ACES-Based Testbed and Bayesian Game-Theoretic Framework for Dynamic Airspace Configuration

Intelligent Automation, Inc.

Technical Abstract

This SBIR effort is focused on developing a Dynamic Airspace Configuration (DAC) concept where-in ARTCCs can benefit from re-configuring airspaces based on Traffic Flow Management (TFM) restrictions, and the development of a preliminary Airspace Concept Evaluation System (ACES)-framework and initial algorithms to demonstrate that ARTCCs need to engage in a coordination framework of exchanging TFM restriction until they determine mutually-agreeable optimal airspace configuration. The development of algorithms that leverage and recognize the interactions and interdependencies between DAC and TFM is the key innovation of this effort. Some examples of expected operational improvements include 1) reduction in congestion and delays when sector capacities (Monitoring Alert Parameter or Dynamic Density) are violated, 2) reduction in controller workload and improved safety, 3) ability to accommodate user preferred routes and weather uncertainty and 4) achieve a balance between airborne delay and grounding holding delay. The SBIR Phase-I effort demonstrated how a combined DAC-TFM algorithm determines an optimal airspace configuration different from a DAC-only algorithm and could result in minimization of peak count and dwell time variance. The effort also included the design and preliminary implementation of a TFM model that uses ARTCC sector configuration to determine the delays that is generated, absorbed and propagated. The Phase II effort includes development of DAC-TFM framework as an enhancement to NASA's ACES- DADS (Dynamic Airspace Design Service) work and interaction of NASA's airspace partitioning DAC algorithms such as MxDAC, DAU slicing and Sector Combination algorithms with the TFM models using the same framework.

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2008 Phase II
Proposal A3.01-8875

Use-Driven Testbed for Evaluating Systems and Technologies (U-TEST)

Aptima, Inc.

Technical Abstract

NextGen will require the development of novel solutions to shape the airspace of tomorrow. Along with the ability to generate new systems and technologies comes the need to rigorously evaluate, and eventually validate, the effectiveness of these concepts. However, it is often challenging to translate simulation data into useful, integrated, and contextually-based assessments. Many critical findings are not identified for this reason, which could otherwise guide researchers toward advancements with NextGen technologies. Aptima proposes to develop the Use-driven Testbed for Evaluating Systems and Technologies (U-TEST), a flexible toolset that helps NextGen researchers to efficiently extract findings on pilot performance in simulated flight environments. Three primary components are: (1) context-capturing software will guide researchers to key events and allow important contextual information to be gathered for analysis; (2) a data integration platform that will automate organization of data sources into a format conducive to analysis; and (3) context-based analysis software that will enable deep, focused analysis by combining a quick-look function, an algorithm for focusing analysis, and context-based playback of key events and trials. U-TEST will be an extensible toolset that can help NextGen researchers improve the amount and quality of findings across a range of studies.

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2008 Phase II
Proposal A3.01-9466