Clustering Methods for Mode S Stations: Evaluation and Perspectives

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Grouping of a set of Secondary Surveillance Radar (SSR) Mode S stations into functional entities called clusters has significant operational facets; it calls for a constrained optimization, an important significant constraint being the scarcity of Interrogation Identifier (II) codes. This clustering problem can be approached by two ways, i.e., integer programming methods and heuristic approaches. The definition of a general, usable decision support tool to build up and evaluate clustering strategies in any operational airspace, e.g. the one of a nation or, even more complicated, of a system such as the European one, is a very challenging task. This paper describes some steps toward this envisaged result proposing a mathematical formulation and a heuristic approach for the problem.

Scheduling Wind-Optimal Central East Pacific Flights

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This paper examines alternative methodologies for strategically scheduling flights on wind-optimal routes in the Central East Pacific in order to reduce or eliminate the number of trajectory crossing points that can lead to increased controller workload. New single and multi-objective binary integer programming models, and a simple first-scheduled-first-served heuristic are developed and tested for scheduling these flights. In addition, two heuristics are developed to enhance the computational tractability of the optimization method. The resulting flight schedules are examined in terms of the scheduling delays, the number of residual trajectory crossing points, and the adjusted time savings. The delays associated with the simple first-scheduled-first-served heuristic are found to be 67% to 327% higher than the delays associated with the optimization based approaches, but the runtimes associated with the optimization approaches were often one to two orders of magnitude higher than the first-scheduled-first-served heuristic. When solving the single objective optimization model with the heuristics, delays were found to increase by 24%, and runtime decreased by nearly a factor of 30 when resolving all trajectory crossing points. If schedules that permitted a limited number of trajectory crossing points were allowed then the delays associated with the single objective model were found to decrease by a factor of two and the runtime decreased by a factor of 30 as compared with a similar full run of the single objective binary integer programming model. With the optimization-based approaches, the average adjusted time savings varied between 1.8 minutes and 3.6 minutes per flight. In contrast the simple first-scheduled-first-served heuristic yielded scheduling delays that exceeded the original wind-optimal routing time savings.
**Satisficing Game Theory for Conflict Resolution and Traffic Optimization**

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In the current, centralized approach to Air Traffic Control (ATC) air traffic controllers are responsible for the safe and efficient flow of aircraft. This situation would change with the introduction of Airborne Self-Separation as a distributed and scalable approach to ATC. The major technological challenge that must be tackled to make Airborne Self-Separation a viable alternative to the traditional controller-based approach is to devise a safe and reliable technology to solve conflicts and improve global performances in an uncontrolled environment. In this paper we introduce an algorithm that applies Satisficing Game Theory (SGT) to solve conflicts in the framework of an overall optimization of the traffic flow. This decentralized and cooperative algorithm is inspired by the work presented in [1]. The SGT provides a strategy that permits decision-makers to reach a compromise in the interest of achieving both individual and group goals, implementing altruistic behavior. The paper presents the first results we collected by running a software tool which simulates the behavior of the SGT algorithm in a 3D environment, using air traffic samples provided by the Italian air traffic service provider (ENAV). These results are the starting point of a further enquiry to explore the actual impact of the introduction of such a technology into a realistic ATC environment.

**Managing the Acceptance of Change in ATM**

*Andrew Cook and Graham Tanner*

Much attention is directed at planning the physical processes of change in air traffic management (ATM) and ATC, notably restructuring and automation. Much less is dedicated to the critical understanding of how the industry will manage pilot and controller motivation, and acceptance of such change. The technology supporting next generation systems cannot be implemented in a vacuum. Also, the further ahead we look, the greater the likely effect of societal factors on such changes, including their environmental impact.

This paper explores the relationships between perceived societal and system benefits, i.e. the acceptance of change in a psychosocial and conative context. For the first time in this field the Seven Stages of Change model is used, based on the constructs of the Theory of Planned Behaviour. The paper builds on this to show how intercorrelations of benefit perceptions, known in psychology as the ‘halo’ effect, may allow implementers to more effectively manage the communication, promotion and behavioural motivation of such change in ATM and ATC.