

Expeditionary Mesh for GNSS-Denied Operations

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What Expeditionary Operation Requires

Expeditionary deployments occur in environments where pre-positioned communication infrastructure is absent or destroyed. Tactical military deployments to areas without prior presence. Disaster response after hurricanes, earthquakes, or wildfires that destroy local communications. Critical-infrastructure restoration after attacks or natural events. Each scenario shares a structural property: the responding force must establish communication capability that did not exist before its arrival.

Current architectures for expeditionary communication depend on pre-positioned tactical infrastructure (tactical communications networks, deployable cellular, satellite uplink for centralized routing) or on improvised connectivity that lacks credentialing infrastructure. Both patterns produce structural fragility.

Why Pre-Positioned Infrastructure Is the Wrong Architectural Assumption

The pre-positioned-infrastructure assumption fails most when needed most. Tactical operations into denied terrain. Disaster response after major events that destroy infrastructure. Restoration of critical infrastructure attacked by adversaries who specifically targeted the connectivity layer. The deployment scenarios where

expeditionary mesh actually matters are exactly the ones where the assumption breaks.

The architectural answer is mesh that emerges from the responders themselves. Each responder carries a conforming device. The collective responder population is the mesh; observations and policy propagate through the responders' physical movement; credentialing flows through the credentialed authorities that descend the responder force's hierarchy.

How Responder-Native Mesh Operates

Each responder's device is credentialed by the responding authority before deployment. As responders move into the operating area, their credentialed devices establish mesh connectivity through whatever transport is available (peer-to-peer radio, locally-improvised relay, intermittent satellite uplink, eventual restoration of cellular). Credentialed observations and policy propagate through the responder population's collective movement.

Mobile store-and-forward is the structural element that makes this work. A responder operating in a partition carries observations and policy across the partition; reconnection to other responders propagates the carried content. The architecture supports continuous operation under varying connectivity rather than failing when continuous connectivity is unavailable.

What This Enables for Tactical and Disaster Response

Tactical operations gain mesh capability that does not depend on pre-positioned tactical infrastructure. The responding force is the mesh; the architectural primitive provides the credentialing and propagation that current tactical communications require pre-positioned hardware to provide.

Disaster response gains mesh capability that survives the disaster itself. Responders entering a destroyed-infrastructure area carry mesh connectivity with them. Credentialing flows through the responding-organization hierarchy. The patent positions the primitive at the layer where current expeditionary communication architecture has structural fragility.