Aircraft Flight Plan Optimization with Dynamic Weather and Airspace Constraints

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Abstract— Flight planning is the process of producing a flight plan which describes a proposed aircraft trajectory. This task is typically performed ahead of departure with the intent of minimizing operating costs, while accounting for weather, airspace, traffic, and comfort considerations. Recent improvements in cockpit connectivity present new opportunities for flight crews to continuously re-assess the trajectories once in the air using the latest information sets (weather observations and forecasts, traffic). In turn, this enables flight crews to proactively respond to the uncertain evolution of the weather by steering the aircraft along optimal trajectories. This also brings new challenges as flight crews are ill-equipped to continuously process vast amount of information to perform the trajectory optimization. A framework is therefore proposed to automate the fusion of various sources of information (severe weather, winds aloft, restricted airspace) to feed a trajectory optimizer that continuously updates the aircraft trajectory. This relies on the implementation of the A* algorithm with the objective to minimize cruise fuel burn and emissions. Use-cases are investigated by comparing continuously updated trajectories with actual flight trajectories retrieved from the FAA Traffic Flow Management Systems through consumer-oriented websites. Promising results are observed with fuel burn savings reaching 8%.