Congratulations for seeking Govt. Sponsored Project

Name: **Dr. Priyank Kumar**

Department: Space Engineering & Rocketry

Project Title: **Development of High Angle of Attack CFD Aerodynamics Database & Behaviour Model of Missile Configuration at Varying Geometric and Flow Parameters.**

Funding Agency: Aeronautics Research & Development Board (AR & DB)

Sanction Amount: 39.80696 (in Lakhs)

Sanction Letter No. : ARDB/01/1032138/I. Dated 25th June 2024

Tenure: 3 Years

Abstract:

The AR&DB–funded project titled **"Development of High Angle of Attack CFD Aerodynamic Database and Behaviour Model of Missile Configuration at Varying Geometric and Flow Parameters"** is focused on the systematic generation and analysis of aerodynamic data for a representative missile configuration assigned by DRDO. The study primarily addresses the complex aerodynamic phenomena encountered at high angles of attack, where strong nonlinearities, flow separation, vortex interaction, and unsteady effects dominate the vehicle behaviour and significantly influence stability and control characteristics.

A comprehensive Computational Fluid Dynamics (CFD) campaign is being carried out by varying key flow and geometric parameters, including angle of attack (α), Mach number, control surface deflection (δ), and the longitudinal distance between canard and fin. These parameters are known to strongly affect aerodynamic forces, moments, and control effectiveness, particularly in the high angle of attack regime relevant to agile manoeuvres and off-design flight conditions. The generated CFD database will therefore capture a wide operational envelope, enabling a deeper understanding of aerodynamic trends, sensitivities, and coupling effects associated with canard–fin interactions and compressibility effects.

The validated aerodynamic database will subsequently be utilised to develop a robust behaviour model using surrogate and AI-based modelling techniques. These models will be trained to accurately predict aerodynamic coefficients across the parameter space with minimal computational effort. Such surrogate models offer near–real-time prediction capability while retaining the essential physics embedded in the high-fidelity CFD data.

The outcomes of this project will significantly benefit the defence services by providing rapid and reliable aerodynamic predictions without the need for extensive repeated CFD simulations. This approach will drastically reduce turnaround time and computational cost, while supporting preliminary design, control law development, trajectory optimisation, and real-time analysis, thereby offering a highly economical and efficient solution for missile aerodynamic evaluation.