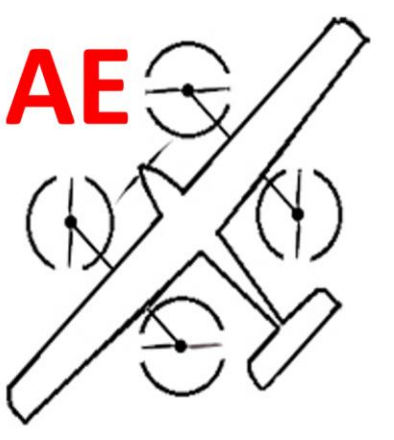


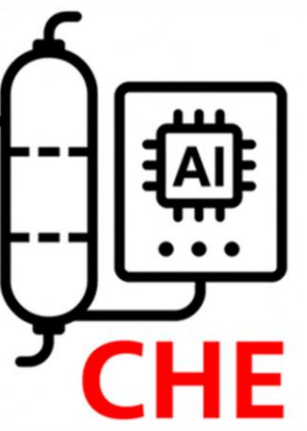
Hydrogen-Powered UAV with Auto Cartridge Swapping

TEAM
M117

- Ali Alasiri (ISE) • Talal Althwaini (ISE) • Yazen A. Zwawi (AE)
 - Abdulrahman Alhuzami (CHE) • Ahmad Alnaem (CHE) • Hadi Almohammedhusain (CHE)
- Coach: Dr. Mohammad Irfan Alam



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Objective

Constraints

System Design

Validation & Verification

- Extend UAV flight endurance beyond battery limitations (**≥ 60 minutes**)
- Ensure a safe operating environment through hydrogen leak detection and automatic shut-off systems
- Develop an cartridge-swapping system (**≤ 5 minutes turnaround**)
- Utilize clean hydrogen energy with lower emissions compared to gasoline-based systems

Operate reliably under humidity (**≤95% RH**) and vibration (**MIL-STD-810H**)

Detect hydrogen **≥ 1000 ppm** near tank/fuel cell

Fuel system mass **≤ 2.5 kg**

Operate in **-10°C to +60°C**



- Verified hydrogen flow rate and stability
- Tested leak detection and automatic shut-off
- Evaluated endurance based on power consumption
- Confirmed thermal and safety limits
- Assessed swapping time performance

Background & Problem Statement

Specifications

Prototype Development

Results & Conclusion

- UAVs are widely used in many applications.
- Most rely on batteries with low energy density.
- Hydrogen fuel cells offer higher energy density.
- UAVs are limited to **20–40 min** flight time.
- charging causes operational downtime and delays.
- Batteries limit payload and performance.
- No rapid refueling solution for continuous missions.

Refueling area **≤ 4 m²** (**≥ 0.8 m aisle**) Flight endurance **≥ 60 min**

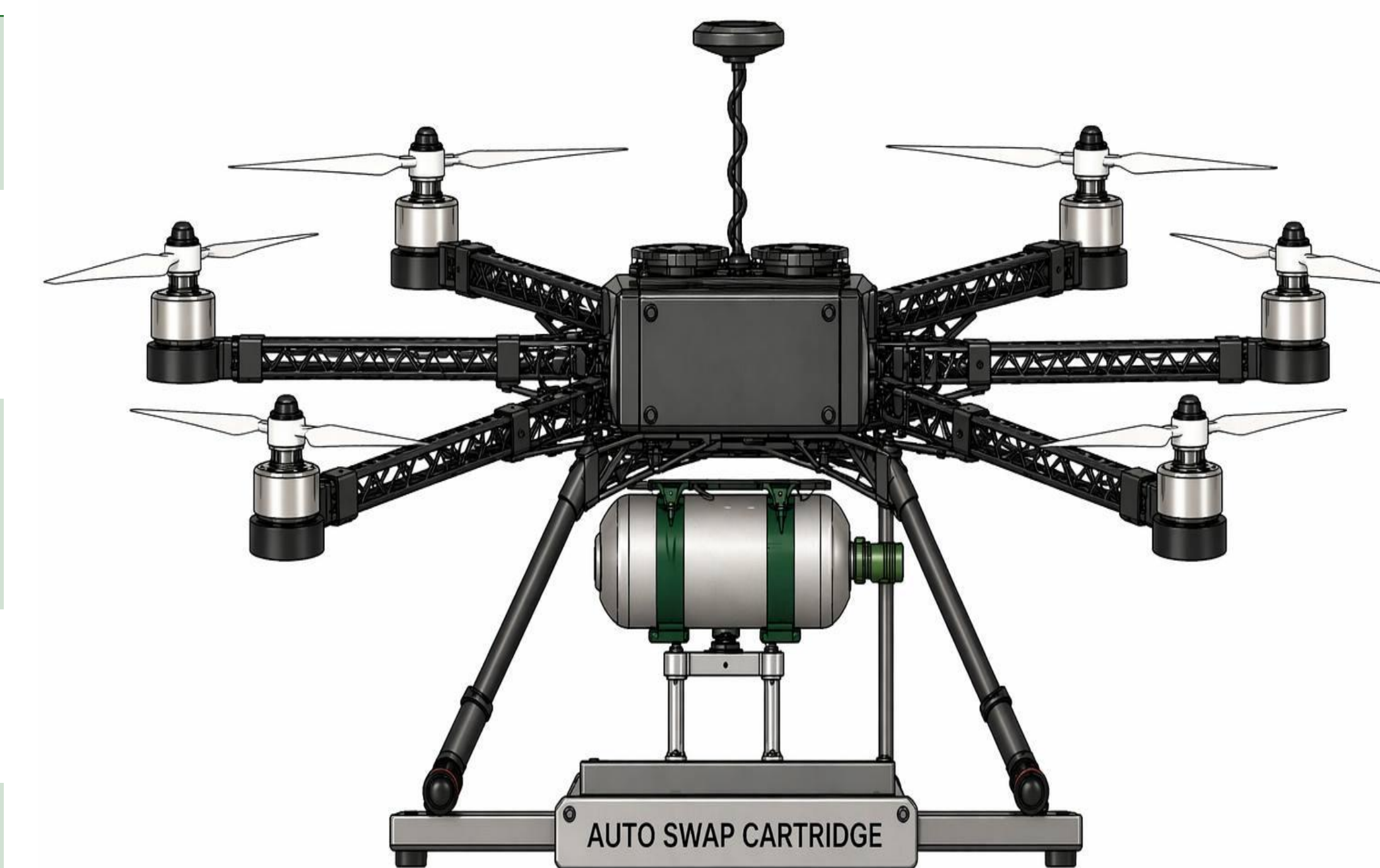
Tank pressure: **350 bar** (relief at 420 bar) swap time **≤ 5 min**

≥ 8 drones/hour throughput Hydrogen flow: **0.6–1.2 g/min (±5%)**

Payload capacity: **1.0 kg** (stable flight) **≥ 2 hydrogen sensors** (auto shut-off **≤ 0.5 s**)

Avionics temperature **≤ 70°C** Electrical output **≥ 95% nominal**

Stack temperature: **50–60°C** Use hydrogen-compatible materials (e.g., stainless steel)



- Extended flight endurance
- Reduced turnaround time
- Compliance with safety and performance requirements
- Fast automated cartridge swapping
- Stable integrated system