PROJECT TITLE: Alternative fuels and their potential impact on climate mitigation of aircraft and other forms of transport

DTP Research Theme(s): Living World, Changing Planet

Lead Institution: University of Bristol
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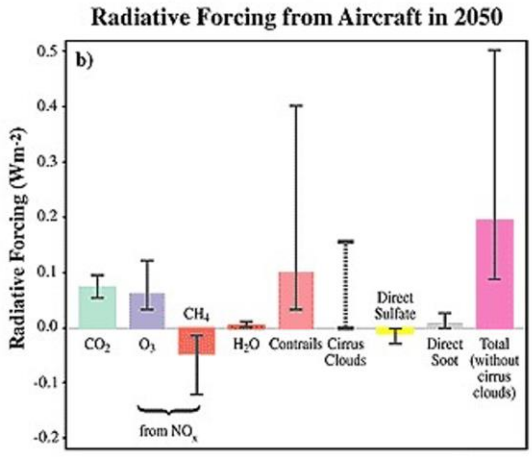
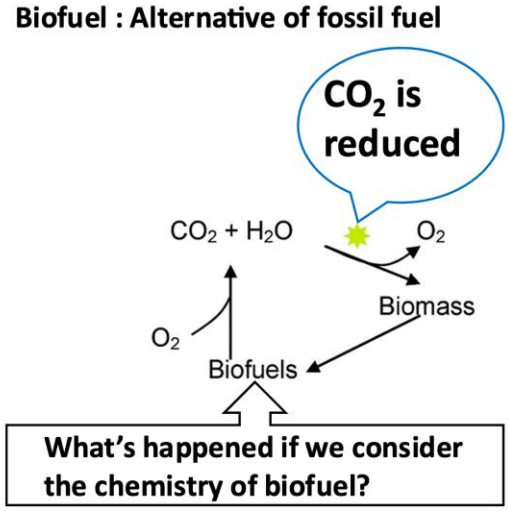
Project keywords: alternative fuels, climate change, net zero, transportation, aircraft, emissions, modelling



Environmental Impact of fossil fuel usage in Aircraft (IPCC, 1999)



Project Background

Climate change and air quality are pressing global problems that threaten to change life on Earth. As we seek alternative energy sources, there must be a transition period where alternative fuels that have a smaller climate and air quality impact are used as clean energy capacity is increased and transportation fleets transition to using clean energy. In this project we focus predominantly on aircraft but will also research surface transportation and how a variety of alternative fuels may impact on air quality and climate through changing emissions of CO_2, nitrogen oxides (leading to ozone formation, itself a potent greenhouse gas) and particles. At the surface, particles can be deleterious to human health, in the upper troposphere, particles can seed contrail formation which can cause climate warming.

Project Aims and Methods

A PhD involves the student co-creating and co-owning the direction of the research and we are keen for students to take an active role in the direction of the PhD. The aims of the project are to explore the impact of alternative fuels (synthetic, natural, H_2) used in aircraft but also in land vehicles, on air quality and climate using computer models and practical experiments to determine emission factors from engines at various thrust settings. Combining experimental data with computer models we will explore what the influence on CO_2 and non-CO_2 climate impacts of aircraft will be using blends of alternative fuels and determine whether certain types of flight (geographic flight track and duration) benefit particularly from using certain fuel types. Conversely, are there fuel types that are detrimental to air quality and climate impacts from aircraft. In addition, we will investigate the impact of alternative fuels on surface transportation and their impact on climate change and air quality.

Candidate requirements

We welcome and encourage student applications from under-represented groups. We value a diverse research environment. We prefer students to have a good mathematical background but do not need to have extensive programming experience. It would be advantageous for candidates to have either a Chemistry or Engineering degree.

Project partners

The Atmospheric Chemistry Research Group at Bristol is a world-leading centre for atmospheric research, being involved in the NASA funded AGAGE project that has since 1978, provided vital data on ozone depleting and climate active gases, informing government and international policy through groups such as the IPCC and WMO. The ACRG are also a centre for excellence in atmospheric modelling, developing new models describing air composition on a variety of scales and the Common Representative Intermediates Scheme, a chemical mechanism being used in many air quality and global models (e.g. UK Met. Office, EU EMEP, US EPA).

The aerospace staff in the Faculty of Engineering at Bristol have extensive experience in numerous facets of aircraft design for improved efficiency and sustainability, working with aerospace organisations such as Airbus, BAE Systems, Leonardo, etc. This includes expertise in mission performance analysis which is essential in the study of aircraft emissions impact on atmospheric chemistry and climate. Complementary expertise in engine design and performance exist in the Engineering school at Cardiff.

Training

The successful applicant will have extensive training in laboratory studies (engine performance and gas and particle phase measurement), atmospheric chemical modelling (on a wide range of scales), data analysis and the use of machine learning and advanced statistical analysis. An appreciation of the principles of aerodynamics and aircraft performance will be valuable. Students will have access to an extremely wide national and international network and periods of time working in partner laboratories is possible during the PhD.

Background reading and references

https://doi.org/10.1016/j.trd.2014.11.022, https://doi.org/10.3390/atmos7060078, https://doi.org/10.3390/aerospace9070355 https://research-information.bris.ac.uk/en/persons/dudley-e-shallcross

Useful links

http://www.bristol.ac.uk/chemistry/courses/postgraduate/
https://www.bristol.ac.uk/study/postgraduate/2023/eng/aerospace-engineering/

Bristol NERC GW4+ DTP Prospectus:

http://www.bristol.ac.uk/study/postgraduate/2024/sci/phd-great-western-four-doctoral-training-partnership-nerc/

How to apply to the University of Bristol:

http://www.bristol.ac.uk/study/postgraduate/apply/

Please note: If you wish to apply for more than one project please contact the Bristol NERC GW4+ DTP Administrator to find out the process for doing this.

The application deadline is Tuesday 9 January 2024 at 2359 GMT. Interviews will take place from 26 February to 8 March 2024.

For more information about the NERC GW4+ Doctoral Training Partnership please visit

https://www.nercgw4plus.ac.uk

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