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Examining the Army’s Future Warrior

Force-on-Force Simulation of Candidate Technologies

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Prepared for the United States Army
Approved for public release, distribution unlimited
The research described in this report was sponsored by the United States Army under Contract No. DASW01-01-C-0003.
Summary

Introduction

The U.S. Army is in the process of adapting to meet the needs of the new millennium. The vision for accomplishing this, as defined by the senior Army leadership, will ultimately lead to an increase in the Army’s ability to quickly and effectively respond to situations across a full spectrum of contingencies. Much of this work has focused on examining alternative vehicle platforms and technologies for the Future Combat Systems (FCS) concept.\(^1\) As a result, integrating the FCS concepts with future dismounted operations has not been given comparable levels of attention, although soldier systems occupy a prominent position in Army and Lead System Integrator (LSI) documents.\(^2\) The Army Science Board (ASB) Summer Study attempted to balance the picture by focusing on the future soldier.\(^3\) The purpose of the work reported here is to provide an initial quantitative exploratory analysis of objective soldier options, within the context of several

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\(^3\) This study and many other examinations of future soldier systems are reported in the ASB 2001 Summer Study on the Objective Force Soldier/Soldier Team. An electronic copy can be found at https://webportal.saalt.army.mil/sard-asb/ASBDownloads/OFS-Vol-III-All.pdf.
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stressing scenarios. The effort focuses on a series of research questions, starting with How might a current-generation dismounted force perform in a challenging combat situation? and ending with What are the impacts of key, high-leverage technologies in combat? The report also references relevant research prior and subsequent to the ASB summer study.

Approach

Our approach entails a constructive simulation effort that centers on using Janus and a set of locally connected models to represent dismounted operations. Two scenarios were examined, the first a dismounted Blue force attack on a Red force defending inside a treeline, and the second a convoy operation through an urban area. A high-resolution terrain database describing Fort Hunter Liggett was modified with additional foliage to represent the treeline scenario, while data from Sarajevo were used to represent the urban convoy operation. The primary focus of this work was on the treeline scenario.

Before using Janus and associated models, we examined the benefits possible by changing to more sophisticated models: JCATS (Joint Conflict and Tactical Simulation) and OTB (OneSAF Testbed). Each of these models offers advantages when representing urban terrain, including the modeling of noncombatants and presenting the results in the form of 3-D visualization.

Findings

The bulk of our work focused on use of the treeline scenario. Here, a 40-soldier platoon of Blue dismounted soldiers attacked a 13-soldier squad of Red infantry dug into a treeline. The attack was made under covering fire by machine guns, with the force advancing in alternat-

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4 Janus is a system-level force-on-force simulation originally developed by Lawrence Livermore National Laboratory.
ing sprints. We started with a current-generation force, with riflemen with M-16s, M-240 machine gunners, and grenadiers, facing an enemy squad with AK-74s and machine guns. The current Blue force was basically unsuccessful, losing half of its number while the enemy also lost half of its force.

Improvements to the force were tested one at a time and then in combination, and the results (stated as a ratio of improvement to the baseline) are shown in Figure S.1. Adding stealth and smoke to Blue did not improve the outcome, instead simply reducing the typical range of detections, shots, and kills. Adding body armor, the OICW

Figure S.1
LER Improvements as Individual Changes and Then Combinations of Changes Are Made to the Blue Force (Base given value of 1 in chart, actual base case LER = 0.38)

NOTE: BA = Body Armor
IDF = Indirect fires.
RANDMG140-S.1
weapon (Objective Individual Combat Weapon—a rifle and precision explosive round combination—now designated the XM-29), and its forward-looking infrared (FLIR) sensor each helped, but none achieved more than a moderate improvement to the outcome. Linking the force to indirect fires (we used precision cannon fire and missile-based area fires with dual-purpose improved conventional munition—DPICM) attrited some 25 percent of the enemy force and suppressed another portion of it for a short period.

The real differences in outcome came when combinations of improvements were made. When indirect fire and the OICW weapon and FLIR were used, the loss-exchange ratio (LER, here the number of enemy dismounts killed divided by the number of Blue dismounts killed) improved fivefold. When body armor was then added to this mix (able to stop most small arms fire), the LER improvement reached seventeen times the original level. This synergy appeared to result from the indirect fire attriting the part of the enemy force (machine gun teams) that was the main threat to body armor, thus enabling massed Blue fires to be more effective.

Some additional excursions were also revealing. Additional speed of movement by Blue did not help, again just reducing the range of engagement, but slower movement actually hurt. A high level of body armor protection (90 percent against the 7.62 machine gun) made a substantial difference, but there is some question whether this level of body armor protection may be achievable. Surprisingly, equipping only one-sixth of the force with OICW resulted in roughly half the benefits of equipping the entire force. Alternatively, adding six armed unmanned ground vehicles (small UGVs about 1 meter tall) to the Blue force increased survivability of manned systems and improved lethality against the enemy. In fact, the combination of adding six armed UGVs and equipping six soldiers with OICW resulted in performance equivalent to equipping all the Blue force with OICW.

_____5 In the study we assumed the basic room-temperature FLIR planned for the OICW (similar to Javelin FLIR performance), but we also examined the use of a cooled second-generation FLIR.
The second, convoy scenario showed that smoke and UGVs can make a difference, if Blue is not attacking a fixed position. Use of smoke and addition of unmanned vehicles gave much greater survivability in the urban passage, especially when the UGVs were armed.

Conclusions

We found that even in a very stressing attack scenario, a Blue dismounted force with a combination of technologies could defeat an entrenched Red force. The key improvements in this scenario were the OICW weapon and FLIR, links to indirect fires, and capable body armor. In other scenarios, use of obscurants and UGVs may also make significant contributions to survivability. The importance of synergies between systems was especially evident in the studies we made.

Tradeoffs were evident in many runs. Equipping only a portion of the force resulted in a more than proportional improvement in outcome, indicating decreasing marginal returns. Reachback fires were useful, but they required substantial firepower to achieve a limited number of kills of dug-in forces.

This quick-reaction study relied on Janus for most of the analytic findings. Our parallel examinations of JCATS and OTB showed that these simulation tools had great potential for modeling interior fighting, representing noncombatant interactions and collateral damage, and visualizing event chains. At the same time, more needs to be done using man-in-the-loop simulation (especially for command and control issues) and field experiments. The scale of the analysis also needs to increase, with studies devoted to such questions as how closely linked the dismounts should be to the FCS vehicles, the linkages needed for controlling air and ground robotics, and development of new MOEs and MOPs (measures of effectiveness and perform-

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6 While we did not directly compare Janus, JCATS, and OTB across the same scenarios, we found that Janus and JCATS had roughly similar outcomes in similar situations. A full determination of consistency between these models needs to be made.
ance) for operations in complex terrain. All these aspects should be explored in upcoming analytic efforts.