RESEARCH EXPERIENCE

M.Tech Project

Bio-Inspired Drones: Biomimicking the Peregrine Falcon *Jun '25 – Present*

Guide: Prof. Dhwanil Shukla, Dept. of Aerospace Engineering, IIT Bombay

- Investigating **peregrine falcon anatomy** to enhance bio-inspired **flapping wing UAV** systems
- Integrating **perching and grasping** mechanisms into flapping-wing UAVs for **versatile landings**
- Developing a **hybrid** flapping–gliding system to increase endurance and **aerodynamic efficiency**

Mini Project

4-Bladed Rotor Performance & Acoustic Analysis *Jun '25 – Present*

Guide: Prof. Dhwanil Shukla, Dept. of Aerospace Engineering, IIT Bombay

- Conducted experiments using a **coaxial rotor setup** mounted on a test rig to measure **thrust** and **torque**
- Implemented **Arduino-based RPM control** and utilized a **DAQ system** to record and analyze data
- Fabricated a **two-bladed dual-rotor** comparable to a four-bladed rotor in the test setup

M.Tech Seminar

Bio-Inspired Drones: Advances in Flight and Perching Mechanisms *Jan '25 – May '25*

Guide: Prof. Dhwanil Shukla, Dept. of Aerospace Engineering, IIT Bombay

- Reviewed bio-inspired **UAV** designs including fixed-wing hybrids, flapping wings, and **morphing surfaces**
- Evaluated advancements enhancing **perching**, **grasping**, agility, endurance and aerodynamic efficiency
- Proposed future directions in **autonomy**, materials, perching capability and integrated **flapping-wing systems**

B.Tech Project

Autonomous Precision Landing of a Quadcopter on a Floating Platform *Aug '23 – May '24*

Guide: Prof. Subhasis Bhaumik, Dept. of Aerospace Engineering, IIEST Shibpur

- Built autonomous quadcopter landing system in **ROS** with PID control and **ArUco marker tracking**.
- Developed **Unity** simulations featuring realistic **wave generation** using **musical octaves** and platform dynamics
- Integrated **OpenCV** for real-time vision to enable precision landing within **ROS** and **Unity** environments

PROFESSIONAL EXPERIENCE

HAL Koraput

Summer Intern *Jun '23 – Jul '23*

Engine Operations & Testing — Engine Testing Division

- Analyzed **AL31FP jet engine** performance, ensuring compliance with technical standards
- Gained expertise in **aero-engine components**, manufacturing techniques, **CNC machining** and alloy forging
- Studied operational and mechanical systems, covering **power transmission** and component linkages

KEY TECHNICAL PROJECTS

Flow Visualization of Flapping wings using Stroboscopic Effect

Guide: Prof. Joydeep Bhowmik, Dept. of Aerospace Engineering, IIEST Shibpur *May '23 – Jun '23*

- Conducted **flapping wing flow visualization** using synchronized laser and smoke to analyze **vortex formation**
- Integrated a custom setup with **flapping mechanism**, laser strobe, and modified **smoke generator**
- Analyzed **turbulence patterns** and resolved technical issues with laser, smoke system, and vibration control

Aircraft Design & Manufacturing

Guide: Prof. Joydeep Bhowmik, Dept. of Aerospace Engineering, IIEST Shibpur *Oct '23 – Nov '23*

- Designed a third-gen fighter jet concept, performing aerodynamic and stability analyses in **OpenVSP** and **XFLR5**
- Conducted constraint and performance analysis, covering **weight estimation**, propulsion selection, and wing sizing
- Optimized efficiency via wing and drag analysis using **Prandtl's lifting line theory** and **drag buildup methods**.

COURSE PROJECTS

Performance Mapping Of Drones & Helicopters – Python Based Tool

Guide: Prof. Dhwanil Shukla, Course: Rotary Wing Aerodynamics *Jul '24 – Dec '24*

- Developed a **Python** framework to analyse performance based on Blade Element Momentum Theory (**BEM**)
- Designed rotors by varying **blade parameters** such as twist, taper & pitch to meet given flight conditions
- Validated the results obtained against experimental data and successfully achieved less than **5% error**

Numerical Rotor Flow Analysis via (MRF) Method — Ansys Fluent

Guide: Prof. Ganapathi Bhat, Course: Computational Heat Transfer and Fluid Flow *Jan '25 – Apr '25*

- Performed **CFD analysis** of a ceiling fan (Rotor) using the **MRF** approach with **82k cell mesh**
- Simulated performance at multiple RPMs to study flow, pressure, and torque trends
- Visualized results through **velocity** and **pressure plots** for performance evaluation of the rotor

Airfoil Enhancement of LRN1015 — Optimization Project

Guide: Prof. Rajkumar S. Pant, Course: Introduction to Flight *Jul '24 – Dec '24*

- Optimized **NASA LRN 1015** airfoil using **XFLR5** through 6 design iterations to meet HALE UAV constraints
- Implemented **aerodynamic optimization** techniques, increasing **Cl/Cd by 112%** and reducing **Cm(@2°) by 79%**
- Achieved final airfoil design with an Airfoil Score of 4637.63 under ISA cruise conditions

Computation of Lid-Driven Cavity Flow Using Vorticity-Stream Function Formulation

Guide: Prof. J.C Mandal, Course: Computational Fluid Dynamics *Jan '25 – Apr '25*

- Solved **2D lid-driven cavity flow** at Re=100 using vorticity–stream function formulation and **FEM**
- Achieved **RMS** velocity residual convergence below **1 × 10−8** in 2000 iterations, ensuring **solution stability**
- Ensured accuracy of results by validating against experimental data, successfully maintaining less than **3% error**

Numerical Simulation of Quasi-1D Nozzle Flow Using Van Leer Flux Vector Splitting

Guide: Prof. J.C Mandal, Course: Computational Fluid Dynamics *Jan '25 – Apr '25*

- Implemented **a van Leer Flux Vector Splitting** scheme in **Python** to solve quasi-1D Euler equations
- Computed Mach number and pressure distributions using a 101-point grid with **CFL-based time-stepping** for **stability**
- Validated results against exact quasi-1D solutions, achieving close agreement for Pe/P0=0.585

KEY COURSES

Post Graduate level	Graduate Level
• Computational Heat Transfer and Fluid Flow	• Computational Fluid Dynamics
• Rotary Wing Aerodynamics	• Turbulent Flow
• Finite Element Method	• High Speed Aerodynamics
• Heat Transfer - Aerospace Applications	• Numerical Methods and Computational Tools
• Fluid Dynamics	• Adavanced strength of materials
• Aerodynamics of Aerospace Vehicles	• Fundamentals of Viscous Flow

POSITIONS OF RESPONSIBILITY

Teaching Assistant

Prof. Dhwanil Shukla

Rotary Wing Aerodynamics *Jun '25 – Present*

- Collaborated with a team of **4** to guide a cohort of **50+** undergraduate and postgraduate students

Low Speed Aerodynamics *Jan '25 – May '25*

- Guided a batch of **70+ UG** with a team of **6**; involved in proctoring examinations and clearing doubts

Introduction to Aerodynamics & Propulsion Laboratory *Jul '24 – Dec '24*

- Mentored a batch of **60+ UG** students in designing and building a glider within given constraints.

TECHINCAL SKILLS

Unity	C#,	**ROS - Gazebo**	**Python**	C++
OpenFOAM	SU2	**Ansys Fluent**	**FUSION 360™**	MATLAB,
LaTex	AutoCad	MS Excel	MS Office	DAMASK

COURSES & CERTIFICATIONS

- Participated in **Hoverpod, Lift-off** at NSSC, IIT Kharagpur, showcasing design and prototyping skills
- Completed the "**Introduction to Experiments in Flight**" program at Flight Laboratory, IIT Kanpur
- Achieved **7** out of **8** levels in Hindi language certification from **Dakshina Bharat Hindi Prachar Sabha**

INTERESTS

- Chess, Football and Watching anime