

PROJECT AVONA: A SUSTAINABLE VISION FOR THE SPACE INDUSTRY

University of Bristol, United Kingdom



Our Intentions

Project Avona embarks on a mission to make the space industry more sustainable. Encompassing **five post graduate research programmes**. Each programme is a standalone piece of research, yet they all converge on a singular, vital mission: **propelling sustainability** to the forefront of the space industry.

Our desire to improve the communication of research to industry will see us undertake a series of **high-altitude launches** over the next **four years**. These missions are pivotal, to elevate the technology readiness level of our research by ensuring each project withstands the rigor of real flight conditions.



BEN BROWN
ANALYSIS AND REALISATION OF AN
ALTITUDE COMPENSATION NOZZLE

ALEX WALSH
ANALYSIS ON THE ATMOSPHERIC
IMPACT OF ROCKET ENGINE ORBITAL
INSERTION EMISSIONS WITH A STUDY
ON METHODS OF MITIGATION

ANGELINE PANG
CHARACTERISING THE ENVIRONMENTAL
IMPACTS OF HYDROGEN GENERATION
AND COMBUSTION



JACOB COX
ANALYSIS OF LOW CARBON COMPOSITE
STRESSED MEMBER AEROSTRUCTURES

LILLIAN MACBETH
FIRE ANALYSIS OF LOW CARBON FLAME
TRENCH STRUCTURES

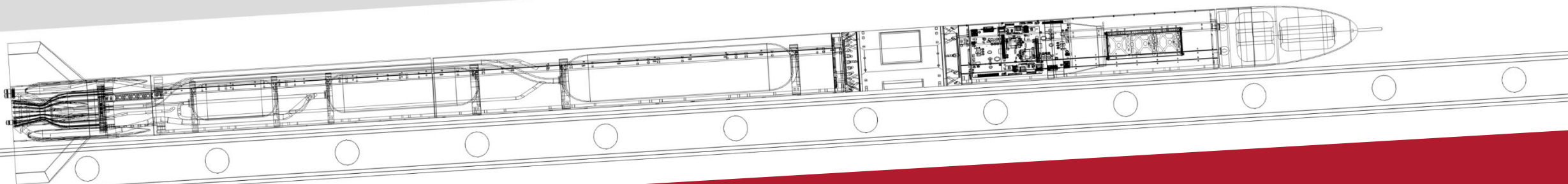
The Group

Our group was founded during our first year of undergraduate studies, as five students looked for an engaging space project to occupy our eager minds during the pandemic. Our collective passion has fuelled the creation of five rockets, with our latest reaching an altitude of 3km. Currently we are **developing a Bi-propellant liquid engine** along with a drag optimised airframe as a platform to build Project Avona from.

Over four transformative years, we have not only developed our knowledge of rockets, but also realised a stark reality: the space industry is lacking **sustainability as a fundamental value**. It is this realisation that gave rise to Project Avona, which has already garnered support from the university and industry

Value Added to Industry

- Intention to **expand group** to include Masters and Bachelors research projects.
- Project will highly engage **University student community**.
- Opportunity for industry to **co-author** publications.
- **Foresight on recommendations** to be made to industry and government.
- Industry **support will be credited** in presentations at conferences.
- **Programmes to run engagement** at festivals and conferences with the public.
- Project Avona will **deliver social value** through outreach engagement and widening participation.
- Enable multiple **high-altitude rocket** launches with your sponsorship.
- **Join a network** of over 15 science and engineering academics at the University of Bristol.



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BEN BROWN: ANALYSIS AND REALISATION OF AN ALTITUDE COMPENSATION NOZZLE

Personal Profile

University of Bristol :
BEng Aerospace Engineering with a Year in Industry
Aston Martin Cognizant
Formula 1 Team
Current Work

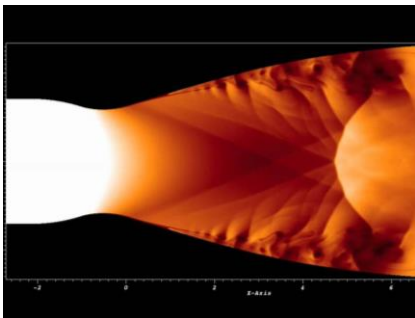


Researching the mechanism for the reduced power required to fly in the smallest insects
Aerodynamics Lead for Bristol EuRoC'24 Team

Research Objectives

Development of a novel atmospheric compensation nozzle:

- Evaluate current methods of viscous-thermal boundary layer manipulation
- Utilise atmospheric cold gas blowing to alter effective exhaust area
- Evaluate trade off in nozzle efficiency and mass gained



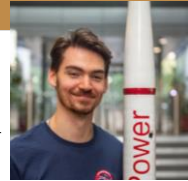
Contact Information

Researcher: ben.brown.2020@bristol.ac.uk
Supervisor: nick.zang@bristol.ac.uk

ALEX WALSH: ANALYSIS ON THE ATMOSPHERIC IMPACT OF ROCKET ENGINE ORBITAL INSERTION EMISSIONS

Personal Profile

University of Bristol :
MSci Physics
Industry Experience
RF Seeker Modelling Engineer
Current Work



Research on thermodynamic modelling techniques for liquid rocket engines.
Head of Propulsion for Bristol EuRoC'24 Team
Team lead for BristolSEDS Experimental Propulsion group

Research Objectives

Study methods for climate impact mitigation of orbital insertion rocket engines:

- Utilising atmospheric chemistry models
- Computational optimisation of flight paths for climate impact mitigation
- Characterisation of rocket engine emissions through transient states



Contact Information

Researcher: a.walsh.2020@bristol.ac.uk
Supervisor: steve.bullock@bristol.ac.uk

ANGELINE PANG: ENVIRONMENTAL IMPACTS OF HYDROGEN GENERATION AND COMBUSTION

Personal Profile

University of Bristol :
BEng Engineering Design (Aerospace) with a Year in Industry



Research Engineer – the Francis Crick Institute
Current Work
Research on biohydrogen generation for remote community applications.
Integration Lead for Bristol EuRoC'24 Team

Research Objectives

Hydrogen generation and a life cycle analysis of the impact of combustion for spaceflight on the atmosphere:

- Optimising the hydrogen generation process to decrease its environmental impacts.
- Propellant lifecycle assessment of hydrogen from generation to combustion in space applications.



Contact Information

Researcher: ange.pang.2020@bristol.ac.uk
Supervisor: i.rowlandson@bristol.ac.uk

JACOB COX: ANALYSIS OF LOW CARBON COMPOSITE STRESSED MEMBER AEROSTRUCTURES

Personal Profile

University of Bristol :
BEng Engineering Design (Mechanical) with a Year in Industry



Jaguar TCS Racing
Formula E Team
Current Work
Research and multi-physics modelling of undersea limestone accretion.
Launch-Vehicle Lead for Bristol EuRoC'24 team

Research Objectives

Document analysis procedure for design of stressed member propellant tanks:

- Coupon material characterisation of low carbon materials
- Development and validation of aeroelastic model
- Create design tool for stressed member tank integration



Contact Information

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Supervisor: ian.hamerton@bristol.ac.uk

LILLIAN MACBETH: FIRE ANALYSIS OF LOW CARBON FLAME TRENCH STRUCTURES

Personal Profile

University of Bristol :
BEng Civil Engineering with a Year in Industry | Taylor Woodrow x Institution of Civil Engineers QUEST Scholar
Current Work



Research quantifying the carbon saving measures on HS2
Team Lead for Bristol EuRoC'24 Team
Assistant Temporary Works Engineer on HS2

Research Objectives

Establish Carbon-Integrated Guidelines for Vertical Launch Spaceports:

- Whole LCA Environmental Impact Assessment of Launch Operations
- Specification of Materials for Flame Trench Thermal Environments
- Modelling of Shock Loading and High Impulse Flames in Trenches



Contact Information

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