Sustainable Aviation: Fuel Use Reduction Through Algorithmic Routing

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Globally, commercial aviation generates one billion tons of CO2 emissions annually. Fuel consumption is 30.1% of the airline budget. While current practices automate the complex handoffs from a safety perspective, they assume static conditions and retain the historically reductionist approach to known waypoints for route planning. Our work relies on the ubiquity of inexpensive compute to densify the network, to expand the node space available for route planning, both ahead of filing a flight plan, and in real-time. The model was trained on N=2,819 flights from December 2022 and takes into account weather, airspace congestion, winds aloft, time, and aircraft weight, prior ATC approvals and altitude-based fuel burn curves as inputs and solves for minimal fuel use through a modified, bound 4-D Dijkstra implementation. The scope of our robotic routing applies to climb, cruise and descent phases of the flight. Specifically, the model directed the aircraft to fly at cruise altitude longer and descend along an efficient glide path. It has resulted in fuel savings of 426 kg on average per flight on n=96 simulated FLL-HVN routes. This translates into a reduction of between 5.3% and 6.9% in fuel spend per flight. Separately, selecting the optimal approach bearing reduces fuel use of the descent phase by 10.4-14.3%. Such an algorithmic approach, if scaled globally, could deliver a drop in global atmospheric temperature of 1.6-2.3 degrees centigrade, enabling direct reductions in climate liability for commercial aviation.