Relevance and Prestige of Information in Air Traffic Control Towers

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The relevance and prestige of information relayed to air traffic controllers must work within the controllers’ existing communications framework. Relevance reflects the controller’s information needs; it is measured by the criticality of the information, its importance, and the number of tasks that use the information. Prestige reflects the extent to which the tower supplies the information; it is measured by the number of sources that display that information. Based on a previous task analysis, we analyzed details about (1) which control position uses the information, (2) the relevance of that information to the different tower positions as well as to the tower as a whole, and (3) the prestige of the information. Results indicated that although the local controller uses the majority of information available in the tower, there are also a considerable number of information objects used by all three tower positions. This information used universally tended to be about status and tower procedures. Primary target and the level of precipitation were the most relevant pieces of information used in the control tower. Mode-C altitude seemed to be the most prestigious piece of information. Overall, however, highly prestigious information tended also to be more relevant, suggesting the tower’s information architecture is reasonably well suited to meet the controllers’ information needs.

A New Algorithm of Radar to ADS-B Registration

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In the Air Traffic Control (ATC) systems, multi-sensor based fusion is essential for accurate target tracking and display. With the development of Automatic Dependent Surveillance-Broadcast (ADS-B) techniques in the ATC, detecting and correcting the position and time biases between a radar system and ADS-B is necessary. In this paper, a new approach for the radar to ADS-B registration is developed based on an alternating optimization technique. The algorithm uses ADS-B reports as a trusted reference of target position to compute not only the range and azimuth biases but also the time bias in radar measurements. The algorithm provides a robust and efficient solution for calibrating radar biases. With three scenarios, the simulation results show that the proposed algorithm can accurately estimate the radar biases with fast convergence.
Flexible Airline Generation to Maximize Flow Under Hard and Soft Constraints

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A fully capable traffic flow management system must solve a multicriteria optimization problem of simultaneously routing several classes of aircraft through an airspace in which constraints apply in different ways to different aircraft. In this problem, we route several classes of aircraft through an airspace at a fixed flight level in the presence of hard and soft constraints. Hard constraints are formed by hazards through which no aircraft can safely fly (e.g., severe convection, turbulence, or icing). Soft constraints are formed by hazards through which some pilots or airlines decide to fly while others do not (e.g., moderate turbulence or icing). We compute flight paths for two aircraft classes: Class-1 aircraft avoid hard constraints but are willing to fly through soft constraints, and Class-2 aircraft avoid both hard and soft constraints. Our work assists in designing future operational concepts in which jetway routing is retired and aircraft paths are allowed to adjust to the shapes and positions of constraints. We are interested in determining the capacity of an airspace and feasible routes across an airspace with hard and soft constraints, given as input the demand profile indicating how many Class-1 and Class-2 aircraft are scheduled to enter the airspace. We report on experiments both with real and with synthesized weather data.