Spring Research Conference
May 2015
Cincinnati, Ohio

Statistical Engineering in Air Traffic Management Research

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NASA is working to develop an integrated set of advanced technologies to enable efficient arrival operations in high-density terminal airspace for the Next Generation Air Transportation System. This integrated arrival solution is being validated and verified in laboratories and transitioned to a field prototype for an operational demonstration at a major U.S. airport. Within NASA, this is a collaborative effort between Ames and Langley Research Centers involving a multi-year iterative experimentation process. Designing and analyzing a series of sequential batch computer simulations and human-in-the-loop experiments across multiple facilities and simulation environments involves a number of statistical challenges. Experiments conducted in separate laboratories typically have different limitations and constraints, and can take different approaches with respect to the fundamental principles of statistical design of experiments. This often makes it difficult to compare results from multiple experiments and incorporate findings into the next experiment in the series. A statistical engineering approach is being employed within this project to support risk-informed decision making and maximize the knowledge gained within the available resources. This presentation describes a statistical engineering case study from NASA, highlights statistical challenges, and discusses areas where existing statistical methodology is adapted and extended.