Mesh Networking in Amateur Radio Emergency Service (ARES)

> **Operational Note:** This page may be consulted during active emergency operations. All procedures are based on current FCC regulations and ARRL ARES guidelines as of 2025. Verify local ARES group policies before deployment.

What Is ARES?

The **Amateur Radio Emergency Service (ARES)** is a program of the American Radio Relay League (ARRL) that organizes licensed amateur radio operators to provide emergency communication support to government agencies, relief organizations, and other served agencies when normal communications infrastructure fails or is overloaded. ARES is organized at the local, section, and national levels, with Emergency Coordinators (ECs) managing groups at the county or city level, Section Emergency Coordinators (SECs) at the state level, and national leadership through the ARRL.

ARES members hold FCC amateur radio licenses (Technician, General, or Extra class) and participate in regular nets, exercises, and deployments. ARES groups typically operate on designated VHF/UHF repeater frequencies for voice communications and may also operate HF stations for long-range traffic handling. The National Traffic System (NTS) provides formal written message traffic capability via radiogram.

How LoRa Mesh Complements VHF/UHF ARES Operations

Traditional ARES operations are voice-centric: operators check into nets, relay verbal messages, and pass formal radiograms by voice or digital modes like Winlink. LoRa mesh (particularly Meshtastic) adds a complementary *data layer* that addresses specific gaps in traditional ARES capabilities:

Capability	Traditional ARES (VHF/UHF Voice)	LoRa Mesh Addition

Short text messaging	Voice relay only; requires operator attention	Asynchronous store-and-forward; no operator attention needed for relay
Position reporting	Verbal position reports; APRS on separate system	Automatic GPS position sharing on mesh; visible to all nodes
Net congestion	Single voice channel; traffic serialized	Parallel data channel; does not compete for voice net time
Message logging	Manual logging by net control	Automatic message log on all receiving nodes
No-license users	Not applicable (licensed only)	Part 15 operation allows non-licensed served agency staff on mesh
Infrastructure requirement	Repeater or simplex range	No infrastructure; ad-hoc mesh self-forms

LoRa Mesh as a Supplemental Data Layer

In ARES deployments, LoRa mesh is most valuable as a **supplemental data layer** running alongside, not replacing, the primary voice net. Common use cases include:

- **Position tracking:** Each ARES operator with a Meshtastic node automatically broadcasts GPS position. A Meshtastic client running on a laptop at net control can display all operator positions on a map without consuming voice net time for position reports.
- **Short message traffic:** Operators in the field can send short status messages ("shelter at Lincoln School now at 47 occupants") without requiring net control to be available to receive a voice transmission.
- **Pre-positioned relay nodes:** ARES groups can deploy solar-powered mesh relay nodes at elevated sites (hilltops, water towers, repeater sites) to extend mesh coverage across the operating area.
- **Served agency liaison:** A mesh node running in Part 15 mode at the served agency (Red Cross shelter, hospital, EOC) allows served agency staff to send text messages to ARES operators without needing a ham license.

How to Introduce Mesh to Your Local ARES Group

1. **Start with the EC (Emergency Coordinator).** Schedule a 15-minute briefing. Lead with the problem mesh solves: "We can't track field operator positions without using net time." Avoid jargon. Bring a working demo node.

2. **Run a small demo at a regular meeting.** Set up two or three Meshtastic nodes in the room. Demonstrate position sharing on a phone screen. Let skeptical operators handle the hardware.
3. **Propose a parallel track at the next exercise.** Ask permission to run mesh alongside the normal voice exercise - not as a replacement. Offer to provide equipment for participants who want to try it.
4. **Document results.** After the exercise, provide a written after-action report comparing mesh message delivery vs. voice net efficiency. Numbers matter: "Mesh delivered 23 position updates automatically while voice net handled 8 formal messages."
5. **Propose group endorsement.** After successful exercises, request the EC formally endorse mesh as an ARES supplemental tool and add mesh node operation to the local ARES training curriculum.

FCC Part 15 vs. Part 97: Regulatory Considerations for ARES

Critical Regulatory Distinction

Meshtastic devices operating in the 915 MHz ISM band (US) operate under **FCC Part 15** - the same rules as Wi-Fi and Bluetooth. Part 15 operation:

- Requires **no license** to operate
- Limits power to typically 1 watt EIRP (30 dBm) in the 915 MHz band with frequency hopping spread spectrum
- Prohibits causing harmful interference to licensed services
- Requires accepting interference from other Part 15 devices
- Does **not** allow power increases beyond Part 15 limits, even by licensed amateurs

Part 97 (Amateur Radio) allows licensed amateurs to operate in the 33 cm (902 - 928 MHz) band with higher power (up to 1500W PEP in some cases, subject to local coordination). However, Part 97 operation **prohibits**:

- Encryption of message content (except for certain control signals)
- Commercial use or pecuniary interest
- Communications in which the licensee has a pecuniary interest

Meshtastic's default encryption (AES-128) means Meshtastic operation is *technically not Part 97 compliant* for content transmission, as Part 97 prohibits obscuring the meaning of messages. ARES groups should operate Meshtastic nodes under Part 15 rules with channels

configured to unencrypted or use encryption only for served-agency traffic not transmitted under Part 97 authority.

Practical guidance: For ARES operations, use Part 15 power levels and configure channels with no encryption (or document your encryption key for legal Part 97 operation in jurisdictions where encryption is approved by your Section Manager). Consult your ARRL Section Manager for local guidance.

Getting ARES Group Endorsement for Mesh Infrastructure

Formal ARES group endorsement provides several benefits: shared deployment of pre-positioned nodes, group funding or donations for equipment, and integration into official exercise planning. To pursue endorsement:

1. Write a one-page proposal for the EC describing: (a) the problem mesh solves, (b) equipment required and cost, (c) regulatory compliance (Part 15), (d) maintenance plan, (e) training requirements.
2. Present the proposal at a group meeting and invite questions.
3. Offer a formal training session covering Meshtastic setup, channel configuration, and emergency protocols.
4. Request inclusion in the group's Standard Operating Procedures (SOPs) as "Supplemental Mesh Data Layer."
5. Coordinate with the Section Emergency Coordinator (SEC) if seeking section-level endorsement or cross-group interoperability.

Quick Reference: ARES + Mesh Checklist

☐ EC briefed and supports mesh integration
☐ At least one mesh exercise conducted alongside voice net
☐ After-action report documenting mesh performance documented
☐ Channel plan documented and distributed to all mesh operators
☐ Part 15 power compliance verified on all deployed nodes
☐ Encryption policy documented and compliant with Section Manager guidance
☐ Mesh roles assigned in ARES activation plan (mesh coordinator, relay node operators)
☐ At least two operators trained on mesh node setup and troubleshooting
☐ Mesh node inventory maintained with deployment locations
☐ Mesh SOP incorporated into ARES local plan

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