Day 2 (Wednesday, 26 October) 11:15 - 12:45, Hall C
Technical Session 6 Air Traffic Management 1

T6-1-A

Considering TMA holding uncertainty into in-flight trajectory optimisation

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Crew are aware of the delay they have experienced at departure. However, uncertainties ahead, and in particular holdings at arrival, can have an impact on the performance of their operations. When optimising a trajectory the expected cost at the arrival gate should be considered and consequently, taking into account potential congestion and extra delay at the arrival airspace is paramount to avoid sub-optimal decisions. This paper presents a framework to tactically optimise trajectories considering expected delays at arrival. A flight from Athens (LGAV) to London Heathrow (EGLL) is used for simulate with a systematic range of departing delays and expected holdings.

T6-2-A

A Study of Robustness Between Two Strategic 4D Trajectory Plannings

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Strategic 4D trajectory planning is a promising technology for next-generation air traffic management and systems. Some approaches attempt to satisfy the capacity constraint to reduce traffic congestion, while others aim to reduce potential conflicts between trajectories. This paper investigates two approaches to organizing the real traffic in the French airspace at the strategic level. The first approach minimizes interaction between trajectories, while the second reduces traffic congestion so that the controller maintains the traffic without much effort. The associated optimization problems are formulated and resolved by an approximative approach based on simulated annealing. The departure time perturbation was introduced to study the robustness of the two proposed methods. The evaluation of the robustness is performed by Monte Carlo simulation. According to the results, the strategic deconfliction method completely solved all interactions between trajectories, and the strategic decongestion method reduced traffic congestion by 99.94%. Furthermore, the comparative study shows that the method reducing congestion is more robust against the departure time perturbation than the method minimizing interaction between trajectories. These findings encourage the appropriate use of proposed methods in the strategic 4D trajectory planning framework.

T6-3-A

Slot allocation in a multi-airport system under flying time uncertainty

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Slot allocation in a single airport aims to maximize the utilization of airport declared capacity, while slot allocation in a multi-airport system (MAS) has to take airspace capacity into account. Because the limited capacity of certain departure/arrival fixes in the terminal airspace can cause unnecessary flight delays. The uncertainty of flying time between airport and congested fixes makes it even more complicated for slot alloca-tion in a MAS. Traffic flow may be over capacity when the flying times of flights change. In this paper, we propose a mixed integer-programming model for slot allocation in a MAS. The objective of the model is to minimize the total displacements of flights in the MAS while considering all the capacity constraints as well as the uncertainty of flying time. The constraints at departure/arrival fixes are transformed into chance constraints, and Lyapunov theorem is applied for the transformation. To test the proposed model, a case study of schedule optimization in the MAS of Guangdong-Hong Kong-Macao Greater Bay is presented. Specifically, the impact of the uncertainty of flying time from five airports to airspace fix YIN is investigated. Results show that the total displacements increased if the uncertainty of flying time was considered. The optimized schedule, however, is more robust which can satisfy capacity constraints in various scenarios.