Mesh Communications During Active Disasters

> **If you are reading this during an active emergency:** Jump to the Quick Start section below. Full context follows.

> **Mesh is a supplement, not a lifeline.** LoRa mesh (Meshtastic & MeshCore) is **best-effort with NO guaranteed delivery**: messages can silently fail to arrive, there is no end-to-end delivery guarantee, 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 first; use mesh as a fallback when those are unavailable. Any immediate life-threat (MAYDAY/FLASH/EMERGENCY-class) traffic must always be attempted on voice/911 as the primary path — never routed over mesh alone.

Quick Start: Mesh Operations During Active Disaster

1. **Power on all go-bag/mobile nodes.** Allow up to several minutes for a cold GPS lock — longer under obstructions or after storage. Warm starts are faster, but do not assume a fix in 60 seconds.
2. **Verify channel configuration.** All nodes must be on the same channel with the same key.
3. **Designate a Mesh Coordinator at EOC.** One person monitors mesh traffic; all others operate.
4. **Send a CHECK-IN message** from each active node: "CHECKIN [NODE NAME] [LOCATION] [STATUS]"
5. **Reserve voice for life-safety traffic; route routine status/position updates on mesh.** Remember mesh delivery is best-effort and not guaranteed — any time-

critical or life-safety traffic needs a confirmed-receipt path or voice/911 backup, never mesh alone.

6. **Log all mesh traffic.** Screenshot or print message logs every 30 minutes.
7. **Check battery levels** on all nodes every 2 hours. Recharge before depletion.

Infrastructure Failure Sequence During Major Disasters

Understanding what *typically* fails in what order helps you plan which communications systems to rely on at each phase of a disaster. This is a typical sequence only — the order and timing vary widely by hazard and locale, and should not be treated as a hard rule:

Time After Event	What Typically Fails	What Still Works
0 - 15 min	Grid power (local); some cell towers (congestion); landlines (cable damage)	Cell (may already be congested — do not assume availability in the first minutes of a major event); internet via battery-backed routers; mesh (pre-positioned nodes); battery-backed repeaters; HF radio
15 - 60 min	Cell towers (battery exhaustion in high-call-volume events — backup duration varies widely, often a few hours; 15–60 min applies to worst-case high-load sites); some internet (routing failures)	Mesh (pre-positioned solar nodes); battery-backed repeaters; Winlink HF; satellite (Starlink)
1 - 6 hours	Cell network (extended outage); most commercial internet; repeaters (battery exhaustion if not refueled)	Mesh (solar nodes with LiFePO4 — running on battery at night); HF radio; satellite; generator-powered systems
6 - 72 hours	Generator-powered systems (fuel exhaustion); some repeater sites (refueling issues)	Solar mesh nodes (as long as panels get usable sun — note smoke, heavy cloud, and snow can suppress charging for days; size battery accordingly); hand-charged systems; HF radio
72+ hours	Most unsupported infrastructure	Well-designed solar mesh nodes; manually recharged systems; satellite

Message Prioritization: Life-Safety First

Life-safety traffic over best-effort mesh — read first. LoRa mesh is best-effort: FLASH/EMERGENCY traffic is **NOT guaranteed delivered or acknowledged**, and may be dropped or sit unread with the sender never knowing. A true MAYDAY/life-safety alert must be attempted on **voice and/or 911 as the primary path**; a mesh FLASH is a supplement, not the primary alert. A mesh ACK or green checkmark is a best-effort radio acknowledgment only — it is **NOT proof that a human received or will act on the message**. Senders should require explicit confirmed receipt and re-send/escalate (via voice/911) if none arrives within a set time.

All mesh message traffic should be evaluated against this priority hierarchy. The Mesh Coordinator at the EOC is responsible for escalating high-priority mesh traffic to the incident commander — but escalation over mesh is supplementary to, never a substitute for, voice/911 on life-threatening traffic.

Mesh Message Priority Hierarchy

Priority	Traffic Type	Example	Action Required
FLASH	Life safety - immediate threat to life	"MAYDAY SHELTER4 FIRE IN BUILDING EVACUATING NOW" (sent as a *supplemental record* — the primary MAYDAY must go out on voice/911)	Attempt voice/911 first as the primary path. Mesh is best-effort: a FLASH may not be delivered and the sender cannot assume it was received. Mesh Coordinator relays any received FLASH to the incident commander via voice immediately; require an explicit acknowledgment and re-send/escalate if none is received within a set time. Do not rely on mesh as the sole path.

Priority	Traffic Type	Example	Action Required
URGENT	Medical emergency; immediate resource need	"URGENT SHELTER4 CARDIAC PATIENT NEEDS ALS NOW"	Relay to IC within 2 minutes. Log and timestamp. For an immediate life-threat, back up on voice/911.
PRIORITY	Significant situation change; safety-relevant	"PRIORITY ROAD12 BRIDGE OUT NORTHBOUND IMPASSABLE"	Log, brief IC at next opportunity. Note on situational map.
ROUTINE	Status updates, resource counts, position	"ROUTINE SHELTER4 CENSUS 47 OCCUPANTS NEEDS: WATER"	Log. Include in next situation report cycle.

Training requirement: All mesh operators must know the priority hierarchy before an activation. Because mesh is best-effort and depends on a single Mesh Coordinator noticing the traffic, a FLASH message that sits unread in a mesh log because the Mesh Coordinator is unavailable defeats the purpose — which is exactly why life-threat traffic must always also go out on voice/911 and never rely on mesh alone.

The Mesh Coordinator Role at the EOC

In any activation with more than three mesh nodes, designate a dedicated **Mesh Coordinator** at the EOC. This is a full-time position during active operations; it cannot be effectively combined with net control or other communication roles in high-tempo situations.

Mesh Coordinator Responsibilities

- Monitor all mesh message traffic on the EOC laptop/display in real-time
- Maintain position awareness of all active nodes on the map view
- Immediately escalate FLASH and URGENT traffic to incident command
- Log all PRIORITY and ROUTINE traffic in the message log
- Update the physical or digital situational display with position and status data from mesh
- Troubleshoot connectivity issues: identify nodes that have gone offline or have coverage gaps
- Manage channel discipline: send reminders to operators who are sending non-essential mesh traffic
- Coordinate with voice net control to de-conflict mesh and voice traffic handling

Mesh Coordinator Equipment at EOC

- Laptop running Meshtastic web interface or Meshtastic map view
- Dedicated EOC mesh node with elevated antenna (not the go-bag portable; a proper fixed station)
- Message log sheet (paper backup if laptop fails)
- Direct communication link to incident commander (voice radio or in-person)

Operating Mesh During Specific Disaster Types

Hurricane

- Pre-position infrastructure before landfall (do not deploy during hurricane force winds)
- Antenna mounts must meet the design wind speeds in TIA-222 (the structural standard for antenna-supporting structures) and your local wind-load code, including the standard safety factors — not merely ad-hoc comparison against a forecast peak gust. Use a qualified professional for tower/mast structural design.
- After landfall: flooding may isolate neighborhoods; mesh provides connectivity across flooded roads
- Key nodes: shelters, fire stations, EOC, National Guard staging areas
- Solar charging will be degraded during storm cloud cover; ensure adequate battery reserves (40Ah+ per node)

Wildfire

- Mesh supports evacuation tracking: position data from evacuation checkpoints
- Rapidly changing fire perimeter means coverage needs change; mobile relay operators may need to reposition
- Cool smoke (particulates) is largely transparent to 915 MHz LoRa, so smoke alone does not significantly degrade RF. However, an active flame front with ionized combustion gases can attenuate UHF signals — proximity to active fire can degrade performance even though smoke plumes generally will not.
- Risk: pre-positioned nodes in the fire path may be destroyed; plan for rapid cache-and-deploy backup
- Key nodes: evacuation shelters, resource staging areas, fire camp EOC

Earthquake

- Immediate aftermath: grid power out, cell out, roads blocked. Pre-positioned mesh is often among the few surviving local comms options, alongside amateur HF/VHF and satellite phones/messengers — but it is best-effort, so do not treat it as the sole or guaranteed path for life-safety traffic.
- Building collapse may destroy some pre-positioned nodes; surviving nodes carry the load
- Search and rescue teams benefit most: continuous position tracking, message relay to command
- Key nodes: EOC, hospitals, fire stations, neighborhood triage sites
- Plan for aftershocks: operators should secure equipment against secondary shaking

Coordination with Public Information Officers (PIOs)

> **Warning:** Mesh message content is not authorized for public release without PIO review. Mesh operators do not speak for the incident command. All public information must be cleared through the designated PIO. Mesh operators should not post mesh message content to personal social media accounts during an active incident.

Logging Mesh Traffic for After-Action Review

All mesh traffic during an activation should be preserved for the after-action review (AAR). This serves multiple purposes: legal documentation, performance evaluation, and training improvement.

- **Meshtastic message logs:** The Meshtastic app and web client maintain a local message log. Export or screenshot the complete log at the end of each operational period.
- **Bridge logs:** If running a mesh-to-internet bridge, the bridge log captures all traffic with timestamps automatically. Preserve these files.
- **Paper log backup:** The Mesh Coordinator should maintain a paper log of FLASH and URGENT traffic as a backup. Paper survives power failures and software crashes.
- **Retention:** Retain mesh logs for at least 90 days post-incident, or per your served agency's policy or local records-retention law, whichever is longer (and longer still if the

incident results in legal proceedings). The default retention figure is kept consistent with the mesh-to-internet bridge guidance; set the actual period from the served agency or applicable records law rather than an arbitrary number.

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