

## **Improving Terrain Analysis within Combat Modeling Programs**

**Zachary Kunkle, Matthew Williams, Daniel Park and Robert Kewley**

Department of Systems Engineering  
United States Military Academy  
West Point, New York

Corresponding author's Email: [Zachary.Kunkle@usma.edu](mailto:Zachary.Kunkle@usma.edu)

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**Abstract:** This project implements decision algorithms in combat modeling to enhance artificial intelligence (AI) capabilities to analyze terrain. In conjunction with Edgewise Technologies and the Army Research Lab (ARL) in the Synthetic Natural Environment Division from the Army Simulation and Training Technology Center (STTC), the project developed multiple value model algorithms in the Component Object Framework for Experimentation and Evaluation (COFFEE) behavior simulator. The COFFEE program is a rapidly changing user interface system that examines the interactions between dismounted friendly and enemy forces in accordance with doctrine while considering the military aspects of terrain. Stakeholder analysis suggested that terrain analysis and autonomy of AI were two of the most important features missing from existing dismounted combat models. In order to meet these requirements the mission task of reacting to contact was developed in COFFEE. Within the program AI will respond to enemy engagements, evaluate multiple options based on terrain features, and choose the best outcome from calculated values. In order to solve this complex issue, the development team utilized concepts of system engineering to ensure the derived solution or changes to the existing combat modeling programs achieved the requirements. The literary review and stakeholder analysis, provided awareness to the challenges of AI in the areas of terrain analysis, improper enemy identification, doctrinal usage, and inflexible behavior. To solve these four issues, we developed the following top level requirements: Analyze terrain, appropriately engage enemy, correct usage of doctrine, and autonomous action by program entities. The mission task "React to Contact" was chosen as it best demonstrated the ability to portray all of these requirements. The mission was broken down into subtasks, which were the foundations of each sprint in the software development. The subtasks within the sprints were validated using video presentation of COFFEE created by the lead program developer. The videos showed that COFFEE correctly calculated and executed the developed algorithms, thus validating the established requirements. The creation of "React to Contact" within COFFEE shows how tactical terrain analysis and decision algorithms can be implemented to mitigate the current AI shortfalls of existing combat modeling programs.