Hybrid Rocket Thruster for Vertical Take-off and Landing in Earth's Atmosphere

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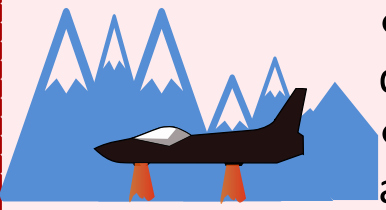
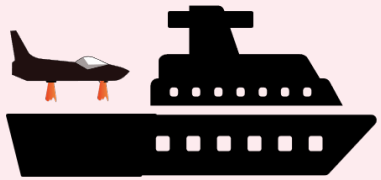
Objective

Develop a controllable hybrid rocket motor and demonstrate its suitability for vertical take-off and landing system

Motivation



- Reduced runway demand
- Good and easy accesibility



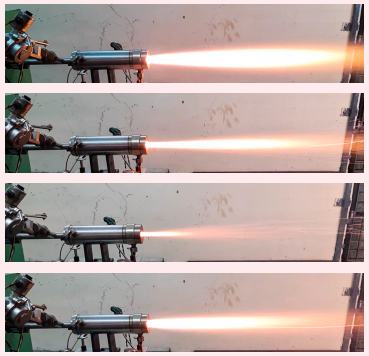
- Less complex VTOL from an aircraft carrier

Drawback of current VTOL aircraft

- Compromise on payload and fuel
- Underutilised main engine

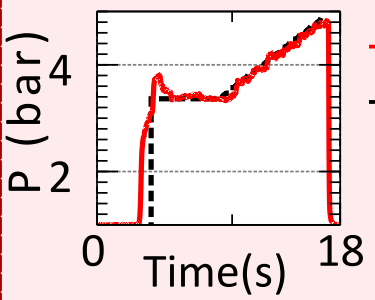
Studies and Highlights

1. Throttling Study



5.5:1 Thrust turn-down ratio

2. Closed-loop Control Study

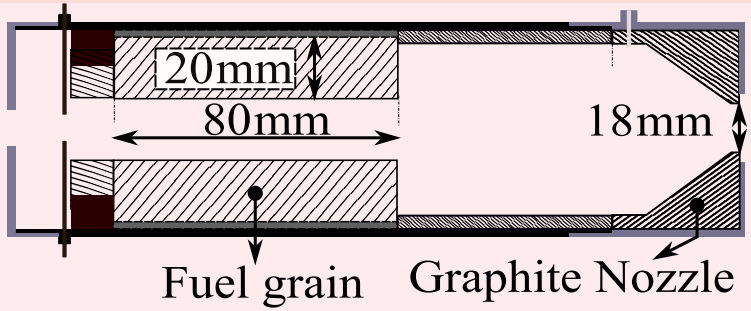


PID controller

Pressure (P) feedback

Fuel: Wax + Aluminium + Viton

Oxidiser: Compressed air at room temp.



Ball valve and servo motor based flow control valve for regulating oxidiser

3. Hardware-in-the Loop Simulation for Vertical Landing

System: Platform with 3 thruster

HILS Framework

Hardware: one hybrid rocket motor

Model: Vertical transilation of system

Observation

Touch-down velocity of <1 m/s

4. Attitude Stabiliation Study

Good performance with cold flow

Minor tuning required for hot flow