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Technical capabilities for significant improvements in communication, navigation, and surveillance (CNS) over the oceans are currently available through the use of satellites. However, all aircraft operators will not equip simultaneously because of the high costs required. Consequently, as these CNS systems are integrated into the oceanic air transportation architecture, the controller will have to manage a mixed equipage fleet. Also, planned reductions in separation minima are based on aircraft equipage, therefore oceanic controllers will need to apply a set of mixed separation standards. The cognitive effects of the mixed equipage environment were studied through field observations and experimental analysis. The results confirm that methods are needed to minimize human performance issues with integrating mixed CNS equipage, and ensure safety and efficiency in the mixed equipage environment.

Modeling and Simulation of Air Traffic and Changes in the Northern Pacific Airspace: Investigation of the Effects on System Performance

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This paper presents the details of research with the purpose of investigating the effects of an RNP-based reduction in separation standards in the Northern Pacific airspace. This is accomplished through the development of a simulation model which consists of three distinct modules. Factors such as weather, traffic volume, minimum separation standards, and individual aircraft characteristics are considered in simulating air traffic crossing the Pacific Oceanic Airspace. Various scenarios reflecting possible future system changes are simulated for comparison, and results and analysis are presented. It is concluded that both increasing the percent of traffic to which reduced separation standards are applied and decreasing the longitudinal separation standard result in improvements in several key performance measures.
Turn-Constrained Route Planning for Avoiding Hazardous Weather

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We investigate the problem of algorithmically synthesizing turn-constrained routes that minimize exposure to hazardous weather. Such a problem is suitable to air traffic management automation and aircraft flight management systems. Our algorithm synthesizes routes that aircraft may follow from a specified start to finish location. Example applications include synthesizing routes (1) from airport metering fix locations to runway final approach fixes, and (2) from sector boundary crossing locations to airport metering fix locations. The algorithm takes into account aircraft dynamics limits on velocity and acceleration, pilot and controller workload considerations (e.g., the number of turn maneuvers), and other constraints (e.g., utilizing arrival vs departure corridors or avoiding special use airspace regions). The solution approach is based on searching in an appropriate discretization of a geometric model of the airspace using a dynamic programming algorithm for optimal paths having a bounded number of turns. Examples are given for Dallas Ft. Worth Airport.