

GRADUATE SCHOOL

Doctoral Research Highlights 2021



Reducing aircraft emissions by SURFING THE WIND

By 2050, the aviation industry aims to be carbon neutral, requiring huge changes that could take decades to implement. However, with commercial flights responsible for more than 2% of manmade greenhouse gas emissions, efforts to reduce carbon dioxide released during flights must start now.

Although there are many exciting and revolutionary projects in development, including changes to aircraft design and the kind of fuel used, an improvement in operational efficiency is the only way to make immediate cuts to emissions. New satellite coverage of the North Atlantic means that aircraft and Air Traffic Control can now be more aware of the position of all transatlantic traffic. We therefore have the opportunity to plan individual flight paths to minimise emissions.

Constant altitude and airspeed routes were created to use the shortest time possible each day to travel between London and New York, taking into account the daily wind conditions. Flying eastwards, prevailing winds can be used to reduce time of flight by increasing speed relative to the ground, whereas westbound flights must try to avoid headwinds, which reduce ground speed. These trajectories were then compared

with flights simulated to fly each of the Organised Track System (OTS) daily routes through the same winds. In this way, it was possible to show that, by designing routes specifically with the wind field in mind, fuel-use and thus emissions can be reduced significantly.

Our research shows that, by following the OTS, certain wind conditions can cause aircraft to travel a distance of 16% further than needed. Using data about the number of aircraft flying along each track each day, we found that using these tracks leads to 6.7 million kg of unnecessary CO₂ emissions each winter. The research was published in the Environmental Research Letters journal and attracted coverage from news agencies worldwide. It was even cited by National Air Traffic Services in their decision to experiment with the adjustment of the OTS on some days.

The next stage of this work is to minimise fuel use, rather than time, to provide more fuel-efficient, fixed-time flights that would work as part of a seasonal timetable. By varying the heading angle, altitude and airspeed of an aircraft, emissions for each small stage of a flight can be minimised, reducing the flight's total climate impact. By comparing results for different combinations of



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these control variables, the influence of each factor can be assessed. The aim is to produce viable flight routes which will provide substantial and immediate cuts to emissions.

Cathie Wells is a PhD researcher in the Department of Mathematics.



A Wider Lens on FILMMAKING

By failing to bring disabled filmmakers into frame, the film industry misses out, argues Shweta Ghosh.

In a time when anyone with a digital video device can shoot a film and the internet provides a free platform to showcase a diversity of stories, it should be possible for anyone to make one. Nonetheless, people with disabilities remain almost invisible in India, which is home to one of the world's largest film industries.

My doctoral research project, We Make Film, sought to understand the experiences of filmmakers with disabilities in urban India, and the billion-dollar media and entertainment industry that rarely sees them as audio-visual storytellers. It explored the various ways that disability and filmmaking interact in urban Indian

contexts, focusing on the inaccessibility of film and video technology, barriers to film consumption and education, and how filmmakers continue to negotiate these barriers and articulate their creative vision.

The research showed that, even though people with disabilities work in exciting ways to create films, filmmaking still centres the perspectives and practices of non-disabled people, both on and off the screen. Where disabled stories do feature in films, these are told through a non-disabled gaze and without disabled filmmakers driving the storytelling themselves. Our experiences of films are traditionally restricted to audio and visual senses (sight and hearing), but

a broadening to include other sensory experiences can actually open whole new creative avenues and experiences. For example, blind filmmakers may use tactile means (touch) to learn the visual diversity offered by different camera movements, or understand and communicate the spatial organisation of objects and actors when directing a scene.

When disabled individuals tell their own stories, authentic representations of people with disabilities are more likely to emerge, enriching the film experience for everyone. The industry, in my view, should re-evaluate working practices and aesthetic approaches that are rooted in ableism, and build a broader creative environment.

Shweta Ghosh, recently completed her PhD and is now a Lecturer in the Department of Film, Theatre & Television.



For more information, please contact:

GRADUATE SCHOOL

Old Whiteknights House
University of Reading
Whiteknights
Reading RG6 6DN

www.reading.ac.uk/graduateschool



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