

Sainath Barbhai

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EDUCATION

M.S. in Aerospace Engineering, University of Illinois, Urbana-Champaign (Focus: Fluids and Combustion Studies) **Jan 2022- May 2025**
Combustion Summer School (1-week), Princeton University, New Jersey **Jun 2023 & Jun 2024**
B.E. in Mechanical Engineering, University of Mumbai, India **Jun 2018-May 2021**

PUBLICATIONS

- [1] **Barbhai, S.**, Yang, Z., & Feng, J. (2025). Effect of polymeric compound layer on jetting dynamics produced by bursting bubbles. *RSC Advances*, 15(10), 7710-7720. <https://doi.org/10.1039/D5RA00228A>
- [2] Yang, Z., **Barbhai, S.**, Ji, B., & Feng, J. (2024). Effect of surface viscoelasticity on top jet drops produced by bursting bubbles. *Soft Matter*, 20(25), 4868-4877. <https://doi.org/10.1039/d4sm00243a>

RELEVANT EXPERIENCES

Graduate Research Assistant: Experimental Fluid Mechanics

Oct 2023- Present

Department of Mechanical Engineering

Advisor: Prof. Jie Feng

- Working in the Fluid, Interfaces, and Transport (FIT) Lab to research and experimentally investigate the bursting phenomenon of non-Newtonian compound bubbles in a Newtonian free surface. This research aims to model real-life biocontaminated bubble behavior and its impact on aerosol production for transporting rheologically complex contaminants in marine ecosystems.
- Experimentally studying non-Newtonian hollow compound droplets on a superhydrophobic solid substrate to explore its fluid dynamics and applications in fields like pharmaceuticals, coatings, and material synthesis.

Teaching Assistant (TA): ECE 445- Senior Design Laboratory

Jan 2023 – Present

Department of Electrical and Computer Science

Course Instructor: Arne Fliflet

- Assisted senior Electrical and Computer Engineering students (average class size ~200) with capstone projects focused on solving real-world problems through innovative solutions.
- Mentored over 100 students across two years, with several teams winning prestigious class awards.
- Serving as a co-head TA for the past two semesters and handling additional responsibilities such as organizing and delivering lectures, managing logistics, coordinating TA meetings, and addressing team-related challenges.

Hybrid Propulsion Student Engineer: Illinois Space Society of UIUC

Feb 2022 – May 2023

- Designed an oxidizer tank to successfully store Nitrox96 during the actual rocket flight that aims to reach 10,000 ft. vertically with a payload of 5 kg.
- Conducted cold-flow tests of the manufactured engine to test the injector atomization and basic flow characteristics in the combustion chamber.

Propulsion Simulation Engineer Intern: Manastu Space Technologies, India

June 2021 – Dec 2021

- Appointed to develop monopropellant satellite thrusters at this start-up in collaboration with the Indian Institute of Technology, Bombay (IIT-B) and the Defense Research and Development Organization (DRDO).
- Conducted multiple cold-flow and hot-flow tests with various geometry combinations to optimize and ensure the reliability of the thruster system based on analyzed test data.
- Designed a flight-ready prototype of the propellant tank, minimizing sloshing and self-degradation against the propellant. Also, established its standard operating procedure (SOP).
- Conceptualized catalyst loading methods and developed an in-house catalyst shaker device that reliably increased the combustion efficiency by ~35% in just 20 USD.
- Ran computational simulations to understand the combustion and decomposition kinetics of the propellant and catalyst used within the thruster system.

Trainee Intern: Air India Engineering Services Ltd., India

June 2019 – July 2019

- Worked in the Engines Overhaul Department on the maintenance of General Electric GE-90-115B, Safran CFM-56-7B, and Pratt and Whitney PW-4056 turbofan engines.
- Shadowed a senior engineer in the Components Overhaul Division, maintaining pressure vessels (mainly on oxygen cylinders, and safety slide raft inflating cylinders), repairing and overhauling of wheels and brakes of Boeing 737, 777-200, 777-300 ER, 747-400 & 787-8 Dreamliner, NDT processes such as fluorescent particle testing & magnetic particle inspection.

PROJECTS AND EXTRA-CURRICULAR ACTIVITIES

NAR Level 1 Certified High-Powered Rocket (Aug 2022)

- Designed and successfully launched ([on 2nd attempt](#)) a model rocket with an H-class high-powered motor. The apogee noted by the onboard altimeters was ~1430 ft.
- Features included a 16" drogue chute and a 36" main chute (released at 300 ft. during descent), a 3D printed nose cone, and a 4-fin design.

- The [first attempt failed](#) due to the incorrect positioning of the motor into the metal casing, resulting in a fire and burning of the booster section of the rocket on the launch pad itself.

Schlieren and Shadowgraph Imaging to Analyze Flow Fields (Aug 2023)

- Experimentally investigated flow fields of a sub-sonic jet and thermal gradients from a soldering iron using a Z-type schlieren and shadowgraph imaging technique to understand the working fundamentals of such visualization methods.
- The images taken were post-processed using Fiji ImageJ software.

Laser Doppler Velocimetry for Air Jet Velocity Estimation (Sept 2023)

- Performed this technique to measure fluid velocity by analyzing the frequency shift of laser light scattered by moving particles (oil droplets) within the fluid, to experimentally identify the velocity information of a sub-sonic air jet.

Delta wing wind tunnel testing and surface flow visualization (Sept 2023)

- Conducted lift, drag, and pitching moment analysis for a 65° sweep angle delta wing at different angles of attacks in a low-speed wind tunnel. Also, used oil-based flow visualization techniques to additionally observe the aerodynamic properties of the wing.

Rocket Trajectory modeling using ODE methods (Jul 2022)

- Numerically [modeled rocket trajectory](#) using the Runge-Kutta-4 (RK-4) and the Euler-based method, with the ability to prescribe initial boundary conditions and the launch scenario.
- The numerical analysis was performed in three sections- powered flight, unpowered ballistic flight until apogee, and ground impact.

K-12 STEM Outreach (Student-Run Organization) (Jan 2019- Jan 2020)

- Engaged with underprivileged K-12 students through the Indian Society of Heating, Refrigerating, and Air Conditioning Engineers (ISHRAE) collegiate club, fostering interest in STEM fields through science outreach programs.

Society of Automotive Engineers (SAE) International (Student-Run Organization) (Jan 2018- Jan 2020)

- Served as Program Head for SAE International's collegiate club leading project initiatives and engaging in hands-on automotive engineering activities.

SKILLS

- **Tools-** MATLAB, SolidWorks, AutoCAD Mechanical, Ansys (FLUENT, Static Structural, Thermal), ImageJ, Microsoft Office (Word, PowerPoint, and Excel), Gordon-McBride Chemical Equilibrium, OpenRocket, Laser-Cutting, 3D Printing, GD&T
- **Coursework-** Thermodynamics, Fluid Mechanics, Finite Element Analysis, Computational Techniques, Aerospace Propulsion (Air-Breathing & Rocket), Combustion Fundamentals, Intermediate Gas Dynamics, Optical Diagnostics for Propulsion, Rheology of Non-Newtonian Fluids

AWARDS AND HONOURS

- Won first place in the Illinois Design Challenge (April 2022) in the Brunswick i-Jet Challenge category for designing a '[Single Person Electric Scooter](#)' concept which was judged by Brunswick Corporation.
- Received a sponsored trip by UIUC to attend the Massachusetts Institute of Technology's (MIT) New Space-Age Conference (March 2022) to learn more about the recent development in space technology and their future plans.
- Stood 2nd in overall Mechanical Engineering department in the sophomore year of engineering.
- Awarded multiple certificates in diploma for ranking 1st in the entire college for 2 consecutive years.

PERSONAL

- Volunteer work: Service Over Self (SOS) community development and home repair (Memphis, USA); K-12 STEM outreach (Mumbai, India).
- Sports: Recreational ice hockey player.