









# **Defence & Intelligence Summit**

## **Rise of UAS & C-UAS**

# The Paradigm Has Shifted: Drones Are Now the Tip of the Spear

## OPERATIONAL RANGES OF DRONE CATEGORIES

NAME	FIGURATION	OPERATIONAL RANGE
DEEP STRIKE DRONES		←————— up to 2000 km —————→
MARITIME DRONES		←————— up to 1600 km —————→
MIDDLE STRIKE DRONES		←———— up to 200 km —————→
RECONNAISSANCE DRONES		←———— up to 200 km —————→
MULTICOPTER BOMBERS		←—— up to 60 km ———→
FPV DRONES		←—— up to 40 km ———→
INTERCEPTOR DRONES		←—— up to 30 km ———→
GROUND DRONES		←—— up to 20 km ———→

### From Support to Primary

Unmanned systems have crossed a critical threshold. No longer ISR assets or force multipliers — they are now the primary instruments of tactical and operational strike across modern conflict zones.

### What This Means for Doctrine

- Distributed, networked, drone-centric operations are displacing platform-centric warfare
- Traditional air power economics are being structurally inverted
- "Kill chains" are giving way to dynamic, persistent kill webs
- Mass precision — not mass firepower — defines the new operational logic

# Drones as Primary Strike Systems: The Ukraine Proof Point

## Operational Reality

- **80–85%** of frontline targets in Ukraine are now engaged by unmanned systems — a figure that would have been unthinkable five years ago
- FPV drones operate at **sub-\$1,000 per unit**, enabling mass attrition at industrial scale
- Drones have assumed the targeting, reconnaissance, and strike roles once reserved for manned aviation

## Strategic Implication

The drone is no longer a supplementary tool. It is the dominant tactical weapon system of peer-and-near-peer conflict. **Militaries that treat UAS as auxiliary face asymmetric disadvantage against adversaries who do not.**




**Key Takeaway: Any force without organic UAS mass is structurally under-armed.**

# Software-Defined Warfare: Iteration Speed as a Combat Multiplier

## The New Development Cycle

- Ukrainian drone units iterate on design, firmware, and countermeasure adaptations in **weeks — not years**
- Battlefield feedback loops feed directly into next-production-run specs — a closed-loop R&D model
- Software updates deployed over-the-air can render yesterday's jammer ineffective overnight
- Improvised workshops near the front lines outpace traditional procurement pipelines

 The decisive advantage is no longer hardware specification — it is the **speed of adaptation**. Forces with agile software architectures will dominate those locked into legacy procurement cycles.

# AI-Enabled Strike Drones: Autonomy Moves from Lab to Battlefield

## **Autonomous Targeting**

The Helsing HX-2 integrates AI-driven target recognition and engagement logic, enabling precision strikes without continuous human-in-the-loop control — a doctrinal inflection point.

## **Swarm Capability**

Designed for coordinated multi-drone operations, the HX-2 can operate as part of networked swarms, distributing targeting load and complicating adversary intercept solutions.

## **100 km Strike Radius**

Extended range with onboard AI processing decouples strike capability from proximity of human operators — expanding the operational envelope dramatically.

## **Policy Threshold**

AI-enabled autonomous engagement raises urgent questions around IHL compliance, escalation control, and rules of engagement in contested airspace.

# EW-Driven Drone Evolution: The Electromagnetic Battlefield

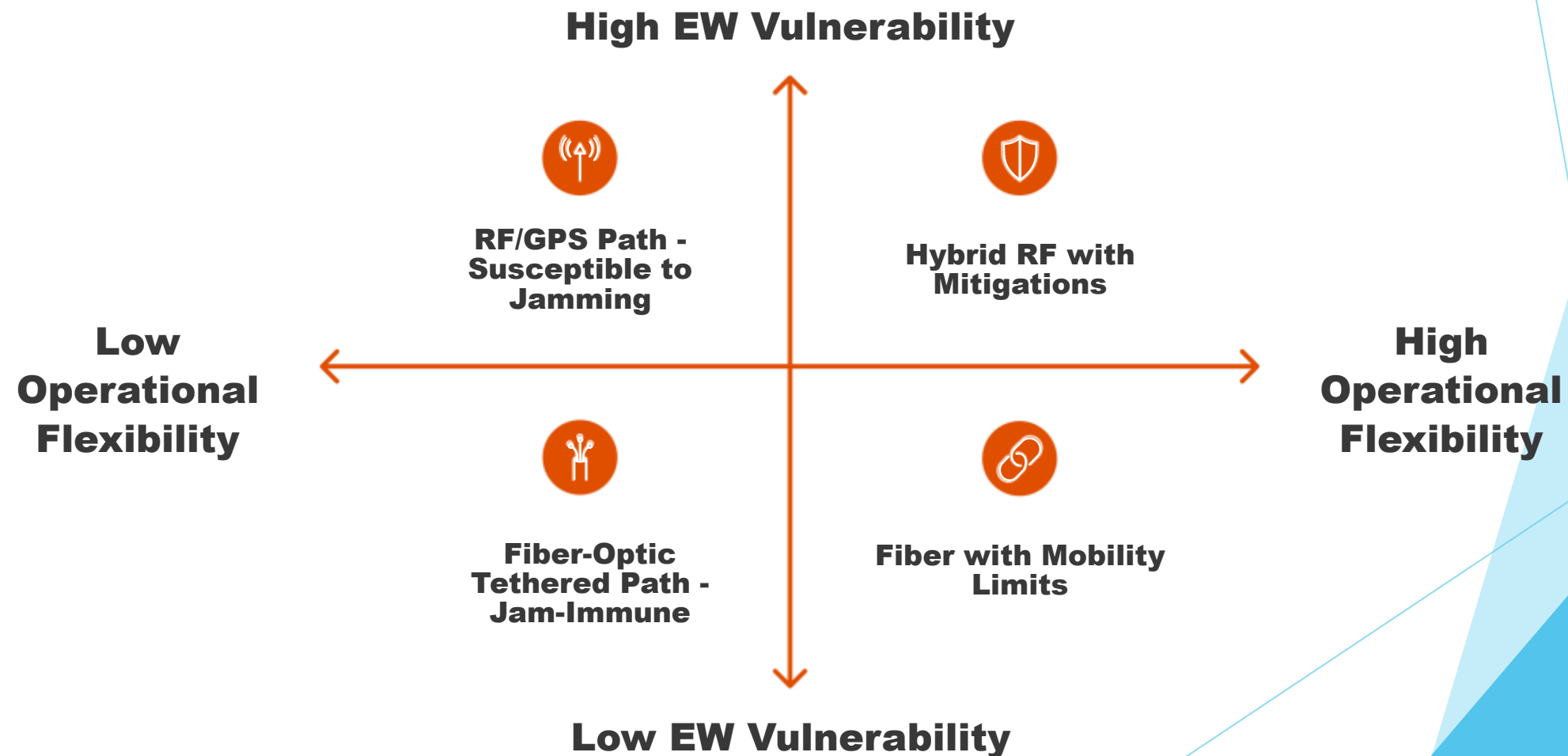
## The EW-UAS Arms Race

- GPS denial and RF jamming have become standard adversary tactics across all contested theaters
- Russian jamming systems have forced Ukrainian operators to abandon GPS-guided navigation entirely in some sectors
- **Fiber-optic FPVs** represent the direct counter: physically tethered guidance eliminates all RF and GPS dependency
- Drone design is now shaped first by the electromagnetic environment — not payload or aerodynamics

## Tactical Inflection

Fiber-optic drones are operationally limited by tether length but immune to electronic attack — creating a new sub-category of drone optimized for high-jamming environments.

The implication: **no single drone architecture dominates**. Forces must field electromagnetically diverse drone fleets to remain effective across the full spectrum of contested environments.

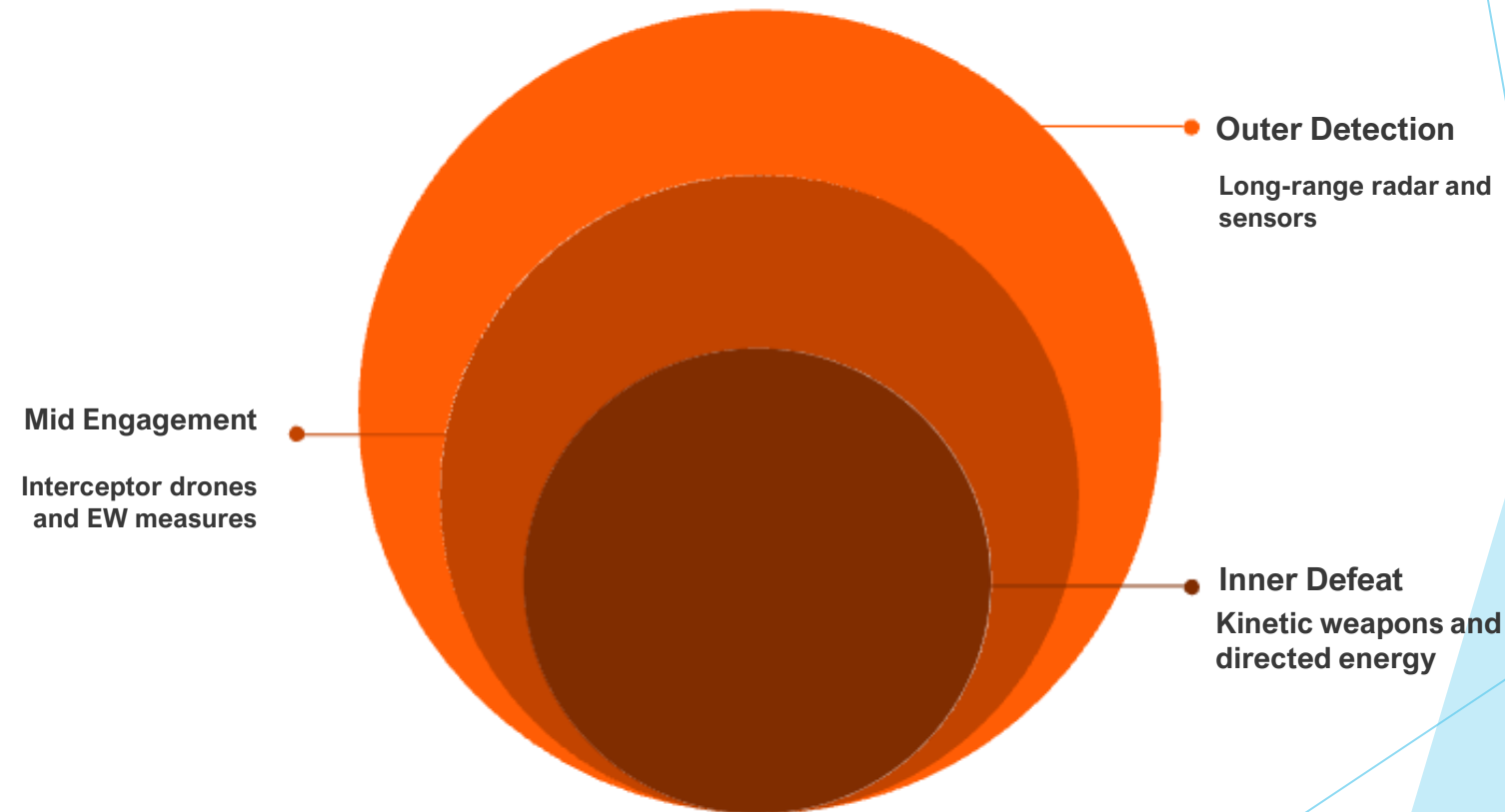


# Layered Counter-UAS: No Single System Wins Alone

## The LIDS Architecture

The U.S. Army's **LIDS (Low, slow, small UAS Integrated Defeat System)** pairs the **Raytheon Coyote** interceptor drone with the **KuRFS** radar — demonstrating that effective C-UAS demands sensor-effector integration, not standalone platforms.

- KuRFS: 360° radar, optimized for Group 1–3 UAS detection
- Coyote: Expendable loitering interceptor, network-guided
- Multi-effector layering covers kinetic, EW, and directed energy options



# Drone-on-Drone Warfare: The Interceptor as a Weapon System

## Anduril Roadrunner-M: The Paradigm Case

The **Roadrunner-M** is a reusable, jet-powered autonomous interceptor designed to defeat drone swarms at speed. Unlike missile-based intercepts, it can abort an engagement and return to base — fundamentally changing the cost calculus of air defense.

- Autonomous intercept of Group 1–3 UAS threats
- Reusable airframe — reduces cost-per-engagement dramatically
- AI-driven intercept logic enables autonomous target prosecution
- Operates as part of a networked, multi-vehicle kill web



Drone-on-drone combat introduces a new competitive domain: **intercept AI vs. evasion AI** — an algorithmic arms race with direct tactical consequences.

# Directed Energy vs. Swarms: High-Power Microwave Enters the Fight

## The Swarm Problem

Kinetic and even EW-based defenses struggle against coordinated swarm attacks where individual defeat requires per-unit engagement — exhausting interceptor magazines rapidly against cheap attritors.

## Epirus Leonidas HPM

The Leonidas High-Power Microwave system defeated a **49-drone swarm** in U.S. testing — simultaneously and at near-zero marginal cost per engagement. HPM attacks electronics, not airframes, bypassing kinetic defeat entirely.

## Strategic Value

HPM offers a compelling cost-exchange inversion: a single sustained-power burst can defeat dozens of drones, eliminating the magazine-exhaustion vulnerability that plagues conventional C-UAS effectors against mass attacks.

# Laser-Based Air Defence: Speed-of-Light Engagement at Scale

## The Directed Energy Advantage

Laser systems engage at the speed of light with effectively zero cost-per-shot — the most structurally favorable cost exchange in C-UAS. Power supply and thermal management remain the primary engineering constraints.

- Dwell time on target determines lethality — atmospheric conditions affect beam quality
- Scalable power output allows graduated response: dazzle, disable, or destroy
- No magazine constraints — operational endurance limited only by power generation

## From Lab to Field

Programs including **LOCUST** and allied directed-energy initiatives are transitioning from demonstration to fielded capability. Integration with ground-based air defense architecture is the near-term operational challenge.



Radar Detect

Laser Track

Beam Dwell



# Integrated Fixed-Site Defence: Rafael Drone Dome as the Benchmark

## System Architecture

The **Rafael Drone Dome** integrates radar detection, electro-optical tracking, RF jamming, and optional laser defeat into a single networked architecture — the benchmark for integrated fixed-site C-UAS.

- Multi-spectral detection: radar + EO/IR + RF direction-finding
- Graduated response: jam first, defeat kinetically if required
- Hardened for operation in GPS-contested environments

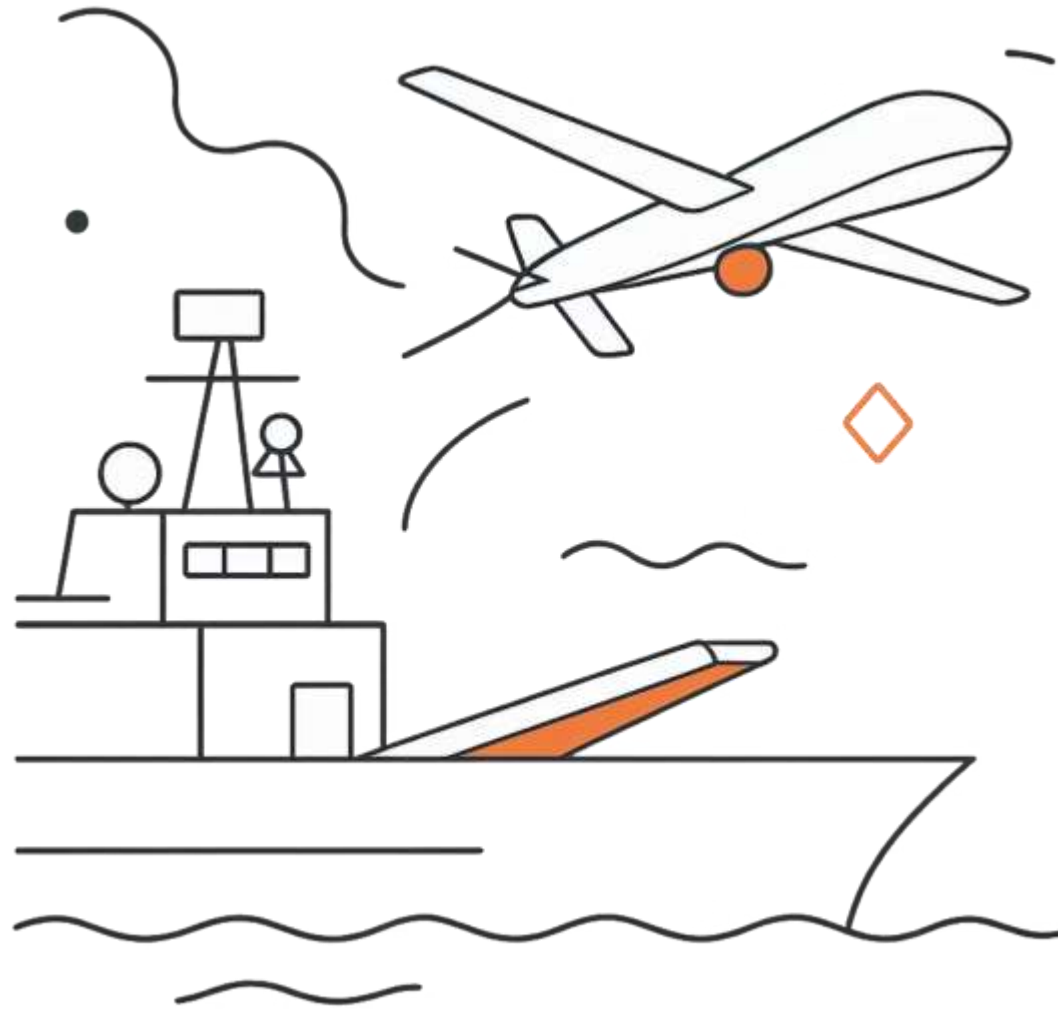
## Operational Lessons

- Combat-proven in Israel and exported to allied nations
- Fixed-site architecture enables deeper sensor integration than mobile alternatives
- Command-and-control latency remains the critical variable: sensor-to-effector timelines must compress below drone reaction windows



**Integration — not sensor capability alone — determines system effectiveness in high-density threat environments.**

# Maritime Drone Operations: The Naval Dimension Opens Up



## Shield AI V-BAT: VTOL UAS at Sea

The **Shield AI V-BAT** demonstrates the viability of persistent UAS operations from naval vessels without catapult infrastructure — a capability threshold that expands organic drone reach to the full fleet.

- Vertical takeoff and landing eliminates deck space constraints
- Persistent ISR and targeting support for naval task groups
- Extends the sensor horizon beyond organic ship-based systems
- Drone swarms launched from dispersed naval platforms create a distributed maritime kill web

**ⓘ Maritime C-UAS is structurally harder: radar clutter, deck motion, and limited engagement geometry compress decision timelines severely.**

# Hybrid Drone-Missile Threats Stress Naval Defence

## The Houthi Campaign

- Houthi forces deployed coordinated drone-missile hybrid salvos against U.S. and allied naval assets — forcing continuous high-cost intercepts
- SM-2 and SM-6 missiles — at \$1–2M per shot — were expended against \$20,000 drones, creating an unsustainable cost-exchange ratio
- Magazine depth and reload cycles emerged as the critical operational vulnerability

## Strategic Implications

- Hybrid saturation attacks are now a validated operational concept available to non-state actors
- Naval air defense architecture was not designed for drone-volume threats — adaptation is urgent
- Directed energy and lower-cost kinetic interceptors are now accelerated acquisition priorities for all major navies



The Red Sea is the first operational proof-of-concept for economic warfare through drone-missile hybrid saturation.

# Battle Management Systems: Data Fusion as the Force Multiplier

## Ukraine's DELTA System

Ukraine's DELTA battlefield management system aggregates data from drones, ground sensors, OSINT feeds, and allied intelligence into a single operational picture — enabling faster targeting decisions than any legacy C2 architecture.

- Real-time target fusion from heterogeneous sensor networks
- Tasking of strike drones directly from the common operating picture
- Decentralized access: company-level commanders engage time-sensitive targets without higher-echelon approval delays

## The Command Advantage

In a drone-saturated battlespace, the decisive edge belongs to the force that can **observe, decide, and act faster** than the adversary can re-task or adapt. Battle management software is now as operationally critical as any weapons platform.



**Better data integration beats better platforms — the DELTA model is a template for allied forces to adopt and scale.**

# Cost-Exchange Warfare: The Economic Inversion of Air Defence

## The Asymmetry in Numbers

\$1K

FPV Strike Drone

Average cost per unit for front-line strike drones — mass-produced at industrial scale

\$100K+

Kinetic Interceptor

Minimum cost per intercept for radar-guided missiles and interceptor munitions

100:1

Cost Exchange Ratio

The structural imbalance that makes drone saturation an economically rational strategy

## The Alliance Response

NATO and allied nations are accelerating trials of **low-cost kinetic interceptors** — purpose-built sub-\$10,000 munitions designed to restore cost-exchange equilibrium against drone threats. No fielded solution yet achieves the required cost threshold at scale.

⚠️ Until cost-competitive intercept is achieved at scale, mass drone attacks represent a strategically rational — and affordable — offensive tool for any adversary.

# Civilian & Infrastructure Defence: The Expanded Threat Perimeter

## Beyond the Battlefield

Critical infrastructure — airports, energy facilities, government sites — now faces persistent UAS threat from state proxies, non-state actors, and lone-actor threats. **Dedrone** systems demonstrate scalable detection and mitigation for non-kinetic environments.

- Passive RF detection identifies drone signatures without revealing sensor position
- AI-driven classification distinguishes commercial, modified, and military-grade UAS
- Integration with facility security management systems enables automated alert and response
- Legal constraints on kinetic defeat in civilian airspace make EW the primary countermeasure



**📌 Civilian C-UAS operates under fundamentally different rules of engagement — detection and deterrence, not defeat, is the primary design requirement.**

# Sovereignty & Industrial Scale: Domestic Production Is Now a Security Imperative

## The Ukraine Model

Ukraine has built a distributed domestic drone ecosystem — dispersed production cells, decentralized design iteration, and sovereign supply chains — demonstrating that **industrial resilience is a warfighting requirement**, not a procurement preference.

- Over 200 Ukrainian drone companies operating under wartime conditions
- Production targets of 1–2 million FPV drones annually
- Dependency on foreign components remains a structural vulnerability

## The European Imperative

- Helsing HX-2 represents Europe's bid for sovereign AI-enabled strike drone capability
- EU defence industrial strategy now explicitly targets domestic UAS supply chain development
- Nations without domestic production capacity are dependent on allied supply in peer conflict — an unacceptable strategic risk

⚠ Supply chain sovereignty is now a frontline military capability. Drone dependency on adversary-controlled components is an existential vulnerability.

# The Air Littoral Is Now Contested Territory

Forces that adapt fastest — in doctrine, software, and industrial scale — will define the character of the next conflict.

**The window for strategic adjustment is narrowing.**



# Key Strategic Takeaways

1

## Drones = Mass Precision Warfare

The combination of volume, cost, and targeting precision redefines what "mass" means in modern conflict. Quantity with accuracy is now achievable below \$1,000 per engagement.

2

## EW Dominance = Airspace Control

Electronic warfare is no longer a support function — it is the primary contest for control of the lower airspace. Forces that cannot operate through jamming are tactically blind and deaf.

3

## Swarms Challenge All Existing Air Defence

No currently fielded system can reliably defeat coordinated swarm attacks at scale without exhausting magazines or exceeding sustainable cost-exchange ratios.

4

## Software + Data > Platform Advantage

The force that adapts fastest — through software iteration, AI integration, and data fusion — holds decisive advantage over the force with superior hardware but slower adaptation cycles.

5

## Cost-Exchange is the New Battlefield Logic

Economic sustainability of intercept is now a primary design requirement for all C-UAS systems. Forces that cannot restore cost-exchange equilibrium will be attrited into strategic paralysis.

Ukraine showed what drones can do?

Iran showed how to scale them.

Israel showed how to defend against them.

Nations are now trying to integrate all three lessons.