Safety Analysis for Advanced Separation Concepts

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Advanced separation assurance concepts involving higher degrees of automation must meet the challenge of maintaining safety in the presence of inevitable subsystem faults, including the complete failure of the supporting automation infrastructure. This paper examines the types of design features and safeguards that might be used to preserve safety in a highly automated environment. The Advanced Airspace Concept (AAC) being developed by NASA is used as the basis for a fault-tree analysis. Multiple layers of protection, with carefully specified fault management strategies, appear to be important to achieving the desired level of safety.

Human Factors Implications of Continuous Descent Approach Procedures for Noise Abatement

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Continuous Descent Approach (CDA) procedures can be effective at reducing aircraft noise in the vicinity of airports. The air traffic control human factors implications of transitioning from conventional to CDA procedures are addressed in this paper. A cognitive difference analysis revealed the impacts on intent, controllability and structure-based abstractions in the lateral, vertical and speed domains. An experiment is presented that probes the cognitive implications of changing speed profiles during the approach, which was one of the key differences between the procedures identified in the cognitive difference analysis. Based on the results, recommendations were made for CDA procedure designers to standardize deceleration profiles, design procedures to be non-interacting and to consider allocating separation authority to the pilot with a view to easing transition and controller acceptance.

Simulation of Terminal-Area Flight Management System Arrivals with Airborne Spacing


A simulation evaluated the feasibility and potential benefits of using decision support tools to support time-based airborne spacing and merging for aircraft arriving in the terminal area on charted Flight Management System (FMS) routes. Sixteen trials were conducted in each treatment combination of a 2x2 repeated-measures design. In trials ‘with ground tools’ air traffic controller participants managed traffic using sequencing and spacing tools. In trials ‘with air tools’ approximately seventy-five percent of aircraft assigned to the primary landing runway were equipped for airborne spacing, including flight simulators flown by commercial pilots. The results indicate that airborne spacing improves spacing accuracy and is feasible for FMS operations and mixed spacing equipage. Controllers and pilots can manage spacing clearances that contain two call signs without difficulty. For best effect, both decision support tools and spacing guidance should exhibit consistently predictable performance, and merging traffic flows should be well coordinated.
Quantifying Convective Delay Reduction Benefits for Air Traffic Management Systems

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Quantifying convective weather (i.e., thunderstorm) delay benefits for air traffic management (ATM) systems is increasingly important, but has proven to be difficult due to the nature of convective weather and its interaction with the air system. This paper summarizes key aspects of convective weather disruptions of the aviation system, suggests how the weather severity can be characterized, and presents the results of quantifying delay reduction benefits for two operational systems by a variety of approaches. The comparison of delays before and after a system is introduced was found to have many major difficulties. Real time observations of system usage, followed by detailed analysis of specific convective weather cases before and after the system is introduced, are recommended as a near term approach while research proceeds on robust methodologies for the use of delay statistics.

The Use of Panel Data Analysis Techniques in Airspace Capacity Estimation

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Air traffic in Europe is increasing at a rapid rate and traffic patterns no longer display pronounced daily peaks but instead exhibit peak spreading. This paper considers the factors that affect controller workload throughout the whole day. It provides a framework for using cross-sectional time-series analysis with simulated data to derive a model that describes a functional relationship between the workload and the factors that influence it for en-route airspace. Simulation studies are presented for two contrasting regions of European airspace to determine robustness and transferability of the model. An important feature of the analysis was the use of controller input, via interviews, to create variables that were reliable indicators of workload. The results indicate that a sub-set of traffic and sector variables and their parameter estimates can be used to predict controller workload, and hence capacity, in any sector of the two regions simulated in any given hour.