OAK DEFENSE — DRONE AI

Drone-installed software that drives your EW payload — Detect · Identify · Mitigate

A **drone-installed software package** that **drives your EW payload**. A single lightweight agent runs on the drone's companion computer and **drives multiple hardware devices at once** — ESM / ELINT and COMINT receivers, RF-link / DF sensors, and RF / GNSS jammer controllers — over any mix of transports (TCP · serial · SCPI · UDP) and wire protocols, through one pluggable device-adapter + codec layer. The **Ground-Station C2 Console** tasks the payload over Link 16 / SATCOM and shows live telemetry. Behind it, thirteen applications span the **DETECT → IDENTIFY → MITIGATE** workflow against the small / medium drone threat (DoD UAS Groups 1–3), with an AI core for drone-type identification, fused tracking, decision support and model hardening — under an operator sign-in / audit / classification governance layer. (The software is the brains and the integration layer; the RF is your licensed payload hardware.)

Applications

Counter-UAS Console
DETECT · IDENTIFY · MITIGATE

Scores the DETECT→TRACK→IDENTIFY→MITIGATE kill chain against UAS Groups 1–3, with layered radar / RF / EO-IR / acoustic sensing, RF + GNSS defeat and a swarm-saturation analysis.

Radar Detection
DETECT

Small-RCS drone echoes through a generic receiver: pulse compression, Doppler + MTI, CA-CFAR detection and a range-Doppler map.

EO/IR Sensor (IRST)
DETECT

Drone IR signature vs temperature, MWIR/LWIR atmospheric transmission, and detection range vs target and weather.

EO Video Tracker (AI)
IDENTIFY

A staring camera detects, tracks and classifies air targets (UAV vs fighter / missile / projectile) from image-plane motion.

RF / GNSS Jammer Effects
MITIGATE

Defeat the control link and navigation: comms jamming J/S + verdict, GNSS denial-range mapping and GNSS spoofing.

NAVWAR / GNSS Denial
MITIGATE

Multi-constellation GNSS denial, INS holdover drift by IMU grade + aiding, and a composite PNT-resilience score.

AI Drone-ID Model Trainer
AI

Train / evaluate pure-numpy classifiers to identify drones from RF signatures — wired to the public DroneDetect dataset.

AI Drone-Type ID
AI

Purpose-built drone-TYPE classifier (DJI/OFDM quad, FPV, RC, fixed-wing ISR, tactical UAS) with a 'Bird' confuser — from RF link, kinematics and micro-Doppler/acoustic rotor signature (~92% accuracy).

Multi-INT Fused Track Picture
IDENTIFY · COP

Correlates radar / RF / EO-IR / acoustic into one fused common operating picture: inverse-variance position, confidence by corroborating sensors.

AI Counter-Drone Advisor
AI

ML classifies each track, assesses threat & priority and recommends a counter-drone effect — with feature-level explainability and a live ESM feed.

Autonomous Cognitive Agent
AI

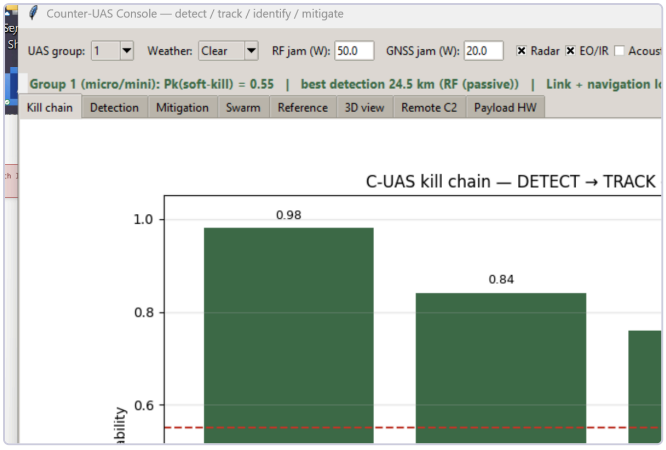
A closed-loop agent that learns which effect beats which drone class and out-performs a fixed doctrine.

Adversarial-ML Hardening
AI

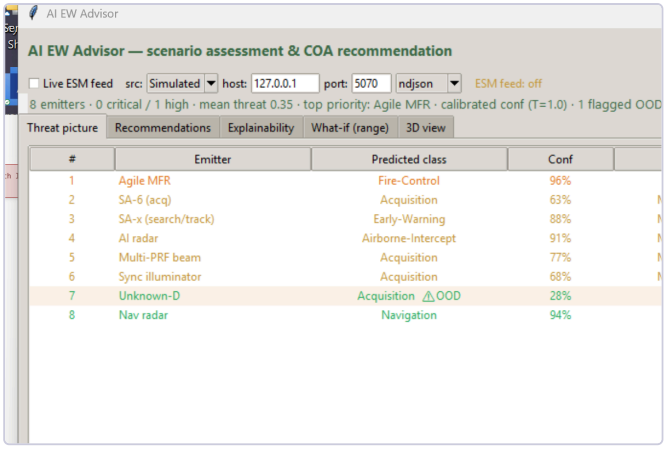
Stress-tests the drone classifier (FGSM / PGD / mimicry / poisoning) and hardens it (adversarial training, smoothing, OOD guard).

Ground-Station C2 Console
C2 · INTEGRATE

Operator console for the onboard agent: connect over Link 16 / SATCOM, task the fitted payload (effector setpoints, ARM / transmit — gated on the drone) and watch live receiver + effector telemetry.



Counter-UAS Console — DETECT→TRACK→IDENTIFY→MITIGATE kill chain & soft-kill Pk



AI Counter-Drone Advisor — classification, threat priority & recommended effect

AI core

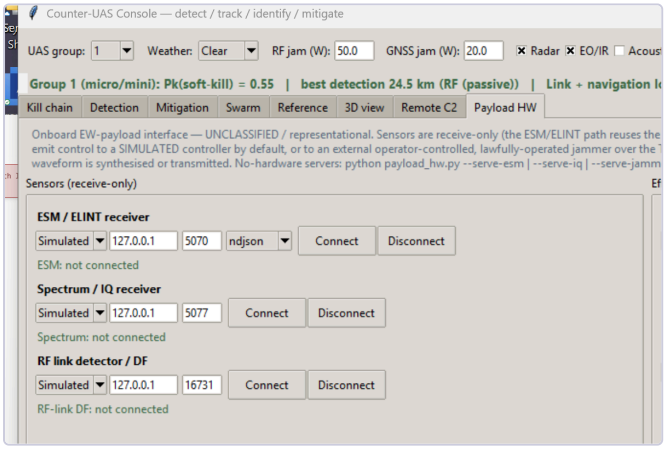
Identify with AI. Train pure-numpy classifiers on the public **DroneDetect** RF dataset, prioritise threats with the ML Advisor (calibrated confidence + out-of-distribution guard + explainability), and run a cognitive agent that learns which effect beats which drone class.

Trustworthy by design. The Adversarial-ML bench stress-tests the classifier (FGSM / PGD / mimicry / poisoning) and hardens it (adversarial training, randomised smoothing, OOD guard) — so you can rely on the identification before you act on it.

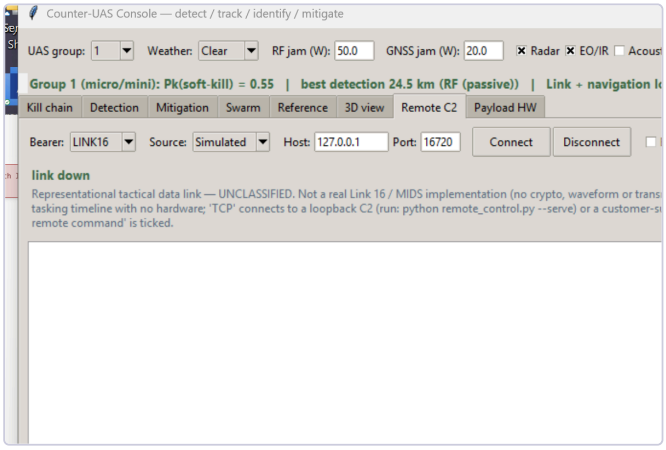
Integration & interfaces

Remote control — Link 16 / SATCOM. Every app can be remotely tasked over a representational tactical-data-link bus (J-series-flavoured, with Link 16 and SATCOM bearer profiles) and streams telemetry back. The command link can run **encrypted with mutual-certificate authentication (mutual TLS)**. Each app exposes its own controls to the link.

Onboard EW payload. Connect the drone's ESM/ELINT receiver, spectrum/IQ receiver and RF-link DF (receive-only), and command RF/GNSS jammer effectors through an ARM + dry-run interlock and a TCP/SCPI hardware seam. A live ESM feed drives the AI Advisor directly.



Onboard payload — ESM/ELINT, spectrum/IQ, RF-link DF + effector control



Remote C2 — Link 16 / SATCOM tasking & J-series telemetry

Security & governance

Operator accountability. Role-based sign-in (viewer / analyst / operator / admin), an append-only **audit log** of sign-ins, remote taskings and effector actions, and a **classification banner** on every window.

Guarded effects. Commanding an effector to transmit requires an operator/admin role plus the two-stage ARM + dry-run interlock; the Link 16 / SATCOM command bus is **encrypted and mutually authenticated (mutual TLS)**, with a shared-secret token and auto-reconnect.

Assurance & release

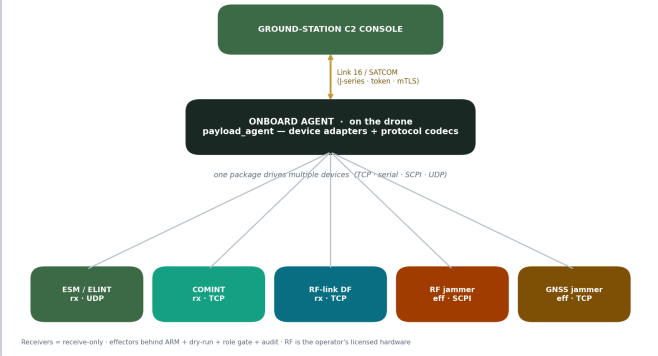
Validated, honestly. v1.0 ships with a transparent **k-fold cross-validation report** for the drone-ID model (per-class precision / recall and a deliberate "Bird" false-alarm check), labelled by data

Pilot-ready. A versioned 1.0 release with an evaluation EULA, an authoritative **capabilities-&-limitations** brief, a security review + hardening checklist and a code-signing guide — plus a structured

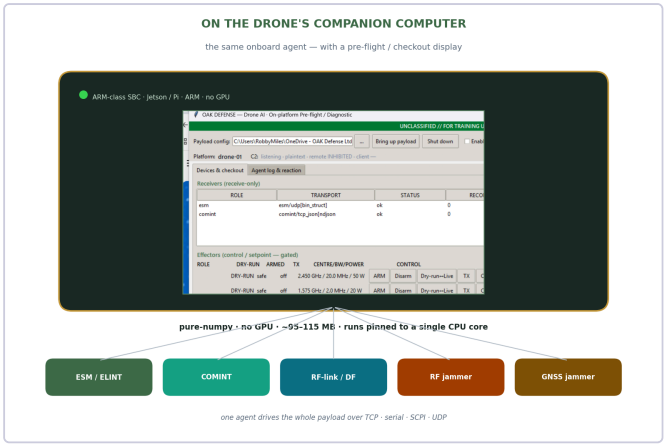
provenance — synthetic results are called synthetic and real-data validation is flagged as pending. No inflated numbers.

dry-run pilot / evaluation plan to prove value before any operational fielding.

One software package — drives your whole payload



One onboard agent drives multiple devices via pluggable adapters + protocol codecs; the GCS tasks it over Link 16 / SATCOM



On-platform pre-flight / checkout GUI — the onboard agent on the companion computer (Jetson / Pi-class), or run headless in flight

On the drone. A headless **onboard agent** runs on the drone's companion computer (Linux/ARM or Windows) — GUI-free, pure-numpy, few-MB footprint, systemd auto-start. One package **drives multiple devices at once** and hosts the C2 endpoint.

Drives multiple hardware devices. ESM/ELINT & COMINT receivers, RF-link/DF sensors, RF & GNSS jammer controllers — over **TCP · serial · SCPI · UDP** and any wire format (ndjson / SCPI / CSV / binary records) via a **pluggable device-adapter + protocol-codec layer**. A new device is configuration, not code; a custom record is a one-line plugin.

At the ground station. The **GCS C2 Console** connects over Link 16 / SATCOM, tasks the payload (effector setpoints, ARM / transmit — gated on the drone) and shows live receiver + effector telemetry.

Guarded. Receivers are receive-only; effectors run behind an ARM + dry-run interlock, an operator-role gate and an audit log. The software drives the hardware; the RF stays in your licensed payload.

Deployment & classification

Runs anywhere. Windows 10/11 desktop GCS, no GPU and no network required; onboard agent on a Jetson / Pi-class board. Single per-user installer with shortcuts, or run from Python source.

Honest by design. Unclassified · representational training / analysis. First-principles, published models — no operational exploit, payload or attack code. Threats scoped to DoD UAS Groups 1–3.

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