

Demonstrating a Weather Simulation Federate for Distributed Mission Operations

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Military modeling and simulation (M&S) enables scientists, engineers, planners and warfighters to operate in a combat environment that is non-destructive, reproducible, and, ideally, realistic. Although the key performance parameters for each of these groups are somewhat different, the realism of the combat environment is a critical component to any meaningful outcome. Within the simulation domain, representing the natural environment—atmosphere, ocean, and terrain—is among the most challenging of tasks. Weather affects combat operations through communications, platforms, sensors, and weapon systems, driving operational planning and tactical re-planning; weather also helps identify asymmetries in Red and Blue force capabilities. Simulated combat should be similarly affected if these simulations are to deliver value in training and mission rehearsal.

To meet this challenge, we must address broad issues in **engineering content, simulation consistency, and dynamic representation**. Content required by physical models rarely matches available weather data in parameters, time or spatial resolution; fast, effective transformation from weather content (e.g. temperature, humidity) to engineering content (e.g. transmissivity by wavelength) is required to support live, virtual and constructive simulation. Consistency in simulation requires that all federates see and respond to this content similarly; to ensure a fair fight, for example, F-15C and F-16CM federates should be similarly affected by clouds in their internal models of electro-optical or infrared (EO/IR) targeting. Finally, the weather scenario and associated engineering content should be dynamic, aligned with training objectives and modifiable by exercise controllers to increase or decrease difficulty in real time while maintaining a consistent environment representation across federates.

The DoD, Navy and Air Force have made progress in addressing these issues with active research and development. In this paper, we outline current Air Force and DoD efforts, then discuss the mid and near-term gaps in natural environment representation. We then present ongoing research and development to help close these gaps and to more fully integrate weather into Distributed Mission Operations (DMO) and, ultimately, improve the combat realism of simulations and the combat readiness of our Airmen.

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