

The Multicriteria Aircraft Landing Problem

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Safety considerations based on aerodynamic principles require minimum separations between aircraft as they arrive on a common runway. These wake-vortex separations translate into temporal separations on the order of 50 to 150 seconds in runway threshold arrival times, depending upon lead and trail aircraft type. The aircraft landing problem involves sequencing and scheduling aircraft landings, typically to minimize delay, while meeting wake-vortex constraints (for instance, Psaraftis, 1978). Soomer and Koole (2008) discuss fairness and the aircraft landing problem. Fairness is difficult to define but air traffic controllers often seek to spread delay evenly among airlines, prioritize long-haul flights, and avoid excessively delaying any individual flight. Solveling et al. (2011) formulated and solved various versions of the aircraft landing problem using objective functions that combine delay, fuel, and various environmental costs.

We formulate and solve the aircraft landing problem as a multicriteria optimization problem. The approach allows us to illustrate trade-offs between various air traffic control objectives, and to avoid having to specify relationships between objectives. We extend previous work solving the aircraft landing problem using dynamic programming, either by grouping aircraft by type (Psaraftis, 1978) or by constraining how an initially provided sequence can be altered (Balakrishnan and Chandran, 2010). We solve multicriteria analogues using various labeling algorithms. We introduce various objective functions based on environmental concerns and notions of fairness. We discuss computational results solving different multicriteria aircraft landing problems using the various identified algorithms. Results indicate that realistic-sized instances of the identified multicriteria problems can be consistently solved in a few seconds.

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