Disaster Preparedness Planning

Pre-positioning infrastructure, operating during active disasters, and building neighborhood resilience.

- Pre-Positioning Mesh Infrastructure for Disasters
- Mesh Communications During Active Disasters
- Building Neighborhood Disaster Preparedness Networks

Pre-Positioning Mesh Infrastructure for Disasters

Core Principle: Infrastructure that survives a disaster is infinitely more valuable than infrastructure deployed after one. Pre-position before the threat window, not during it.

Mesh is a supplement, not a lifeline. LoRa mesh (Meshtastic) is best-effort with no guaranteed delivery: messages may silently fail to arrive, links degrade with terrain, obstruction, and congestion, and a user's device must be within radio range of a surviving, powered node. Pre-positioning improves the odds but does not guarantee a message gets through. It is NOT a replacement for 911, NWS alerts, or licensed voice nets. Validate coverage by testing — do not assume it.

Cache and Deploy vs. Pre-Position: The Critical Distinction

There are two philosophies for emergency mesh infrastructure:

Approach	How It Works	When It Fails	Best For
Cache and Deploy	Nodes stored in a cache (car, emergency kit, warehouse); deployed by personnel after disaster occurs	When roads are impassable, personnel are unavailable, or the deployment window is too short (earthquake, tornado)	Slower-onset disasters (flood, pandemic); go-bag/field kit deployments; ARES activations

Approach	How It Works	When It Fails	Best For
Pre-Positioned Infrastructure	Nodes permanently installed at key sites before any disaster; running continuously on solar power	When the site itself is physically destroyed or solar+battery is exhausted — and, barring hardware/firmware faults, lightning damage, water ingress, antenna/coax failure, RF congestion, or loss of relaying neighbor nodes. Mesh is best-effort with no guaranteed delivery.	Earthquake, hurricane, wildfire, any disaster with a sudden onset or infrastructure destruction phase

For serious EMCOMM capability, pre-positioned infrastructure is the goal. Pre-positioned solar nodes can survive the disaster alongside the buildings they're mounted on and be available without on-the-spot deployment. They are not a guarantee, however: a node can be physically powered yet still fail to deliver a message. A user's device must be within radio range of a surviving node, mesh delivery is best-effort and not guaranteed, and coverage should be validated by testing, not assumed.

Identifying Key Pre-Position Sites

Not all sites are equally valuable for pre-positioning. Priority sites have these characteristics:

- **High elevation or roof access** - extends radio range significantly
- **Likely to survive a regional disaster** - reinforced concrete buildings; fire stations are built to survive fires; hospitals have redundant power; water towers are physically resilient
- **Will be operationally active during a disaster** - someone will be there to notice if the node has a problem; the building has power for recharging if solar fails
- **Geographic distribution** - provides coverage across the operational area, not clustered in one location

Priority Pre-Position Site Types

Site Type	Value	Access Notes
Emergency Operations Center (EOC)	Highest - command and control hub for all emergency operations; must be on the mesh	Requires coordination with county/city OES; often receptive to ARES/amateur support
Fire stations	Very high - elevated, structurally reinforced, staffed 24/7, diesel generator backup	Fire department liaison; node on roof or upper exterior; coordinate with fire chief

Site Type	Value	Access Notes
Water towers	Very high - where present, water towers are often among the highest accessible points and offer wide line of sight	Public utility coordination; typically requires a formal agreement; excellent relay sites
Hospitals	High - critical served agency; will be operationally critical during any mass casualty event	Hospital facilities/communications department; often have ham radio infrastructure already
Schools designated as shelters	High - will become population centers during displacement events	School district facilities department; often easier access than city buildings
Amateur radio repeater sites	High - already at elevated locations with existing antenna infrastructure; often solar-powered	Repeater trustee; ARES can often coordinate directly. Note: a mesh node co-located at an amateur repeater site still operates under FCC Part 15 — it must not cause harmful interference to the licensed repeater and must accept interference from it. Do not combine the mesh onto amateur-licensed transmit equipment; sharing antennas/feedlines must respect each service's rules.
Community/recreation centers	Medium - potential shelter and community gathering sites	Parks and Recreation department; typically accessible

Hardening Pre-Positioned Nodes for Disasters

> **Installation safety and authorization.** Lightning protection, grounding/bonding, rooftop and tower mounting, mast/wind loading, and any mains/AC electrical work must comply with the National Electrical Code and local codes and should be performed or inspected by qualified, licensed professionals. This guidance is informational only and is not a substitute for professional installation — improper work can cause fire, electrocution, or falling-object injury. Work on third-party property (hospitals, fire stations, water towers, schools) requires the property owner's written authorization before any installation.

Power System: LiFePO4, Not LiPo

Strongly prefer LiFePO4 (lithium iron phosphate) batteries for pre-positioned nodes. LiPo (lithium polymer) and standard lithium-ion batteries used in consumer devices pose thermal runaway risk, especially in high-temperature environments (rooftop enclosures in summer). LiFePO4:

- Has a much higher thermal-runaway threshold and resists thermal runaway under abuse conditions
- Tolerates partial state of charge better than LiPo
- Lasts 2,000 - 4,000+ charge cycles vs. 300 - 500 for LiPo
- Tolerates a wide operating window: LiFePO4 can **discharge** from about -20°C to +60°C, but must **NOT be CHARGED below 0°C (32°F)** — charging a cold lithium cell, including LiFePO4, permanently damages it. For cold-climate solar installs, use a BMS with a low-temperature charge cutoff or a self-heating battery (a BMS blocks cold charging; it does not enable it).
- Appropriate for permanent outdoor installation

Recommended: 12V LiFePO4 battery (20 - 40Ah) with a solar charge controller designed for LiFePO4 chemistry (MPPT preferred; Renogy Wanderer Li or Victron SmartSolar are well-proven options). At 40Ah, a node drawing ~100mA can run on the order of ~10-13 days without any solar input after accounting for usable capacity (~80%) and conversion losses. Treat this as an estimate, derate further for cold and battery aging, and do not plan to the theoretical maximum.

Enclosure: IP66 (NEMA 4X) or Better for All External Installations

- Use NEMA 4X (IP66) or better enclosures for all exterior nodes. NEMA 4X protects against hose-directed water (roughly IP66), not prolonged immersion (IP67) — for rain and water jets, IP66/NEMA 4X is the target; only specify IP67 if the enclosure will genuinely be submerged.
- Cable glands (IP68 rated) for all antenna and power connections through the enclosure wall
- Desiccant packs inside enclosure; replace annually
- Avoid vented enclosures in coastal or humid climates; sealed is safer
- For rooftop installations: steel or fiberglass enclosure preferred over ABS plastic (UV resistance)

Antenna Mounts: Wind-Rated

- Use mounts rated for your site's design wind load. As a rule of thumb, allow margin above the highest sustained wind on record for your area (e.g. ~20%), but for any permanent or tall install defer to TIA-222 (Structural Standard for Antenna Supporting Structures and Antennas) wind-load design or your local building-code wind maps rather than a flat percentage.
- Stainless steel hardware for all mounting hardware (not zinc-plated; it corrodes faster than the antenna)
- J-pole or mast mounts with two attachment points minimum
- Guy wires for masts that extend well above their mount — roughly 3 feet is a common rule of thumb, but actual guying need depends on mast diameter, material, wind load, and antenna size; defer to the mast manufacturer's specs or TIA-222 guying guidance.
- Annual inspection: check all mounting hardware, antenna condition, and coax connections

Lightning Protection

- All antenna coax must pass through an inline lightning arrestor before entering the enclosure (Polyphaser IS-50NX or equivalent)
- Lightning arrestor must be bonded to a solid earth ground (ground rod or structural ground) in accordance with NEC Article 810 and local code; have grounding/bonding performed or inspected by a qualified professional.
- In areas with high lightning incidence: consider a standalone suppressor at the Meshtastic node's antenna port as additional protection
- Disconnect protocol: if a major lightning storm is forecast and the node is safely accessible beforehand, disconnect the antenna cable at the node side to protect the radio. **Never service a rooftop node during an active storm** — disconnect only when it is safe to access the node well ahead of the storm.

Inventory Management: Know Where Every Node Is

During an emergency activation, you need to know immediately: which nodes are deployed, where, what their power status is, and who is responsible for each one. Without an inventory system, critical nodes will be forgotten, batteries will die unnoticed, and coverage gaps will appear at the worst time.

Node Inventory Template

Node ID	Long Name	Location	GPS Coords	Power Type	Battery Capacity	Installed Date	Last Inspected	Custodian	Notes
!ab12cd34	RELAY-EOC-1	County EOC Roof	34.052°N, 118.243° W	Solar/LiFePO4	40Ah	2024-03-15	2025-01-10	John Smith W6XXX	MPPT controller; checked OK
!ef56gh78	RELAY-FIRESTN-3	Fire Station 3 Roof	34.061°N, 118.251° W	Solar/LiFePO4	20Ah	2024-05-02	2025-01-10	Jane Doe KD6YYY	Battery replaced 2025-01; check seal

Pre-Positioning Checklist

☐ All pre-position sites identified and written agreements in place with site owners. Site agreements should address liability, insurance/indemnification, who maintains the equipment, access, and removal/restoration obligations; have counsel review agreements for installations on third-party property.
☐ Node inventory spreadsheet current with all installed nodes
☐ All nodes using LiFePO4 batteries (no LiPo in outdoor installations)
☐ All exterior enclosures IP66+ (NEMA 4X) rated with sealed cable glands
☐ Lightning arrestors installed and bonded to earth ground on all antenna runs (per NEC and local code; professionally installed or inspected)
☐ Antenna mounts rated for local design wind speed (per TIA-222 / local code)
☐ Solar panels oriented and angled correctly for maximum winter sun
☐ Annual inspection schedule in calendar; last inspection date recorded for each node
☐ Coverage map updated showing all pre-positioned node locations and expected coverage
☐ Each node has a named custodian responsible for maintenance
☐ All nodes on a tested, known-good firmware version compatible across the fleet (do not blindly chase the latest release on hard-to-reach nodes)
☐ Channel configuration consistent across all pre-positioned nodes
☐ Go-bag reserve nodes stored separately for cache-and-deploy if pre-positioned nodes are damaged

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.

Building Neighborhood Disaster Preparedness Networks

Target Audience: CERT team leaders, neighborhood emergency preparedness group organizers, block captains, and city OES liaisons. No amateur radio license is required for the core mesh network described here: it operates on the 915 MHz ISM band under FCC Part 15, which requires no amateur license when using FCC-certified equipment within Part 15.247 limits (1 W / 30 dBm conducted max, must accept interference and cause no harmful interference).

Mesh is a supplement, not a lifeline. LoRa mesh is best-effort with no guaranteed delivery - messages may silently fail to arrive, the shared channel saturates under load, and coverage exists only where a path of powered, in-range nodes is available. It is not a replacement for 911, NWS alerts, or licensed amateur/voice nets. For any life-threatening emergency, use 911/voice first and keep a non-mesh backup; treat mesh as a fallback.

Why Neighborhoods Are the Right Unit for Mesh Networks

The first 72 hours after a major disaster are the most critical for community survival - and they are precisely when official emergency services are most overwhelmed and least available. FEMA and Ready.gov recommend being prepared to be self-sufficient for at least 72 hours (and current guidance often recommends longer - several days to two weeks; see ready.gov). A neighborhood-scale mesh network provides:

- **Hyperlocal situational awareness:** Who needs help on your block? Who has medical training? Which houses are damaged? Mesh can carry this communication when phones are down - but only where a path of powered, in-range nodes exists, and delivery is best-effort with no guarantee.

- **Resource coordination:** "I have a generator and can share power." "We need insulin in the refrigerator on Elm Street kept cold." Short mesh messages coordinate resources without driving through blocked streets. *Privacy note: mesh messages are typically broadcast and may be unencrypted. Avoid broadcasting sensitive personal or medical details and specific vulnerable-person locations on open channels; use direct messages or a private channel and exercise basic privacy judgment.*
- **Connection to official emergency services:** A mesh node at the neighborhood EOC staging area, connected to the official mesh network, bridges the neighborhood to city-level response.
- **Community resilience:** Neighbors who have trained together and have communication tools recover faster and experience less psychological distress during disasters.

CERT Teams and Neighborhood Preparedness Groups as Mesh Early Adopters

Community Emergency Response Teams (CERT) - FEMA-trained volunteer groups that provide immediate disaster response at the neighborhood level - are natural mesh early adopters. CERT teams:

- Already train for disasters; mesh is a natural addition to their toolkit
- Have an organizational structure that can absorb mesh training
- Have a relationship with city OES that provides legitimacy for mesh integration
- Are geographically distributed across the community - ideal for mesh coverage

How to approach your local CERT team: Contact the CERT coordinator through your city's OES or Fire Department (CERT programs are usually run by Fire). Offer a free 30-minute demonstration. Propose providing 2 - 3 Meshtastic nodes for CERT team use. Ask to be included in the next CERT exercise.

The Block Captain Model

The most scalable neighborhood mesh model assigns one mesh node to each **block captain** - a neighbor who has volunteered to be the communication point for their immediate block. The block captain:

- Maintains a Meshtastic node (typically a small, low-cost device like a WisBlock Meshtastic kit)

- Knows how to send and receive messages on the neighborhood channel
- Serves as the communication relay for neighbors who don't have mesh nodes
- Reports to a neighborhood zone leader (who reports to city OES)
- Checks in during exercises and activations

The number of block captains needed depends heavily on terrain, antenna height, building density, and node placement - there is no fixed node count that guarantees whole-neighborhood coverage. Rather than assuming a flat figure (e.g., 8-12) gives adequate coverage for all occupied blocks, plan your node count from an on-site walk test / range survey (see below). Block captain nodes can also relay for neighbors who have their own Meshtastic devices (phones running the app, personal nodes, etc.).

Coverage Mapping for Your Neighborhood

Before committing to node placement, map your coverage. Two approaches:

Walk Test Method

1. Place one node at the proposed location of the primary relay (highest point accessible: roof, upper floor).
2. Walk the entire neighborhood with a second node (phone running Meshtastic).
3. Send test messages every 100 meters. Mark locations where messages fail to deliver on a map.
4. Identify coverage gaps. Add relay nodes at elevated points within the gap areas.
5. Repeat walk test after adding relays.

Coverage Prediction Method

1. Use a radio propagation prediction tool (HeyWhatsThat, RadioMobile, or SPLAT!) to model 915 MHz coverage from each proposed node location.
2. Input antenna height and terrain data, and compute the LoRa link budget rather than assuming a fixed number. Link budget = TX power (dBm, up to +30 dBm conducted under Part 15.247) + TX antenna gain + RX antenna gain - RX sensitivity (dBm). Note that RX sensitivity is spreading-factor-dependent (roughly -120 to -148 dBm; see the Semtech SX1262 datasheet), so a single "~140 dB" figure is only a rough placeholder, not a "medium-range Meshtastic" constant.
3. Overlay coverage predictions on a neighborhood map to identify gaps before physical deployment.

4. Verify predictions with a walk test after deployment.

Integrating with City OES

City Office of Emergency Services (OES) departments vary widely in their receptiveness to amateur mesh technology. Approach strategically:

1. **Start with the CERT liaison.** If your city has a CERT program, the CERT coordinator is your best entry point. They already work with volunteers and understand non-professional capabilities.
2. **Request to participate in city exercises.** Most OES departments hold annual exercises. Request observer/participant status and demonstrate mesh alongside official comms.
3. **Offer to complement, not compete.** Never suggest mesh replaces city radio systems. Position it as "last-mile neighborhood comms" that fills a gap city systems don't cover.
4. **Provide documentation.** After exercises, provide written reports showing mesh performance and how it integrated with official operations.
5. **Pursue MOU/Letter of Support.** A formal letter of support from the OES director significantly increases the group's credibility when recruiting block captains and securing sites. Any MOU should be reviewed by counsel and should allocate liability and insurance, and explicitly state that the mesh network is supplemental, volunteer-run, and best-effort - not a guaranteed or primary emergency service.

Equipment Storage and Rotation Plans

A neighborhood mesh program is only as good as its equipment. Establish a storage and rotation plan to ensure equipment is operational when needed:

Item	Storage Location	Maintenance Interval	Responsible Party
Block captain nodes (personal)	Block captain's home (kept on a USB charger for readiness)	Monthly charge check; annual firmware update	Block captain (self)
Pre-positioned relay nodes (elevated)	Installed at site (solar powered)	Annual physical inspection; firmware update; battery test	Designated node custodian
Reserve/loaner nodes (cache)	Neighborhood emergency supply cache or CERT storage	Quarterly charge cycle; annual inspection	CERT coordinator or neighborhood team leader

Item	Storage Location	Maintenance Interval	Responsible Party
Phone batteries / USB power banks	Stored with reserve nodes	Quarterly discharge/recharge cycle to maintain capacity	CERT coordinator

Battery longevity note: keeping a node permanently at 100% on a USB charger ages its internal lithium battery over time. Continuous float charging is acceptable for readiness, but plan to replace internal cells periodically and do not assume the battery will hold full capacity after years of float charging. For nodes kept in a cache rather than powered, store the internal lithium battery at roughly 40-60% state of charge and top up to full only before deployment.

Equipment Rotation Policy

- LiFePO4 batteries: inspect annually. Many LiFePO4 packs last 8-10+ years, but for life-safety standby consider replacement at 5-7 years or when capacity drops below 80% (check the cell/pack datasheet).
- LiPo/Li-ion power banks: replace after 2 - 3 years or if capacity has dropped below 80%
- Meshtastic nodes: firmware-update annually; replace hardware after 5 - 7 years or if hardware fails
- Coaxial cable: inspect annually; replace any cable with cracked jacket or corroded connectors
- Antenna mounts: inspect annually; replace if corrosion is visible on structural hardware

Annual Testing Exercise Plan

An annual exercise keeps skills sharp, identifies equipment problems before a real disaster, and provides a regular community engagement opportunity. Template:

Annual Neighborhood Mesh Exercise: 2-Hour Format

Time	Activity	Objective
T+0:00	Exercise kickoff; "simulated earthquake" announced; all participants power on nodes	Verify all nodes come online and have GPS lock

Time	Activity	Objective
T+0:10	All block captains send check-in message with simulated damage report	Verify message delivery from all locations; identify coverage gaps
T+0:20	Neighborhood coordinator sends resource request messages to each captain	Test bidirectional communication; verify message latency
T+0:40	Inject: "One pre-positioned relay node is offline" - identify and diagnose	Practice troubleshooting; identify backup coverage path
T+0:60	Simulated mass casualty: FLASH message sent; all captains relay to households. Because mesh is best-effort with no delivery guarantee, any FLASH/life-safety message must be confirmed received (reply or voice) - the exercise should test detection of non-delivery, not assume the broadcast reached every household.	Test priority message handling; verify Mesh Coordinator response; test detection of non-delivery
T+1:20	Equipment inspection: check battery levels, antenna condition, enclosure seals	Identify maintenance needs before next exercise
T+1:40	Debrief: what worked, what didn't, action items for next year	Continuous improvement; document corrective actions
T+2:00	Exercise close; data collection forms collected	Document message delivery rates, latency, and participation count

Neighborhood Preparedness Network Checklist

☐ Neighborhood or CERT team organizational structure established
☐ Block captain model defined; at least 50% of blocks have a mesh-equipped captain
☐ Coverage map completed; coverage gaps identified and addressed
☐ At least one pre-positioned relay node at highest accessible point in neighborhood
☐ Reserve node cache established (minimum 2 spare nodes)
☐ All captains trained on Meshtastic operation (send/receive/check battery)
☐ Channel configuration documented and shared with all participants
☐ Neighborhood mesh coordinator identified and trained
☐ OES or CERT coordinator briefed; relationship established
☐ Annual exercise scheduled and completed at least once
☐ Equipment inventory and maintenance log current

☐ Connection to city-level mesh infrastructure established (or in progress)