

# Running a Mesh-Enabled EMCOMM Exercise

**Planning Note:** This page is a planning and evaluation guide for emergency communications exercises that incorporate LoRa mesh alongside traditional voice operations. Use this as a template and adapt to your local group's capabilities, geography, and served agency relationships.

## Why Combined Voice + Mesh Exercises?

Training separately on voice and mesh produces operators who can use each system independently. Combined exercises reveal how the systems interact, where they complement each other, and - critically - where operators might accidentally rely on mesh when they should use voice or vice versa. Combined exercises also let you measure mesh performance in realistic field conditions before relying on it in an actual emergency.

## Scenario Design

### Scenario Elements That Benefit from Mesh

- Multiple geographically dispersed field teams that need to track each other's positions
- Served agency location (shelter, hospital, EOC staging area) that needs to report resource status periodically
- Net control station that needs to track field team positions without consuming voice net time for position reports
- A simulated infrastructure failure (repeater "goes down" at a pre-planned time mid-exercise) to test mesh as a fallback

Sample Scenario: [Earthquake Response](#), Day 1

SCENARIO: 6.2 magnitude earthquake, 0730 local time.

Infrastructure status: Cell towers out, internet out, primary repeater unknown (simulate partial coverage).

ARES activation: County EC activates all available operators.

Objectives: - Establish EOC comms link (primary: voice on simplex; supplemental: mesh) - Assess four pre-designated shelter sites (teams of 2 per site) - Report shelter status (capacity, occupancy, needs) every 30 minutes - Track all field team positions continuously - Pass a minimum of 10 formal ICS-213 messages via mesh

Inject at T+60 min: Primary simplex frequency congested; shift mesh position reporting to free up voice channel for priority traffic.

Inject at T+90 min: Shelter #3 reports mass casualty event; all traffic deprioritized except medical coordination.

# Pre-Positioning Infrastructure

## Infrastructure Checklist (T-7 days before exercise)

- Identify all exercise areas and map expected operating locations
- Identify elevated relay sites within exercise area (hilltops, buildings, repeater sites)
- Deploy solar relay nodes at 1 - 3 elevated sites at least 24 hours before exercise
- Verify relay node solar charging is functioning (check battery voltage)
- Test message delivery from all expected field team operating areas to EOC node
- Configure all nodes with exercise channel (separate from operational channel)
- Assign node names following naming convention (e.g., RELAY-HILLTOP-1, FIELD-TEAM-A)
- Verify all field team nodes have GPS lock in outdoor test
- Brief all participants on channel configuration before exercise day
- Assign backup power (charged batteries or power banks) to all deployed nodes

## Assigning Mesh Roles to Participants

Role	Responsibilities	Equipment
<b>Mesh Coordinator (EOC)</b>	Monitors mesh map at EOC; logs all mesh message traffic; escalates time-sensitive messages to voice net control; manages mesh channel discipline	Laptop running Meshtastic web client with map view; dedicated EOC mesh node with antenna

Role	Responsibilities	Equipment
<b>Field Team Leader</b> (per team)	Sends periodic status reports via mesh; monitors team position on <a href="#">Meshtastic app</a> ; escalates voice if mesh delivery fails	Meshtastic handheld node; phone running Meshtastic app (BLE connected)
<b>Relay Node Monitor</b>	Checks relay node status periodically; adjusts or repositions if coverage is inadequate; troubleshoots connectivity issues	Laptop or phone with access to relay node; spare node and hardware
<b>Served Agency Liaison</b> (if applicable)	Operates mesh node at served agency location; sends structured status reports; reports mesh problems to field team leader	Pre-configured Meshtastic node; phone or tablet with Meshtastic app
<b>Exercise Evaluator</b>	Records all mesh message delivery data (sent time, received time, recipient); tracks voice net traffic for comparison; notes any mesh failures or anomalies	Log sheet or tablet; Meshtastic client with message log visible

# Evaluating Performance: Key Metrics

## Message Delivery Rate

The primary mesh performance metric is the percentage of sent messages that were received by the intended recipient within an acceptable latency window. Calculate separately for:

- Direct node-to-node (single hop) delivery rate
- Multi-hop delivery rate (messages relayed through 2+ hops)
- Delivery rate under different field conditions (urban, rural, elevated)

## Latency Measurement

Record the timestamp when each message is sent and the timestamp when it is confirmed received at the destination. Meshtastic's message log provides send time; the receiving node's log provides receive time. Target latency benchmarks:

Hop Count	Acceptable Latency	Concerning Latency
Direct (0 hops)	< 2 seconds	> 5 seconds
1 hop	< 5 seconds	> 15 seconds
2 - 3 hops	< 15 seconds	> 30 seconds
4 - 7 hops (max)	< 30 seconds	> 60 seconds

# Net Efficiency Comparison

Record the number of voice net transmissions consumed for position reports and status updates before mesh was deployed vs. after. A successful mesh integration typically reduces voice net traffic by 30 - 60% for routine status/position traffic.

## Post-Exercise Debrief Template

### Exercise After-Action Report: Mesh Component

**Exercise Name:** \_\_\_\_\_

**Date:** \_\_\_\_\_ **Duration:** \_\_\_\_\_

**Participants:** \_\_\_\_\_ **Mesh Nodes Deployed:** \_\_\_\_\_

#### Quantitative Metrics

- Total mesh messages sent: \_\_\_\_\_
- Total mesh messages received at intended destination: \_\_\_\_\_
- Message delivery rate: \_\_\_\_\_%
- Average delivery latency (single hop): \_\_\_\_\_ sec
- Average delivery latency (multi-hop): \_\_\_\_\_ sec
- Voice net transmissions for position/status BEFORE mesh: \_\_\_\_\_
- Voice net transmissions for position/status WITH mesh: \_\_\_\_\_
- Voice net efficiency improvement: \_\_\_\_\_%
- Infrastructure node failures or outages: \_\_\_\_\_

#### Qualitative Assessment

- What worked well with mesh integration?
- What failed or caused confusion?
- Were there coverage gaps? Where?
- Did any operators misuse mesh (sent life-safety traffic that should have been voice)?
- Was the Mesh Coordinator role effectively staffed?
- Were served agency liaisons able to use mesh without difficulty?

#### Corrective Actions

#	Issue Identified	Corrective Action	Owner	Due Date
1				
2				
3				

## Recommendations for Next Exercise

- Additional relay nodes needed at: \_\_\_\_\_
- Training improvements needed: \_\_\_\_\_
- Equipment changes recommended: \_\_\_\_\_
- SOP changes recommended: \_\_\_\_\_

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