Liquid Injection Thrust Vector Control Valve

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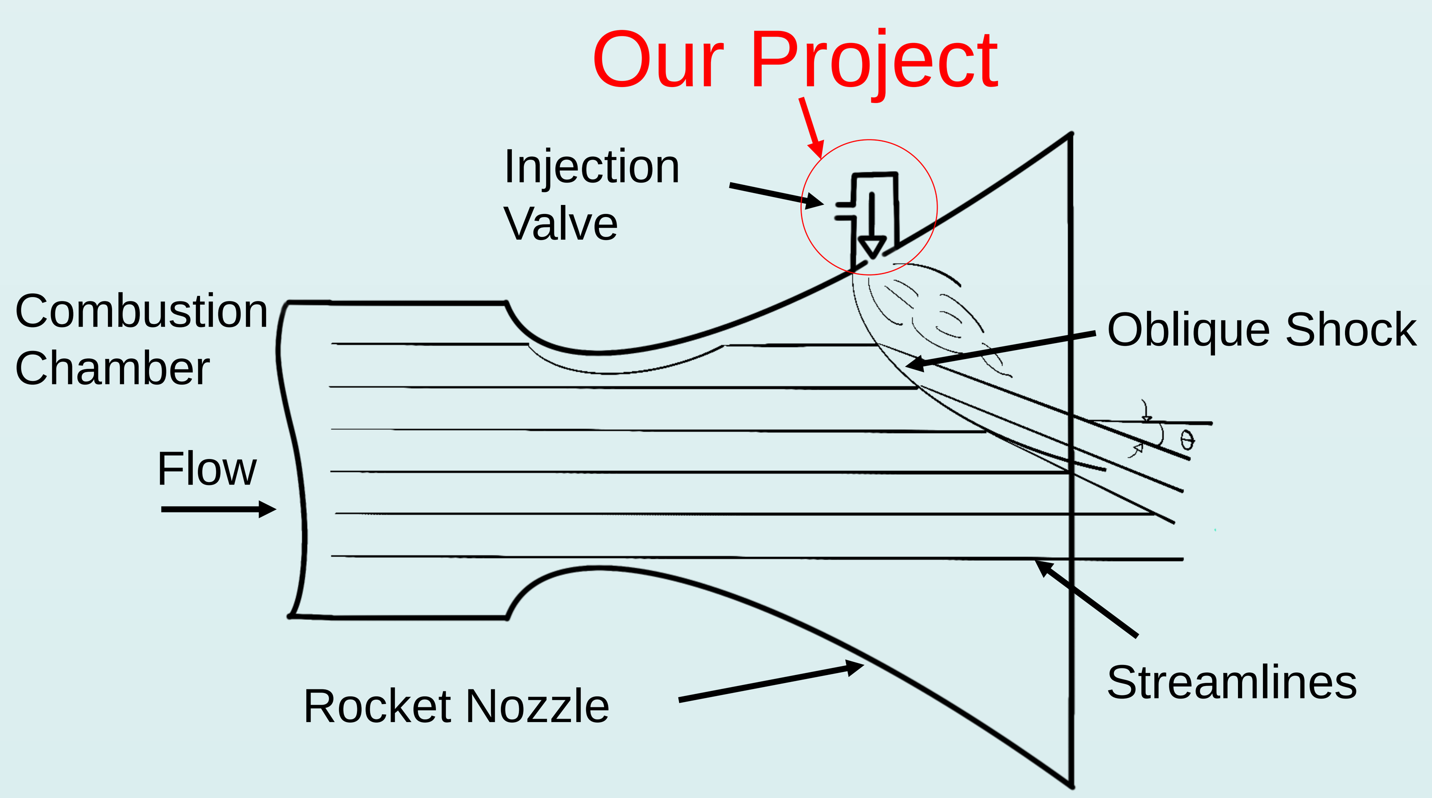
CAPSTONE TEAM 24

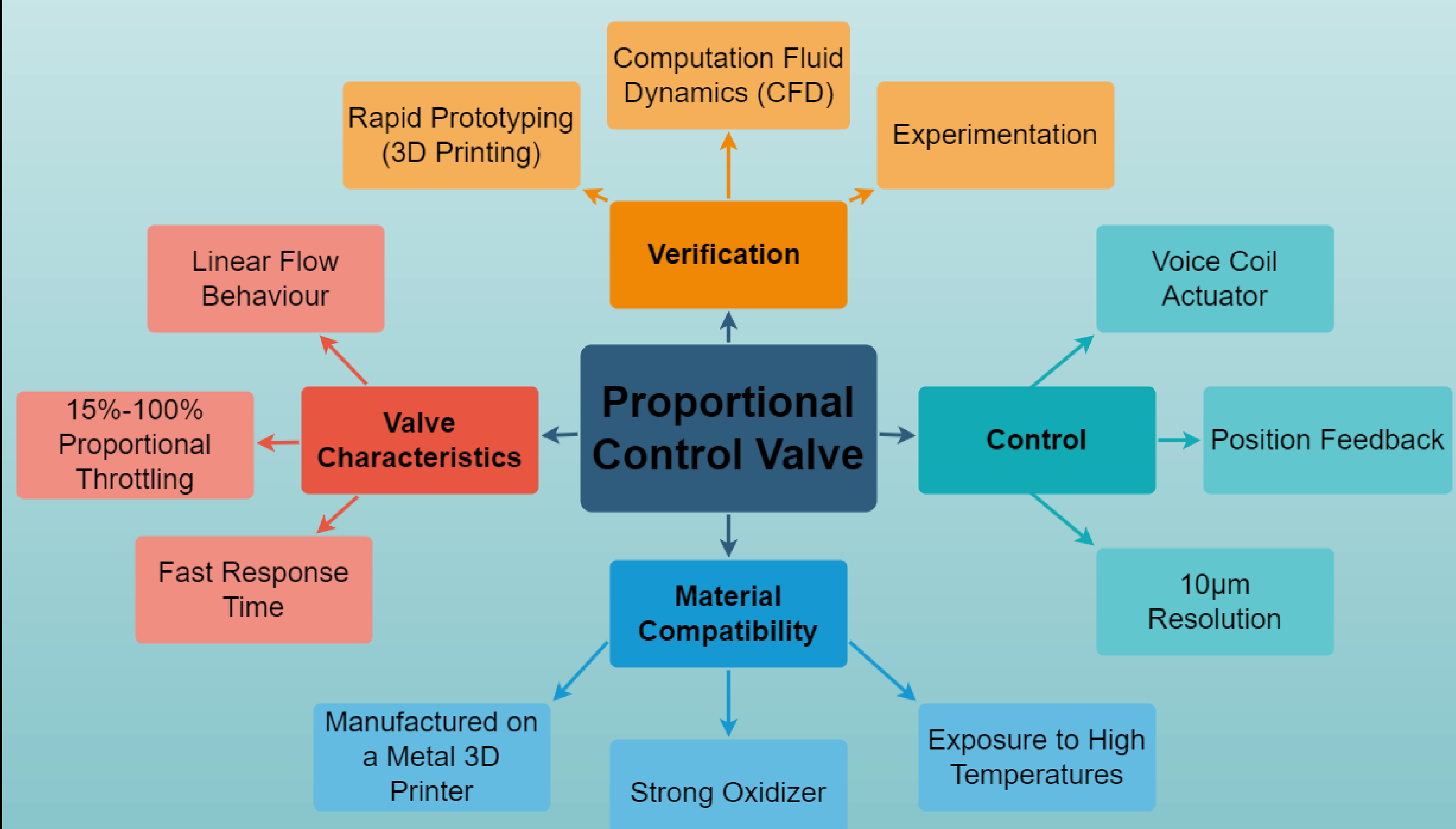
Sponsored by: REACTION DYNAMICS

Purpose

Hybrid rockets utilize Liquid Injection Thrust Vectoring to steer the rocket. Our valve will control the amount of fluid injected into the rocket's nozzle, resulting in a steering adjustment.



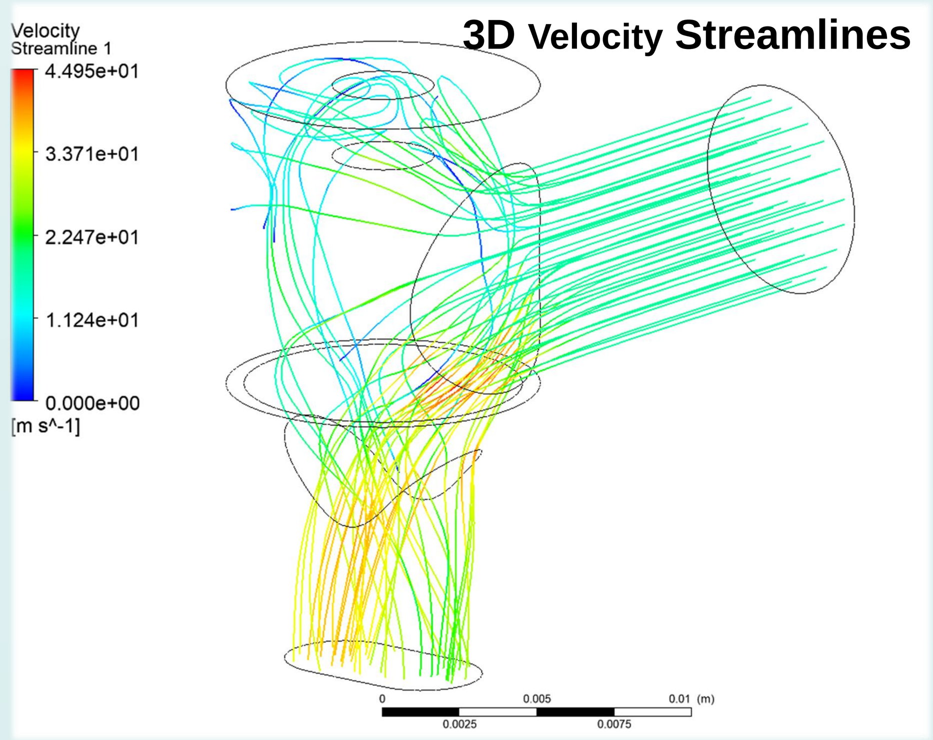
Designing the Control Valve

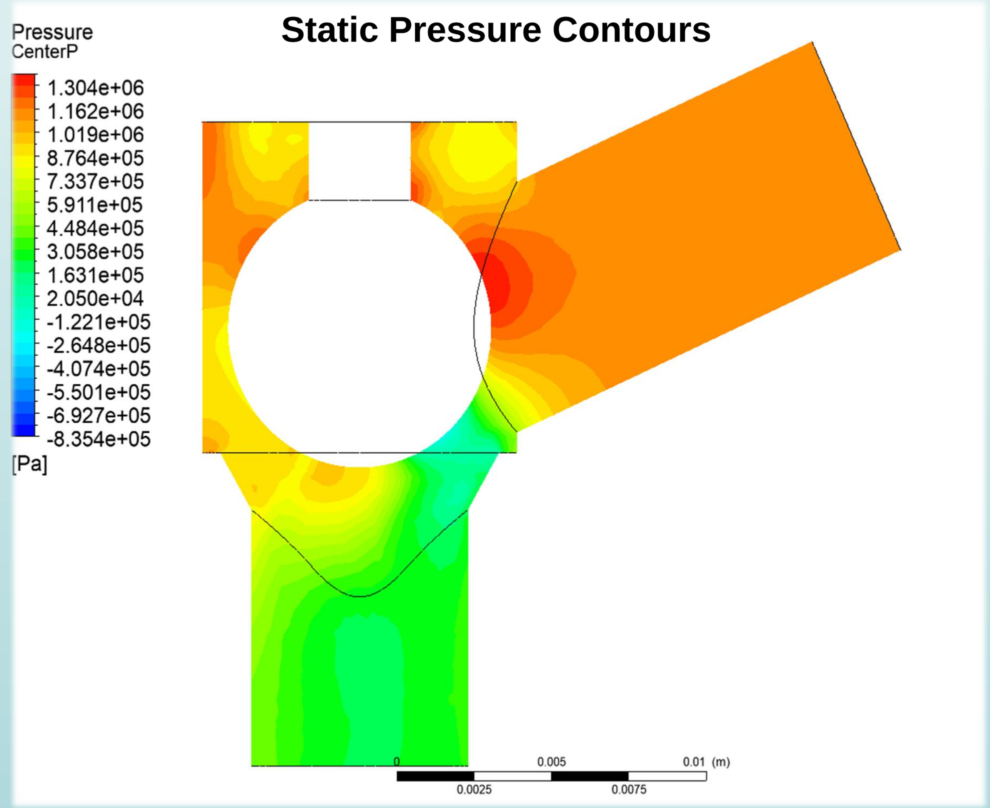


Anatomy of the Control Valve Design Process

Computational Analysis

Ansys Fluent 3D CFD Simulations helped us converge on an efficient and effective design



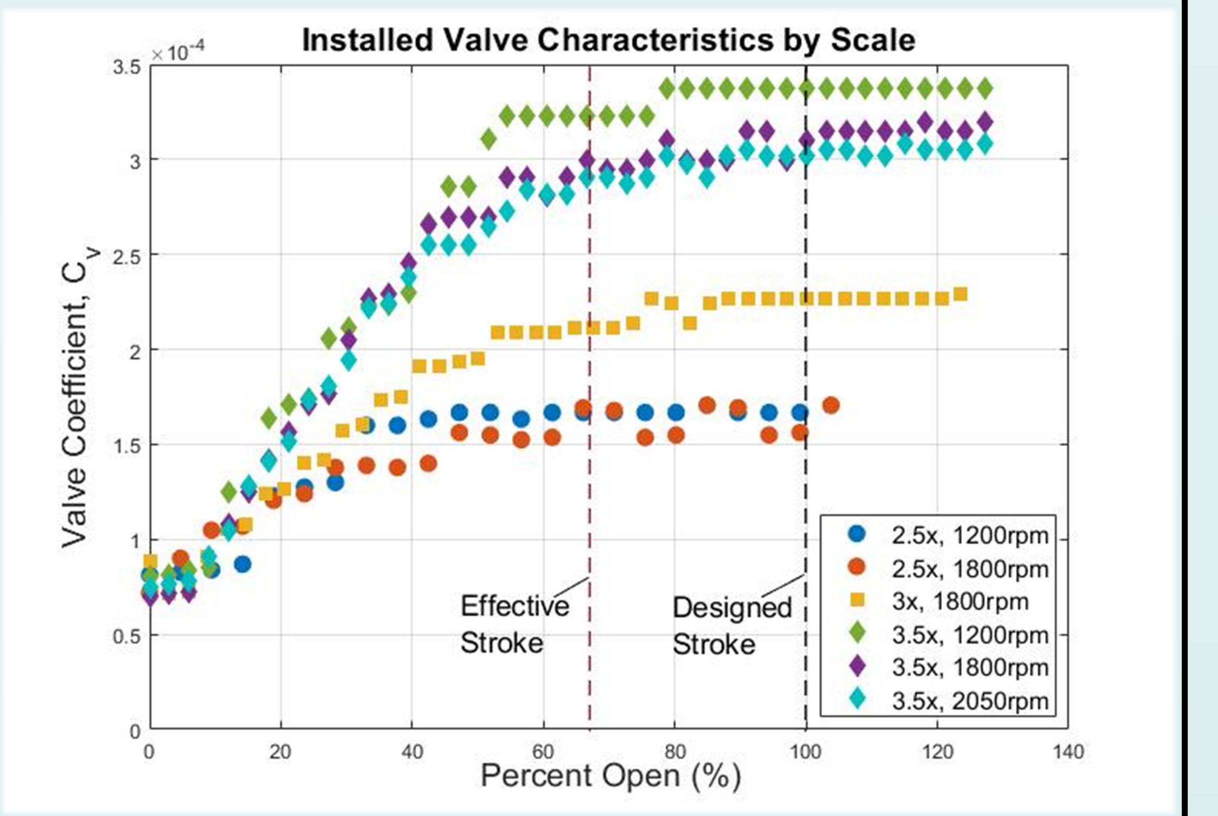


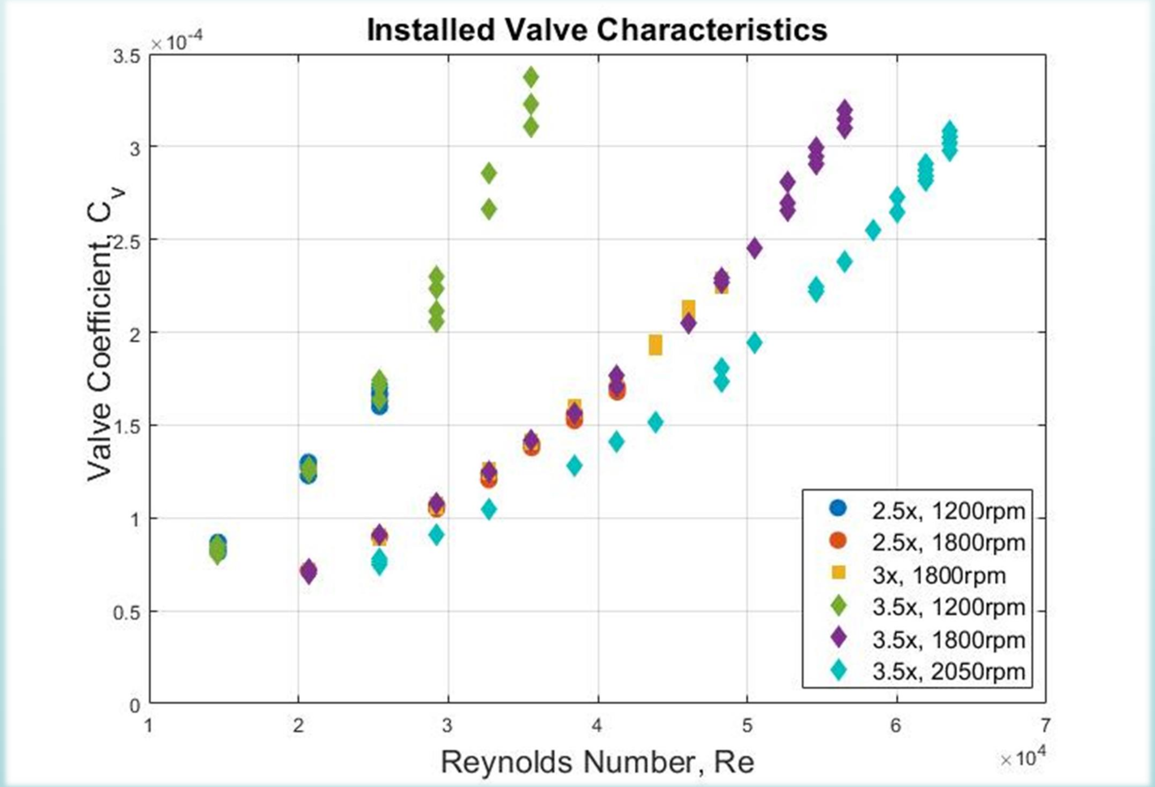
Experimental Analysis

Analyzing valve coefficient, Reynolds number, and flowrates at different valve openings validated our design

$$C_V = Q\sqrt{\frac{\Delta P}{SG}}$$

Q = Flow Rate
ΔP = Pressure Drop
SG = Specific Gravity

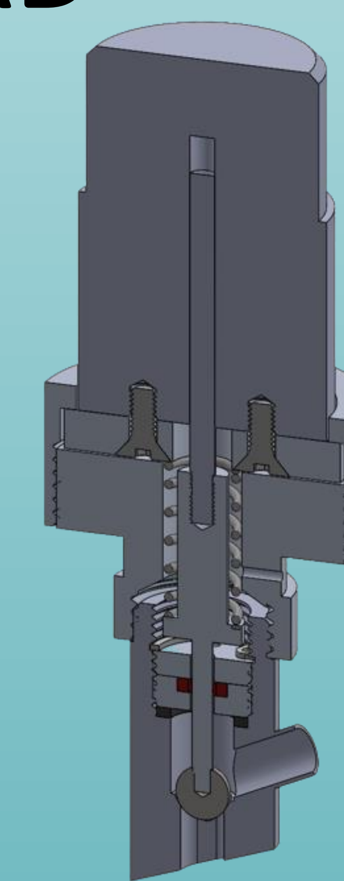




Actuation

- Sensata Double Acting Linear Voice Coil Actuator
- Position feedback (Hall Effect Sensor)
- 89N Peak/17N Continuous

CAD



Conclusion

Experimental results have validated the valve's ability to reach the targeted 1 kg/s at the operating pressures.

Valve behaviour scales linearly with respect to Reynolds number