

Title: The Joint Fires Rehearsal Center and the Future of SOF Mission Readiness Through AI-Enabled Synthetic Environments

Authors:

Joshua Ridley, AI Lead JFRC

Hunter Miller, Innovation and Integration Lead JFRC

Track: Mission Readiness

Preparing Special Operations Forces for modern conflict requires more than rehearsal against a scripted enemy in a generic environment. It requires synthetic spaces that reflect the actual complexity of the battlespace, populations that behave, adversaries that adapt, and terrain that matters. The Joint Fires Rehearsal Center exists to make that possible.

The JFRC serves as SOCOM's primary venue for mission rehearsal, distributed mission operations, and AI-enabled wargaming. It sits at the intersection of Joint Staff doctrine and JSOC operational execution, functioning as the place where emerging technology gets tested against real warfighter requirements and either proven or set aside. The JFRC's role spans the full readiness cycle, from pre-mission rehearsal through force-on-force wargaming to post-event analysis, and each phase places specific demands on the fidelity and responsiveness of the training environment.

Two AI-driven capabilities are changing how the JFRC meets those demands.

The first addresses environment production. Generating geographically accurate, operationally relevant terrain has historically been a weeks-long manual process that rarely aligned with actual planning timelines. The JFRC now uses AI-enabled geotypical world generation to produce photorealistic environments at planetary scale, covering terrain, structures, and vegetation, in hours rather than weeks. That compression matters because rehearsal only works when the environment reflects where the force is actually going.

The second addresses population behavior. A geographically accurate environment with no behavioral population is still a hollow training problem. The JFRC has integrated a distributed simulation architecture that sustains up to one million cognitive virtual actors concurrently, including civilian populations, adversarial networks, and neutral actors, each running emergent Pattern-of-Life behavior. These populations update in response to social media injects, kinetic events, and information environment changes without requiring manual scripting. Adversarial agents adapt using reinforcement learning. The training value is that operators and battle staffs are no longer working against a predictable scenario. They are working against an environment that responds to what they do.

When these two capabilities operate together, the JFRC can generate a mission-relevant environment and populate it with behaviorally realistic actors in a fraction of the time previously required. Scenario preparation that once took months has been accomplished in hours. That is not a projected outcome. It was demonstrated at a Joint Staff-level demonstration in 2025.

This presentation covers how the JFRC built and operationalized this capability, what was learned through integration, and what this approach means for mission readiness across the broader JLVC enterprise.