Validating \textit{airspace}Analyzer Metrics for En Route ATC Sector Complexity

\textit{William P. Niedringhaus}

The MITRE Corporation’s Center for Advanced Aviation System Development (CAASD) has developed a tool, \textit{airspace}Analyzer, to measure sector complexity. It does so by performing automated air traffic control—separating traffic while respecting aircraft performance and restrictions on altitude and miles-in-trail. It outputs a suite of raw metrics, derived from characteristics of these resolutions. We performed experiments first to calibrate, then to validate, the model.

To define a “correct” value for sector complexity against which to calibrate and validate, we enlisted a team of experts (retired Certified Professional Controllers). The experts performed air traffic control for en route sectors in Indianapolis Center in a realistic simulation environment. They provided periodic assessments of the sector’s complexity on a scale from 1 (minimum) to 7 (maximum). We averaged the assessments of all participating experts at a particular time to define the correct answer for that time.

We calibrated \textit{airspace}Analyzer to output a metric that matched as closely as possible the “correct” answers. Then, we performed validation experiments on a new set of four scenarios, which featured realistic, but somewhat different, traffic flows and restrictions. The validation set involved three Indianapolis sectors (including one not used in calibration) and seven experts (including three not used in calibration). Assessments were obtained from each expert at 20-30 times during each scenario, for a total of 101 data points. Using its calibrated metric, \textit{airspace}Analyzer predicts the correct answer with a root mean square error of at most 0.687 points on the 1-7 scale. That it could match the human experts this well is evidence for the validity of \textit{airspace}Analyzer as a predictor of sector complexity.

Getting to the Point: A Safety Assessment of Arrival Operations in Terminal Airspace

\textit{Derek Fowler}

The article entitled “2020 Foresight” in a recent edition of Air Traffic Control Quarterly [ATC Quarterly, 2011] explained why traditional approaches to safety assessment are inadequate for the major operational and technology changes that are planned for introduction into European Air Traffic Management (ATM) up to 2020 and beyond. The article showed that a broader approach is needed in order to address the positive contribution that a fully functioning ATM service makes to aviation safety (the new, “success” approach) and not just the negative effects that failures within the ATM system might have on the risk of an accident (the traditional “failure” approach). Now, in this article, the example of a new operational concept for arrival management in Terminal airspace, known as Point Merge, is used to detail how the broader approach to safety assessment, developed by EUROCONTROL, is being applied to projects typical of SESAR - the Single European Sky ATM Research programme (equivalent to the US NextGen programme).
The article shows that the broader approach is unique in that it starts with a safety validation of the operational concept, for all foreseeable operational conditions - i.e. normal, abnormal and internal-failure scenarios. This approach is followed by the equivalent validation of the high-level design of the corresponding ATM system, to ensure that it is capable of realising the concept from a safety viewpoint. The third stage - implementation of the design - is not addressed herein since it does not raise significant issues beyond those associated with a traditional failure-only approach. The reader will find this concept to be a more intelligent way of doing a safety assessment as well as finding Point Merge to be a smart and safe way to manage arrivals!

Airport Configuration Management

*Stephen Atkins and Christopher Provan*

This paper presents a concept for an airport configuration planner that is practical to apply at any airport, despite the uniqueness of each airport. The concept adheres to current procedures, while being extensible to future operational scenarios. A laboratory prototype of the concept’s core algorithm has been implemented and studied within a fast-time simulation environment. The paper presents the underlying algorithmic approach as well as simulation results for several airports under various weather and traffic conditions. This prototype could be implemented and provide benefits within the current National Airspace System (NAS). Future research will extend the concept and algorithm to provide coordinated plans for metroplex airports.