UAV Battery Efficiency Estimator

Technical Math Appendix

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UAV Battery Estimator

Technical Math Appendix

1. Battery Energy and Flight Time

Flight Time (min) = (Battery Capacity [Wh] / Power Draw [W]) x 60
Energy Used (Wh) = (Power Draw [W] x Time [min]) / 60

2. Climb Energy Calculation

Climb Energy (Wh) = (mass [kg] x 9.81 m/s^2 x height [m]) / 3600

3. Air Density Factor

Air Density Factor = rho_alt / rho_0
Where rho_0 = 1.225 kg/m3 (sea level), rho_alt is density at altitude

4. Wind and Drag Estimation

Effective Speed = Flight Speed + Wind Speed (headwind)
Drag ~ v^2, Power Draw ~ v^3 (simplified scaling)

5. Hybrid Power Modeling

Battery Draw (Hybrid) = Total System Draw x 0.10
Remaining 90% assumed to be from combustion engine

6. Distance Estimation

Distance (km) = (Flight Speed [km/h] x Time [min]) / 60

7. Safety Logic and Battery Cutoff

Abort Condition: Remaining Battery <= Safety Reserve Threshold (e.g., 1 Wh)