Modeling Human Factors for the Soldier Systems Enterprise Architecture

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Abstract: The Soldier System Enterprise Architecture (SSEA) is a collaborative effort to standardize systems engineering practices in the Army. The reference architecture for SSEA is tied into a Distributive Modeling Framework (DMF) that allows for the analysis of human systems integration, human performance optimization, and materiel development. This study sets out to enhance the existing modeling framework by adding dimensions of human capabilities into existing models. In particular, movement models were analyzed and improved to account for Soldier load and fitness levels. Additionally, shooting models were enhanced to account for Soldier weapon, firing position, skill level, and exhaustion level. These model updates allow for better analysis of Soldier performance during a standard movement to contact mission. The models updated with human factor inputs were compared to existing models and demonstrated a higher degree of fidelity.

Keywords: Model, Human Performance, Soldier Load

1. Background

In recent years, the Army has fielded various forms of equipment for dismounted Soldiers, which have brought both advantages and disadvantages to battlefield engagements. On one hand, these fielding initiatives added new capabilities to the Soldier; however, they have also resulted in Soldiers being significantly loaded. The physical load is often upwards of 100 pounds and significantly restricts Soldier movement. This issue partially arose due to the technologies not being properly integrated onto the Soldier. For example, the Improved Outer Tactical Vest (IOTV) was not designed with the Soldier’s task of driving in tightly enclosed vehicles for extended periods of time. Additionally, the IOTV did not account for the effects of bearing the large load in hot desert environments. Another fundamental cause for Soldier overloading is the Army’s reliance on materiel solutions, rather than any of the other potential techniques to close capability gaps.

In an attempt to lessen the negative impacts of equipment on Soldier performance, the Army is taking a systems engineering approach that treats the Soldier as a system. To achieve this goal, the Natick Soldier Research and Development Center (NSRDEC) is developing the Soldier System Enterprise Architecture (SSEA) in order to quantify and optimize Soldier performance in relation to his/her equipment and task. This study supports the SSEA in enhancing its modeling to more holistically account for the Soldier as a system.

1.1 Overview of Soldier System Enterprise Architecture

The SSEA strives to integrate Soldiers, small units, equipment, and tasks into a complex set of mission scopes. A primary goal of the SSEA is to nest with the Department of Defense’s Doctrine, Organization, Training, Materiel, Leadership, Personnel, and Facilities (DOTMLPF) concept, which outlines methods for the DoD to address capability gaps. SSEA’s holistic systems approach seeks to move away from the DoD’s tendency to provide materiel solutions to these capability gaps by fully accounting for the effects that materiel solutions have on Soldier performance.

Modeling and simulation are key components for Soldier performance analysis in the SSEA. The SSEA ties into a Distributed Modeling Framework (DMF), where individual stateless models exist in a cloud setting. Since the models are stateless, a number of models can be linked together through their inputs and outputs. The existing DMF for the SSEA includes a collection of standard military models; many of these models need to be updated to account for the full Soldier as a system.

1.2 Soldier-Equipment-Task Framework

The SSEA uses the Soldier-Equipment-Task (SET) Framework as its architecture to view the Soldier as a system. The SET Framework is shown in Figure 1. The SET Framework’s purpose is to provide new constructs and approaches for how to