2       | 0          |
| Not relevant to me                              | 0.5        | 2.5      | ICV1    | RNCO         | 0      | 0        | 1.2       | 0          |
| Synchronize with higher--Short                  | 5          | 2.5      | ICV1    | RNCO         | 4      | 0        | 3.7       | 7          |
| Radio out for info (RFI)                        | 5.5        | 0.5      | ICV1    | RNCO         | 3.7    | 2        | 1.2       | 2.2        |
| COLLECT INFO                                    | 0          | 0        | ICV1    | RNCO         | 0      | 0        | 0         | 0          |
| Search for Digital Info                         | 10         | 4.5      | ICV1    | RNCO         | 7      | 0        | 5.3       | 7          |
| Reply to voice                                  | 30         | 10       | ICV1    | RNCO         | 3.7    | 4.3      | 4.6       | 2.2        |
| DISCUSS   | 5.5        | 1.5      | ICV1    | RNCO         | 3.7    | 4.9      | 3.7       | 2.2        |
| Display change recognition                      | 0.1        | 0.2      | ICV1    | RNCO         | 3.7    | 0        | 3.7       | 0          |
| Synchronize with higher--long                   | 60         | 30       | ICV1    | RNCO         | 4      | 0        | 3.7       | 7          |

|                                  |      |      |      |      |     |     |     |     |
|----------------------------------|------|------|------|------|-----|-----|-----|-----|
| Email                            | 0    | 0    | ICV1 | RNCO | 0   | 0   | 0   | 0   |
| Receive radio info               | 5.5  | 0.5  | ICV1 | RNCO | 3.7 | 4.9 | 3.7 | 0   |
| ESTIMATE IMPACT--Long            | 45   | 15   | ICV1 | RNCO | 7   | 0   | 7   | 0   |
| Discuss with PL                  | 5.5  | 1.5  | ICV1 | PL   | 0   | 0   | 0   | 0   |
| Pull up email                    | 2    | 0.3  | ICV1 | RNCO | 3.7 | 0   | 1   | 7   |
| Internal Trigger                 | 0    | 0    | ICV1 | RNCO | 0   | 0   | 0   | 0   |
| ID Current Mission               | 0.5  | 0.5  | ICV1 | RNCO | 3.7 | 0   | 3.7 | 7   |
| ID Environment Change            | 0.5  | 0.25 | ICV1 | RNCO | 3.7 | 0   | 3.7 | 7   |
| ID environment                   | 0.5  | 0.5  | ICV1 | RNCO | 3.7 | 0   | 3.7 | 0   |
| ID who from                      | 0.5  | 0.5  | ICV1 | RNCO | 3.7 | 0   | 3.7 | 7   |
| ID priority                      | 0.5  | 0.5  | ICV1 | RNCO | 3.7 | 0   | 3.7 | 0   |
| Find digital info                | 5.5  | 4.5  | ICV1 | RNCO | 7   | 0   | 4.6 | 7   |
| TAKE ACTION                      | 0    | 0    | ICV1 | RNCO | 0   | 0   | 0   | 0   |
| Voice Msg                        | 0    | 0    | ICV1 | RNCO | 0   | 0   | 0   | 0   |
| Verbal request                   | 6.5  | 5.5  | ICV1 | RNCO | 3.7 | 4.9 | 4.6 | 2.2 |
| Receive verbal information       | 6.5  | 5.5  | ICV1 | RNCO | 3.7 | 4.9 | 4.6 | 1   |
| Update COA                       | 15   | 7.5  | ICV1 | RNCO | 7   | 2   | 6.8 | 7   |
| Voice out                        | 5.5  | 0.5  | ICV1 | RNCO | 3.7 | 2   | 3.7 | 2.2 |
| Send email                       | 1    | 1    | ICV1 | RNCO | 0   | 0   | 0   | 0   |
| Receive email response           | 0.5  | 0.23 | ICV1 | RNCO | 3.7 | 4.9 | 3.7 | 7   |
| START MONITOR                    | 0    | 0    | ICV1 | RNCO | 0   | 0   | 0   | 0   |
| See Visual Change                | 1.5  | 0.3  | ICV1 | RNCO | 4   | 0   | 3.7 | 0   |
| Display update                   | 0    | 0    | ICV1 | RNCO | 0   | 0   | 0   | 0   |
| pause                            | 1    | 30   | ICV1 | RNCO | 0   | 0   | 0   | 0   |
| ID ACTIONABLE CHOICES            | 5.5  | 4.5  | ICV1 | RNCO | 5.9 | 0   | 7   | 0   |
| START LISTEN                     | 0    | 0    | ICV1 | RNCO | 0   | 4.9 | 3.7 | 0   |
| Mission profile update           | 0    | 0    | ICV1 | RNCO | 0   | 0   | 0   | 0   |
| ID Functionality                 | 0.5  | 0.5  | ICV1 | RNCO | 4   | 0   | 4.6 | 0   |
| No action                        | 1    | 1    | ICV1 | RNCO | 0   | 0   | 0   | 0   |
| Discuss with Co Robotics<br>NCO  | 5.5  | 1.5  | ICV1 | RNCO | 0   | 0   | 0   | 0   |
| Open/Read Message                | 1.12 | 1    | ICV1 | RNCO | 5.9 | 0   | 4.6 | 2.2 |
| Discuss with SL2                 | 5.5  | 1.5  | ICV1 | RNCO | 0   | 0   | 0   | 0   |
| Switch to appropriate I/F        | 1.5  | 1    | ICV1 | RNCO | 3.7 | 0   | 3.7 | 7   |
| ID appropriate channel           | 0.5  | 0.5  | ICV1 | RNCO | 4   | 0   | 4.6 | 0   |
| Switch to appropriate<br>channel | 1    | 0.5  | ICV1 | RNCO | 3.7 | 0   | 1   | 2.2 |
| Listen                           | 5.5  | 1.5  | ICV1 | RNCO | 3.7 | 4.9 | 4.6 | 0   |
| No action                        | 1    | 1    | ICV1 | RNCO | 0   | 0   | 0   | 0   |
| Pause                            | 1    | 30   | ICV1 | RNCO | 0   | 0   | 0   | 0   |
| Finalize COA--Long               | 60   | 30   | ICV1 | RNCO | 3.7 | 0   | 6.8 | 7   |

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## Appendix C. Scenario Description

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### Platoon-Level Communications Model and Scenario

Message traffic was developed for a portion of a full 24 hour mission being conducted by the 1<sup>st</sup> Platoon, Alpha Company, 2<sup>nd</sup> Combined Arms Battalion (CAB). The scenario used for the operation reflects the FCS Organizational and Operational (O&O), Jun 2003, Entry Operations Vignette. The scenario includes nine phases:

- I. Planning
- II. Reconnaissance
- III. Movement to the Objective
- IV. Clearing a Danger Area
- V. Assaulting Enemy Positions
- VI. Consolidation and Reorganization
- VII. Movement to the Objective (OBJ Black)
- VIII. Assaulting of the Objective (OBJ Black)
- IX. Consolidation and Reorganization

Mission: 1<sup>st</sup> Platoon, Alpha Company, 2<sup>nd</sup> CAB conducts an assault of Objective Black vicinity UG34981765 no later than 0230 hours to destroy enemy forces and to seize Objective Black.

The message traffic however, currently only focuses on the types of communications within the Platoon during Phase IV Clearing a Danger Area, which lasts 37 minutes. The individuals and robotic assets specifically addressed in this portion of the scenario and of which the communications traffic was derived from are:

- Platoon Leader (PL)
- Robotics NCO (RNCO)
- One Squad Leader (SL)
- Two Team Leaders (TLA, TLB)
- Two Riflemen (Rifleman 1A, Rifleman 1B)
- Two Grenadiers (Rifleman 2A, Rifleman 2B)
- Two Automatic Riflemen (Rifleman 3A, Rifleman 3B)
- The ICV Commander of 1<sup>st</sup> Squads vehicle (VC)
- All ICV Drivers (limited) (DVR1, DVR2)
- Class I Unmanned Aerial Vehicle (UAV) (Platoon)
- Aerial Reconnaissance Vehicle (ARV)-A(L)

The scenario could best be described as mid-intensity.

Since this scenario has been derived from the FCS O&O the region of the world depicted for this scenario is Azerbaijan. However the open and rolling terrain could be applied to different countries in other theatres.

### Message Traffic:

The messages start with Phase IV of the scenario, clearing a danger area. From the utilization of forward sensors, to include platoon level UAVs, the ARV-A(L), and Unit of Action (UA) sensors, the PL has identified a danger area where sensor coverage is not providing adequate information on the status of possible enemy positions. The PL then decides to stop the platoon's movement and dismount a single squad and maneuver them along with robotic assets (Platoon organic) to clear the danger area. The communication traffic depicts information being sent to or by the individuals listed above. The types of information the scenario includes are:

- Voice
- Display Updates (provides situational awareness (SA))
  - User Defined Operating Picture (UDOP-formerly COP)
- Mission Profiles Updates, to include mission packages (all relevant mission information)
- Collaborative planning tools
  - To include planning tools for robotic assets
- Digital text messages (to include emails)
  - Used primarily for robotics control and interaction
- Video
  - Used primarily for robotic control and interaction

Each message is time stamped at the time it enters the model and is depicted in 5 second or more intervals. Furthermore the communication traffic includes who (human/robot) sent and received the message, the type of message it was and notes on the content of the message. Each message in the scenario is mapped to a processing path.

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## Appendix D. Message Traffic From Scenario

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### Key

**Time=**Time message enters scenario

**Priority**

**h=**high

**m=**medium

**l=**low

### Operators (Operator From and Operator To)

**LDRS=**all leaders in the platoon

**SQD=**squad

**1/SQD=**1<sup>st</sup> Squad

**1/SL=**1<sup>st</sup> Squad Leader

**A/TM=**A team

**B/TM=**B team

**DVR=**Driver **All soldiers=**all soldiers in the platoon **RNCO=**Robotics Non-commissioned officer

**R=**Rifleman (1A, 1B)

**GR=**Grenadier (2A, 2B)

**AR=**Automatic Rifleman (3A, 3B)

**PL=**Platoon Leader

**A Co CDR=**A Company Commander

**Medic=**Medic

**VC=**Vehicle Commander

**ICV CO=**

**TLA=**A Team Leader

**TLB=**B Team Leader

### Type of Message

**Voice message**

**Display update**

**Display change**

**Update mission pack**

**Digital drawing**

**Text**

**Mission profile update**

**Internal trigger**

**Digital whiteboard**

**System=**automatic updates

**Internal trigger=**cognitive thought

**SA=**Situation awareness **Text of message**

**SOP=**standard operating procedure

**ARV=**aerial reconnaissance vehicle

**UAV=**unmanned aerial vehicle

**ASAP=as soon as possible**

**UDOP=**

**SUGV=Sensor unmanned ground vehicle**

**SITREP=situation report**

**ARV-L=aerial reconnaissance vehicle (light)**

| Time of Message | Operator From | Operator To   | Type of Message           | Text of Message                             | Priority of Message |
|-----------------|---------------|---------------|---------------------------|---|---------------------|
| 45:40:00        |               |               |                           |   |                     |
| 45:45:00        | PL            | All LDRs/DVRs | Voice message             | Prepare to stop.                            | h                   |
| 45:50:00        | LDRS          | System        | Update mission pack       | Start.                                      | m                   |
| 45:55:00        | SL (all)      | All Soldiers  | Voice message             | Download new mission package.               | h                   |
| 45:55:30        | SL (all)      | All Soldiers  | Download new mission pack |   |                     |
| 46:00:00        | SL (all)      | All Soldiers  | Display update            |   |                     |
| 46:05:00        | System        | All Soldiers  | Display update            |   | h                   |
| 46:10:00        |               |               |                           |   |                     |
| 46:15:00        |               |               |                           |   |                     |
| 46:20:00        |               |               |                           |   |                     |
| 46:25:00        |               |               |                           |   |                     |
| 46:30:00        | PL            | All LDRs      | Voice message             | Stop.                                       | h                   |
| 46:30:00        | PL            | DVRs          | Voice message             | Stop.                                       | h                   |
| 46:35:00        | PL            | All LDRs/DVRs | Display update            | Display shows stop.                         | h                   |
| 46:40:00        | System        | All Soldiers  | Display update            |   | h                   |
| 46:50:00        |               |               |                           |   |                     |
| 46:55:00        | PL            | DVRs          | Voice message             | Move off road and pull security as per SOP. | h                   |
| 46:55:00        | PL            | All LDRs      | Voice message             | Move off road and pull security as per SOP. | h                   |
| 47:00:00        | PL            | All LDRs      | Display update            | Shows security parameter.                   | h                   |
| 47:05:00        |               |               |                           |   |                     |
| 47:10:00        | PL            | RNCO          | Voice message             | Move ARV to this location                   | h                   |
| 47:15:00        | System        | All Soldiers  | Display update            |   | h                   |
| 47:20:00        | PL            | RNCO          | Display update            | White board activity                        | h                   |
| 47:25:00        | RNCO          | PL            | Voice message             | Roger, moving vehicle now                   | h                   |
| 47:30:00        | RNCO          | PL            | Display update            | Shows vehicle moving                        | h                   |
| 47:35:00        | RNCO          | ARV-L         | Digital drawing           | Draws location and send ARV.                | h                   |
| 47:40:00        |               |               |                           |   |                     |
| 47:45:00        |               |               |                           |   |                     |
| 47:50:00        | RNCO          | PL            | Display update            | ARV moving.                                 | h                   |
| 47:55:00        | System        | All Soldiers  | Display update            |   | h                   |
| 48:00:00        | RNCO          | PL            | Voice message             | UAV ready to deploy.                        | h                   |
| 48:05:00        |               |               |                           |   |                     |
| 48:10:00        | PL            | RNCO          | Voice message             | Roger, deploy UAV.                          | h                   |
| 48:15:00        |               |               |                           |   |                     |
| 48:20:00        | System        | All Soldiers  | Display update            |   | h                   |
| 48:25:00        | RNCO          | PL            | Display update            | Sees path and orbit planned for UAV.        | h                   |
| 48:30:00        |               |               |                           |   |                     |
| 48:35:00        |               |               |                           |   |                     |
| 48:40:00        |               |               |                           |   |                     |
| 48:45:00        | RNCO          | PL            | Display update            | UAV on path.                                | h                   |

|          |         |              |                               |   |   |
|----------|---------|--------------|-------------------------------|---|---|
| 48:50:00 |         |              |                               |   |   |
| 48:55:00 | UAV     | RNCO         | digital text                  | Take off normal: on path. All systems normal.   | h |
| 49:00:00 |         |              |                               |   |   |
| 49:05:00 | PL      | 1st SQD LDR  | Display update                | Circle location on map.   | h |
| 49:10:00 | PL      | 1st SQD LDR  | Voice message                 | Prepare to move to location I have circled on your display.   | h |
| 49:15:00 | System  | All Soldiers | Display update                |   | h |
| 49:20:00 | PL      | 1/SL         | Digital drawing               |   | h |
| 49:25:00 | UAV     | RNCO         | message                       | On station. All systems OK.   | h |
| 49:30:00 | 1/SL    | PL           | digital message/voice message | Sir, I am going to take my team toward the river bed moving through the woods on the south of the road. | h |
| 49:35:00 | 1/SL    | PL           | Display change                | Shows SQD moving  | h |
| 49:40:00 | System  | All Soldiers | Display update                |   | h |
| 49:45:00 | 1/SL    | PL           | Digital drawing/voice message | I will request feed from the ARV if it detects anything along our path of travel.                       | h |
| 49:50:00 |         |              |                               |   |   |
| 49:55:00 | System  | All Soldiers | Display update                |   | h |
| 50:00:00 |         |              |                               |   |   |
| 50:05:00 |         |              |                               |   |   |
| 50:10:00 |         |              |                               |   |   |
| 50:15:00 |         |              |                               |   |   |
| 50:20:00 | System  | All Soldiers | Display update                |   | h |
| 50:25:00 | 1/SL    | PL           | Digital drawing               | I will also request UAV footage if it detects anything or there is an area I can not see.               | h |
| 50:25:00 | 1/SL    | PL           | Voice message                 | I will also request UAV footage if it detects anything or there is an area I can not see.               | h |
| 50:30:00 |         |              |                               |   |   |
| 50:35:00 | System  | All Soldiers | Display update                |   | h |
| 50:40:00 | 1/SL    | PL           | Digital drawing/voice message | I also have priority of fires during the movement and through the clearing.                             | h |
| 50:45:00 | PL/1/SL | 1/SQD        |                               | Watching mission plan on display.   | m |
| 50:50:00 |         |              |                               |   |   |
| 50:55:00 | System  | All Soldiers | Display update                |   | h |
| 51:00:00 | PL      | 1/SL         | Voice message                 | Sounds good/dismount ASAP.  | h |
| 51:05:00 | UAV     | RNCO         | text                          | All systems OK  | h |
| 51:10:00 |         |              |                               |   |   |
| 51:15:00 |         |              |                               |   |   |

|          |        |              |                        |   |   |
|----------|--------|--------------|------------------------|---|---|
| 51:20:00 | 1/SL   | 1/SQD TLs    | Voice message          | Any questions on what we are doing?   | h |
| 51:25:00 |        |              |                        |   |   |
| 51:30:00 | TLA    | 1/SL         | Voice message          | Negative.   | h |
| 51:35:00 |        |              |                        |   |   |
| 51:40:00 | TLB    | 1/SL         | Voice message          | Do you want my team to take an SUGV?  | h |
| 51:45:00 | System | All Soldiers | Display update         |   | h |
| 51:50:00 | 1/SL   | TLs          | Voice message          | Roger, take your SUGV and have the Rifleman carry it. We may need it to clear under the bridge. | h |
| 51:55:00 | 1/SL   | TLs          | Display update         |   | m |
| 52:00:00 |        |              |                        |   |   |
| 52:05:00 | TLB    | 1/SL         | Voice message          | Roger.  | h |
| 52:10:00 |        |              |                        |   |   |
| 52:15:00 | SL     | 1/SQD        | Voice message          | Any questions?  | h |
| 52:20:00 |        |              |                        |   |   |
| 52:25:00 |        |              |                        |   |   |
| 52:30:00 | UAV    | RNCO         | Text                   | At location, starting search.   | h |
| 52:35:00 | UAV    | RNCO         | Display update         |   | m |
| 52:40:00 | System | All Soldiers | Display update         |   | h |
| 52:45:00 | SL     | 1/SQD        | Voice message          | OK good. Get ready to move.   | h |
| 52:50:00 |        |              |                        |   |   |
| 52:55:00 |        |              |                        |   |   |
| 53:00:00 |        |              |                        |   |   |
| 53:05:00 | PL     | A Co CDR     | Voice message          | 1/SQD is moving to clear the danger area.   | h |
| 53:10:00 | PL     | A Co CDR     | Display update         |   | m |
| 53:15:00 | 1/SL   | PL           | Voice message          | Roger, dismounting.   | h |
| 53:20:00 | 1/SL   | PL           | Display update         |   | m |
| 53:25:00 | 1/SL   | 1/SQD        | Voice message          | Dismount and follow me.   | h |
| 53:30:00 | 1/SL   | 1/SQD        | Display update         |   | m |
| 53:35:00 | 1/SL   | 1/SQD        | Voice message          | A/Tm take the lead. B/Tm follow. All remain alert.  | h |
| 53:40:00 | System | All Soldiers | Display update         |   | h |
| 53:45:00 | TLB    | TM B         | Voice message          | Follow me and watch your separation.  | h |
| 53:50:00 | TLB    | TM B         | Display update         |   | m |
| 53:55:00 | System | All Soldiers | Display update         |   | m |
| 54:00:00 | TLA    | TM A         | Voice message          | Follow me and watch your separation.  | h |
| 54:05:00 | TLA    | TM A         | Display update         |   | m |
| 54:10:00 | 1/SL   | 1/SQD/PL     | Voice message          | I am changing the UDOP update.  | h |
| 54:15:00 | 1/SL   | 1/SQD/PL     | Mission profile update |   | l |
| 54:20:00 | Medic  | system       | Display change         | Shows medical status of soldiers.   | m |
| 54:25:00 | Medic  | PL           | Voice message          | 1/SQD is looking good. No issues  | h |

|          |        |              |                |  |   |
|----------|--------|--------------|----------------|--|---|
| 54:30:00 | System | All Soldiers | Display update |  | h |
| 54:35:00 | ARV    | RNCO/PL      | Text           | In position.   | h |
| 54:35:10 | ARV    | RNCO/PL      | Display change |  | m |
| 54:40:00 | System | 1/SQD        | Display update |  | h |
| 54:45:00 | ARV    | RNCO         | Text           | Searching.   | h |
| 54:50:00 |        |              |                |  |   |
| 54:55:00 | System | 1/SQD        | Display update |  | h |
| 55:00:00 | SL     | TLB          | Voice message  | Move behind the next cover and concealed position you find and stop.             | h |
| 55:05:00 | System | All Soldiers | Display update |  | h |
| 55:10:00 |        |              |                |  |   |
| 55:15:00 |        |              |                |  |   |
| 55:20:00 | SL     | TLA          | Voice message  | Move behind the next cover and concealed position you find and stop.             | h |
| 55:25:00 | System | 1/SQD        | Display update |  | h |
| 55:30:00 |        |              |                |  |   |
| 55:35:00 | System | 1/SQD        | Display update |  | h |
| 55:40:00 | TLB    | SL           | Voice message  | We are there.  | h |
| 55:45:00 | System | All Soldiers | Display update |  | h |
| 55:50:00 | TLA    | SL           | Voice message  | We are there.  | h |
| 55:55:00 | System | 1/SQD        | Display update |  | h |
| 56:00:00 |        |              |                |  |   |
| 56:05:00 | System | 1/SQD        | Display update |  | h |
| 56:10:00 | 1/SL   | RNCO         | Voice message  | Do either the UAV or ARV detect any targets at this time?                        | h |
| 56:15:00 | System | 1/SQD        | Display update |  | h |
| 56:20:00 |        |              |                |  |   |
| 56:25:00 | System | 1/SQD        | Display update |  | h |
| 56:30:00 | RNCO   | 1/SL         | Voice message  | Negative, no targets nor any movement is detected so far in your objective area. | h |
| 56:35:00 | System | 1/SQD        | Display update |  | h |
| 56:40:00 | 1/SL   | RNCO         | Voice message  | Thank you. Please keep us informed.  | h |
| 56:45:00 | System | 1/SQD        | Display update |  | h |
| 56:50:00 |        |              |                |  |   |
| 56:55:00 | System | 1/SQD        | Display update |  | h |
| 57:00:00 | SL     | TLB          | Voice message  | Deploy the SUGV and hand off control to the VC.                                  | h |
| 57:05:00 |        |              |                |  |   |
| 57:10:00 | System | 1/SQD        | Display update |  | h |
| 57:15:00 | TLB    | Rifleman     | Voice message  | Deploy the SUGV and handoff control to the VC.                                   | h |
| 57:20:00 |        |              |                |  |   |
| 57:25:00 | System | 1/SQD        | Display update |  | h |

|          |          |          |                |   |   |
|----------|----------|----------|----------------|---|---|
| 57:30:00 | Rifleman | TLB      | Voice message  | Roger   | h |
| 57:35:00 | System   | 1/SQD    | Display update |   | h |
| 57:40:00 | TLB      | VC       | Voice message  | Take control of our SUGV and link with SL for more direction.   | h |
| 57:45:00 | System   | 1/SQD    | Display update |   | h |
| 57:50:00 | Rifleman | VC       | Voice message  | The vehicle is ready. Do you have control?  | h |
| 57:55:00 | System   | 1/SQD    | Display update |   | h |
| 58:00:00 |          |          |                |   |   |
| 58:05:00 | System   | 1/SQD    | Display update |   | h |
| 58:10:00 |          |          |                |   |   |
| 58:15:00 | ICV CO   | Rifleman | Voice message  | Roger. I have control over the vehicle.   | h |
| 58:20:00 | System   | 1/SQD    | Display update |   | h |
| 58:25:00 |          |          |                |   |   |
| 58:30:00 | TLB      | 1/SL     | Voice message  | VC now has control over the SUGV.   | h |
| 58:35:00 | System   | 1/SQD    | Display update |   | h |
| 58:40:00 | 1/SL     | VC       | Voice message  | Drive the SUGV to the bridge and search the area for any signs of the enemy. Remember to use caution. | h |
| 58:45:00 |          |          |                |   |   |
| 58:50:00 | System   | 1/SQD    | Display update |   | h |
| 58:55:00 | ICV CO   | SL       | Voice message  | Roger.  | h |
| 59:00:00 | System   | 1/SQD    | Display update |   | h |
| 59:05:00 |          |          |                |   |   |
| 59:10:00 | 1/SL     | TLA/TLB  | Voice message  | Pickup and move toward the bridge.  | h |
| 59:15:00 | 1/SL     | TLA/TLB  | Display update |   | m |
| 59:20:00 | 1/SL     | TLA/TLB  | Voice message  | Stay behind the SUGV.   | h |
| 59:25:00 | 1/SL     | TLA/TLB  | Display update |   | m |
| 59:30:00 |          |          |                |   |   |
| 59:35:00 | TLA      | A TM     | Voice message  | Pick up and follow me.  | h |
| 59:40:00 | System   | 1/SQD    | Display update |   | m |
| 59:45:00 |          |          |                |   |   |
| 59:50:00 | TLB      | B/TM     | Voice message  | Pick up and follow me.  | h |
| 59:55:00 | System   | 1/SQD    | Display update |   | h |
| 60:00:00 | 1/SL     | RNCO     | Voice message  | Can I get video from the UAV on the bridge?   | h |
| 60:05:00 |          |          |                |   |   |
| 60:10:00 |          |          |                |   |   |
| 60:15:00 | RNCO     | 1/SL     | Voice message  | Standby   | h |
| 60:20:00 |          |          |                |   |   |
| 60:25:00 |          |          |                |   |   |
| 60:30:00 |          |          |                |   |   |
| 60:35:00 | RNCO     | 1/SL     | Video          | Video images from UAV. Bridge is clear.   | h |
| 60:40:00 |          |          |                |   |   |
| 60:45:00 | 1/SL     | RNCO     | Voice message  | Thank you.  | h |

|          |        |              |                         |  |   |
|----------|--------|--------------|-------------------------|--|---|
| 60:50:00 | System | 1/SQD        | Display update          |  | h |
| 60:55:00 | PL     | RNCO         | Voice message           | Input two fire missions into the ARV, one on the near side and one on the far side of the bridge.            | h |
| 61:00:00 | PL     | RNCO         | Mission profile update  |  | h |
| 61:05:00 |        |              |                         |  |   |
| 61:10:00 |        |              |                         |  |   |
| 61:15:00 | RNCO   | PL           | Voice message           | Roger, standby.  | h |
| 61:20:00 | System | 1/SQD        | Display update          |  | h |
| 61:25:00 | RNCO   | PL           | Voice message           | Ready.   | h |
| 61:30:00 | System | 1/SQD        | Display update          |  | h |
| 61:35:00 | 1/SL   | VC           | Voice message           | SITREP on the SUGV.  | h |
| 61:40:00 |        |              |                         |  |   |
| 61:45:00 | System | 1/SQD        | Display update          |  | h |
| 61:50:00 |        |              |                         |  |   |
| 61:55:00 | ICV CO | 1/SL         | Voice message           | Nothing yet, still moving. Can you see its location in relation to you?                                      | h |
| 62:00:00 | System | 1/SL         | Display update          |  | h |
| 62:05:00 |        |              |                         |  |   |
| 62:10:00 | 1/SL   | VC           | Voice message           | Roger.   | h |
| 62:15:00 | System | 1/SL         | Display update          |  | h |
| 62:20:00 |        |              |                         |  |   |
| 62:25:00 | 1/SL   | TLB          | Voice message           | Halt and keep your eyes out for movement.  | h |
| 62:30:00 |        |              |                         |  |   |
| 62:35:00 | System | 1/SL         | Display update          |  | h |
| 62:40:00 |        |              |                         |  |   |
| 62:45:00 |        |              |                         |  |   |
| 62:50:00 | 1/SL   | TLA          | Voice message           | Halt and keep your eyes out for movement.  | h |
| 62:55:00 |        |              |                         |  |   |
| 63:00:00 | System | 1/SL         | Display update          |  | h |
| 63:05:00 |        |              |                         |  |   |
| 63:10:00 | TLB    | R/GR/AR      | Voice message           | Halt. Pull security  | h |
| 63:15:00 | System | 1/SL         | Display update          |  | h |
| 63:20:00 |        |              |                         |  |   |
| 63:25:00 | TLA    | R/GR/AR      | Voice message           | Halt. Pull security  | h |
| 63:30:00 | System | 1/SL         | Display update          |  | h |
| 63:35:00 |        |              |                         |  |   |
| 63:40:00 |        |              |                         |  |   |
| 63:45:00 | System | All Soldiers | Display update          |  | h |
| 63:50:00 | System | 1/SL         | Display update          |  | h |
| 63:55:00 |        |              |                         |  |   |
| 64:00:00 | 1/SL   | Self         | Internal trigger for SA | The last covered and concealed positions are here. (Marks on map). A/TM will go here and B/TM will go there. | h |
| 64:05:00 | System | 1/SL         | Display update          |  | h |

|          |        |              |                        |  |   |
|----------|--------|--------------|------------------------|--|---|
| 64:10:00 |        |              |                        |  |   |
| 64:15:00 |        |              |                        |  |   |
| 64:20:00 |        |              |                        |  |   |
| 64:25:00 | 1/SL   | TLB/TLA      | Voice message          | Look at your displays and lets synch up.   | h |
| 64:30:00 | System | All Soldiers | Display update         |  | h |
| 64:35:00 |        |              |                        |  |   |
| 64:40:00 |        |              |                        |  |   |
| 64:45:00 | 1/SL   | TLB          | Voice message          | I'm there.   | h |
| 64:50:00 | System | 1/SL         | Display update         |  | h |
| 64:55:00 | 1/SL   | TLA          | Voice message          | I'm there.   | h |
| 65:00:00 | System | 1/SL         | Display update         |  | h |
| 65:05:00 | System | All Soldiers | Display update         |  | h |
| 65:10:00 | 1/SL   | TLA/TLB      | Voice message          | OK, I want A/TM here, and I want B/TM there. As far as I can see these are the last two covered and concealed positions.   | h |
| 65:10:00 | 1/SL   | TLA/TLB      | Digital whiteboard     | OK, I want A/TM here, and I want B/TM there. As far as I can see these are the last two covered and concealed positions.   | h |
| 65:15:00 | 1/SL   | TLA/TLB      | Mission profile update |  | h |
| 65:20:00 | 1/SL   | TLA/TLB      | Display update         |  | h |
| 65:25:00 |        |              |                        |  |   |
| 65:30:00 |        |              |                        |  |   |
| 65:35:00 |        |              |                        |  |   |
| 65:40:00 |        |              |                        |  |   |
| 65:45:00 |        |              |                        |  |   |
| 65:50:00 |        |              |                        |  |   |
| 65:55:00 | System | 1/SL         | Display update         |  | h |
| 66:00:00 |        |              |                        |  |   |
| 66:05:00 | System | 1/SL         | Display update         |  | h |
| 66:10:00 | 1/SL   | TLA/TLB      | Voice message          | At that point we will conduct a last check of the UAV/ARV and SUGV sensors and then we will clear the bridge. It is imperative to check the underside before crossing, so A/TM that is your mission. | h |
| 66:10:00 | 1/SL   | TLA/TLB      | Digital whiteboard     | At that point we will conduct a last check of the UAV/ARV and SUGV sensors and then we will clear the bridge. It is imperative to check the underside before crossing, so A/TM that is your mission. | h |
| 66:15:00 |        |              |                        |  |   |
| 66:20:00 | 1/SL   | TLA/TLB      | Display update         |  | h |
| 66:25:00 |        |              |                        |  |   |

|          |        |              |                |   |   |
|----------|--------|--------------|----------------|---|---|
| 66:30:00 |        |              |                |   |   |
| 66:35:00 |        |              |                |   |   |
| 66:40:00 |        |              |                |   |   |
| 66:45:00 |        |              |                |   |   |
| 66:50:00 |        |              |                |   |   |
| 66:55:00 | System | All Soldiers | Display update |   | h |
| 67:00:00 | System | 1/SL         | Display update |   | h |
| 67:05:00 | 1/SL   | VC           | Voice message  | Hold short of the objective area until further instructed.                                      | h |
| 67:10:00 |        |              |                |   |   |
| 67:15:00 | System | 1/SL         | Display update |   | h |
| 67:20:00 | ICV CO | 1/SL         | Voice message  | Roger.  | h |
| 67:25:00 |        |              |                |   |   |
| 67:30:00 | System | All Soldiers | Display update |   | h |
| 67:35:00 | 1/SL   | TLA/TLB      | Voice message  | Move into positions.  | h |
| 67:40:00 |        |              |                |   |   |
| 67:45:00 | System | 1/SL         | Display update |   | h |
| 67:50:00 | TLB    | R/GR/AR      | Voice message  | Follow me.  | h |
| 67:55:00 |        |              |                |   |   |
| 68:00:00 |        |              |                |   |   |
| 68:05:00 | System | All Soldiers | Display update |   | h |
| 68:10:00 | TLA    | R/GR/AR      | Voice message  | Follow me.  |   |
| 68:15:00 |        |              |                |   |   |
| 68:20:00 | System | 1/SL         | Display update |   | h |
| 68:25:00 |        |              |                |   |   |
| 68:30:00 | 1/SL   | PL           | Voice message  | We are moving to the last covered and concealed positions available before we clear the bridge. | h |
| 68:35:00 |        |              |                |   |   |
| 68:40:00 | System | All Soldiers | Display update |   | h |
| 68:45:00 |        |              |                |   |   |
| 68:50:00 |        |              |                |   |   |
| 68:55:00 | System | 1/SL         | Display update |   | h |
| 69:00:00 | PL     | 1/SL         | Voice message  | Roger. I am monitoring your status. I will let you know if we see anything out there.           | h |
| 69:05:00 |        |              |                |   |   |
| 69:10:00 | System | 1/SL         | Display update |   | h |
| 69:15:00 |        |              |                |   |   |
| 69:20:00 | System | All Soldiers | Display update |   | h |
| 69:25:00 | PL     | RNCO         | Voice message  | Have we detected anything in the area yet?  | h |
| 69:30:00 |        |              |                |   |   |
| 69:35:00 | System | 1/SL         | Display update |   | h |
| 69:40:00 |        |              |                |   |   |
| 69:45:00 | System | 1/SL         | Display update |   | h |
| 69:50:00 | RNCO   | PL           | Voice message  | Negative. If I do I will populate the UDOP and  | h |

|          |        |              |                |   |   |
|----------|--------|--------------|----------------|---|---|
|          |        |              |                | give you a call.  |   |
| 69:55:00 |        |              |                |   |   |
| 70:00:00 | System | All Soldiers | Display update |   | h |
| 70:05:00 |        |              |                |   |   |
| 70:10:00 |        |              |                |   |   |
| 70:15:00 | System | 1/SL         | Display update |   | h |
| 70:20:00 |        |              |                |   |   |
| 70:25:00 |        |              |                |   |   |
| 70:30:00 |        |              |                |   |   |
| 70:35:00 | System | All Soldiers | Display update |   | h |
| 70:40:00 |        |              |                |   |   |
| 70:45:00 | System | 1/SL         | Display update |   | h |
| 70:50:00 |        |              |                |   |   |
| 70:55:00 | TLB    | 1/SL         | Voice message  | In position.  | h |
| 71:00:00 |        |              |                |   |   |
| 71:05:00 | System | All Soldiers | Display update |   | h |
| 71:10:00 |        |              |                |   |   |
| 71:15:00 | TLA    | 1/SL         | Voice message  | In position.  | h |
| 71:20:00 | System | 1/SL         | Display update |   | h |
| 71:25:00 |        |              |                |   |   |
| 71:30:00 |        |              |                |   |   |
| 71:35:00 | System | All Soldiers | Display update |   | h |
| 71:40:00 | 1/SL   | RNCO         | Voice message  | We are ready to clear the bridge. Anything showing up?                                  | h |
| 71:45:00 |        |              |                |   |   |
| 71:50:00 | System | 1/SL         | Display update |   | h |
| 71:55:00 |        |              |                |   |   |
| 72:00:00 | RNCO   | 1/SL         | Voice message  | Negative. You are clear I'll keep watching,   | h |
| 72:05:00 | System | All Soldiers | Display update |   | h |
| 72:10:00 |        |              |                |   |   |
| 72:15:00 |        |              |                |   |   |
| 72:20:00 | System | 1/SL         | Display update |   | h |
| 72:25:00 | PL     | RNCO         | Voice message  | Move the sensors on the ARV to across the bridge. Watch for enemy approaching that way. | h |
| 72:30:00 |        |              |                |   |   |
| 72:35:00 | System | All Soldiers | Display update |   | h |
| 72:40:00 | RNCO   | PL           | Voice message  | Roger.  | h |
| 72:45:00 |        |              |                |   |   |
| 72:50:00 | System | 1/SL         | Display update |   | h |
| 72:55:00 | TLB    | VC           | Voice message  | Move the SUGV under the bridge and let me know what you see.                            | h |
| 73:00:00 |        |              |                |   |   |
| 73:05:00 | System | All Soldiers | Display update |   | h |
| 73:10:00 |        |              |                |   |   |
| 73:15:00 | System | 1/SL         | Display update |   | h |

|          |        |              |                        |  |   |
|----------|--------|--------------|------------------------|--|---|
| 73:20:00 |        |              |                        |  |   |
| 73:25:00 |        |              |                        |  |   |
| 73:30:00 | 1/SL   | TLA          | Voice message          | Moveout.                                     | h |
| 73:35:00 | System | All Soldiers | Display update         |  | h |
| 73:40:00 |        |              |                        |  |   |
| 73:45:00 | TLA    | R/GR/AR      | Voice message          | Team with me, watch your sectors.            | h |
| 73:50:00 | System | 1/SL         | Display update         |  | h |
| 73:55:00 |        |              |                        |  |   |
| 74:00:00 |        |              |                        |  |   |
| 74:05:00 | System | All Soldiers | Display update         |  | h |
| 74:10:00 |        |              |                        |  |   |
| 74:15:00 | ICV CO | 1/SL/PL      | Voice message          | Bridge all clear.                            | h |
| 74:20:00 | System | 1/SL         | Display update         |  | h |
| 74:25:00 | 1/SL   | TLA/TLB      | Voice message          | TLB cross the bridge and clear the far side. | h |
| 74:30:00 |        |              |                        |  |   |
| 74:35:00 | System | All Soldiers | Display update         |  | h |
| 74:40:00 |        |              |                        |  |   |
| 74:45:00 | TLB    | 1/SL         | Voice message          | Roger, moving.                               | h |
| 74:50:00 | System | 1/SL         | Display update         |  | h |
| 74:55:00 |        |              |                        |  |   |
| 75:00:00 | System | 1/SL         | Display update         |  | h |
| 75:05:00 |        |              |                        |  |   |
| 75:10:00 |        |              |                        |  |   |
| 75:15:00 |        |              |                        |  |   |
| 75:20:00 |        |              | Start of Assault Phase |  |   |
| 75:25:00 |        |              |                        |  |   |

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