Hybrid Electric STOL Air Taxi

**Introduction**
- Problem Statement
  - Current regional air travel is inconvenient and inefficient.
  - A new, hybrid-electric aircraft with strict runway requirements is to be developed to remedy these challenges.
- Motivation and Background
  - Transportation has been a driving force in growing metropolitan areas and connecting people.

**Product Requirements**
- STOL: 300ft runway with 80ft vertical obstacle at both ends.
- Cruise speed of 150 knots (160 knots preferred).
- Hybrid electric propulsion with tech available in 2028.
- 400 nmi range plus 45 minute reserve.
- 3 passengers + 1 pilot.
- 15 minute turn-around time between missions of 50 nmi.

**Aerodynamics and Flight Mechanics**
- Stall Speed: 35 knots.
- Cruise Speed: 170 knots.
- Range: 450 nmi (including reserves).
- Max Lift Coefficient of 3.4 using high lift slats and Fowler flaps.
- Takeoff and landing achieved in 300 feet at max weight.

**Design Approach**
- Weight approximation using Roskam’s rapid weight sizing method.
- Trade studies vs. other aircraft to adjust body sizing.
- In depth performance review for takeoff, landing, cruise, and power characteristics.
- Digital DATCOM to finalize sizing and stability of aircraft.

**Power Systems and Propulsion**
- Max Lift Coefficient of 3.4 using high lift slats and Fowler flaps.
- Takeoff and landing achieved in 300 feet at max weight.
- Stall Speed: 35 knots.
- Cruise Speed: 170 knots.
- Range: 450 nmi (including reserves).

**Key Specifications**
- 241 hp turboshift engine.
- Projected technology available in 2028.
- Lithium Sulfur Battery.
  - Battery power density: 1.41 hp/lb ~ 2.32 kW/kg.
  - Battery energy density: 796.53 Wh/lb ~ 514 Wh/kg.
  - Voltage: 305V.
  - Maximum current: 630A.
  - Cycles: 1500.
  - (until 80% capacity).
  - 100% battery energy utilization.
- Fuel cost: $96/hr.
  - Cessna 182 [a]: $60/hr.
  - Airbus A350 [b]: $209/hr.

**Completed Work**
- Design approach trade studies.
- Overall aircraft characterized and sized.
- Flight parameters.
- Aircraft performance and stability.
- Propulsion architecture.
- High level design.
- Analysis of flight cost and fuel consumption completed.

**Future Work**
- Detailed component design required to build prototype.
- Minimization of power system and subsystem electronics.
- Actuator design.
- Advanced structure optimization.
- UAS demonstrator.
- Flight testing.
- Study on passenger comfort during steep climbs and descents.

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