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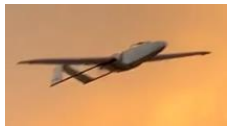
INDY
RAPACE Project

CONFIDENTIAL

INSTITUT CARNOT Energies du Futur

PROJECT OBJECTIVES

- Project RAPACE objective: to fly a ~30 kg drone powered by a Hydrogen Fuel Cell System



- 3 stakeholders:
  - CEA: development and operation of the FC system, H2 filling
  - CREA (Research Center of French Air and Space Force Academy): drone user
  - ATECHSYS: supplier of the vehicle (drone without FC system)

- CREA objectives:
  - Study of signatures (thermal, chemical, and acoustic) of a H2 FC drone vs other propulsion systems
  - Pilot training

- CEA objectives:

  vs predecessor FC system SHOCAPIK (CARNOT demonstrator 1 kW TRL3 that operated for 2 hours in the lab)
  - **Lighten & compactify**
  - **Develop/optimize** components and operating strategies, add new functions
  - **Integrate** into the drone and fly

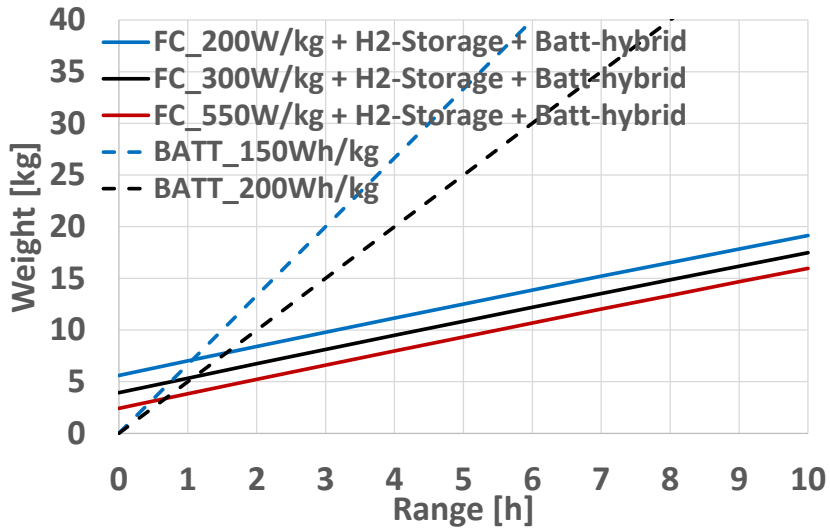
- CEA/CREA common objectives:
  - Study/Experience feedback on H2 FC drone
  - Communication

RAPACE DIFFERENTIATING POINTS

- **Operation in all weather conditions: Closed-cathode and liquid cooled FC, similar to automotive technology (e.g., Nexo automotive system: ambient temperature -30°C to +50°C)**
  - Nearly all PEMFCs for drones are open-cathode and air cooled (except the Protonex/USA FC system)
    → Advantage of open-cathode and air cooling: lighter / Disadvantage: restricted ambient temperature between approximately 0°C and 35°C.

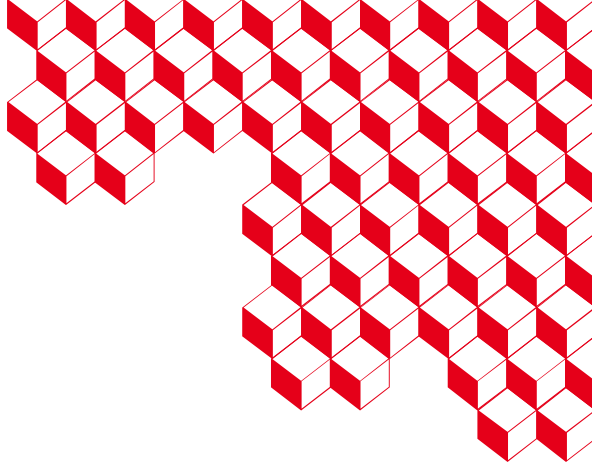
- **Sovereignty: CEA stack technology, FC system developed and optimized at CEA, supply of critical components from both France and the EU**

- **Benefits of H2 FC drones:**
  - Stealthier compared to combustion engines
  - Longer endurance compared to batteries (battery weight)



SOME RAPACE FEATURES

- Wingspan, mass, and cruising speed: 5,6 m, 32 kg, 60 km/h
- Propulsion power of drone in cruise: ~1 kW
- H2 tank: gaseous H2, 300 bar



Thank you