ARMY RESEARCH LABORATORY

Effects of Redundant Alerts on Platoon Leader Performance and Decision Making

by Andrea S. Krausman, Rodger A. Pettitt, and Linda R. Elliott

ARL-TR-3999 **April 2007**

Approved for public release; distribution unlimited.

NOTICES

Disclaimers

The findings in this report are not to be construed as an official Department of the Army position unless so designated by other authorized documents.

Citation of manufacturer's or trade names does not constitute an official endorsement or approval of the use thereof.

DESTRUCTION NOTICE—Destroy this report when it is no longer needed. Do not return it to the originator.

Army Research Laboratory
Aberdeen Proving Ground, MD 21005-5425

ARL-TR-3999 **April 2007**

Effects of Redundant Alerts on Platoon Leader Performance and Decision Making

Andrea S. Krausman, Rodger A. Pettitt, and Linda R. Elliott
Human Research and Engineering Directorate, ARL

Approved for public release; distribution unlimited.

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing the burden, to Department of Defense, Washington Headquarters Services, Directorate for Information Operations and Reports (0704-0188), 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to any penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.
PLEASE DO NOT RETURN YOUR FORM TO THE ABOVE ADDRESS.

1. REPORT DATE *(DD-MM-YYYY)* April 2007	**2. REPORT TYPE**	**3. DATES COVERED (From - To)** September 2005 to June 2006
4. TITLE AND SUBTITLE Effects of Redundant Alerts on Platoon Leader Performance and Decision Making		**5a. CONTRACT NUMBER** **5b. GRANT NUMBER** **5c. PROGRAM ELEMENT NUMBER**
6. AUTHOR(S) Andrea S. Krausman, Rodger A. Pettitt, and Linda R. Elliott (all of ARL)		**5d. PROJECT NUMBER** 62716AH70 **5e. TASK NUMBER** **5f. WORK UNIT NUMBER**
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) U.S. Army Research Laboratory Human Research and Engineering Directorate Aberdeen Proving Ground, MD 21005-5425		**8. PERFORMING ORGANIZATION REPORT NUMBER** ARL-TR-3999
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)		**10. SPONSOR/MONITOR'S ACRONYM(S)** **11. SPONSOR/MONITOR'S REPORT NUMBER(S)**

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release; distribution unlimited.

13. SUPPLEMENTARY NOTES

14. ABSTRACT

Future U.S. Army capabilities, coupled with network-centric warfare concepts, will enable huge advancements in information distribution and display and will provide a combat advantage. However, conveying information in a manner that enhances Soldiers' ability to manage the information and in turn, increases their situational awareness is problematic, especially when we consider the high operational tempo, uncertainty, and stress of combat. Past research suggests that multi-sensory information display may be an effective technique for enhancing the information management and situational understanding of Soldiers. Moreover, using a redundant combination of display modalities may be an effective method of information presentation. A study was conducted to examine the effects of redundant alerts on platoon leader decision making and performance. Eleven platoon leaders completed three simulated missions. During each mission, participants received tactical communications and monitored activity on their displays. Tactical communications were accomplished via digital messaging and voice commands. Some of the digital messages were preceded by a visual, visual + auditory, or visual + tactile alert. Time to respond to each of the digital messages was measured. The results indicate that when a platoon leader is engaged in visually demanding tasks such as scanning displays, response time can be as much as 63% slower for a single visual alert, compared to the redundant alerts. Subjective data indicated that participants thought the visual + auditory and visual + tactile alerts were more effective at getting their attention than the visual alert alone. Applications of this research include the development of display design guidelines that will transition to FCS equipment developers.

15. SUBJECT TERMS
alerts; future combat systems; information management; situational understanding; workload

16. SECURITY CLASSIFICATION OF:			**17. LIMITATION OF ABSTRACT**	**18. NUMBER OF PAGES**	**19a. NAME OF RESPONSIBLE PERSON**
a. REPORT	**b. ABSTRACT**	**c. THIS PAGE**			Andrea S. Krausman
Unclassified	Unclassified	Unclassified	SAR	55	**19b. TELEPHONE NUMBER** (*Include area code*) 410-278-5933

Standard Form 298 (Rev. 8/98)
Prescribed by ANSI Std. Z39.18

Contents

List of Figures v

List of Tables v

Acknowledgments vii

1. Background 1

2. Objective 2

3. Method 2

3.1 Participants 2

3.2 Apparatus 2

3.2.1 Scenarios 2

3.2.2 Alerts 3

3.2.3 Simulation Platform 4

3.2.4 Questionnaires 7

3.3 Experimental Design 7

3.3.1 Independent Variable 7

3.3.2 Dependent Variables 7

3.4 Procedures 7

3.5 Data Analysis 8

4. Results 8

4.1 Objective Data 8

4.2 Subjective Data 9

4.2.1 Item 1: Alert Was Effective in Getting my Attention 9

4.2.2 Item 2: Alert Was Helpful 9

4.2.3 Item 3: Alert Was Annoying and Unnecessary 10

4.3 Preference Rankings 10

4.4 Participant Comments 11

5. Discussion 11

6. Conclusions and Future Work **12**

7. References **14**

Appendix A. Volunteer Agreement Affidavit **17**

Appendix B. Scenarios **21**

Appendix C. Alert Evaluation **31**

Appendix D. Alert Ranking **33**

Appendix E. Health and Demographics Questionnaire **35**

Appendix F. Operations Order (OPORD) **37**

Distribution List **45**

List of Figures

Figure 1. Wireless tactile control unit and tactors. 4
Figure 2. M-Body AEDGE simulation platform components. 5
Figure 3. Platoon leader's 2-D map view. 5
Figure 4. Text and communications view. 6
Figure 5. UAV view. 6
Figure 5. Mean standard deviation (SD) response time for each alert type. 9
Figure 6. Mean (SD) rating for effectiveness in getting attention. 9
Figure 7. Mean (SD) rating for annoying. 10
Figure 8. Frequency counts for effectiveness of alert in getting attention. 10
Figure 9. Frequency counts for helpfulness of alerts. 11

List of Tables

Table 1. Mission scenarios and events. 3
Table 2. Description of alert presentation. 3
Table 3. Presentation order. 7

INTENTIONALLY LEFT BLANK

Acknowledgments

The authors would like to express their appreciation to the following individuals who assisted in the conduct of this research:

U.S. Army Infantry Center (USAIC) personnel: CPTs Kennedy, Cole, and Woodruff;

U.S. Army Research Laboratory personnel: Mr. Tim White and Mr. Chuck Bonnett.

Last, but never least, the authors would like to thank the Infantry Soldiers from USAIC at Fort Benning, Georgia, who participated in this research for their enthusiasm and dedication to this project.

INTENTIONALLY LEFT BLANK

1. Background

The proposed study is the second in a series of studies being conducted in support of the Situational Understanding Army Technology Objective (SU ATO). The goal of the SU ATO is to provide interface design recommendations that will enable Soldiers to gain and maintain SU to enhance planning and overall mission performance within the unit of action (UA). In order to achieve this goal, a task network model of a platoon leader mounted inside an infantry carrier vehicle (ICV) was developed to identify periods of high mental workload experienced by crew members during the modeled mission. Model output indicated that the platoon leader's visual channel was overloaded when he was performing mission-related tasks such as scanning battlefield displays, communicating, and monitoring remote operations. Therefore, it was hypothesized (Wickens & Hollands, 2000) that distributing tasks and information across other sensory modalities (i.e., auditory, tactile) would help alleviate the overload. To test the hypothesis, two simulation experiments were conducted. The first study examined the effects of single alerts (visual, auditory, and tactile) on platoon leader decision making and performance. Results showed that response time for the visual alert was significantly slower than for the auditory and tactile alerts (Krausman, Elliott, & Pettitt, 2005), which was expected because the platoon leader was already engaged in visually demanding tasks. Participant comments indicated that the visual alert was not very effective in getting Soldiers' attention. Preference data showed that participants favored the auditory and tactile alert because it easily got their attention but did not interfere with mission-related tasks. This alert is described in the literature as an ideal alert or interruption: one that minimally distracts ongoing task performance while providing a clear signal of another source requiring the individual's attention (Hopp, Smith, Clegg, & Heggestad, 2005). Participants also noted that caution should be exercised when one is using auditory and tactile alerts in combat vehicles. For example, environmental noise and the use of multiple radio nets within a vehicle may mask the auditory alert. Also, the tactile alert may not be detected in a moving vehicle because of vehicle vibration.

Many challenges exist when one is designing interfaces with sensory feedback. Because many interfaces rely heavily on the visual channel for information processing, using visual cues or alerts may result in visual overload and fatigue (Hopp et al., 2005). Auditory cues, although considered an effective "attention grabber," have limitations as well. Some auditory cues are difficult to identify or recognize (Edworthy, Stanton, & Hellier, 1995), whereas others are too distracting and difficult to suppress, resulting in "auditory clutter" (Sarter, 2000). Tactile cues are also capable of capturing attention, but, as mentioned previously, they may be difficult to detect in moving vehicles. As a result, a redundant combination of display modalities may be an effective alternative to presenting information to a single modality. For example, using a combination of cues would enable a platoon leader to hear a message or alert while he continues to scan the battlefield, but he would also be able to see the information being displayed, if

necessary (Helleberg & Wickens, 2001). Redundancy has been used effectively to code targets (visual warning with auditory beep), thus resulting in faster response times (Miller, 1991). The concept of using redundant alerts was explored in the present study.

2. Objective

The objective of this experiment was to examine the effects of redundant alerts on platoon leader performance and decision making in event-based scenarios.

3. Method

3.1 Participants

Eleven male infantry officers (11A), recent graduates of the Infantry Officer Advanced Course (IOAC), volunteered to participate in this study. All participants met the vision and hearing requirements outlined in the infantry physical profile: visual acuity of 20/20, correctable to 20/30 in each eye, and an audiometer average level for each ear not more than 25 dB at 500, 1000, and 2000 Hz with no individual level greater than 30 dB and not over 45 dB at 4000 Hz. Participants ranged in age from 26 to 40 years (mean = 29.6, SD = 4.4) and had several years of military experience (mean = 7 years, SD = 5 years).

The voluntary, fully informed consent of the persons used in this research was obtained as required by 32 Code of Federal Regulations 219 and Army Regulation (AR) 70-25 (appendix A). The investigators adhered to the policies for the protection of human subjects as prescribed in AR 70-25. Participants did not receive monetary compensation for their participation and were free to withdraw from the study at any time without penalty. A coding scheme was used to identify the data by participant number only (i.e., Subject 1) to maintain confidentiality. All photographs taken during the course of the study were modified to ensure that participants could not be identified.

3.2 Apparatus

3.2.1 Scenarios

Three scenarios (see table 1) developed in collaboration with subject matter experts (SMEs) ensured realism and mission relevance. For each scenario, experienced infantry platoon leaders (PL) played the role of the PL mounted inside a vehicle and performed typical mission-related tasks such as communications, monitoring tactical information on computer displays, and command decision making. These tasks were based on SME interviews and data from an

Improved Performance Research Integration Tool (IMPRINT) task network model (Mitchell, Samms, Glumm, Krausman, Brelsford, & Garrett, 2004). Researchers played the roles of infantry company commander (CO), infantry squad leader (SL), infantry platoon sergeant (PSG), and robotics non-commissioned officer (NCO). Scenario scripts helped direct the order of scenario events and communications (appendix B). These scripts were developed with the assistance of SMEs. All PL actions and communications were unscripted.

Table 1. Mission scenarios and events.

Scenario	Scenario events
1	Indirect fire, direct fire, danger area and, improvised explosive device (IED)
2	Direct fire, disabled ICV, danger area/chemical attack
3	Obstacle and direct fire, indirect fire chemical attack, mine field

3.2.2 Alerts

Visual, visual + auditory, and visual + tactile alerts signaled the PL of incoming text messages (see table 2). When alerted of an incoming message, the PL clicked the "show message" button on the communication window of the primary display to receive the content of the message. Alerts were continuous and stopped when the PL clicked the "show message" button.

Table 2. Description of alert presentation.

Alert	Description
Visual	Solid red box on bottom portion of communications console of primary display.
Auditory	Recorded sound file ("beep") similar to an email alert. Presented to both ears at the same time via a headset.
Tactile	"Buzz" from two tactors arranged side by side in armband and secured with a Velcro[1] strap over the battle dress uniform sleeve.

Tactile alerts were presented to the PL via the wireless tactile control unit (WTCU) developed by Dr. Lynette Jones at the Massachusetts Institute of Technology (MIT) under the Advanced Decision Architectures (ADA) Collaborative Technology Alliance (CTA). The tactile sensors, called tactors, are small electomechanical vibrators that use the same DC motor found in cell phones (Lockyer, 2004). A Lycra[2] sleeve, worn on the upper arm, encapsulated the tactors (see figure 1).

[1]Velcro is a registered trademark of Velcro USA, Inc.

[2]Lycra is a registered trademark of E. I. DuPont de Nemours and Company, Inc.

Figure 1. Wireless tactile control unit and tactors.

3.2.3 Simulation Platform

The M-Body AEDGE (agent-enhanced decision guide environment) simulation platform used for this study was developed by 21st Century Systems, Inc., under a Phase II Small Business Innovation Research (SBIR) program, sponsored by the U.S. Army Tank-Automotive and Armaments Command–Armament Research, Development, and Engineering Center (TACOM-ARDEC). The platform simulated three movement-to-contact scenarios and consisted of two interconnected workstations with 17-inch flat panel monitors and a 48-inch flat panel for three-dimensional (3-D) graphics (figure 2). Each workstation provided users with (a) two-dimensional (2-D) and 3-D map views with grid coordinates (figure 3); (b) communications via voice and text messaging (figure 4); (c) visual, auditory, and tactile cues; (d) vehicle movement; (e) terrain information; (f) mission-specific icons and graphics; and (g) unmanned aerial vehicle (UAV) views (figure 5). Keyboard commands controlled the movement of vehicles in the simulation. Communications were sent by text messaging or voice via a headset. Alerts (visual, auditory, and tactile) signaled incoming information. A pull-down menu allowed selection of the desired alert type.

1. 2-D Map View: displayed map graphics such as grid coordinates, line of departure, objectives, friendly and enemy positions, obstacles, etc.

2. Text + Comms: displayed communications sent and received during missions. The CO and PSG sent digital messages. In order to see the contents of a digital message, the PL clicked the show message button at the bottom of the communications display. All communication between the SL and PL were via simulated radio (verbal).

3. UAV 3-D View: displayed images of the battlefield from a simulated UAV.

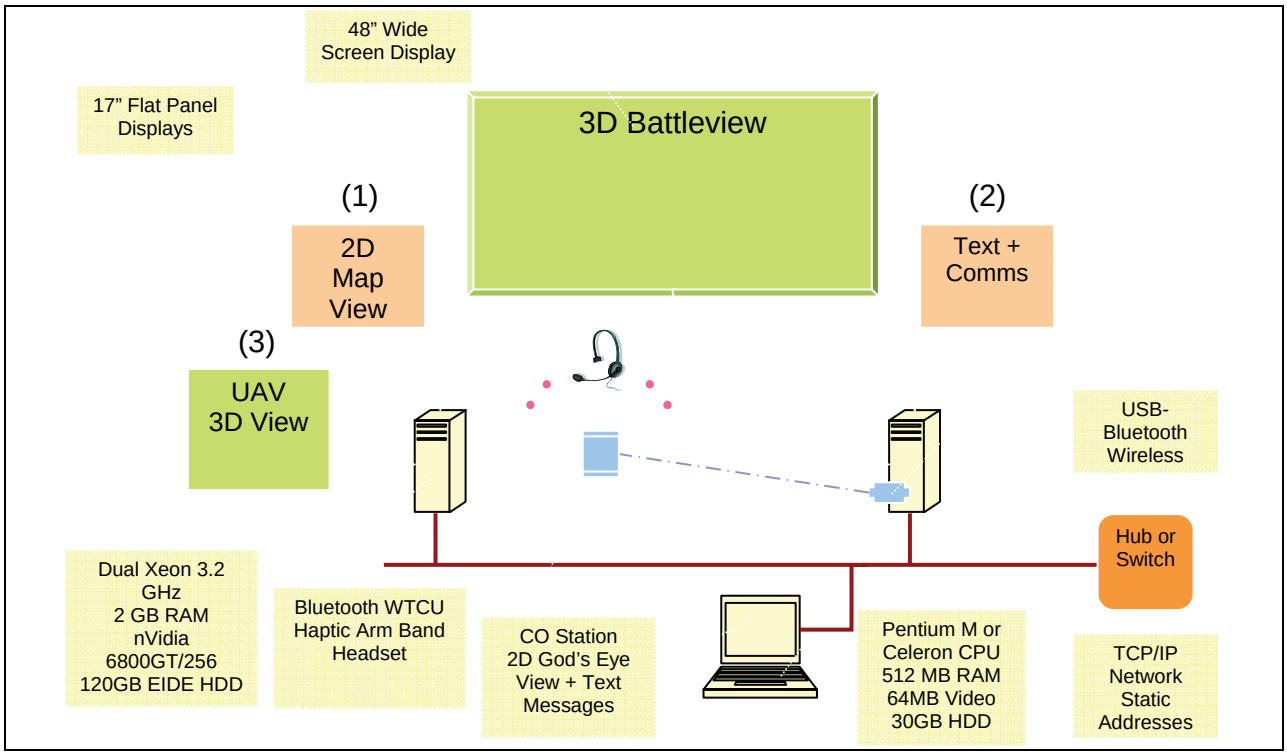


Figure 2. M-Body AEDGE simulation platform components.

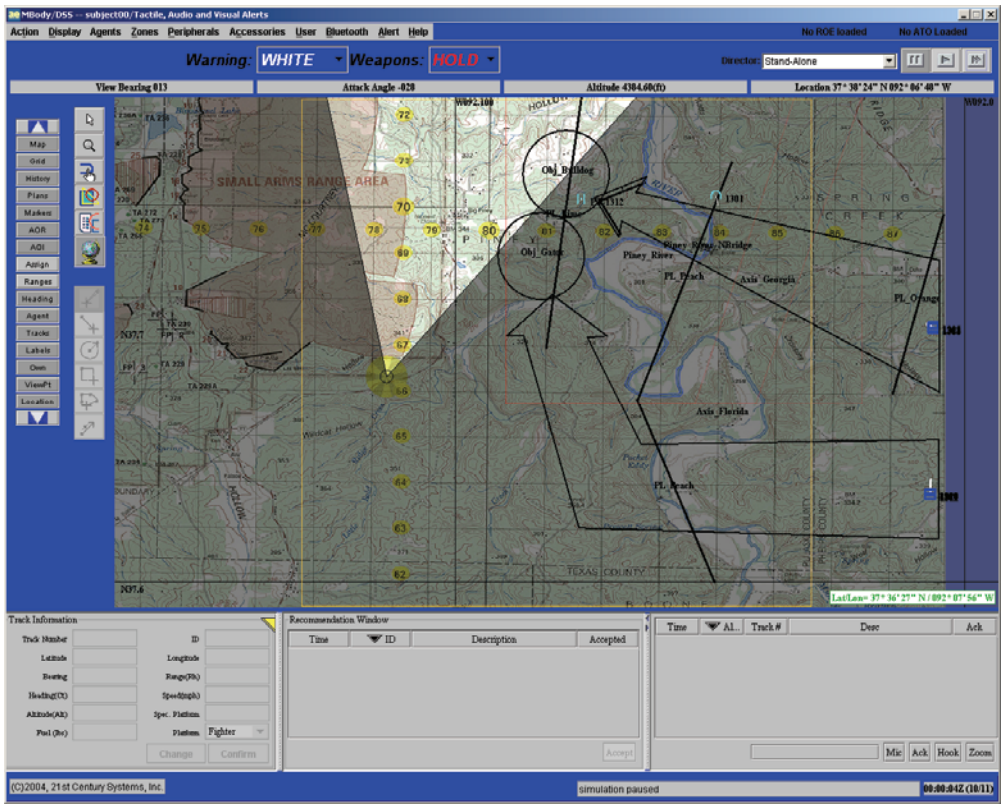


Figure 3. Platoon leader's 2-D map view.

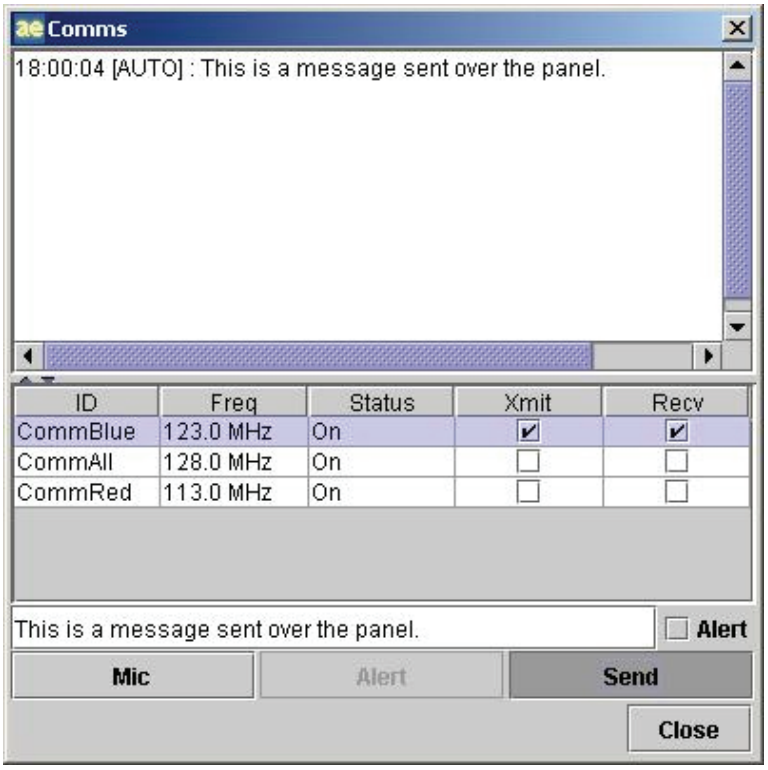


Figure 4. Text and communications view.

Figure 5. UAV view.

3.2.4 Questionnaires

Two questionnaires evaluated participant performance:

a. **Alert evaluation** – Participants rated the effectiveness, helpfulness, and necessity of the three alerts using a Likert scale in which 1 = strongly agree and 5 = strongly disagree (appendix C).

b. **Alert ranking** – Participants ranked the effectiveness and helpfulness of the three alerts from 1 to 3 (appendix D).

Health and Demographics Questionnaire – Participants provided information about their current medical condition, gender, age, length of service, education level, and combat experience (appendix E).

3.3 Experimental Design

3.3.1 Independent Variable

The experimental design was a one-way within-subjects design. Alert type (visual, visual + auditory, and visual + tactile) was the independent variable. Presentation order for type of alert and scenario was counterbalanced with a balanced Latin square (see table 3).

Table 3. Presentation order.

Participant	Alert	Scenario	Alert	Scenario	Alert	Scenario
1,7	Visual	1	Visual +Tactile	2	Visual + Auditory	3
2,8	Visual + Auditory	2	Visual	3	Visual +Tactile	1
3,9	Visual +Tactile	3	Visual + Auditory	1	Visual	2
4,10	Visual	1	Visual + Auditory	3	Visual +Tactile	2
5,11	Visual + Auditory	2	Visual +Tactile	1	Visual	3
6	Visual +Tactile	3	Visual	2	Visual + Auditory	1

3.3.2 Dependent Variables

Response time and the subjective alert ratings and rankings were the dependent variables. Response time was defined as the time between the Soldier receiving an alert and clicking the show message button on the communications display.

3.4 Procedures

Before the experiment began, participants completed an informed consent form and a demographic questionnaire and received a short briefing about the experimental procedures and a demonstration of the simulation platform and the various alert types. Each participant was assigned to the

operational scenarios (table 3) and read an operations order (OPORD) that described the mission and objectives (appendix F). All three scenarios used the same OPORD. During the experiment, participants sat in front of the primary display, map display, and UAV display. During each scenario, participants received tactical communications and monitored activity on their displays. An alert (visual, visual + auditory, or visual + tactile) preceded some of the communications. When the PL received an alert, he clicked on the communications console of his primary display to see the new message and made a decision based on the new information. For example, if the PL received a message that indicated there was a dirty area ahead, he may have decided to change course and to notify his platoon. Approximately nine alerts were given for each scenario. The M-Body software recorded the response time. Participants continued their mission until they reached the objective; then they answered the alert evaluation. Participants took a short break between scenarios. This procedure was repeated until all three scenarios were completed, which took approximately 1.5 hours. After completing all three conditions, participants answered the alert ranking questionnaire.

3.5 Data Analysis

First, an examination of the response time data indicated that the task completion time data did not follow a normal distribution, so a reciprocal transformation of the task completion time data was performed (Howell, 1997), and these data were analyzed with a repeated measures analysis of variance (ANOVA) (summary results are presented in original units). Alert ratings were considered as interval data and each question was analyzed with separate repeated measures ANOVAs. Frequency counts were computed for the alert ranking data. *Post hoc* comparisons were made with the Tukey honestly significant difference method. Statistical tests were considered significant when $p < .05$.

4. Results

4.1 Objective Data

Analysis of the response time data showed a significant main effect of alert type, $F(2, 16) = 14.61$, $p = .0002$. *Post hoc* tests revealed that the mean response time for the visual alert was significantly slower than the response times for the visual + auditory and visual + tactile alerts (see figure 5). No significant differences were found between the visual + auditory and visual + tactile alert response time ($p = .8864$).

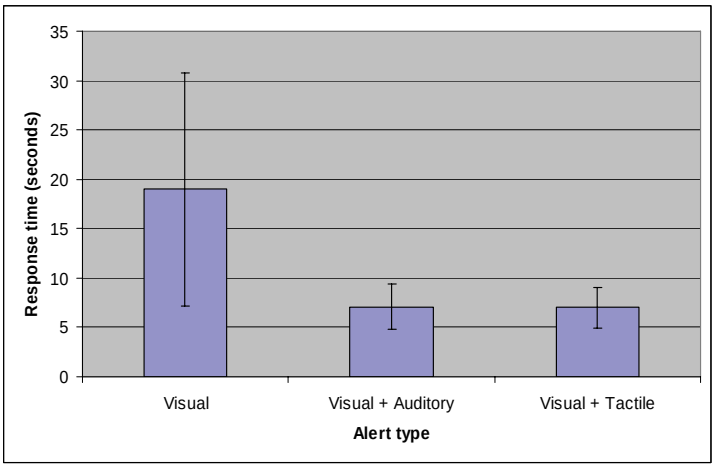


Figure 5. Mean standard deviation (SD) response time for each alert type.

4.2 Subjective Data

4.2.1 Item 1: Alert Was Effective in Getting my Attention

Alert type, $F(2, 20) = 11.04$, $p < .0006$, had significant effects on question 1. Mean ratings were significantly higher for the visual alert (see figure 6), which suggests that participants thought that the visual + auditory and visual + tactile alerts were more effective at getting attention than the visual alert.

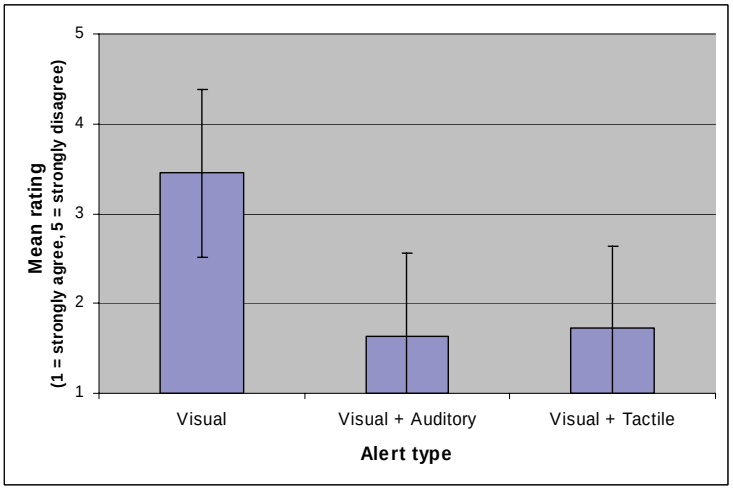


Figure 6. Mean (SD) rating for effectiveness in getting attention.

4.2.2 Item 2: Alert Was Helpful

No significant effects of alert type were found on question 2 ($p = .332$). Mean (SD) ratings for the alert types were as follow: visual = 2.27 (0.90), visual + auditory = 1.73 (0.79), visual + tactile = 1.82 (0.98).

4.2.3 Item 3: Alert Was Annoying and Unnecessary

Alert type, $F(2, 20) = 4.12$, $p = .0317$, had significant effects on question 3. Mean ratings were significantly higher for the visual alert than the visual + auditory alert (see figure 7), suggesting that participants thought that the visual + auditory alert was slightly more annoying than the visual alert alone. No significant differences were found between the ratings for the visual and visual + tactile alerts.

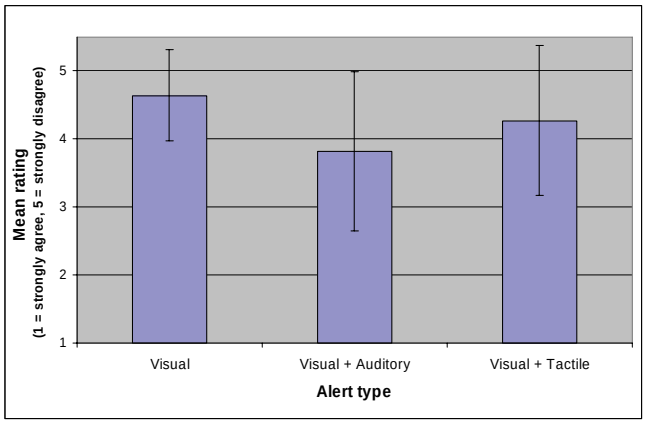


Figure 7. Mean (SD) rating for annoying.

4.3 Preference Rankings

Frequency counts helped identify the type of alert that participants considered the best, next best, and worst choice for getting their attention and helpfulness. For getting attention (see figure 8), participants chose the visual + auditory alert as the most effective at getting their attention. The visual + tactile alert was selected as the next best choice, and the visual alert was the least effective at getting the participants' attention. With respect to the helpfulness of alerts (see figure 9), the combined alerts (visual + auditory, visual + tactile) were selected as the most and next most helpful, and the visual alert was clearly identified as the least helpful.

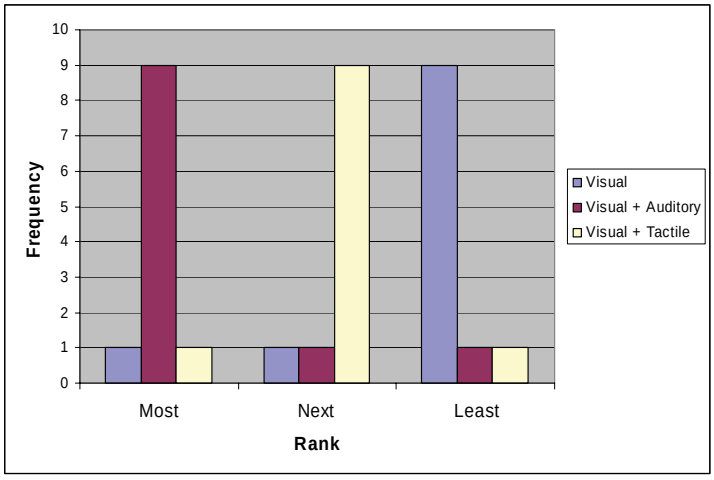


Figure 8. Frequency counts for effectiveness of alert in getting attention.

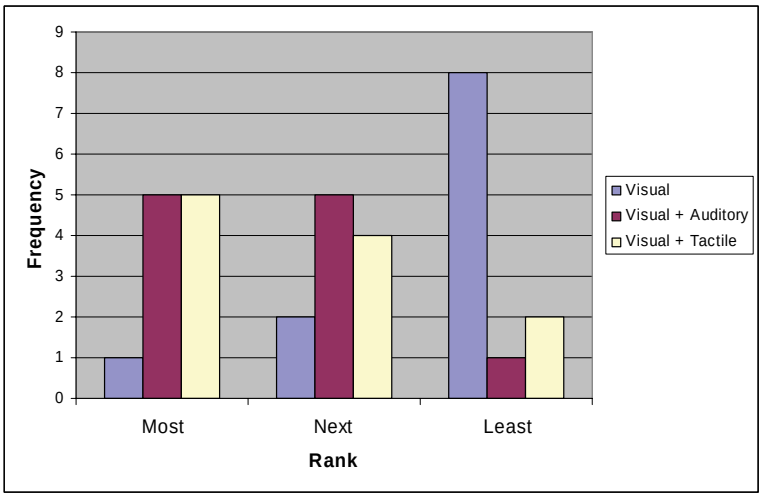


Figure 9. Frequency counts for helpfulness of alerts.

4.4 Participant Comments

As reflected by the objective and subjective data, participants thought the visual alert was the least effective at getting their attention and the least helpful. Participants indicated that the visual alert required constant checking to avoid missing messages and added that it would be impossible to conduct operations and maintain constant awareness of the visual alert. With regard to the combination alerts, participants perceived these alerts as effective because they were able to monitor multiple sources of information without focusing all their attention on the primary display. The visual + tactile alert was considered to be less distracting than the visual + audio alert because it did not interfere with the other senses that were already engaged. As mentioned in the first study, participants stated that vehicle noise and vibration may interfere with or mask the auditory and tactile stimuli. Participants also mentioned that they thought the alerts would be more effective if information were prioritized (i.e., different sounds or patterns for routine and urgent messages).

5. Discussion

Many challenges exist when one is designing interfaces that provide sensory feedback, especially when we consider that many interfaces rely heavily on the visual channel, which can easily become overloaded (Hopp et al., 2005). As mentioned previously, the literature about information processing suggests that Multiple Resource Theory (MRT) may be a useful tool in designing interfaces for applications in which operators perform several tasks at the same time (Boles, 2001). For example, since the platoon leader's visual channel is overloaded, distributing tasks and information across other sensory modalities, such as the auditory and tactile modalities, may help reduce overall workload (Wickens & Hollands, 2000; Sarter, Waters, & Ho, 2003).

However, implementing auditory and tactile alerts in moving combat vehicles could be problematic because of environmental noise and vibration, which would make the alerts difficult to detect. As a result, a redundant combination of display modalities may be an effective alternative to presenting information to a single modality. For example, using a combination of cues would enable a platoon leader to hear a message or alert while continuing to scan the battlefield, but he would also be able to see the information being displayed, if necessary (Helleberg & Wickens, 2001).

The concept of using redundant alerts was examined in the present experiment. Results indicated that the response time for the visual alert alone was 63% slower when compared to the visual + auditory and visual + tactile alerts. Wickens and Hollands (2000) suggest that redundantly coding targets across modalities (visual warning coupled with an auditory beep) shortens response time, which was demonstrated in the present study. Redundancy can also serve as an aid for visual search and detection of changes that occur on complex visual displays (Tan, Gray, Young, & Irawan, 2001). One potential advantage to designing redundancy into future combat systems is that in case vehicle noise or vibration masks the auditory or tactile portion of the alert, the operator could still rely on the visual alert.

Subjective data from the second experiment were consistent with the objective data and indicated that the redundant alerts (visual + auditory, visual + tactile) were more effective in getting the PL's attention than the single visual alert. No differences were found for the aspect of alert helpfulness; however, the visual + auditory alert was considered more annoying than the other alerts. This was also described in the participant comments. One possible explanation is that the auditory portion of the alert made it difficult to attend to other ongoing audio communications. Perhaps building a level of prioritization into the alert (i.e., different sounds for routine and urgent messages) would reduce distraction and help the PL know where to focus his attention. Another solution may be to code additional information into the alert. For example, using an auditory icon, that is, a recognizable sound such as a siren that has specific inherent meaning would get the PL's attention and would indicate that a chemical agent has been detected. Rank data were also consistent with other data. Participants identified the redundant alerts as the best and next best choices for effectiveness in getting attention and helpfulness, and the visual alert was identified as the worst choice.

6. Conclusions and Future Work

As mentioned previously, the overall goal of this project was to use the principles outlined in MRT to guide development of displays for presenting critical information to the platoon leader, thereby enhancing his decision making. Results of the experiments described support the results of the IMPRINT task-network model described in the methodology section. That is, display designs that incorporate a visual alert only can lead to response times that are twice as long as

using additional auditory and tactile modalities, when in a visually demanding environment. In the present study, using the concept of redundancy resulted in response times that were as much as 63% faster than a single visual alert. These results suggest that alerts provide an effective method of information management in a visually demanding environment. In addition, using redundant alerts may ease some of the challenges associated with implementing single auditory and tactile alerts in combat vehicles.

To address the challenge of implementing tactile signals in moving vehicles, future research will examine the tactile signal characteristics that enhance detectability in moving vehicles and when combat assault maneuvers are performed. Other efforts will examine how coding additional information into the alerts enhances their effectiveness.

7. References

Boles, D. B. Multiple Resources. In W. Karwowski (Ed.), *International Encyclopedia of Ergonomics and Human Factors*. Taylor & Francis, 271-275, 2001.

Edworthy, J.; Stanton, N.; Hellier, E. Warnings in Research and Practice. *Ergonomics* **1995**, *38*, 2145-2154.

Headquarters, Department of the Army. *Use of Volunteers as Subjects of Research*; AR 70-25; Washington, DC, 1990.

Helleberg, J.; Wickens, C. D. Effects of Data Link Modality on Pilot Attention and Communication Effectiveness. *In Proceedings of the 11th International Symposium on Aviation Psychology*. Columbus, Ohio: The Ohio State University, 2001.

Hopp, P. J.; Smith, C.A.P.; Clegg, B. A.; Heggestad, E. D. Interruption Management: The Use of Attention-Directing Tactile Cues. *Human Factors* **2005**, *47*, 1-11.

Howell, D. C. Simple Analysis of Variance. *Statistical Methods for Psychology*. CA: Duxbury Press, 1997.

Krausman, A. S.; Elliott, L. R.; Pettitt, R. *Effects of Visual, Auditory, and Tactile Alerts on Platoon Leader Performance and Decision Making*; ARL-TR-3633; U.S. Army Research Laboratory: Aberdeen Proving Ground, MD, 2005.

Lockyer, B. *Operation Manual for the MIT Wireless Tactile Control Unit*. Cambridge, MA: Massachusetts Institute of Technology, 2004.

Miller, J. Channel Interaction and the Redundant Target Effect in Bimodal Divided Attention. *Journal of Experimental Psychology: Human Perception and Performance* **1991**, *17*, 160-169.

Mitchell, D. K.; Samms, C.; Glumm, M.; Krausman, A.; Brelsford, M.; Garrett, L. *Improved Performance Research Integration Tool (IMPRINT) Model Analyses in Support of the Situational Understanding as an Enabler for Unit of Action Maneuver Team Soldiers Science and Technology Objective (STO) in Support of Future Combat Systems (FCS)*; ARL-TR-3405; U.S. Army Research Laboratory: Aberdeen Proving Ground, MD, 2004.

Sarter, N.B. The Need for Multisensory Interfaces in Support of Effective Attention Allocation in Highly Dynamic Event-Driven Domains: The Case of Cockpit Automation. *International Journal of Aviation Psychology* **2000**, *10*, 231-245.

Sarter, N. B.; Waters, M.; Ho, C. Y. Supporting Effective Communication and Coordination on the Battlefield Through Adaptive Multimodal Information Exchange. *Proceedings of the Collaborative Technology Alliances Conference*, 2003.

Tan, H. Z.; Gray, R.; Young, J. J.; Irawan, P. Haptic Cueing of a Visual Change-Detection Task: Implications for Multimodal Interfaces. *In Proceedings of the 9th International Conference on Human-Computer Interaction*, 678-682, 2001.

Wickens, C. D.; Hollands, J. G. Attention, Time Sharing, and Workload. *Engineering Psychology and Human Performance.* NY: Prentice Hall, 2000.

INTENTIONALLY LEFT BLANK

Appendix A. Volunteer Agreement Affidavit

VOLUNTEER AGREEMENT AFFIDAVIT:
ARL-HRED Local Adaptation of DA Form 5303-R. For use of this form, see AR 70-25 or AR 40-38

The proponent for this research is:	**U.S. Army Research Laboratory** **Human Research and Engineering Directorate** **Aberdeen Proving Ground, MD 21005**

Authority:	Privacy Act of 1974, 10 U.S.C. 3013, [Subject to the authority, direction, and control of the Secretary of Defense and subject to the provisions of chapter 6 of this title, the Secretary of the Army is responsible for, and has the authority necessary to conduct, all affairs of the Department of the Army, including the following functions: (4) Equipping (including research and development), 44 USC 3101 [The head of each Federal agency shall make and preserve records containing adequate and proper documentation of the organization, functions, policies, decisions, procedures, and essential transactions of the agency and designed to furnish the information necessary to protect the legal and financial rights of the Government and of persons directly affected by the agency's activities]
Principal purpose:	To document voluntary participation in the Research program.
Routine Uses:	The SSN and home address will be used for identification and locating purposes. Information derived from the project will be used for documentation, adjudication of claims, and mandatory reporting of medical conditions as required by law. Information may be furnished to Federal, State, and local agencies.
Disclosure:	The furnishing of your SSN and home address is mandatory and necessary to provide identification and to contact you if future information indicates that your health may be adversely affected. Failure to provide the information may preclude your voluntary participation in this data collection.

Part A • Volunteer agreement affidavit for subjects in approved Department of Army research projects

Title of Research Project:	**Effects of redundant alerts on platoon leader task performance and decision cycle time.**	
Human Use Protocol Log Number:	**ARL-20098-05016**	
Principal Investigator:	Andrea S. Krausman, U.S. Army Research Laboratory Human Research & Engineering Directorate Aberdeen Proving Ground, MD 21005	Phone: 410-278-5933 E-Mail: ahynes@arl.army.mil
Associate Investigator(s)	Mr. Rodger Pettitt Dr. Linda Elliott U.S. Army Research Laboratory Human Research & Engineering Directorate Fort Benning, GA	Phone: 706-545-9145 Phone: 706-545-9142
Location of Research:	U.S. Army Research Laboratory, Fort Benning, GA	
Dates of Participation:	September 6 – 9, 2005	

Part B • To be completed by the Principal Investigator

Note: Instruction for elements of the informed consent provided as detailed explanation in accordance with Appendix C, AR 40-38 or AR 70-25.

Purpose of the Research

The purpose of this experiment is to evaluate the effectiveness of combinations of visual, auditory, and tactile alerts on your ability to accomplish a mission.

Procedures

Before beginning the experiment, you will be complete a short training session so that you can become familiar with the visual, auditory, and tactile (vibration) alerts. For the experiment, you will assume the role of a platoon leader and will carry out three missions, while seated in front of a map display, commo display, and UAV display. You will be given a short operations order (OPORD) that describes your mission and objectives. During each mission, you will receive tactical communications via the radio and text messaging. You will also be monitoring activity on your displays. Some of the text messages will be preceded by an alert (visual, visual + auditory, or visual + tactile). Visual alerts appear as a red light on the bottom of the communications display. Tactile alerts (a series of buzzes) will be presented by small mechanical motors encapsulated in a lycra sleeve worn on your upper arm. Auditory alerts will be presented as a series of "beeps" that you will hear in your headphones. When the alert is given, you will click the "show message" button on the communications console of your primary display to see the new message. You may be required to make a decision based on the information presented in the message. There are approximately 10 alerts given for each mission. The software will log the timing of events and actions taken. You will continue your mission until you reach the objective at which time you will fill out a scenario event questionnaire and alert evaluation. A short break will be given and you will move on to the next scenario. After completing all three missions, you will complete two questionnaires to obtain your opinion about the effectiveness of the alerts, and a rating of your performance. The entire experiment will take approximately 1.5 hours to complete.

Benefits

You will receive no benefits from participating in the project, other than the personal satisfaction of supporting the development of effective displays for Future Combat Systems (FCS).

Risks

Risks associated with this study are minimal, and are similar to those encountered when seated in front of a computer (i.e. eye strain). The tactile sensors, called tactors, are small electomechanical vibrators that use the same DC motor used in cell phones and pagers, so there is no danger posed by the vibrations.

Confidentiality

All data and information obtained about you will be considered privileged and held in confidence. Complete confidentiality cannot be promised, particularly if you are a military service member, because information bearing on your health may be required to be reported to appropriate medical or command authorities. In addition, applicable regulations note the possibility that the U.S. Army Medical Research and Materiel Command (MRMC-RCQ) officials may inspect the records.

Disposition of Volunteer Agreement Affidavit

The Principal Investigator will retain the original signed Volunteer Agreement Affidavit and forward a photocopy of it to the Chair of the Human Use Committee after the data collection. The Principal Investigator will provide a copy of the signed and initialed Affidavit to you.

Contacts for Additional Assistance

If you have questions concerning your rights on research-related injury, or if you have any complaints about your treatment while participating in this research, you can contact:

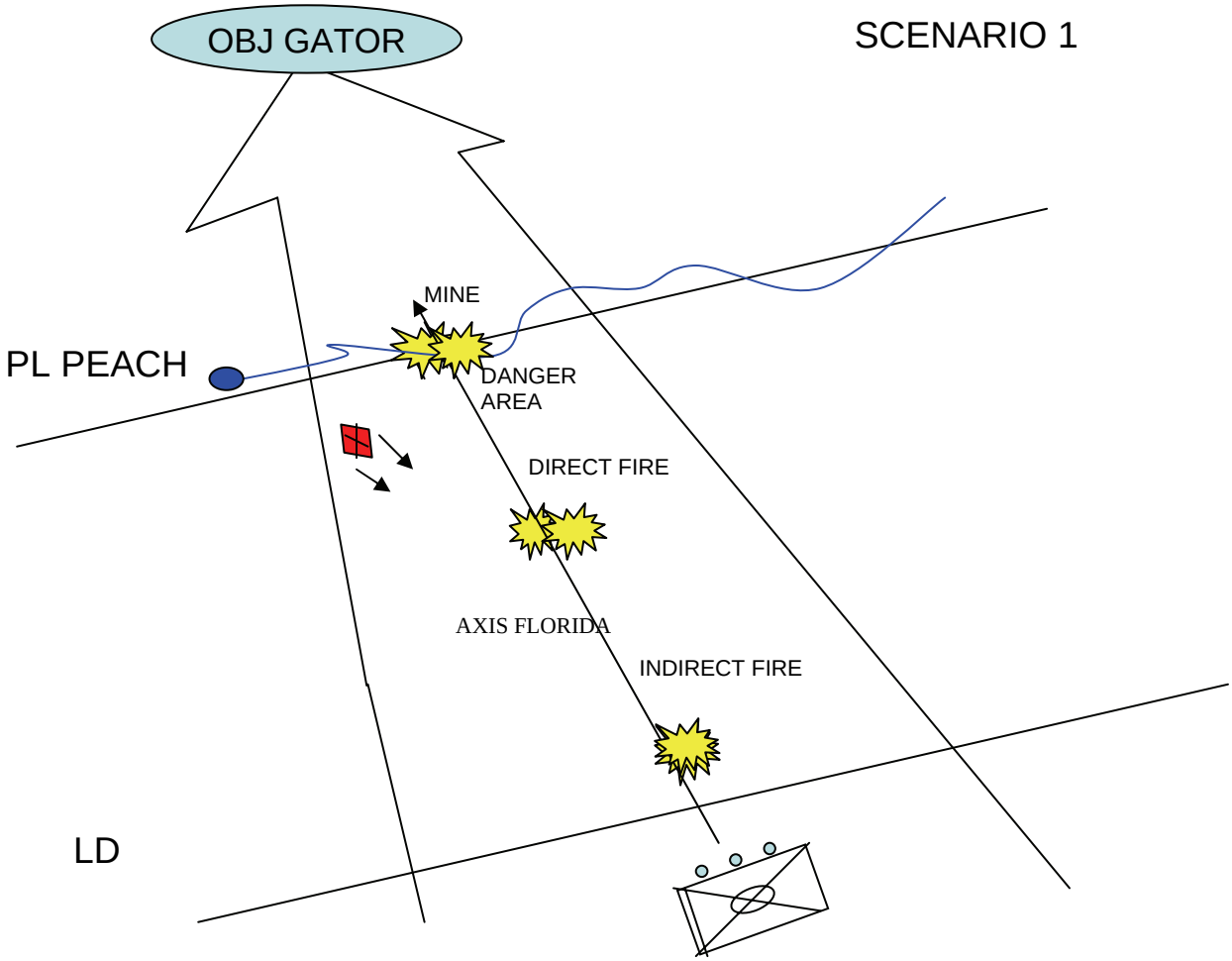
Chair, Human Use Committee **U.S. Army Research Laboratory** **Human Research and Engineering Directorate** **Aberdeen Proving Ground, MD 21005** **(520) 538-4705 or (DSN) 879-4705**	**OR**	**Office of the Chief Counsel** **U.S. Army Research Laboratory** **2800 Powder Mill Road** **Adelphi, MD 20783-1197** **(301) 394-1070 or (DSN) 290-1070**

I do hereby volunteer to participate in the research project described in this document. I have full capacity to consent and have attained my 18th birthday. The implications of my voluntary participation, duration, and purpose of the research project, the methods and means by which it is to be conducted, and the inconveniences and hazards that may reasonably be expected have been explained to me. I have been given an opportunity to ask questions concerning this research project. Any such questions were answered to my full and complete satisfaction. Should any further questions arise concerning my rights or project related injury, I may contact the **ARL-HRED Human Use Committee Chairperson at Aberdeen Proving Ground, Maryland, USA by telephone at (520) 538-4705 or DSN 879-4705.** I understand that any published data will not reveal my identity. If I choose not to participate, or later wish to withdraw from any portion of it, I may do so without penalty. I understand that military personnel are not subject to punishment under the Uniform Code of Military Justice for choosing not to take part as human volunteers and that no administrative sanctions can be given me for choosing not to participate. I may at any time during the course of the project revoke my consent and withdraw without penalty or loss of benefits. However, I may be required (military volunteer) or requested (civilian volunteer) to undergo certain examinations if, in the opinion of an attending physician, such examinations are necessary for my health and well being.

Printed Name of Volunteer (First, MI., Last)	
Social Security Number (SSN)	***Permanent Address of Volunteer***
Date of Birth (Month, Day, Year)	
Today's Date (Month, Day, Year)	***Signature of Volunteer***
Signature of Administrator	

INTENTIONALLY LEFT BLANK

Appendix B. Scenarios



SCRIPT 1
(Bold text indicates when an alert was given)
(Blue text shows a sample of the unscripted platoon leader communications)

CO (to PL): On order, cross LD and report when all elements are across

PL to CO: Roger, will report when all elements are across

PL (to SL): Repeats message "on order…."

CO (to PL): Cross LD now, and report when all elements are across

PL (to SL): Orders SLs to cross LD

SL (to PL): 2nd platoon has crossed LD

PL (to CO): Informs CO of crossing

SL (to PL): Receiving indirect fire

PL (to SLs): Move through impact area

SL (to PL): Roger, main gun down

CO (to PL): FRAGO: Enemy strong point detected – grid 856688, report contact, destroy strong point, and continue mission to objective gator.

PL (to CO): 2nd platoon indirect fire contact and main gun down on ICV

PL (to CO): Roger, received FRAGO

PL (to SLs): FRAGO: Enemy strong point detected – grid 856688, report contact, destroy strong point, and continue mission to objective gator.

SL (to PL): Roger, received FRAGO

SL (to PL): Enemy strong point destroyed

PL (to SL): acknowledges SL and reports enemy strong point destroyed

PL (to CO): reports enemy strong point detected

SL (to PL): Enemy at 10 o'clock taking direct fire, we are engaging enemy

PSG(to PL): FM commo down and we have 2 casualties requiring evacuation.

1st SL (to PL): ICV disabled

PL (to CO): Reports contact, disabled ICV, and casualties

SL (to PL): Enemy withdrawing, we are in pursuit

PL (to SL): Roger, continue to pursue

PSG (to PL): We have one additional casualty requiring MEDEVAC

CO (to PL): Break contact/cross load disabled ICV and continue across Peach to consolidate and evacuate casualties.

PL (to CO): Roger, wilco

PL (to SLs): Cross load, break contact, and continue across PL Peach to consolidate and evacuate casualties.

SL (to PL): Roger

SL (to PL): Cross load complete

PSG (to PL): Casualties stabilized

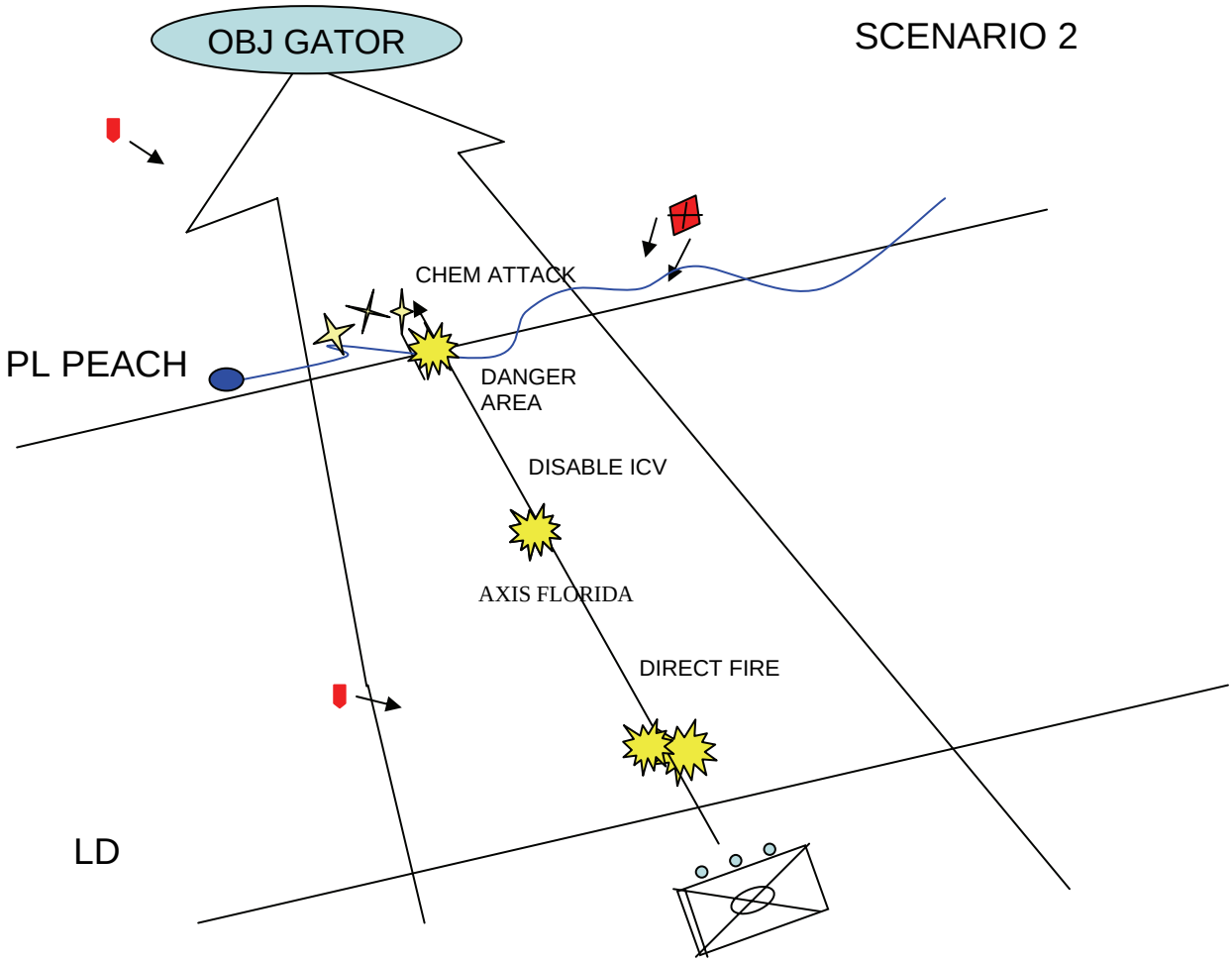
PL (to CO): Cross load complete, casualties stabilized, proceeding to PL Peach.

CO (to PL): FRAGO: Consolidate in place and on order be prepared to assume support for 1st platoon attack of Objective Bulldog.

2nd SL (to PL): 3rd squad ICV hit mine and is destroyed
PSG (to PL): **All personnel in 3rd squad killed**

2nd SL (to PL): Enemy contact at bridge, engaging enemy at this time

PL (to CO): Acknowledges FRAGO, reports enemy contact, ICV destroyed by mine, all personnel killed.


OBJ GATOR
SCENARIO 2
CHEM ATTACK
PL PEACH
DANGER
AREA
DISABLE ICV
AXIS FLORIDA
DIRECT FIRE
LD

SCRIPT 2
(Bold text indicates when an alert was given)
(Blue text shows a sample of the unscripted platoon leader communications)

CO: On order, cross LD and report when all elements are across

PL to CO: Roger will report when all elements are across

PL to SLs: On order cross LD and report when all elements are across

SLs to PL: acknowledge

CO to PL: Cross LD now

PL to SLs: Cross LD now

2nd SL to PL: 2nd Platoon has crossed LD

PL to CO: 2nd Platoon has crossed LD

2ndSL to PL: Receiving enemy fire from 9 o'clock

PSG to PL: Driver has been killed and replaced

1SL to PL: Maneuvering toward enemy position

PL to CO: Reporting contact with enemy

2nd SL to PL: Vehicle is disabled – can't proceed w/ mission

CO to PL: Bypass contact adjacent unit will engage enemy

PL to CO: Acknowledge order and reports disabled vehicle

RNCO to PL: Enemy tank section spotted by UAV at 3km and closing in, grid 824698

CO to PL: Leave local security and continue mission

PL to CO: Reports enemy activity spotted by UAV

PL to SLs: Alerts platoon of enemy position and closing

CO to PL: Establish hasty defense CAS will be deployed against tanks

PL to CO: acknowledge

PL to SLs: Deploy in defensive posture

SLs to PL: acknowledge

CO to PL: Enemy tanks have been destroyed, leave local security for disabled vehicle and continue mission

PL to SLs: Leave security and continue mission

RNCO to PL: on UAV screen- enemy mortar position spotted at 835675

PSGT to PL: Chemical agent detected

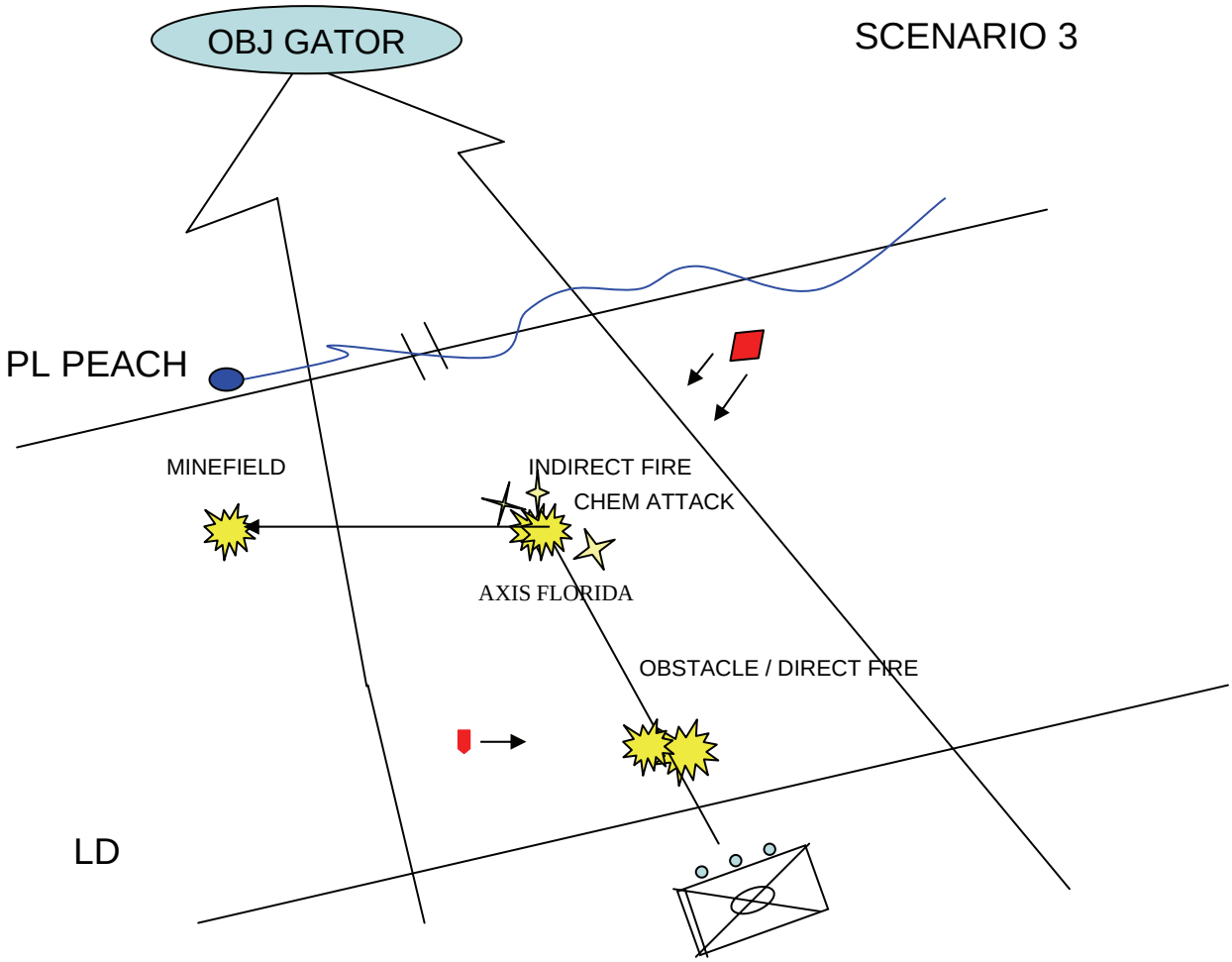
SL to PL: Receiving indirect fire

PL to SLs: Assume chemical posture, continue to move

PL to CO: Reports indirect fire contact, chemical agent

SL to PL: 2 casualties from chemical attack

CO to PL: Break contact and conduct linkup with 1st platoon at pl Peach on axis Georgia


OBJ GATOR
SCENARIO 3
PL PEACH
MINEFIELD
INDIRECT FIRE
CHEM ATTACK
AXIS FLORIDA
OBSTACLE / DIRECT FIRE
LD

SCRIPT 3
(Bold text indicates when an alert was given)
(Blue text shows a sample of the unscripted platoon leader communications)

CO: On order, cross LD and report when all elements are across

PL to CO: Roger will report when all elements are across

PL to SLs: On order cross LD and report when all elements are across

SLs to PL: Acknowledges

CO to PL: Cross LD now

PL to SLs: Cross LD now

2nd SL to PL: 2nd Platoon has crossed LD

PL to CO: 2nd Platoon has crossed LD

1st SL to PL: Wire obstacle – need to go on road to avoid it

PL to CO: Reporting Obstacle

RNCO to PL: Reporting enemy observation post at Grid 864673

1st SL to PL: Receiving fire from op @ 10:00—engaging enemy at this time

PSG to PL: Tank commander wounded from enemy fire/can continue mission

PL to CO: Reporting contact with OP and casualty

WSL to PL: reports enemy destroyed

CO to PL: destroy op and report

RNCO to PL: Enemy tank section spotted by UAV at 3km and closing on their location @ grid location 844732

PSG to PL: Reporting that casualties are stabilized and able to continue mission

PL to CO: casualties are stabilized, enemy observation post destroyed, enemy tank section sighted @ grid location 844732

CO to PL: Continue mission

1stSL to PL: receiving indirect fire

RNCO to PL: tanks firing at us

PSG to PL: 1st squad ICV is destroyed with no survivors

PL to CO: reports indirect fire and destroyed vehicle and casualties

CO to PL: FRAGO: Move south to axis Georgia link up with 1st platoon at PL peach

2nd SL to PL: Chemical agent detected

PL to CO: reports presence of chemical agent

PL to SLs: gives change of mission- get into chemical posture

SL to PL: reports ICV hit mine and is immobile

RNCO to PL: tank section destroyed

PSG to PL: Weapons squad ICV hit mine and is immobile

CO to PL: Self extract from mine field – consolidate and reorganize

INTENTIONALLY LEFT BLANK

Appendix C. Alert Evaluation

Alert Evaluation

Participant _____ Scenario _____ Alert _____

Please rate the type of alert you received during this scenario.

Alert was effective at getting my attention :	☐ Strongly Agree	☐ Agree	☐ Neither agree nor disagree	☐ Disagree	☐ Strongly Disagree
Alert was helpful:	☐ Strongly Agree	☐ Agree	☐ Neither agree nor disagree	☐ Disagree	☐ Strongly Disagree
Alert was annoying and unnecessary:	☐ Strongly Agree	☐ Agree	☐ Neither agree nor disagree	☐ Disagree	☐ Strongly Disagree

Please answer the following questions:

In your opinion, what are the strengths (if any) of this type of alert?

In your opinion, what are the weaknesses (if any) of this type of alert?

If this type of alert is used in combat vehicles, what do you think it would be most useful for?

Other comments:

INTENTIONALLY LEFT BLANK

Appendix D. Alert Ranking

Alert Ranking

Participant _____

Please rank the visual, auditory, and tactile alerts for each category.

Effective attention getter: (1 = most effective, 2 = next most effective, 3 = least effective)

Visual ____ Auditory____ Tactile ____

Helpful: (1 = most helpful, 2 = next most helpful, 3 = least helpful)

Visual ____ Auditory____ Tactile ____

Please provide any additional comments you may have regarding the types of alerts and how they should be used.

INTENTIONALLY LEFT BLANK

Appendix E. Health and Demographics Questionnaire

Health and Demographics Questionnaire

Participant Number: _____ Date: _____

1. Are you currently on medical profile? (Circle One): Yes No

1a. If yes, please describe the problem(s) below:

_____
_____

2. Do you have any other current condition or are you currently taking any medications that may prevent you from performing the tasks described to you in the volunteer consent form? (Circle One): Yes No

3a. If yes, please describe the ailment(s) below:

_____
_____

3. What is your branch of service? (Circle One):
Air Force Army Marine Corps Navy Coast Guard

4. What is your age? _____

5. How long have you been in the service? _____ Years _____ Months

6. Please list below your MOS, ASI, NEC or AFS and briefly describe your job:

_____
_____
_____

6a. How long have you been performing this MOS, ASI, NEC or AFS? _____ years _____ months

7. What is your gender? (Circle One): Male Female

8. What is your education level? High School/GED: ____ Vocational Technical: ____ College:_____

9. What military schools have you attended (check all that apply): { } AIT { } BNCOC

{ } ANCOC { } WOBC { } Wheeled & Track Recovery Course

{ } M2/3 Family Fighting Vehicle Familiarization Course

{ } M1 Tank Familiarization Course { } Others _____

_____
_____

10. What civilian schools have you attended? _____
_____

11. What positions have you held during your military tour? _____

_____

12. Do you have combat experience?
12a. If yes, identify location, time frame and your duty position.

Geographic Area (check all that apply)		**Duration of Tour**	**Did you see Combat?** circle either: yes/no	**If "YES"** Duty Position During Combat
Bosnia	( )	____years ___ months	yes/no	_____
Afghanistan	( )	____years ___ months	yes/no	_____
Iraq 1991	( )	____years ___ months	yes/no	_____
Iraq 2003	( )	____years ___ months	yes/no	_____
Other	( )	____years ___ months	yes/no	_____

_____

_____

_____

_____

Appendix F. Operations Order (OPORD)

TASK ORGANIZATION:

Headquarters Platoon	1st Platoon	2nd Platoon
2 M998 HMMWV	5 ICV'S (PL-1,2,3SQD-WPNS SQD) 1UAV	5 ICV'S (PL-1,2,3SQD-WPNS SQD) 1UAV

1. SITUATION:

a. Effects of Terrain and Weather.

Terrain: Terrain favors the enemy. It provides excellent cover and concealment allowing the enemy to move forces on the battlefield unobserved. This results in the enemy being able to mount a counterattack from an unknown location. Additionally, friendly forces are forced to move mounted elements through choke points and roads.

b. Enemy Forces.

(1) Disposition: Intelligence confirms that the 2/7 Kirtuq MRB(-) is conducting a hasty defensive operation to secure its NW penetration along Wildcat Road Two companies are retreating and are believed to be blending back into the civilian population. The remnant of one company is defending in the vicinity of Big River This is the company we will face. They are defending in less than platoon size elements. The company appears to have consolidated up to two sections of troops vic GL 805705. Over the past 24 hours a number of "freedom fighters" have reinforced the company defense, but are believed to fight independently and not abide by higher orders. The enemy is limited in its use of indirect fires. Due to the past 24 hours precision bombing campaign, a number of artillery positions were destroyed. However, a number of small caliber mortar systems and rounds are still at large, and can disrupt our forces as we move along the sector.

(2) Composition: The 2/7 Kirtuq MRB (-) is comprised of both NATO and Warsaw Pact Equipment (see table F-1). The MRB (-) appears to be arrayed with only one reinforced company. Enemy forces are believed to be about 33-50% strength in personnel and equipment.

(3) Strength: See table F-1.

Unit	Main Weapon	Ranges	100 %	90 %	80 %	70 %	60 %	50 %
MRB (BMP)								
Tank Co (1)	64A/72/80/90		10	9	8	7	6	5
BMP Co (3)	1/2/3		10	9	8	7	6	5
Mortar Btry	2B11-120mm or 2B9-82mm	7200m 5000m	6	5	5	4	4	3
Recon plt	BMP		3	3	2	2	2	1
ADA plt	BMP/SA-16s	6000m	3/9	3/8	2/7	2/6	2/5	1/4
AT plt	BMP AT-4/RPG22 or 26	2000m/1000 m	3/6, 3	3/ 5,3	2/ 5,2	2/ 4,2	2/ 4,2	2/ 3,1
AGS-17 plt	BMP/AGS 17	1250m	3/6	3/5	2/5	2/4	2/4	1/3
MRC (BMP)								
Tanks	T-64A/72/80/90		3	3	2	2	2	1
BMP	1/2/3		10	9	8	7	6	5
MRP (BMP)								
Tanks	T-64A/72/80/90		1	1	1	0	0	0
BMP	1/2/3		3	3	2	2	2	1
DIBS/sqd			7	6	5-6	5	4	3-4
RPG/RPK			3/3	3/3	3/3	3/3	3/3	3/3

Fig 1-1

MRB (BMP)

DIBS/sqd 7 6 5-6 5 4 3-4

RPG/RPK 3/3 3/3 3/3 3/3 3/3 3/3

(4) Capabilities:

(a) Maneuver: Enemy forces are transforming from an organized army to a reinforced “guerilla” force. Many of their organized tactics are being exchanged for more “hit and run” operations in an attempt to buy time for rearward troops to organize. The enemy does not have an identifiable front and therefore its difficult to estimate the number, and type of forces that we will confront.

(b) Fire Support: The MRB(-) is likely to employ the remainder of his mortar battery in split sections to provide disrupting fires to the remaining company.

(c) Intelligence: The enemy’s formal intelligence assets have been largely neutralized. However, the enemy is likely to rely on human intelligence relayed by Kirtuq sympathizers. It is critically important that our forces do not interface with the civilian population IOT prevent operational information from getting in their hands.

(d) Mobility, Counter-Mobility, Survivability: Very few obstacles remain in place. Most of the obstacles were reduced using indirect fires by the battalion scouts. However, remnants of some obstacles still remain on throughout the AO - vic. PL Peach (Box Springs Rd.) and GL 865675

(e) Air Defense: The enemy is likely to have a large number of US made air defense weapon systems, such as the Stinger. These missiles can be employed against both our attack and support aviation assets. However, in a desperate attempt, the enemy can attempt to employ these systems against our ICVs or light skinned vehicles.

(f) Combat Service Support: The enemy does not possess an established CSS network. He relies heavily on support from the local civilian population for food, water and shelter, and is able to re-supply his forces through a growing network of foreign insurgents.

(g) Command and Control: The enemy’s formal organization of troops is currently being diminished. Their leadership’s inability to properly sustain them throughout the war has created large instability within their chain of command. Furthermore, the outside “freedom fighters” that have come to fight against US troops have undermined the existing chain of command, and has recently created a separate network of cells that conduct operations independently from the conventional forces.

(5) Enemy’s most probable course of action is to continue conducting operations in platoon or smaller size elements. They will delay our advance by disrupting our forces along the route. The enemy is most likely to employ man-portable anti-armor weapons such as RPGs. In addition, the enemy is likely to employ IEDs to disrupt our forces and delay our movement. The enemy has a limited number of forward observers, so we can expect him to focus his indirect fire assets on known points such as road intersections and hilltops.

(6) Decisive to the enemy’s operation is his ability to disrupt our forces along the route, and prevent our forces from pinpointing his exact location.

(7) He will accomplish this by operating in less than platoon size elements (Section or ≤), conducting anti-armor ambushes, and blending into the civilian population. Therefore deceiving our troops as to their exact disposition.

(8) The purpose of his fires is to disrupt.

(9) The purpose of his engineers is to Counter-Mobility.

(10) Enemy's most dangerous course of action is the employment of chemical weapons (blister or nerve agents) delivered using man-portable indirect fire systems such as 81/120mm mortars. This will not only deny us the ability to move along the sector, but it will severely delay our advance, and provide the enemy time to reinforce.

c. Friendly Forces:

(1) Higher Unit's Mission and Commander's Intent:

(a) 2 Levels Up: 29TH IN Regt.

1. Mission: Seize the town of Lenardwood IOT prevent enemy forces from establishing an operational logistical network.
2. CDRs Intent: Secure Highways 280, 137, & 27

(b) 1 Level Up: 1-29th (Mech)

1. Mission: Seize OBJ Darby IOT prevent enemy forces from organizing and mounting terrorist attacks against our troops.
2. CDRs Intent: Deny the enemy the ability to prepare and sustain his forces. Maintain the initiative to force the enemy to continue disorganizing, but prevent his forces from blending back into the civilian population.

(2) Left Unit's Mission: A/1-29th destroys enemy forces in AO Snickers to prevent enemy forces from mounting offensive operations against the battalion main effort.

(3) Right Unit's Mission. A/2-79th AR destroys enemy forces in AO Milky Way to prevent enemy forces from mounting offensive operations against the battalion main effort.

(4) Rear Unit's Mission. B/1-29th (ME) seize OBJ Darby IOT prevent enemy forces from organizing and mounting terrorist attacks against our troops.

(5) Forward Unit's Mission: BN Scouts screen to prevent enemy forces from conducting surprise attacks against our troops.

d. Attachments and Detachments: 3rd PLT attached to A/2-79 AR until 05 1200 APR 04.

2. MISSION: O/O C/1-29th (Mech) seize OBJ Tiger (GL 795698) IOT prevent the 2/7 MRB (-) from mounting offensive operations against the battalion main effort.

3. EXECUTION:

a. Company Commander's Intent: I intend to seize OBJ Tiger by maintaining the initiative and force the enemy to continue his withdrawal. Our forces will move along the designated routes with speed to prevent the enemy from disrupting our advance. The endstate of this operation is OBJ Tiger seized, our forces placed in hasty defensive positions and prepared to conduct further offensive operations.

b. Concept of the Operation: We will accomplish this by conducting an envelopment. The decisive point of this operation is the seizure of OBJ Bulldog. It is decisive because it will

deny enemy forces observation and the ability to place effective fires on the main effort. One platoon will maneuver along the East (Axis Georgia) to seize OBJ Bulldog. One platoon will maneuver along the West (Axis Florida) to seize OBJ Gator.

(1) Maneuver.

(a) O/O, 1st PLT (SE) moves along Axis Georgia to seize OBJ Bulldog (GL 805679) IOT prevent the enemy from placing effective fires on 2nd PLT (ME).

(b) O/O 2nd PLT (ME) moves along Axis Florida to seize OBJ Gator (GL 805695) IOT prevent the 2/7 MRB (-) from mounting offensive operations against the battalion main effort.

(2) Fires.

(a) Task: Suppress

(b) Purpose: Prevent the enemy from massing direct fires.

(c) Method:

1. AA to LD (PL Orange) – CO HQ
2. PL Orange to PL Peach – 1st PLT
3. PL Peach to PL Lime – 2nd PLT

(3) Engineer. N/A
(4) Air Defense: N/A

c. Tasks to Maneuver Units:

(1) 1st PLT (SE):

(a) Seize OBJ Bulldog.

(b) Establish a hasty perimeter oriented SE after OBJ Tiger is seized, and occupy SBF #1.

(c) B/P to pass B/1-29th IN (BN ME) to the south.

(d) Report all obstacles along Axis Georgia. Open a lane or establish a bypass and mark with white engineer tape on the left side of the lane.

(2) 2nd PLT (ME):

(a) Seize OBJ Gator.

(b) Establish a hasty perimeter oriented SW after OBJ Tiger is seized, and occupy SBF #2.

(c) Report all obstacles along Axis Florida. Open a lane or establish a bypass and mark with white engineer tape on the left side of the lane.

d. Tasks to Combat Support Elements:

(1) FSO:

(a) Allocate three targets per maneuver element and assist in fire support planning.

(b) Develop fire support matrix.

(c) Establish NFAs to prevent fratricide and assist in clearance of fires.

e. Coordinating Instructions:

(1) Time Line:

14 1800– CO OPORD
15 1300– UAV Flyover/CO BACKBRIEFS
15 2000– NLT PLT OPORD
15 2100– NLT PCIs
15 2200– NLT PLT REH
16 0500– STAND TO
16 0530– PCCs
16 0800– 2nd PLT Cross LD
16 0830– 1st PLT Cross LD
16 1100– OBJ Tiger Seized
16 1200 A– NLT Occupy SBF

(2) CCIR.

(a) PIR:

1. Location and strength of enemy forces along Axis Florida and Axis Georgia.
2. Strength of counterattack and direction of movement.
3. Identify type and size of obstacles along Axis Florida and Axis Georgia.

(b) EEFI:

1. Location of key leaders.
2. Location of company trains.

(c) FFIR:

1. Location of possible IEDs.
2. Loss of one or $\geq$ infantry squads.
3. Civilians on the Battlefield (COB).

(3) Risk Reduction.

(a) MOPP: Level 0

(b) Passage of Lines with B/1-29th IN will be on order and lane will be marked with white engineer tape.

(c) Main effort will conduct final assault after 1st PLT has seized OBJ Bulldog.

(d) Maintain nametag defilade at all times while moving in the BFV.

(e) Do not move in the BFV if internal communication is lost between the BC and the driver.

(4) ROE.

(a) Maintain 50M between personnel and vehicle engagements and 10M between personnel engagements. “Close Kill” within 10M.

(b) Engagement Priorities: See table F-2.

WEAPON	1st PRIORITY	2nd PRIORITY	3rd PRIORITY
25mm BFV	PC	Truck	Troops
TOW	Tanks	PC	Truck
M47	PC	Truck	POVs
AT-4	PC	Truck	POVs
COAX/M240	Troops	Truck	POVs

Fig 3-1

(c) Disengagement Criteria: Destruction of two or more ICVs.

(d) Environmental Considerations: A number of historical burial grounds/sensitive areas are in our AO. They are marked with white signs. They are off-limits for vehicle movement. If you find yourself in one of these areas move out as fast as tactically possible. Report any POL product spills to a cadre member.

(5) Force Protection.

(a) Direct Fire Control Measures:

1. PL Sugar – Shamanski Rd.
2. PL Orange – Resaca Rd.
3. PL Peach – 1st Division Rd.
4. PL Lime – Helmet Trail.

(b) Rehearsal Priorities:

1. Actions on OBJ
2. Actions on Contact
3. Crossing Danger Areas
4. Establish and Mark a Lane

4. SERVICE SUPPORT:

a. Concept of Support: Company trains will remain in AA and displace O/O. Certain elements of the company trains, such as communications and medics, will move forward, but remain one phase line behind the company team. Company trains will conduct emergency re-supply once OBJ Tiger is seized. Priority of re-supply is 2nd PLT, 1st PLT, & HQ. Priority of rearward movement is to friendly casualties, NMC vehicles, and lastly EPWS.

b. Materials and Services.

(1) Class I:

(a) Ration Cycle: M/M/M (CL I will be pushed forward during LOGPAC)
(b) Water: Vehicles will carry 5 gal of water minimum

(2) Class II: None for 48 hours.

(3) Class III: Vehicles will refuel during LOGPAC.

(4) Class IV: Limited supply at the company trains (AA). Coordinate with cadre for equipment required.

(6) Class V: Coordinate with cadre for required amount. Ammo will be pushed forward during LOGPAC.

(7) Class VI: None for 48 hours.

(8) Class VII: The Company maintains two M2A2 ODS floats at the AA.

(9) Class VIII: None for 48 hours.

(10) Class IX: Will be pushed forward during LOGPAC.

c. Medical Evacuation and Hospitalization (CASEVAC).

(1) Company CCP:

(a) Enroute: PL Peach
(b) OBJ: OBJ Bulldog

(2) Casualty Marking: Tracked vehicles with wounded or KIA will be marked with a Red Cross on both sides and in the front to allow priority of movement on MSR.

d. EPWs.

(1) EPW collection point is located at PL Peach
(2) EPWs will be treated IAW Geneva Convention and the 5S.

e. Personnel.

(1) Available replacements will be sent forward from company trains to the platoons at OBJ Tiger during consolidation & reorganization.

5. COMMAND AND SIGNAL:

a. Command.

(1) Company Commander will move one phase line behind the ME (& SE).

(2) Succession of Command: XO (notional), 2nd PL, 1st PL, CO 1SG (notional).

b. Signal.

(1) Frequencies:

(a) BN CMD: 31.100
(b) BN A&L: 41.500
(c) CO CMD: 34.550 (Team #1) / 37.850 (Team #2)
(d) 1st PLT: 41.300
(e) 2nd PLT: 79.900
(f) CO FS: 36.350

(3) Red Star/smoke casualty and request for medical evacuation. White smoke represents effects of friendly indirect fires.

ACKNOWLEDGE: All recipients will acknowledge and understanding.

NO. OF COPIES	ORGANIZATION
1 (PDF ONLY)	DEFENSE TECHNICAL INFORMATION CTR DTIC OCA 8725 JOHN J KINGMAN RD STE 0944 FORT BELVOIR VA 22060-6218
1	US ARMY RSRCH DEV & ENGRG CMD SYSTEMS OF SYSTEMS INTEGRATION AMSRD SS T 6000 6TH ST STE 100 FORT BELVOIR VA 22060-5608
1	DIRECTOR US ARMY RESEARCH LAB IMNE ALC IMS 2800 POWDER MILL RD ADELPHI MD 20783-1197
1	DIRECTOR US ARMY RESEARCH LAB AMSRD ARL CI OK TL 2800 POWDER MILL RD ADELPHI MD 20783-1197
2	DIRECTOR US ARMY RESEARCH LAB AMSRD ARL CS IS T 2800 POWDER MILL RD ADELPHI MD 20783-1197
1	ARMY RSCH LABORATORY - HRED ATTN AMSRD ARL HR M DR M STRUB 6359 WALKER LANE SUITE 100 ALEXANDRIA VA 22310
1	ARMY RSCH LABORATORY - HRED ATTN AMSRD ARL HR ML J MARTIN MYER CENTER RM 2D311 FT MONMOUTH NJ 07703-5601
1	ARMY RSCH LABORATORY - HRED ATTN AMSRD ARL HR MZ A DAVISON 199 E 4TH ST STE C TECH PARK BLDG 2 FT LEONARD WOOD MO 65473-1949
1	ARMY RSCH LABORATORY - HRED ATTN AMSRD ARL HR MD T COOK BLDG 5400 RM C242 REDSTONE ARSENAL AL 35898-7290

NO. OF COPIES	ORGANIZATION
1	COMMANDANT USAADASCH ATTN ATSA CD ATTN AMSRD ARL HR ME MS A MARES 5800 CARTER RD FT BLISS TX 79916-3802
1	ARMY RSCH LABORATORY - HRED ATTN AMSRD ARL HR MO J MINNINGER BLDG 5400 RM C242 REDSTONE ARSENAL AL 35898-7290
1	ARMY RSCH LABORATORY - HRED ATTN AMSRD ARL HR MM DR V RICE BLDG 4011 RM 217 1750 GREELEY RD FT SAM HOUSTON TX 78234-5094
1	ARMY RSCH LABORATORY - HRED ATTN AMSRD ARL HR MG R SPINE BUILDING 333 PICATINNY ARSENAL NJ 07806-5000
1	ARL HRED ARMC FLD ELMT ATTN AMSRD ARL HR MH C BURNS BLDG 1467B ROOM 336 THIRD AVENUE FT KNOX KY 40121
1	ARMY RSCH LABORATORY - HRED AVNC FIELD ELEMENT ATTN AMSRD ARL HR MJ D DURBIN BLDG 4506 (DCD) RM 107 FT RUCKER AL 36362-5000
1	ARMY RSCH LABORATORY - HRED ATTN AMSRD ARL HR MK MR J REINHART 10125 KINGMAN RD FT BELVOIR VA 22060-5828
1	ARMY RSCH LABORATORY - HRED ATTN AMSRD ARL HR MV HQ USAOTC S MIDDLEBROOKS 91012 STATION AVE ROOM 111 FT HOOD TX 76544-5073
1	ARMY RSCH LABORATORY - HRED ATTN AMSRD ARL HR MY M BARNES 2520 HEALY AVE STE 1172 BLDG 51005 FT HUACHUCA AZ 85613-7069

NO. OF COPIES	ORGANIZATION
1	ARMY RSCH LABORATORY - HRED ATTN AMSRD ARL HR MP D UNGVARSKY BATTLE CMD BATTLE LAB 415 SHERMAN AVE UNIT 3 FT LEAVENWORTH KS 66027-2326
1	ARMY RSCH LABORATORY - HRED ATTN AMSRD ARL HR MJK J HANSBERGER JFCOM JOINT EXPERIMENTATION J9 JOINT FUTURES LAB 115 LAKEVIEW PARKWAY SUITE B SUFFOLK VA 23435
1	ARMY RSCH LABORATORY - HRED ATTN AMSRD ARL HR MQ M R FLETCHER US ARMY SBCCOM NATICK SOLDIER CTR AMSRD NSC SS E BLDG 3 RM 341 NATICK MA 01760-5020
1	ARMY RSCH LABORATORY - HRED ATTN AMSRD ARL HR MY DR J CHEN 12423 RESEARCH PARKWAY ORLANDO FL 32826
1	ARMY RSCH LABORATORY - HRED ATTN AMSRD ARL HR MS MR C MANASCO SIGNAL TOWERS 118 MORAN HALL FORT GORDON GA 30905-5233
1	ARMY RSCH LABORATORY - HRED ATTN AMSRD ARL HR MU M SINGAPORE 6501 E 11 MILE RD MAIL STOP 284 BLDG 200A 2ND FL RM 2104 WARREN MI 48397-5000
1	ARMY RSCH LABORATORY - HRED ATTN AMSRD ARL HR MF MR C HERNANDEZ BLDG 3040 RM 220 FORT SILL OK 73503-5600
1	ARMY RSCH LABORATORY - HRED ATTN AMSRD ARL HR MW E REDDEN BLDG 4 ROOM 332 FT BENNING GA 31905-5400
1	ARMY RSCH LABORATORY - HRED ATTN AMSRD ARL HR MN R SPENCER DCSFDI HF HQ USASOC BLDG E2929 FORT BRAGG NC 28310-5000

NO. OF COPIES	ORGANIZATION
1	ARMY G1 ATTN DAPE MR B KNAPP 300 ARMY PENTAGON ROOM 2C489 WASHINGTON DC 20310-0300
	ABERDEEN PROVING GROUND
1	DIRECTOR US ARMY RSCH LABORATORY ATTN AMSRD ARL CI OK TECH LIB BLDG 4600
1	DIRECTOR US ARMY RSCH LABORATORY ATTN AMSRD ARL CI OK TP S FOPPIANO BLDG 459
1	DIRECTOR US ARMY RSCH LABORATORY ATTN AMSRD ARL HR M F PARAGALLO BLDG 459
6	DIRECTOR US ARMY RSCH LABORATORY ATTN AMSRD ARL HR SB A KRAUSMAN BLDG 459