ONE MIND, MANY BODIES — OVER THE RADIO A FLEET ACTUALLY FLIES

Nexus over RF: secure, encrypted, jam-tolerant.

One Senua AI mind, shared across a fleet over a kilobit, half-duplex, lossy radio. Three properties make it survivable — and all three fall out of one choice: Senua ships the **diff, not the mind**. Every figure below is measured end-to-end on a two-node arm64 fleet over an emulated 57.6 kbps link.

01 Compression

573 B · 5,979×

Ship the diff, not the state. One new fact reaches the whole fleet as a compact binary delta — never the graph, never JSON. Sync cost scales with the **change**, not the size of the mind, so a 3.4 MB mind updates in a few hundred bytes. This one property is what makes agility and encryption affordable.

PER KNOWLEDGE UPDATE	SHIP THE STATE	SHIP THE DIFF (NEXUS)	ADVANTAGE
Bytes on the wire	3,425,640 B	573 B	**5,979× smaller**
Radio airtime @ 57.6 kbps	475.8 s (7m 56s)	0.080 s	**5,979× less**
Fleet-wide propagation	—	~1.5 s	**one fact, one hop**

02 Anti-jamming

75% band jammed · still syncs

Don't out-power the jammer — never be on its frequency long enough to be caught. A ~570-byte update completes inside a hop dwell; spread across a 32-channel hopping band (100 hops/s), a jammer only blacks out the hops in its slice and the mesh **re-sends on the next clear hop**. Compression buys the agility.

JAMMER COVERAGE OF THE BAND	AIRTIME JAMMED	FACT STILL SYNCS?	SYNC LATENCY
none (control)	0%	**yes**	0.7 s
25% of the band	~25%	**yes**	2.1 s
50% of the band	57%	**yes**	4.8 s
75% of the band	66%	**yes**	4.7 s
100% — full-band barrage	**100%**	**no**	—

03 Encryption

0 B plaintext · +5%

Nothing legible crosses the air. Every delta is sealed with **ChaCha20-Poly1305 AEAD** under a fleet key; the receiver verifies the tag before applying and **drops** a tampered frame. A live packet capture proves it — and it costs +5%, a tax on the compression win, not a trade against it.

ON THE WIRE (CAPTURED WITH TCPDUMP)	PLAINTEXT PATH	SEALED (NEXUS)
Delta magic SXDLT visible	**yes**	**no**
Knowledge text (“fuel reserve = 18 minutes”)	**visible**	**none**
Overhead per delta / still syncs A→B	— / yes	+29 B (~5%) / **yes**

Compression — every fact, live over the RF link

Each row: a distinct fact taught on drone A, recalled on drone B across the radio. On-wire bytes are the actual SXDLT delta the peer applied; airtime is that delta at 57,600 bps; latency is teach→recall wall-clock (conservative — includes cross-continent operator round-trips).

KNOWLEDGE TAUGHT (SURFACE = VALUE)	PAYLOAD	ON-WIRE DELTA	AIRTIME	SYNC LATENCY
alpha status = nominal	7 B	477 B	66 ms	1.59 s
fuel reserve = 18 minutes	10 B	492 B	68 ms	1.78 s
airspeed = 22 metres per second	20 B	494 B	69 ms	1.24 s
threat bearing = south southwest at 12 km	32 B	626 B	87 ms	1.32 s
weather = ceiling 3000 ft, vis 8 km, winds 090/15	57 B	667 B	93 ms	1.26 s
rendezvous = grid 88 N, 0430Z, callsign shell	53 B	683 B	95 ms	1.76 s
Mean	**30 B**	**573 B**	**80 ms**	**1.49 s**

Anti-jamming — the console shows it hopping clear

The current channel steps every poll and stays **outside the jammed slice**. Latency degrades gracefully as the jammer widens; only jamming the **entire** band continuously stops delivery — which costs the adversary enormous power across the whole spectrum and lights them up as a direction-finding target.

Nexus panel — RF channel band (as shown on-console)

ch 0–7 jammed — current ch 17 · hopping clear — 32 channels · 100 hops/s

Why the byte count is the security property

Anti-jam resilience is usually bought with power, directionality or spread-spectrum processing gain. Senua buys it with **information economy**: the less you must transmit to stay coherent, the faster you can hop, the shorter each dwell, the smaller the target. **Compression → agility → survivability.** The hop itself lives in the radio (SiK, ELRS, SDR); Senua makes hopping affordable enough to stay coherent through it.

Encryption — proven, not asserted

Every delta is sealed with ChaCha20-Poly1305 before it enters the transport; the transport (CRC, selective-repeat, resume) runs on ciphertext, and the receiver verifies the tag before applying.

The same capture, with and without the key

A live `tcpdump` on the radio port shows the `INGEST_DELTA` frames crossing — but **zero occurrences** of the delta magic or the taught knowledge. Clear the key and the *same* capture shows all of it in the clear. A tampered or wrong-key frame fails the tag and is dropped, never applied to the shared mind.

Test bed

Nodes	**2 × t4g.large (arm64 Graviton)**
Region	**ap-southeast-2**
Runtime	**pure-.sx daemon, no GPU**
Emulated RF link	**57.6 kbps, half-duplex**
Impairment	**0.1%/byte loss + corruption**
Shared mind	**6,471 facts / 23,016 nodes**
State size	**3,425,640 B (3.27 MiB)**

Protocol stack

Carrier	**Nexus DGRAM (SXDLT delta)**
Integrity	**CRC-32 per frame**
Recovery	**selective-repeat (bitmap ACK)**
Partition	**resumable, byte-exact**
Anti-jam	**FHSS (radio) + re-send on clear hop**
Confidentiality	**ChaCha20-Poly1305 AEAD**
Echo control	**split-horizon by node-id**

The test harness

- **Real, not mocked.** The cognition, daemon, arm64 nodes and Nexus protocol are unmodified and live; only the RF link is emulated (a deliberately hostile telemetry-radio profile).
- **Isolated delta.** Both nodes pre-seed the SAME 6,471-fact mind cold (off-radio); Nexus wires with a `baseline` marker so only facts taught *after* wiring cross — the measurement is the delta alone.
- **Measured.** On-wire bytes from the peer's applied-delta telemetry; latency is teach→first-correct-recall wall-clock (conservative); the plaintext test is a live `tcpdump` on the radio port; the jammer is a multi-channel hop model in the RF emulator.
- **Honest scope.** Latency is an upper bound. The frequency hop lives in the radio; Senua's contribution is the economy that keeps hopping coherent. The fleet key here is pre-shared; per-peer key agreement is a roadmap item. We say jam-tolerant, never jam-proof.