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HOLOGRAPHIC SIMULATION OF SYNTHETIC BATTLEFIELD ENVIRONMENTS

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ABSTRACT

Autonomous seeker systems are comprised of imaging sensors coupled with signal-processing algorithms and the on-board processing power to perform engagement, tracking, and terminal guidance operations against a target or threat. Exhaustive testing of these systems is accomplished using simulation environments with high-resolution terrain, vehicle and discrete object models. With the advancement of seeker systems, improved synthetic simulation imagery is required, which drives the need for higher fidelity and higher resolution models. However, development and evaluation of 3D models using standard 2D computer displays is cumbersome and tedious. Further, configuration and evaluation of battlefield engagements - from mission planning, to pre-flight analysis, to post-flight reconstruction - lack simulation tools that provide a collaborative and holistic perspective of the scenario. The developed holographic simulation tool coupled the Microsoft HoloLens Augmented Reality (AR) device provides a platform for evaluating synthetic battlefield environments as well as terrain, vehicle, and object models that comprise them.

1 INTRODUCTION

Our simulation tool using the Microsoft HoloLens augmented reality device provides an engaging 3D environment for modeling and simulation efforts for military applications. It is designed to enable multidisciplinary teams of engineers to collaborate and provide planning, analysis and evaluation for tactical and strategic missile systems. The tool can be used to evaluate individual terrain, target and discrete object models and it can be used to configure and analyze mission scenarios in a 3D collaborative environment.

2 TARGET AND TERRAIN MODEL INSPECTION

Simulation object models include target models and discrete object models. Along with the terrain clutter, these models are used to exercise the signal-processing algorithms and are high fidelity.

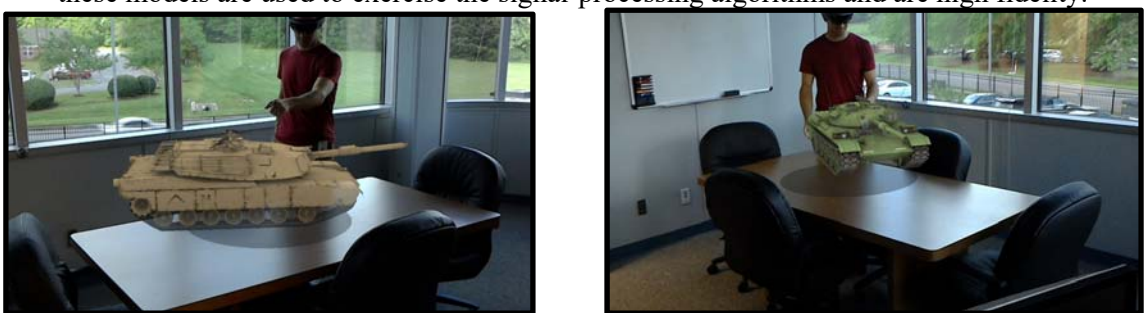

Figure 1: Target models in Holographic Space using AR device.

Target models consist of any target or threat that a missile system is tracking. Discrete object models represent scene clutter and refers to any man-made objects (e.g., buildings and bridges) or any vegetation objects (e.g., trees). Modeling geometric objects, whether they are thermally solved, attributed with materials, or applied with high-resolution empirical textures, requires significant time and assets. The holographic tool provides developers with the ability to rotate, enlarge, and walk around objects in holographic space. For instance, MMW band scene generation requires RF models which contain scatterers that are azimuth-dependant. The application's immersive nature allows objects to be seen at any angle.

Terrain databases used in missile simulation environments represent background clutter and require multi-layered characterization and scenario-specific terrain data to produce a useable terrain model. This includes the terrain geometry in 3D facets, the terrain clutter classification, and the thermally solved temperature map at the exact scenario time. Like the threat and discrete object models, the level of immersion of the augmented reality environment allows close-up inspection of these model layers. The 3D inspection also allows for evaluation and identification of problem areas in source terrain data.

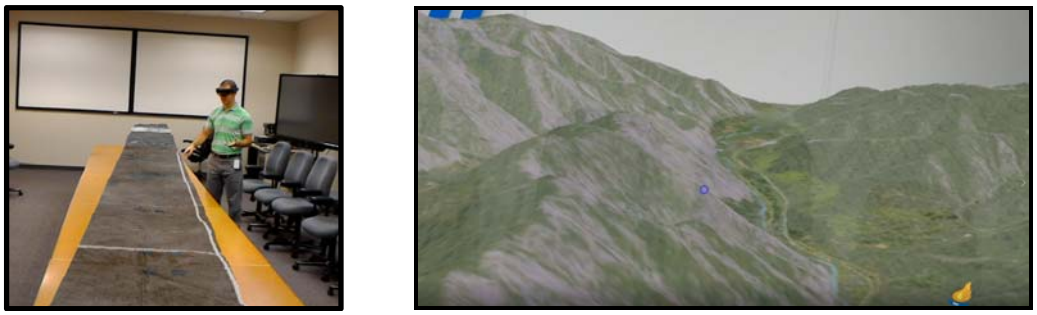

Figure 2: Terrain models with thermal map texture (left) and visible texture (right).

3 BATTLEFIELD SIMULATION

Our simulation tool can pull together terrain, target, and discrete objects in a fully synthesized scene. Adding target motion and missile trajectories provides for full-scale tactical or strategic scenario execution. This capability can be used for mission planning and scenario development, pre-flight analysis or post-flight reconstruction. It allows scenario developers to explore the interaction between the target models, the terrain, and the sensor viewpoints in a 3D immersive environment. The 3D holographic rendering can be performed with in-band IR empirical textures, visible textures or classification textures.

Figure 3: Holographic simulation of tactical scenario (left) with collaborative viewing (right).