Army Expeditionary Warrior Experiment 2016

Automatic Injury Detection

Technology Assessment

05 October 2015—19 February 2016

Battle Lab Report # 346

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I. EXPERIMENT OVERVIEW

A. Introduction. The Maneuver Center of Excellence (MCoE) hosted Training and Doctrine Command's (TRADOC) Army Expeditionary Warrior Experiment (AEWE) 2016 from October 2015-February 2016. AEWE is the Army's live, prototype experiment campaign focused on the Soldier and small unit. AEWE supports the Joint Capabilities Integration Development System (JCIDS) process with early prototype analysis. It is complimentary to other events in the campaign of learning and supports Force 2025 Maneuver objectives. The experiment was supported by ARCIC, all TRADOC Centers of Excellence, the Army Test and Evaluation Command, the Research, Development, and Engineering Command, the Army Material Systems Analysis Activity (AMSAA), the Army Research Institute, and the Joint Deployable Analysis Team.

B. Purpose. AEWE provides operational insights on experiment objectives by integrating prototype capabilities into an operational environment. These insights are leveraged to enhance the capabilities and effectiveness of the current force, contribute to future force interoperability and effectiveness, and to inform Brigade Combat Team (BCT) modernization efforts. Additionally, AEWE serves as a venue to provide capability developers, the Science and Technology (S&T) community, and industry a repeatable, credible, rigorous, and validated operational experiment venue to support both concept and materiel development. This technology assessment is intended to inform the Army, S&T community and vendor partners on the performance of systems.

C. System Description. The Automatic Injury Detection (AID) is a detection film and Adjustable Bluetooth Low Energy (ABLE) chip that is inserted into the Soldier's body armor carrier (Figure 1). The detection film is a light weight sensor circuit that is printed with conductive ink on a flexible panel. AID is designed to detect gunshot and other penetrations of body armor. Once the circuit on the film is penetrated, the AID sends Nett Warrior a "mayday" message and GPS position of the injured Soldier. This information is transmitted over the network through Rifleman Radio to Nett Warrior equipped leaders.

Figure 1, AID

II. METHODOLOGY

A. Experiment Objectives. The TRADOC Centers of Excellence collaborated to develop five experiment objectives. The objectives are linked to the Army Warfighting Challenges (AWfC) and include the following five functional areas: situational understanding, small unit sustainment, mission command, lethality, and protection and mobility. The five overarching experiment objectives for AEWE 2016 are:

- **How do we improve the small unit's ability to develop and sustain a high degree of situational understanding while operating in complex environments? (Linked to AWfC 1)**

- **How can we improve small unit sustainment to maintain freedom of movement and action during sustained and high tempo operations at the end of extended lines of communication in austere environments? (Linked to AWfC 16)**

- **How can we facilitate effective command post operations, information gathering and intelligence fusion at the company level? (Linked to AWfC 1)**

- **How can we enhance air-ground operations to conduct forcible entry and transition rapidly to offensive operations to ensure access, seize the initiative and defeat the enemy in close combat? (Linked to AWfC 11, 12, 13, 15)**

- **How can we improve protection and mobility at the Soldier and small unit level in a way that contributes to operational maneuverability with improved survivability? (Linked to AWfC 12, 13, 15)**

Nested within the objectives were assessments of forty-five concepts and capabilities that were nominated by both government and industry partners. To ensure the concepts and capabilities informed the objectives, the MCoE required each vendor and government sponsor to provide three objectives for each technology. These five experiment and technology objectives were decomposed into a data source matrix consisting of Essential Elements of Analysis (EEAs), Measures of Performance (MoPs), and Measures of Effectiveness (MoEs). This matrix identified data requirements and served as the basis for both data collection and analysis planning.

B. Design.

1) Personnel and Organization. The MBL provided overarching Mission Command through the coordinated actions of the White Cell, Analysis Cell and Red Cell which provided a realistic environment for the Soldiers and enabled positive experimental control. AEWE's Experimental Force (EXFOR) consisted of a battalion (BN) Headquarters (HQ), a reconnaissance section, an Infantry company HQ, U.S. Infantry platoon, a United Kingdom (U.K.) platoon, and a third platoon portrayed in constructive simulation (Figure 2). The EXFOR was augmented by a platoon from the U.K.'s Three Rifles Regiment and two Military Intelligence noncommissioned officers from the ICoE. The Infantry Company HQ controlled both live and simulated Infantry platoons. The BN controlled the reconnaissance section whose missions supported the EXFOR's maneuver. AEWE's Opposing Forces (OPFOR) consisted of a platoon from the Third Infantry Division, which replicated the TRADOC Threat Emulation Force (TEFOR) G2 developed and approved, Decisive Action Training Environment and

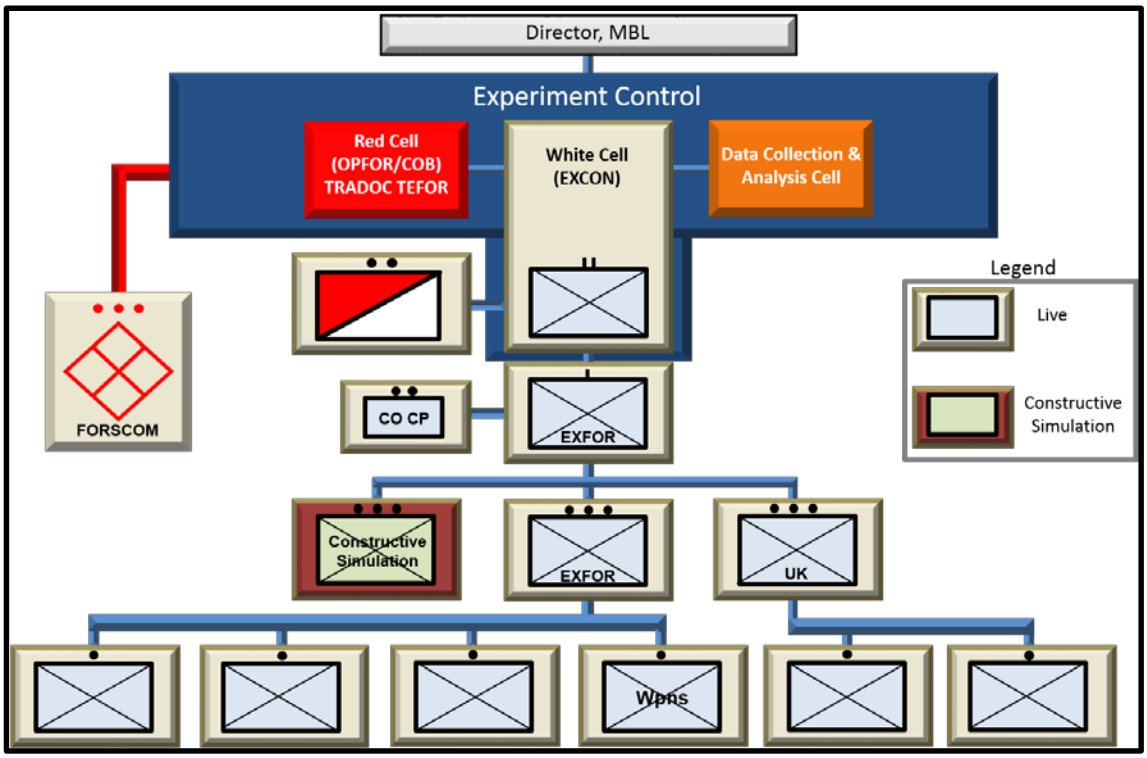

Figure 2, Experiment Organization

Hybrid threat. The OPFOR platoon fielded advanced technologies such as Soldier Borne Sensors, advanced camouflage, and dismounted direction finding equipment.

2) Construct. AEWE 2016 was a live prototype experiment comprised of three distinct phases, each designed to examine the five overarching experiment objectives. The Live Fire Exercise (LFX) phase took place from 06 – 19 October and assessed capabilities that required a live fire venue. The Non-Networked Assessment phase occurred from 19 October – 19 November 2016 and assessed technologies that did not require a tactical network for assessment. AEWE 2016 culminated with a three week Force-on-Force (FoF) phase, 08 – 19 February 2016, consisting of three pilot missions, and two 72 hour continuous operations experimental cases. The mission cases were designed to provide the operational environment necessary to investigate the issues and exercise the participating technologies. Typical mission types in AEWE 2016 were Attack, Defend, Ambush, and Reconnaissance. Vendors provided technology specific New Equipment Training (NET) to ensure Soldiers were proficient in the employment of the technology. Soldiers utilized the technologies during their collective training prior to execution.

3) Data Collection. The MBL analysis team led, coordinated and managed all aspects of data collection planning and execution. This team included members from multiple participating agencies including AMSAA, Intelligence Center of Excellence (ICoE), Cyber Center of Excellence (CCoE) and Subject Matter Experts (SMEs) from the MCoE and ICoE who participated as data collectors. The analysis team collected data through various methodologies to include observations from SMEs, surveys, After Action Reviews, focused interviews, group interviews and experiment excursions designed for a particular capability that could not be addressed during tactical operations.

4) Technology Specific Methodology. AEWE assessed the AID during the LFX Phase of AEWE 16 using live fire, individual movement and knife penetration events.

a) LFX Event. The live fire demonstrated AID's ability to communicate with Nett Warrior and send the proper message when penetrated. Soldiers inserted the AID into a standard issue Improved Outer Tactical Vest (IOTV) with the detection film located in the back of the plate carrier (between the Kevlar insert and the outer shell) which ensured penetration of the AID using a standard issue M9 (9mm Berretta) and M4. The M9 and M4 target mannequins were placed seven and 160 meters from the firing line with a Rifleman Radio located approximately ten meters from each target. The MBL selected two Soldiers to conduct the firing and issued each Soldier five rounds of ammunition for their weapon. Upon command from the MBL, each Soldier fired their weapon at their respective targets with the analysis team recording hits, misses, and Nett Warrior status in between rounds.

b) IMT Event. The IMT event was conducted to assess AID's false report rate. Eight Soldiers were selected to conduct the IMT exercise. AEWE issued two Soldiers AID equipped IOTVs and gave instructions to conduct five – 3-5 second rushes. The NETT Warrior Riflemen Radio was carried by a data collector to ensure connectivity during the event. Upon completion of the 3-5 second rush portion, the Soldiers then

each conducted an approximately 15 meter high crawl. During each movement the NETT Warrior EUD was monitored for false positive messages.

c) Knife Penetration Event. The knife penetration exercise demonstrated AID's ability to detect penetration from a blade. The Analysis team conducted the event using a lock blade pocket knife and AID equipped IOTV. The analysis team stabbed an AID equipped vest four times recording penetrations and Nett Warrior Status in between strikes.

III. SUMMARY

A. Findings. Soldiers were able to install the AID detection film in the IOTVs without difficulty. In all instances, the system successfully communicated with Nett Warrior and transmitted the 10 digit Global Positioning Satellite (GPS) location of the injured soldier as soon as the initial penetration occurred. The AID did not generate any false reports during the assessment.

B. Summary. The AID was easy to use and well received by Soldiers. AID's ability to detect penetrations and provide a location allows for immediate identification of injured Soldiers and increased situational awareness. Once AID detects a penetration, it transmits a 10 digit GPS location to leaders equipped with Nett Warrior. This information could potentially reduce medical response time in the "Golden Hour," thus increasing survivability for casualties.

IV. APPENDICES

Appendix A. Terms and Abbreviations

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Terms & Abbreviations

AEWE	Army Expeditionary Warrior Experiment
AID	Automatic Injury Detection
AMSAA	Army Materiel Systems Analysis Activity
ARCIC	Army Capabilities Integration Center
ARDEC	US Army Research Development and Engineering Command
ARI	Army Research Institute
ARL	Army Research Lab
ATEC	Army Test and Evaluation Command
AWfC	Army Warfighting Challenge
BCT	Brigade Combat Team
Bn	Battalion
CCoE	Cyber Center of Excellence
CoE	Center of Excellence
EEA	Essential Elements of Analysis
EXFOR	Experimentation Force
FoF	Force-on-Force
ICoE	Intelligence Center of Excellence
IMT	Individual Movement Technique

JCIDS	Joint Capabilities Integration Development System
JDAT	Joint Deployable Analysis Team
LFX	Live Fire Exercise
LOE	Limited Objective Experiment
MBL	Maneuver Battle Lab
MFLTS	Machine Foreign Language Translation System
MoEs	Measures of Effectiveness
MoPs	Measures of Performance
NATO	North Atlantic Treaty Organization
NET	New Equipment Training
OPFOR	Opposing Forces
PEO	Program Executive Office
RDEC	Research Development and Engineering Command
SME	Subject Matter Expert
S&T	Science and Technology
TDA	Tables of Distribution and Allowances
TRADOC	Training and Doctrine Command
TEFOR	Threat Emulation Force
U.K.	United Kingdom
U.S.	United States