Nanoveu Limited
ACN 624 421 085
Level 45, 108 St Georges Terrace
Perth WA, 6000 Australia
+61 8 6244 9095
www.nanoveu.com

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Nanoveu to Launch Live Drone Testing to Validate Simulation Results

Crazyflie selected as primary testbed for ECS-DoT endurance validation following 50%+ endurance gains in simulation

Highlights

- EMASS to begin on-air endurance validation of ECS-DoT on palm-sized Crazyflie nano-drones, advancing from simulation to real-world testing.
- Trials build on Phase-2 results averaging endurance gains of 60% (quadcopters), 58% (hexacopters), and 57% (octocopters) achieved without changing batteries, propulsion, or airframes.
- Phase 2 results conducted on over 300 HIL campaigns on Gazebo/ArduPilot tested varied payloads, wind profiles, and flight geometries, establishing robustness.
- In parallel, EMASS will test additional capability of the ECS-DoT chip to improve on-device perception and navigation without external positioning systems, using minimal sensors for obstacle avoidance and real-time path planning.
- Upcoming navigation & hazard-avoidance benchmarking designed to establish ECS-DoT as a multi-chip per device drone opportunity spanning endurance, control, perception, and path-planning for commercial, defence, surveillance, and industrial applications.
- Crazyflie chosen for its robust developer ecosystem and modular architecture, enabling controlled, repeatable endurance experiments.
- Objective is to replicate 50 Hz closed-loop control at <1 mW in real-world environments and verify endurance uplift under natural variability.
- Following Crazyflie validation, EMASS will seek engagements with airframe manufacturers and system integrators to evaluate ECS-DoT on larger drone platforms and mission profiles.

Nanoveu Limited (ASX: NVU, OTCQB: NNVUF) ("Nanoveu" or the "Company"), through its wholly owned subsidiary, Embedded A.I. Systems Pte Ltd ("EMASS"), is pleased to announce commencement of live flight trials to validate ECS-DoT's endurance gains in real world conditions, initially on palm sized drones. This program is the next step following Phase-2 simulation results, which demonstrated substantial flight-time improvements without altering batteries, propulsion, or airframes.

The program will be executed on open-source drone platforms, with Crazyflie nano drone selected for initial integration given its robust developer ecosystem and flexible, modular architecture. The first objective of this campaign will be endurance validation, confirming that ECS-DoT's sub-milliwatt control can extend mission duration on the Crazyflie platform in real-world environments.

In parallel, EMASS will benchmark GPS-free indoor navigation using a minimal sensor suite (e.g., a single monocular camera and IMU) powered entirely by ECS-DoT's milliwatt-class on-board AI. This stream will validate visual-inertial odometry (VIO) for infrastructure-free motion tracking, AI-driven obstacle avoidance using lightweight depth/flow estimation, and adaptive real-time path planning in cluttered environments.

The program aims to provide on-air evidence that ECS-DoT can deliver reliable autonomy without heavy sensors or external positioning systems, establishing a clear proof point ahead of evaluating applicability on larger platforms and mission profiles. This approach reduces technical risk, shortens evaluation cycles, and informs **feature prioritisation** including potential **multi-chip configurations** before any assessment on larger airframes.

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Figure 1: Image of the Crazyflie 2.1+ drone, a versatile open-source flying development platform that weighs 29g to be used in the upcoming live drone testing.

Focus area	Platform	Sensors	ECS-DoT role / objective	Key measures / targets
AI-optimised control for endurance	Crazyflie-class open-source nano-drone (modular; optional AI-deck if required)	Single monocular camera + 6-axis IMU	Learn/adapt propeller speed/attitude in real time to reduce energy per metre and extend mission duration without hardware changes	• Validate endurance uplift vs. PID baseline • Target up to ~60% improvement (to be confirmed on-platform) • Track energy-per-metre and mission time
Indoor navigation with minimal sensors	Same platform	Same baseline sensors	Run lightweight neural nets for visual-inertial odometry (VIO), obstacle detection/avoidance, and path planning within a sub-watt power budget	• Stable VIO tracking indoors (low drift) • Real-time avoidance with low latency • Deterministic control loop timing

Table 1: To illustrate the expanded live testing program focusing on Endurance Validation and Indoor Navigation.

Phase 2 Testing: Real World Scenarios at Scale

ECS-DoT is a multi-purpose control system designed to optimise energy use in AI-driven systems. The Phase 2 evaluation program was structured to determine whether ECS-DoT can extend flight endurance in mission-critical UAV scenarios using AI-optimised control alone, without modifications to batteries, propulsion systems, or airframes. To this end, EMASS conducted more than 300 hardware-in-the-loop (HIL) campaigns on Gazebo/ArduPilot, the same robotics environment relied on by NASA, DARPA and global autonomy leaders.

This program covered a wide range of operational conditions, including varied payloads, wind profiles, and flight geometries. Campaigns incorporated extensive flight-path diversity (e.g., waypoint missions, climb/descent profiles, and manoeuvre-intensive routes) to ensure robustness across mission types.

Component	Details
Simulation Environment	High-fidelity hardware-in-the-loop (HIL) and software-in-the-loop (SIL) frameworks. ECS-DoT processed real-time sensor data and flight control.
Control Cycle Performance	ECS-DoT achieved stable 50H (20ms) closed-loop control cycles while consuming <1 milliwatt of power.
Surrogate Power Models	AI models trained on real propulsion and telemetry data to dynamically predict and optimize energy usage per flight condition.
Test Campaign Scale	Over **300** unique campaigns across multiple drone types, each with **100+** distinct flight paths and mission variations.
Flight Profiles Simulated	• Waypoint navigation and loiter • Climb/descent under wind
Evaluation Metrics	• Energy consumed (Joules) • Distance per Joule • Mission endurance (minutes of flight time)
System Validations	Demonstrated real-time control, energy efficiency, and flight adaptation without modifying battery or propulsion hardware

Table 2: Phase 2 Sim testing and its components

Throughout testing, ECS-DoT maintained deterministic, real-time closed-loop control at 50 Hz while drawing less than one milliwatt of power. This sub-milliwatt control budget enables on-board AI and removes dependence on cloud compute or latency-sensitive links, aligning with the power and weight constraints of commonly deployed UAV platforms.

Performance was assessed using mission-relevant metrics such as total energy consumed (J), distance per joule, and overall endurance (minutes). Phase 2 results consistently exceeded the 50% improvement threshold across platforms, with headline gains of up to:

- 80% for quadcopters (approximately 60–65% average),
- up to 75% for hexacopters under payload stress,
- up to 85% for octocopters (approximately 57% average).

These improvements translate into longer range, higher mission productivity, and improved cost per flight, delivered without hardware changes.

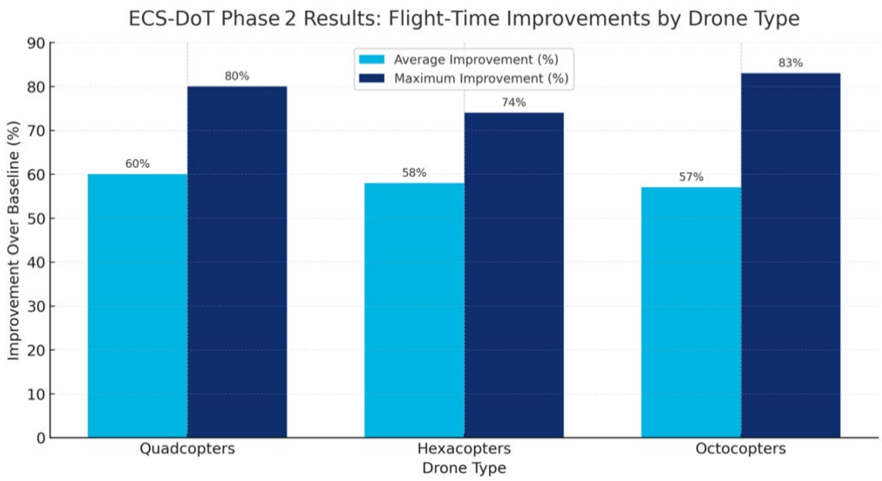

Figure 2: Results from Gazebo testing highlight the average and maximum improvements

With Phase 2 validation complete, EMASS is transitioning from simulation to live operational trials. The Company is initiating endurance trials on the Crazyflie nano-drone to verify sub-milliwatt control performance in real-world environments, to be followed by a staged scale-up to larger airframes as results are received.

Transition to Live Flight Validation

With Phase 2 simulation results established, the program is advancing to the next phase of live flight testing to validate prior endurance gains in real-world conditions. The Crazyflie nano-drone has been selected as the initial on-air platform due to its research-grade reliability, mature developer ecosystem, and suitability for controlled, repeatable endurance trials. This choice allows EMASS to replicate the Phase 2 control policies in real time, verify sub-milliwatt closed-loop operation under natural environmental variability, and generate on-air results that the simulated endurance improvements translate to flight.

The company has chosen small drones to begin this proof-of-concept validation as palm-sized platforms provide the fastest iteration cycles, lowest test risk, and the tightest control of variables making it ideal for proving that endurance gains come from ECS-DoT's energy-aware control rather than from hardware changes. They also stress the hardest constraints (weight, power, compute), so demonstrating capability here sets a high bar for applicability to larger classes.

Simultaneously additional evaluation will benchmark indoor, GPS-free autonomy using a minimal sensor suite (e.g., a single monocular camera and IMU) powered entirely by ECS-DoT's milliwatt-class on-board AI. The benchmarks will cover visual-inertial odometry (VIO) for GPS-free motion tracking, AI-driven obstacle avoidance using lightweight depth/flow estimation, and adaptive real-time path planning for cluttered layouts relevant to defence/ISR, logistics depots, and critical-infrastructure interiors.

Indoor and GPS-limited settings are where small drones deliver outsized value including defence contexts. Tasks like room-to-room reconnaissance, shipboard and subterranean inspection, compound security sweeps, and rapid damage assessment call for low-signature aircraft that can work in tight, cluttered spaces. With milliwatt-class and on-device autonomy, small platforms navigate, avoid obstacles, and capture useful data without heavy sensors or external infrastructure reducing personnel exposure and improving tempo and mission reliability.

ECS-DoT's multi-chip opportunity

As EMASS advances, the simultaneous progression of **endurance validation and indoor autonomy**, the compute picture becomes richer. Rather than one monolithic processor, assigning dedicated ultra-low-power accelerators to each critical task will seek to unlock deterministic timing and preserves flight time creating a genuine multi-chip opportunity per drone. Even on palm-sized platforms, autonomy naturally separates into parallel workloads: energy-aware control, perception (VIO, depth/flow), and navigation/path planning.

- **1× ECS-DoT:** Endurance-optimised control (closed-loop at <1 mW)
- **2× ECS-DoT:** Control **+** VIO (GPS-free odometry) for basic indoor autonomy
- **3× ECS-DoT (or more):** Control **+** VIO **+** obstacle avoidance & real-time path planning
- **Optional add-ons:** On-board compression/encoding, anomaly cues, and other mission aids as capability scales

These trials mark another key step toward commercial validation of EMASS's ultra-low-power AI technology for next-generation drone systems because the impact shows up first in mission economics. By extending time-on-task and reducing battery swaps, ECS-DoT lowers labour and turnaround, cutting cost per mission. The added endurance can be traded for richer sensing (e.g., thermal or multispectral) without larger batteries, while extra margin improves wind-hold, return-to-home safety, and contingency handling. As gains are delivered via software-defined control, operators can retrofit existing fleets as well as design new systems seamlessly.

Nanoveu will provide timely updates as the next phased testing flight results are received. In tandem with the live trial program, the company will seek engagements with other companies, air frame manufacturers and system integrators, to evaluate ECS-DoT on larger drone platforms. Subject to successful outcomes on Crazyflie, the Company further intends to broaden live testing across additional airframes and operating environments and will continue to assess further application-specific trials with OEM partners.

Mark Goranson, CEO – Semiconductor Division, commented: *"Expanding into live testing and indoor autonomy is the logical next turn of the flywheel for EMASS. We've proven our control stack at sub-milliwatt power; now we're taking it from lab to live environments on a palm-sized airframe and building the evidence packs that OEMs need to move to pilots. The goal is simple, demonstrate reliable perception and control with the fewest possible sensors, then scale the same software stack to larger platforms and defence-grade use cases."*

References:

1. ASX Release, Nanoveu Achieves Landmark in Drone Energy Efficiency Using EMASS Edge-AI Chip, 2 September 2025.

This announcement has been authorised for release by the Board of Directors.

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Nanoveu Media
Alfred Chong, Nanoveu MD and CEO
P**:** +65 6557 0155
E: info@nanoveu.com

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About Nanoveu Limited

Further details on the Company can be found at https://nanoveu.com/.

EMASS is a pioneering technology company specialising in the design and development of advanced systems-on-chip (SoC) solutions. These SoCs enable ultra-low-power, AI-driven processing for smart devices, IoT applications, and 3D content transformation. With its industry-leading technology, EMASS will enhance Nanoveu's portfolio, empowering a wide range of industries with efficient, scalable AI capabilities, further positioning Nanoveu as a key player in the rapidly growing 3D content, AI and edge computing markets.

EyeFly3D™ is a comprehensive platform solution for delivering glasses-free 3D experiences across a range of devices and industries. At its core, EyeFly3D™ combines advanced screen technology, sophisticated software for content processing, and now, with the integration of EMASS's ultra-low-power SoC, powerful hardware.

Nanoshield™ is a self-disinfecting film that uses a patented polymer of embedded Cuprous nanoparticles to provide antiviral and antimicrobial protection for a range of applications, from mobile covers to industrial surfaces. Applications include *Nanoshield™ Marine*, which prevents the growth of aquatic organisms on submerged surfaces like ship hulls, and *Nanoshield™ Solar*, designed to prevent surface debris on solar panels, thereby maintaining optimal power output.

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