Deploying Mesh Networks in Disaster Scenarios

Overview

Deploying a LoRa mesh network during an active disaster differs significantly from a planned exercise. Speed, improvisation, and integration with an active ICS structure are paramount. This page walks through the complete deployment sequence from pre-event staging through live operations.

> **Mesh is a supplement, not a lifeline.** LoRa mesh (Meshtastic/MeshCore) is **best-effort with no guaranteed delivery**: messages can silently fail to arrive, the shared half-duplex channel saturates under heavy load, and coverage depends on powered relay nodes being in range. It is not a replacement for 911, NWS alerts, or licensed amateur/voice nets. For any life-threatening emergency, use 911/voice with confirmed receipt first; use mesh as a fallback when those are unavailable, and treat mesh status/position as supplementary.

Pre-Event Staging

The most effective disaster mesh deployments begin well before the event. Pre-staging includes:

- **Fixed relay nodes at key sites**: EOC, hospitals, Red Cross shelters, CERT caches, and strategic high-elevation points (water towers, fire stations) should have permanently installed relay nodes maintained on standby power.
- **Go kit pre-positioning**: Portable node kits stored at ARES/RACES deployment caches, pre-configured with the operational channel and node names.
- **Firmware and configuration freeze**: Two weeks before a forecast event (hurricane, wildfire season), freeze firmware versions and push final channel configurations. Do not update during an active event.
- **Battery maintenance**: Store lithium cells (including LiFePO4) at approximately 40-60% state of charge during standby to limit calendar aging; top up to full only in the 24-48 hours before expected deployment. Never charge any lithium chemistry, including LiFePO4, below 0 °C (32 °F).

Rapid Deployment Sequence

1. **Receive activation order** from COML or ARES EC. Confirm assigned tactical node name, channel plan, and check-in frequency and interval.
2. **Travel to assigned position** with go kit. Log departure time in ICS 214.
3. **Conduct site survey**: Identify best antenna elevation point. Note any obstructions (buildings, terrain, foliage).
4. **Deploy antenna**: Elevate to maximum practical height. Secure coax and weatherproof connections.
5. **Power up node**: Allow 2-5 minutes for GPS cold fix. Confirm node name and channel in Meshtastic app.
6. **Test connectivity**: Send a check-in message to EOC-MAIN. A green checkmark in Meshtastic confirms a protocol ACK for a direct message (best-effort, not a guaranteed end-to-end delivery and not proof a human read it). For anything life-safety, confirm with a human reply before relying on it.
7. **Report to COML**: Via voice radio or mesh message - node name, location (GPS coordinates or address), battery level, estimated endurance, node count visible.
8. **Begin ICS 214 log**: Record activation time, location, initial node count, and all subsequent events.

Antenna Elevation Strategies

In disaster environments, traditional antenna mounting points may be unavailable or unsafe. Practical options:

- **Vehicle rooftop**: Magnetic mount antenna on a metal vehicle roof is fast to deploy and provides 2-4 meters of elevation above grade. Most effective in flat terrain or when working in a parking lot staging area.
- **Temporary mast**: A 3-6 meter telescoping fiberglass push-up mast (e.g., MFJ-1910 or equivalent) with a ground stake can be deployed in under 5 minutes by one person. Provides significant elevation advantage.
- **Existing structure attachment**: In urban rubble environments, attaching a whip antenna to any surviving elevated structure (fence post, utility pole stub, intact second-floor window frame) can provide 3-6 meters of elevation with minimal equipment.
- **Balloon lift**: For extended fixed relay in flat terrain, a helium balloon can lift a lightweight node and antenna to 10-30 meters. Requires tether management and calm wind conditions. Tethered/moored balloons may be subject to FAA rules (14 CFR Part 101), including height, marking, and notification requirements, and pose hazards near power lines and aircraft - check FAA requirements and local conditions before deploying.

Frequency Coordination with Served Agency

Confirm that your LoRa channel center frequency does not conflict with LoRaWAN sensors already deployed by the served agency (e.g., flood sensors on 915.2 MHz). The Meshtastic default US channel preset should be checked against the agency sensor inventory. Document the agreed channel in ICS 205.

Mesh Topology for Disaster Environments

Meshtastic always uses managed flood routing - it does not offer selectable star/mesh/chain routing modes. The patterns below describe how you physically *place* nodes to approximate these shapes; the protocol underneath is the same flood-based mesh in every case.

Placement pattern	Description	When to Use
Star (hub-and-spoke)	Field nodes are placed within direct range of one well-elevated central relay, so most traffic reaches the hub in a single hop.	Open flat terrain; EOC has excellent elevation; small node count (fewer than 10).
Mesh (distributed)	Nodes are spread so each is in range of several neighbors; the flood routing relays messages through multiple nodes to reach the destination.	Urban rubble; blocked line-of-sight; large geographic area; many nodes.
Chain (linear relay)	Nodes placed in a line to extend range along a corridor (road, valley, ridge), each within range of the next.	Evacuation corridor monitoring; search teams moving along a defined route.

Key insight: In obstructed environments, additional well-placed relay nodes can extend coverage through obstructions where a direct link cannot - but each extra hop adds latency and consumes shared airtime, so add relays deliberately rather than maximizing hop count. Do not over-rely on this for search-and-rescue: RF into rubble or below grade is highly unreliable, so a relayed link to a hard-to-reach receiver may or may not get through and must not be treated as a dependable way to reach a trapped or buried person. Each hop re-transmits at the node's normal certified Part 15 power (maximum 1 W / 30 dBm conducted under 47 CFR §15.247) - there is no emergency exception allowing higher power on unlicensed ISM equipment. Meshtastic's default hop limit is **3** (maximum 7); raising the hop limit increases airtime and congestion. Do not reduce the maximum hop count below 3 in disaster deployments.

Interface with ICS Structure

The mesh network is a resource managed by the Communications Unit within the Logistics Section (Service Branch), led by the Communications Unit Leader (COML). In most ICS deployments, significant operational changes (channel reassignment, node redeployment, shutdown) should be coordinated with and authorized by the COML. Field mesh operators report to the COML, not directly to Operations. When Operations Section needs to reach a field team via mesh, the request flows: Operations Chief to COML to mesh operator to field node. This chain maintains ICS unity of command and ensures communications changes are coordinated.

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