Aerospace Propulsion

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Research Overview

Aerospace propulsion faces the dual challenge of performance and sustainability. My research investigates **unsteady combustion, spray dynamics, and flow–flame interactions** to enable **cleaner, more efficient propulsion systems**.
By combining **computational fluid dynamics (CFD)** and **laboratory experiments**, I aim to improve our understanding of turbulent combustion and support the design of **next-generation propulsion technologies**.

Industry Relevance

- **Decarbonization of Aviation**: Contributing to net-zero emission targets through advanced combustion efficiency.
- **Performance & Safety**: Enhanced control of combustion instability and thermal management in propulsion systems.
- **Next-Gen Propulsion Concepts**: Integrating hydrogen, e-fuels, and electrified propulsion architectures.

Methods & Technologies

- ❑ **Hybrid physics–data-driven modelling** to predict instability behaviour.
- ❑ **Multiphysics simulations** coupling combustion, heat transfer, and acoustics.
- ❑ **Optical diagnostics & high-speed imaging** for flame characterization.
- ❑ Collaboration with **Technion Propulsion Centre** and **Tel Aviv University** on experimental and computational propulsion research.

Innovations

- ✓ Uncovered **vortex-driven flame stabilization mechanisms** in cavity-based and strut-based scramjets.
- ✓ Developed **local diluent injection strategies** that suppress instabilities and enhance combustor reliability.
- ✓ Discovered **a new mode of supersonic combustion** driven by shock–flame interactions.
- ✓ Bridging research to **hydrogen and sustainable fuel** applications for zero-carbon propulsion.

Opportunities

We welcome partnerships in:

- ➢ **Hydrogen and sustainable fuel development**
- ➢ **Emission and instability control for aerospace engines**
- ➢ **Hybrid-electric propulsion technologies**
- ➢ **CFD model validation and technology transfer**

CLEAN COMBUSTION AND SUSTAINABLE PROPULSION

RISE WITH US

UWE Bristol