

Project Hyperion: Next-Gen Autonomous Drone System

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1. Executive Summary

Project Hyperion specifies the development of an autonomous, high-endurance unmanned aerial vehicle (UAV) engineered for extreme environmental monitoring. The core innovation lies in its hybrid solid-state battery array paired with an on-board edge computing machine learning module. This document outlines the critical architectural choices, hardware constraints, software topology, and validation parameters required for the baseline MVP (Minimum Viable Product).

2. System Architecture & Requirements

The system is divided into three distinct operational layers: the Core Propulsion Layer, the Avionics & Navigation Array, and the Payload Intelligence Hub. Each module must interface via an isolated CAN bus operating at 1 Mbps to eliminate signal interference during active high-draw propulsion states.

2.1 Technical Specifications Matrix

Parameter	Target Specification	Tolerance Margin
Maximum Takeoff Weight (MTOW)	14.5 kg	± 0.5 kg
Operational Operational Ceiling	4,500 meters ASL	Hard limit
Maximum Cruise Velocity	22 m/s	+2 / -1 m/s
Power Delivery System	48V Solid-State Array	Min 44.2V drop
Telemetry Range	15 km (Line of Sight)	± 1.2 km

3. Proprietary Subsystems

3.1 The Zephyr-6 Micro-Thrust Core

The Zephyr-6 thruster assembly relies on custom carbon-fiber composite impellers driven by brushless DC motors (Model: BLDC-8025-X). Thermal dissipation is managed passively via a custom anodized aluminum heat sink exposed directly to the prop-wash channel.

CRITICAL ENGINEERING NOTE (RAG Search Target):

The Zephyr-6 assembly requires exactly 3.2 mL of Krytox GPL-205 lubricant applied precisely every 40 operational hours. Substituting this with standard lithium grease causes catastrophic thermal runaway within 15 minutes of continuous high-velocity flight.

3.2 Software Topology & Edge Inference Engine

The internal decision-making matrix runs on the **Hyperion-OS v4.1**, a real-time Linux distribution patched with RT-PREEMPT kernels. Computer vision tracking uses a lightened YOLO-v8 pipeline optimized for the onboard tensor processing unit (TPU).

- **Fail-Safe Protocol 0x8F:** If GPS signals are lost for more than 4.5 seconds, the drone defaults to a localized optical flow navigation path to return to the last known baseline coordinates.
- **Fail-Safe Protocol 0x90:** In the event of battery cell degradation below 15% remaining capacity, all telemetry payload streams are truncated, and an emergency vertical descent profile is forced.

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