

Water Sports and Paddling

LoRa mesh for kayaking, canoe expeditions, sailing, and coastal cruising.

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Kayaking and Canoe Expedition Communications

Communication on Multi-Day River and Coastal Expeditions

A multi-day paddling expedition presents a communications challenge that most other outdoor pursuits do not: the group is spread across a linear corridor with no practical ability to cut across terrain to regroup. On a river, there is no shortcut. If the lead boats are three bends ahead of the sweep boat, those three bends of dense riparian vegetation provide complete visual and acoustic isolation. Even powerful VHF radios struggle in winding river valleys where there is no line of sight between boats.

Meshtastic can help in this environment. Note that 915 MHz is a higher frequency than VHF (30-300 MHz), so it actually attenuates more through riparian vegetation and diffracts less around terrain - it does NOT "propagate better" than VHF on physics alone. LoRa's real advantage is its high spreading factor (processing gain): it decodes weak signals far below the noise floor at very low data rates, holding a link where a VHF voice radio would be unusable. Marine and land VHF also run far higher transmit power than the ~1 W Part 15 cap on 915 MHz. Position sharing allows the lead paddler to see the sweep's last-reported position and gauge how far back the group is spread. These position updates are best-effort and may be stale or missing when no relay is in range, so do not rely on them as the sole safety information for scouting rapids or managing portages - confirm visually or by voice for any safety-critical decision.

Waterproofing LoRa Hardware for Paddling

Essential requirement: All electronics used in kayaking and canoeing must be treated as if they will be submerged. Splashing, rain, capsize, and accidental submersion are not edge cases on paddling expeditions - they are routine. Budget accordingly.

Submersible Dry Bags

A submersible dry bag (rated to a submersion depth of 3 m or more) provides the simplest and most reliable waterproofing for any Meshtastic device. (Dry bags are rated by submersion depth, not an IP code; reserve IP67/IP68 ratings for rigid electronics enclosures.) Keep the device in the dry bag inside the cockpit or hull. The bag can be opened briefly to check the screen, then resealed. A window-type dry bag with a clear transparent front allows reading a T-Echo's e-ink display without opening the bag.

Pelican Cases

A Pelican 1010 or 1020 micro case provides IP67 waterproofing with rigid impact protection in its undrilled, factory-sealed state. **Important:** drilling a cable port voids the IP67 rating unless it is sealed with a proper IP67/IP68-rated cable gland (a plain grommet is NOT sufficient and will let water in on immersion). If you add an external antenna, use a rated gland and pressure/leak-test the case before trusting it on the water. For reliable immersion protection, prefer an undrilled case with an internal antenna. Attach the case to a thigh brace or deck rigging with a short tether so it cannot be lost during a capsizing.

Fully Sealed Nodes

For fixed relay nodes mounted on the outside of a boat - such as a node on a sea kayak deck or an open canoe thwart - a fully sealed build is required. Using a RAK WisBlock module with a waterproof antenna pig-tail routed through an IP68-rated cable gland into a sealed PVC junction box provides a robust installation. Conformal coat all exposed PCB surfaces before final sealing.

Mesh as a Safety Net

Supplementing PLBs

Personal Locator Beacons (PLBs) are one-way distress devices: they transmit a 406 MHz distress signal to the COSPAS-SARSAT satellite network when activated. They do not allow two-way communication, position sharing between group members, or any form of coordination. They are activated only as a last resort and require SAR to respond.

Meshtastic fills the day-to-day communication layer that PLBs do not address (as a best-effort supplement, never a replacement for a PLB or satellite messenger):

- Group position awareness throughout the day (best-effort; positions can be stale or missing).

- Short text messaging between boats without radio protocol.
- Route logging for post-incident reference (only positions that reach a gateway are logged).

Note: Meshtastic has NO built-in automatic man-overboard or "boat stopped moving" alert. There is no motion-cessation feature; any such alerting would require custom scripting or integration and must not be relied upon for safety.

Every paddler on a serious expedition should carry both: a PLB for the ultimate emergency signal, and Meshtastic for day-to-day coordination and situational awareness.

Practical Range in River Valleys

River valleys are mixed RF environments. Straight sections with low vegetation provide good propagation; tight meanders with dense willows and alders attenuate signal significantly. The figures below are approximate field estimates that vary widely with LoRa preset, antenna, and conditions:

- **Straight river section, open banks:** roughly 1.5 - 4 km node-to-node (approximate).
- **Meandering section, dense riparian vegetation:** roughly 300 - 800 m around a single bend (approximate).
- **Relay node on a high bank or river island:** can extend range to roughly 2 - 5 km from the relay point in both directions (approximate).
- **Open coastal paddling (sea kayak):** roughly 3 - 8 km in calm conditions (approximate); range degrades with wet conditions and sea spray near low-mounted antennas.

Planning Relay Node Positions

For long multi-day river expeditions, plan relay node placements at:

- Major river islands that provide elevation above the riverbank.
- High cut banks where the river has eroded a clear elevation advantage.
- Established campsites where a fixed node can be left for the duration of the trip and collected at the takeout.

Hardware Recommendation: T-Echo for Water Use

The LilyGo T-Echo is a strong option for paddling applications:

- **E-ink display:** Readable in direct sunlight on the water, where glare renders conventional LCD/OLED screens unreadable without cupping your hands around them. On the water, you cannot cup your hands around a screen - you need both hands for the paddle.
- **Sealed, compact form factor:** The T-Echo fits easily in a chest pocket of a paddling jacket or inside a deck bag. Its low-profile design does not snag on spray skirts or interfere with paddle strokes.
- **Battery life:** Runtime with continuous GPS varies widely; expect roughly 8-20 h from the internal ~850 mAh cell depending on GPS and broadcast settings (less in cold). Carry a small USB power bank for multi-day trips. Note the cell is internal and USB-C rechargeable - there is no AAA option.

Even with the T-Echo's inherent compactness, always carry it in a waterproof bag or case. The T-Echo is water-resistant but not waterproof to immersion depth; a capsized in class III+ water will exceed its splash rating.

Sailing and Coastal Cruising

Cross-Reference: Offshore and Bluewater Sailing

Comprehensive coverage of LoRa mesh for offshore and bluewater sailing - including AIS integration, mast-mounted antenna installation, SSB radio coexistence, and long-passage MQTT gateway strategies - is provided in the *Use Cases* book under the Maritime Operations chapter. This page focuses on recreational day sailing, fleet racing, and harbour approaches where different constraints apply.

Mesh is a coordination tool, not a marine safety system. Meshtastic is best-effort - messages may not get through, and positions can be stale or missing. It does NOT replace marine VHF (Channel 16 distress/DSC), an EPIRB, AIS, a PLB/satellite messenger, or 911. The Coast Guard and search and rescue do NOT monitor Meshtastic. Carry dedicated marine safety gear; use mesh only as a supplement for routine, low-urgency coordination.

Day Sailing and Recreational Fleet Use

A Saturday afternoon race fleet of twenty boats benefits from Meshtastic in ways that differ from an offshore passage. Distances are short, conditions are variable, and the communication needs are primarily coordination rather than emergency signalling.

Start Line to Finish Line Coordination

Race committee boats equipped with Meshtastic nodes can broadcast fleet-wide messages - course changes, postponement signals, and finish line positions - to fleet boats in mesh range. Boats relay the message through the mesh so boats at the far end of the course can receive it (delivery is best-effort and depends on relays being in range), without requiring every boat to monitor a VHF channel attentively.

Pre-race, the course marks can be entered as named waypoints and shared across the fleet, providing an on-screen map of the racecourse that updates as mark boats move into position.

Fleet Position During Races

Position sharing during a race provides a tactical picture that adds to, not replaces, visual observation. Boats that duck behind a headland and disappear from the committee boat's sight may remain visible on the mesh map (when a relay path exists; positions are best-effort and can be stale or missing). This can be a low-cost supplement for multi-leg offshore race tracking, but it is range- and relay-limited and is NOT a replacement for a dedicated AIS or transponder system, which transmit continuously and are designed for vessel tracking and collision avoidance.

Racing rule consideration: Check your racing class rules before using position-sharing devices for tactical purposes during a race. Some classes prohibit electronic position data on instruments during racing. Mesh use for safety and fleet management is generally unaffected.

Harbour Approach Coordination

Returning to a crowded harbour in fading light, following a race fleet or a club rendezvous, involves competing for fairway and dock space with many boats. A mesh message from the harbour master's dock to the approaching fleet - "slips 14 - 20 available, raft to dock B" - can reach boats in mesh range at once without tying up VHF channel 16.

Meshtastic's text messaging capability is well-suited to this low-urgency, high-information-value use case. It does not interfere with VHF radio use for safety calls and allows longer messages than are practical on voice radio. **Note:** VHF channel 16 remains the required distress and calling channel; mesh handles only routine, low-urgency coordination.

Antenna Placement on Small Boats Without a Tall Mast

Offshore and cruising vessels benefit from mast-mounted LoRa antennas at 10 - 15 m elevation, which improves range substantially over a low-mounted antenna (specific figures are community-anecdotal and depend on LoRa preset, antenna, and conditions). Small day sailors and racing dinghies cannot do this. Practical options for low-freeboard small boats:

- **Stern rail mount:** A 1/4-wave whip antenna on a stainless steel stern rail bracket at 1 - 1.5 m above the waterline. This is the most common and practical solution. Range from this height is roughly 2 - 5 km in racing conditions as a rough estimate - actual range varies widely with LoRa settings, antenna, and sea state.
- **Backstay routing:** On sloop-rigged boats with a backstay, a semi-flexible whip can be secured alongside the backstay with UV-stable cable ties, raising the antenna effective height (on the order of 5 - 8 m, approximate). This can improve range, but note that a metal backstay close to the whip can detune the antenna and distort its radiation pattern - keep some separation and test before relying on it.
- **Handheld device in cockpit:** For racing and day sailing, simply keeping the device in the cockpit - not stowed below decks - provides adequate performance. A crew member's chest pocket is roughly 1.5 m above water level; expect a rough 2 - 4 km range in open water, noting that a body close to the antenna absorbs RF and reduces body-worn range.

Waterproofing for Spray, Salt, and Immersion

The marine environment is uniquely hostile to electronics. Salt spray is electrically conductive and corrosive; even "waterproof" devices fail over time when salt crystals accumulate in seals and degrade gaskets. Requirements for sustained marine use:

- **IP67 minimum for deck-mounted hardware:** IP67 indicates 30-minute immersion to 1 m. For spray and rain protection this is adequate; for repeated immersion in rough conditions, budget for IP68 or a secondary dry bag.
- **Fresh water rinse after every salt water exposure:** Rinse all deck-mounted nodes with fresh water after each sailing session. Salt crystal accumulation is the primary failure mode for marine electronics, even sealed ones.
- **Conformal coating on antenna connections:** PL-259 and SMA connectors exposed to salt air oxidise rapidly. Coat connector threads with Lanoline or a marine-grade corrosion inhibitor; conformal-coat the PCB antenna pads inside the enclosure.
- **T-Echo in a window dry bag:** For crew-carried devices during racing and dinghy sailing, an inexpensive window dry bag (submersible-rated) gives strong protection at low cost (typically well under \$20, as of 2026-06-08). Replace annually; UV and salt degrade dry bag welds faster than most users expect.

Range Expectations on the Water

Open water is the best propagation environment for LoRa. Without terrain obstacles, a low-mounted antenna can reach an estimated 5 - 15 km (this is an estimate dependent on LoRa preset and conditions, not a guaranteed figure). With a mast-top antenna, 15 - 40 km is documented by

the community in best-case line-of-sight reports. Note that the radio horizon limits any single hop: it is roughly $4.12 \times$ the square root of the antenna height in metres (in km), so elevation on both ends is what enables the longest links. Key factors:

- Rain has negligible effect on 915 MHz range. Real degradation in rough weather comes from wave crests and wet conditions blocking the path to low-mounted antennas, not the rain itself.
- Dense fog has minimal effect on 915 MHz.
- Other vessels between nodes do not significantly attenuate signal unless they are metal-hulled large ships directly in the path.
- On protected waters (harbours, estuaries), nearby structures and moored vessels create multipath that reduces range compared to open ocean.