

Automated Lightning Monitor and Antenna Disconnect System

Using ECCC lightning-density data, an Arduino UNO R4 WiFi,
and an outdoor physical coaxial disconnect

VE6HQ • 15-minute technical overview

Physical disconnection is an additional protective layer—not a replacement for proper grounding, bonding and surge protection.

1. The problem: Lightning does not wait for the Radio Operator

**UNATTENDED
STATION**

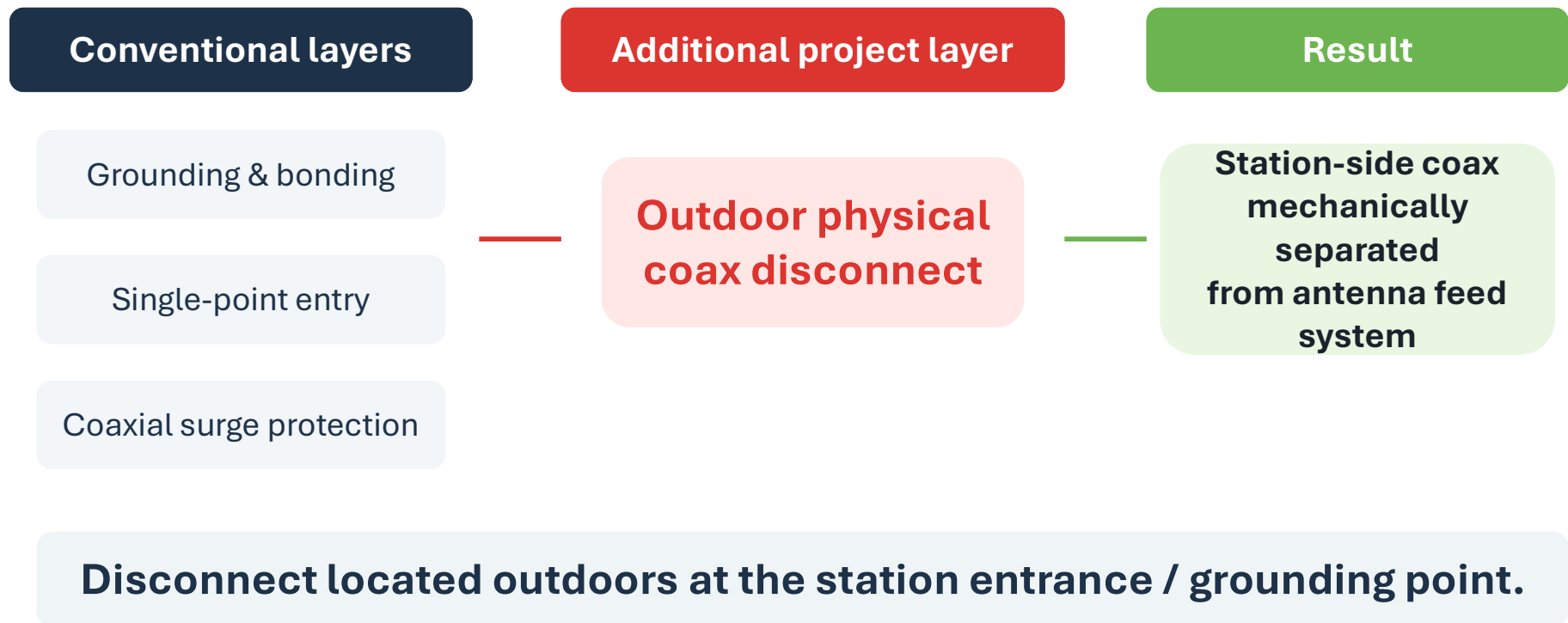


**APPROACHING
LIGHTNING**

- Antennas and feed lines necessarily enter the station from outdoors.
- Surge arrestors and grounding remain essential—but the coax is still physically connected.
- Manual disconnection works only when someone is present and aware of the storm.
- Goal: detect the developing hazard and physically separate the station-side coax outdoors.

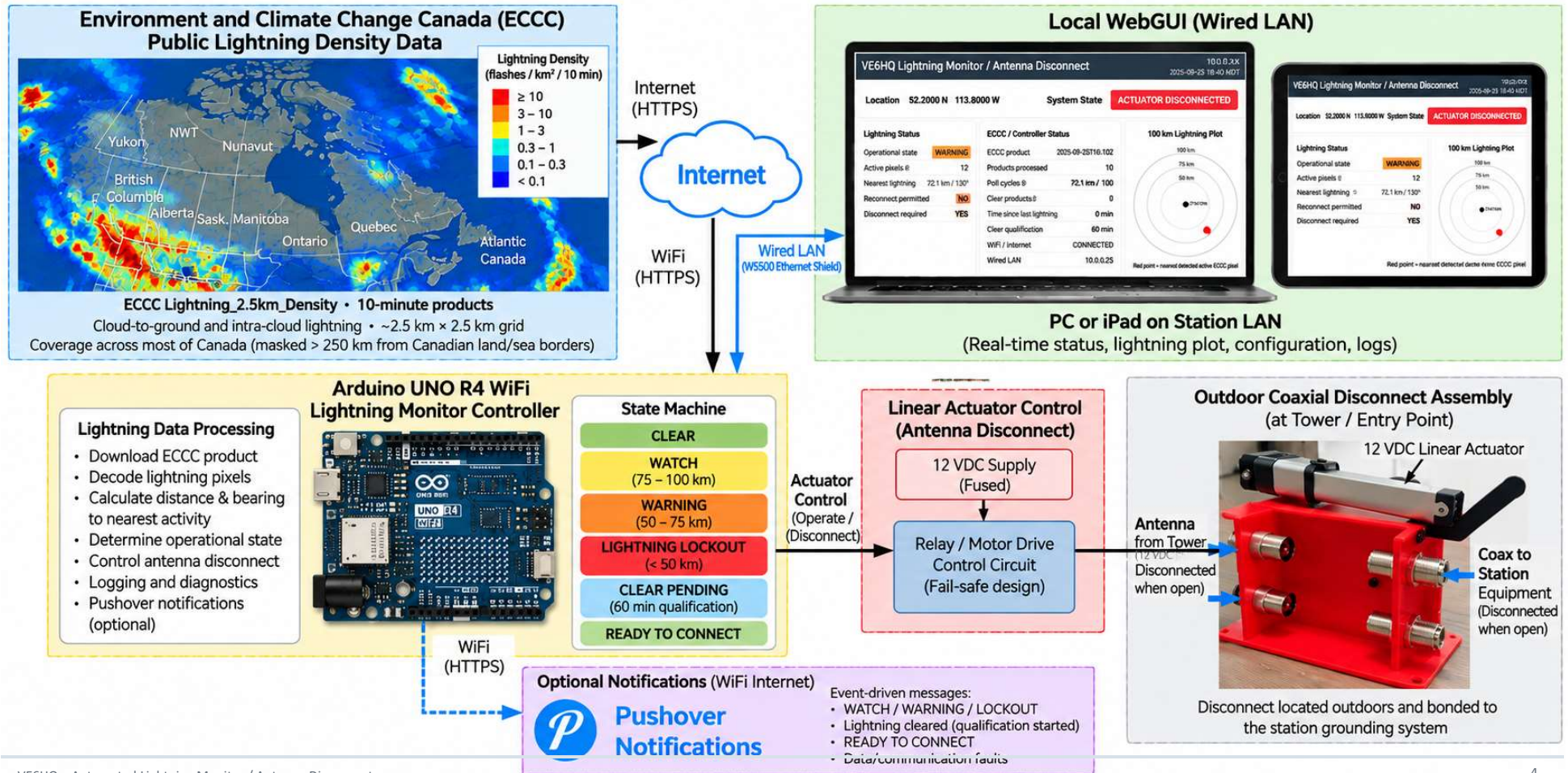
Design principle: surge diversion + physical isolation

2. Protection concept: add Physical / Electrical Isolation

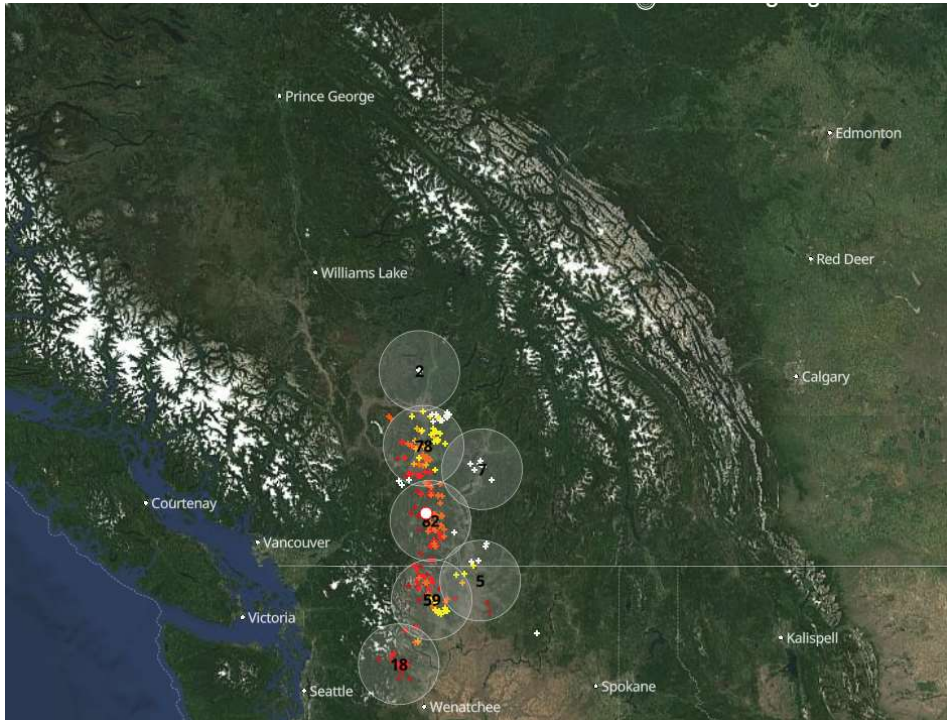


3. System architecture

Separate data, decision, local monitoring and physical-control functions



4. Lightning data source: ECCC public lightning-density product

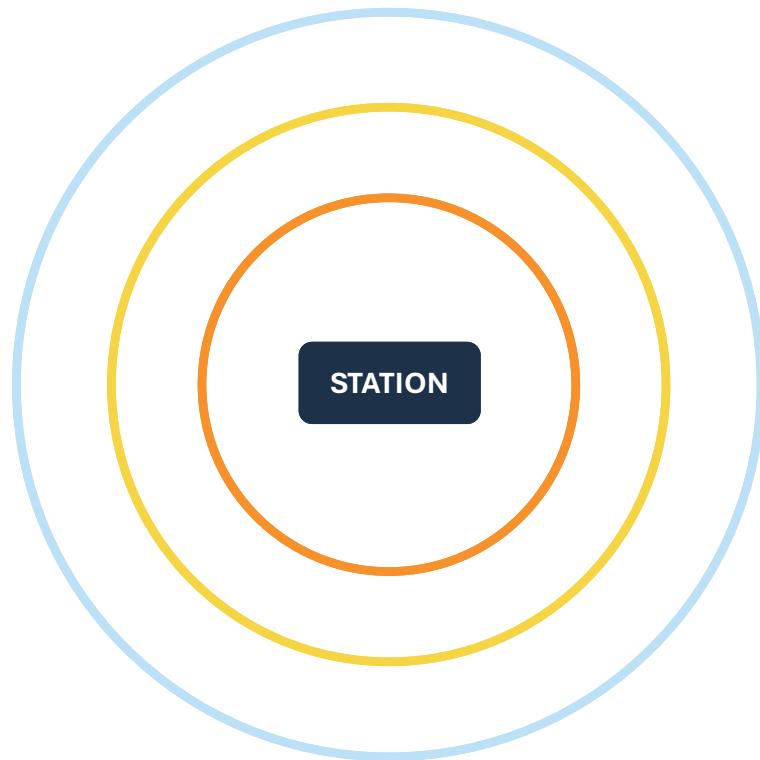


- 10-minute accumulation—not a list of individual strikes.
- Grid resolution approximately 2.5 km × 2.5 km.
- Includes cloud-to-ground and intra-cloud observations.
- An active pixel means lightning activity contributed to that grid cell—not one strike.
- Controller decodes active pixels and calculates distance/bearing from the station.

Public scientific data → real-time station protection input

5. Project operating thresholds

Development thresholds based on ECCC lightning-density data



CLEAR > 100 km

WATCH 75–100 km

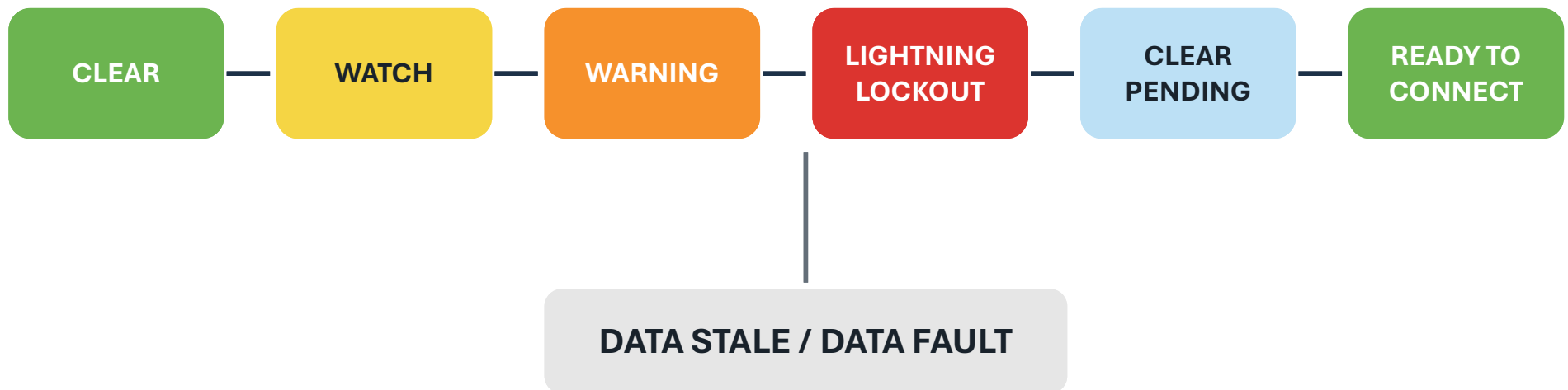
WARNING 50–75 km

LIGHTNING LOCKOUT ≤ 50 km

After lightning clears: CLEAR PENDING → 60-minute qualification → READY TO CONNECT

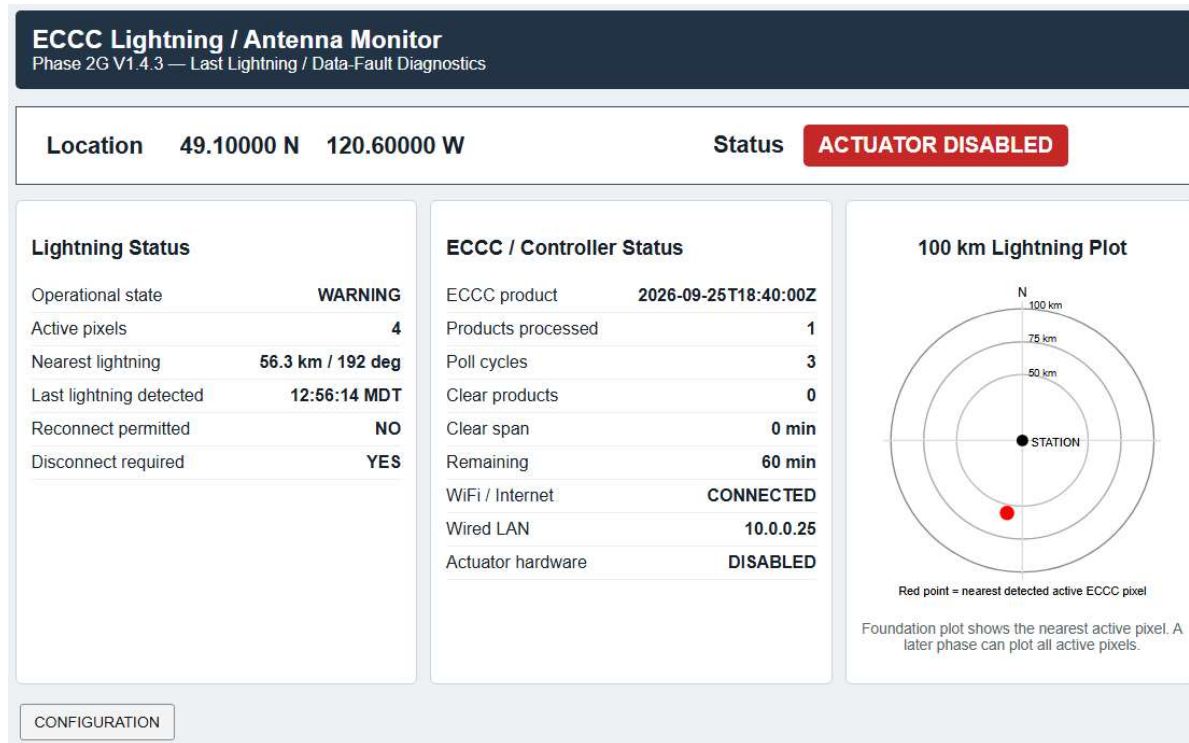
6. Fail-safe state machine

No valid data = no automatic reconnect



- Internet loss, stale ECCC product or decode failure can never become an “all clear.”
- Reconnect requires seven successive clear products spanning 60 minutes.
- Changing station location cancels the previous clear qualification.

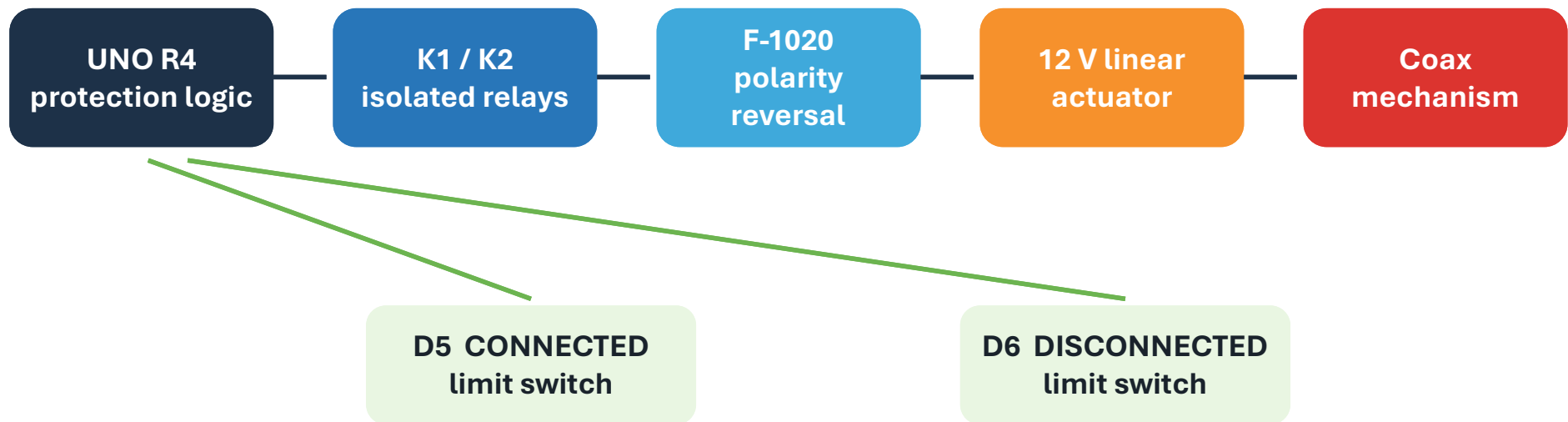
7. Local WebGUI: status without depending on the Internet path



- Separate W5500 wired-LAN interface
- Operational state and active-pixel count
- Nearest lightning distance and bearing
- 50 / 75 / 100 km plot
- ECCC product age and clear qualification
- Configuration, SD event log and diagnostics

Local LAN: 10.0.0.25

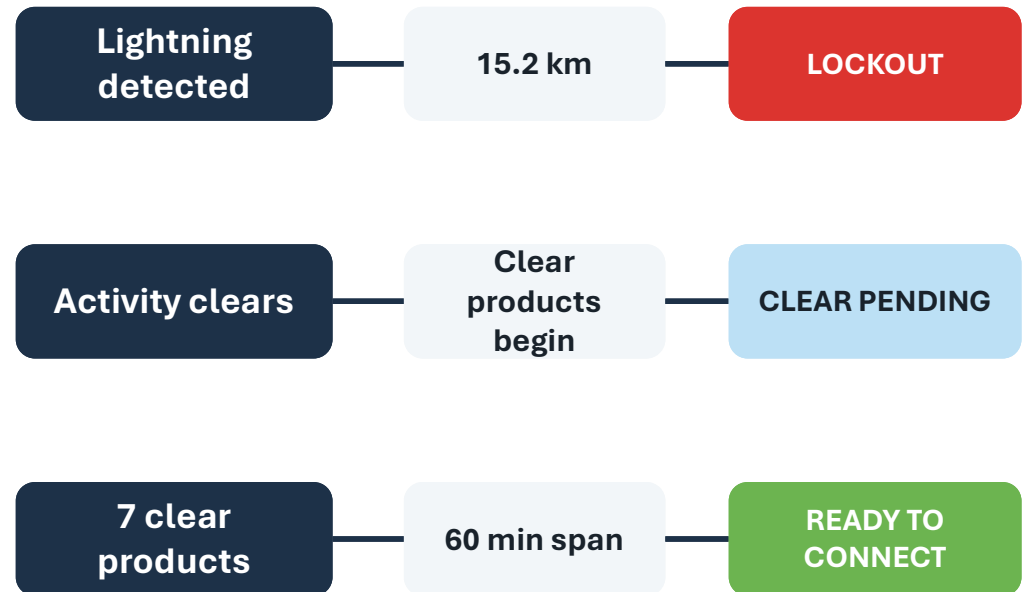
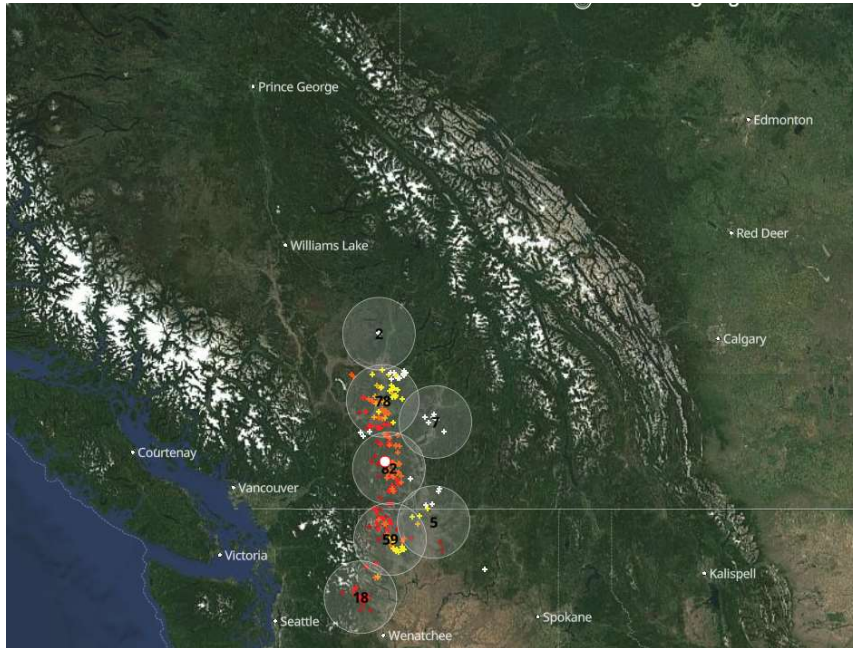
8. Actuator control and independent position feedback



Confirmed physical position—not merely the requested command—is reported as system status.

9. Live lightning validation

Real ECCC activity exercised lockout and recovery



Controller remained fail-safe through the complete storm → clear → reconnect-permitted sequence.

10. System features at a glance

ECCC data

10-min lightning density

Protection zones

100 / 75 / 50 km

Fail-safe logic

stale/fault ≠ clear

Clear qualification

60 minutes

Wired WebGUI

independent local LAN

Lightning plot

distance + bearing

Position feedback

independent D5 / D6

Actuator interlocks

disconnect priority

Manual override

disconnect always available

SD event log

timestamped events

Cycle counter

persistent maintenance data

Wi-Fi RSSI

installation diagnostic

11. Where the project stands

SOFTWARE

- ECCC acquisition & decoding
- Protection state machine
- WebGUI + SD logging
- Position feedback & interlocks
- Connector maintenance counter

NEXT: HARDWARE

- Bench-test linear actuator
- Measure current & travel time
- Integrate F-1020 + K1/K2
- Set external limit switches
- Add travel timeout / actuator fault

FINAL VALIDATION

- Mechanical coax integration
- Manual / automatic tests
- Real lightning protection override
- Outdoor installation

Low-cost embedded hardware + public scientific data + amateur experimentation + AI-assisted development

Conclusions

- Public ECCC lightning data can become a practical station-protection input.
- Fail-safe logic prevents uncertain or stale data from authorizing reconnection.
- Independent feedback verifies the actual mechanical disconnect position.
- The wired WebGUI and event log make the system observable and testable.
- Remaining work: electromechanical integration and final actuator-fault protection.

Questions / Discussion

Appendix: selected references

- Environment and Climate Change Canada — MSC GeoMet / Lightning Density documentation.
- ARRL — Grounding and Bonding for the Radio Amateur, 2nd ed., Ward Silver, NØAX.
- ARRL — Lightning Protection for the Amateur Radio Station, Ron Block.
- John White, VA7JW — “Coaxial Lightning Arrestors,” The Canadian Amateur, Jan–Feb 2014.
- Project article — “An Automated Lightning Monitor and Antenna Disconnect System for the Amateur Radio Station,” VE6HQ.