**CONFERENCE PROGRAMME**

Flight Simulation Conference

**MODELLING AND SIMULATION IN AIR TRAFFIC MANAGEMENT**

**DAY ONE - TUESDAY 14 NOVEMBER 2017**

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<th>Time</th>
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<td>08:30</td>
<td>Registration and Refreshments</td>
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<td>09:00</td>
<td><strong>WELCOME &amp; OPENING REMARKS</strong></td>
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<td><strong>Speaker:</strong> John Cook MRAeS, Director, Parydon Limited and Conference Chairman, Royal Aeronautical Society</td>
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<td>09:10</td>
<td><strong>KEYNOTE ADDRESS</strong></td>
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<td><strong>Speaker:</strong> Dr Tom Edwards, Chief Technology Officer, Crown Consulting Inc</td>
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<td>09:30</td>
<td><strong>SESSION ONE: MODELLING AND SIMULATION TO ENABLE CAPABILITY DEVELOPMENT IN ATM</strong></td>
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<td><strong>Chairman:</strong> TBC</td>
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<td>09:30</td>
<td><strong>1) FAST-TIME MODELING AT THE U.S. FEDERAL AVIATION ADMINISTRATION</strong></td>
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<td>The U.S. Federal Aviation Administration (FAA) is the largest Air Navigation Service Provider in the world, providing air traffic control services for five million square miles of airspace. The FAA is currently engaged in a far-reaching transformation of air traffic management technologies and procedures known as NextGen. In order to analyze the performance of this system-of-systems, evaluate new investment options, and examine the impacts of alternative budget and governance proposals, the FAA relies on a suite of fast-time modeling tools used by many analysts across the organization. These tools span all ATM domains. The presenter will discuss the tools that are currently used at FAA, the problems they are used to address, and future challenges for the air traffic management modeling community.</td>
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<td><strong>Speaker:</strong> Joseph Post, Deputy Director, NAS Systems Engineering and Integration, Federal Aviation Administration</td>
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<td>09:50</td>
<td><strong>2) DEVELOPMENT OF A HIGH-FIDELITY SIMULATION ENVIRONMENT FOR SHADOW-MODE ASSESSMENTS OF AIR TRAFFIC CONCEPTS</strong></td>
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<td>This presentation describes the Shadow Mode Assessment Using Realistic Technologies (SMART-NAS) Test Bed. The SMART-NAS Test Bed is an air traffic simulation platform being developed by the National Aeronautics and Space Administration (NASA). The SMART-NAS Test Bed’s core purpose is to conduct high-fidelity, real-time, human-in-the-loop and automation-in-the-loop simulations of current and proposed future air traffic concepts for the United States’ Next Generation Air Transportation System called NextGen. The principle concepts to be simulated include advanced gate-to-gate, trajectory-based operations, widespread integration of novel aircraft such as unmanned vehicles, and real-time safety assurance technologies to enable autonomous operations. This presentation describes the SMART-NAS Test Bed’s purpose; its concept of use; and the resulting benefits, key capabilities, high-level requirements, architecture, software design and software builds.</td>
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<td><strong>Speaker:</strong> Alan Lee, SMART-NAS Test Bed Deputy Technical Lead, NASA</td>
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<td>10:10</td>
<td><strong>3) SIMULATED SWIM (SYSTEM WIDE INFORMATION MANAGEMENT) SERVICES IN ATM</strong></td>
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<td>This paper seeks to present the concept of System Wide Information Management (SWIM) in ATM, to outline real and potential use cases for simulated services across the solution lifecycle; to describe an approach to simulating</td>
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a SWIM environment using a Service Oriented Architecture, and to report our experiences of simulating SWIM services. Using simulated SWIM services, we have been able to create and run complex operational scenarios including many different types of ATM stakeholders with only a few systems. We have successfully used a mix of existing, simulated and prototype systems from different vendors, leading to cost and time efficient development and validation exercises. We have also been able to demonstrate the value of SWIM and new operational concepts to key decision makers to get funding and support for future development and implementation activities.

**Speaker:** Niklas Häggström, Senior Consultant, Knowledge Agency

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**EVOLUTION OF A SIMULATION TESTBED INTO AN OPERATIONAL TOOL**

This paper describes the evolution of the Future Air Traffic Management (ATM) Concepts Evaluation Tool (FACET) from a National Airspace System (NAS) based simulation testbed into an operational system called NAS Constraint Evaluation and Notification Tool (NASCENT). Over two decades of activity is presented, which included application and infrastructure development, and led to its utility as a tool for various functions. FACET was developed as a testbed for assessing futuristic ATM concepts, such as automated conflict detection and resolution, modelling and optimization of traffic flow management, etc. NASCENT is an operational tool for alerting airspace users of inefficiencies in flight operations and advising time and fuel saving re-routes. It is currently in use at the American Airlines Integrated Operations Center in Fort Worth, TX.

**Speaker:** Dr Kapil Sheth, Flight Trajectory Dynamics and Controls Branch (AFT), NASA Ames Research Center

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**SESSION TWO: ATM SIMULATION BASED DECISION SUPPORT TOOLS**

**Chairman:** TBC

**ESTIMATING THE IMPACT OF ADS-B ONLY SURVEILLANCE AND PROJECTING BENEFITS AT FUTURE LOCATIONS**

The FAA Surveillance and Broadcast Services Program has successfully installed ADS-B sensors across the US National Airspace System (NAS) for use in Air Traffic Management. In many areas, the surveillance coverage volume for ADS-B is greater than the existing radar coverage. In fact, the current ADS-B surveillance floor extends much lower than radar at over 500 NAS airports. The first part of this study uses actual radar and ADS-B coverage profiles at different altitudes to determine relevant towered and non-towerered airports that should receive ADS-B only benefits. The results indicate a significant benefit to the program that was not claimed in the original cost benefit analysis because the difference between the ADS-B and radar coverage volumes was not known. The second part of this study evaluates additional areas where future ADS-B only surveillance would be cost-beneficial. The potential benefits for each grouping was calculated to define optimal sets. The potential benefits were then compared to costs to estimate cost-beneficial locations for future surveillance.

**Speaker:** Dr Dan Howell, Senior Operations Research Analyst, Regulus Group
6) ADAPTIVE AERIAL ECOSYSTEM GENERATION FOR TACTICAL CONFLICT MANAGEMENT RESOLUTION PROCESS
This paper elaborates an innovative automation-based concept in future design of the European ATM system, supporting an irruptive shift from the centrally controlled to a distributed system, in which aircraft create dynamic ecosystems, with self-governed capabilities, to find the most optimal conflict-free resolutions, taking both safety and cost-efficiency into consideration. The approach is seeking for an advanced time horizon, look-ahead time, in which airspace users would have more possibilities to negotiate their resolutions before an ATC directive is issued. The concept is intended to be operable in a highly dense enroute airspace and completely aligned with the Trajectory Based Operations requirements. It deploys several modules for a smooth transition, from trajectory management, separation management, to collision avoidance layer. The airborne and ground-based decision support tools, developed for the ecosystem creation, tracking and resolution process and supported by a multi-agent modelling algorithm, are initially verified with the preliminary simulation results.

Speaker: Marko Radanovic, Researcher, Universitat Autònoma de Barcelona

7) IMPACT OF OPTIMIZED TRAJECTORIES ON THE AIR TRAFFIC FLOW MANAGEMENT
In this study, the impact of multi-criteria optimized free route trajectories on the ATFM system is estimated with respect to the increased ATC controller taskload, the fuel savings and the change in ATC sector capacity, compared to a reference, radar tracked real air traffic scenario. Therefore, we present a unique combination of the fast time Air Traffic Optimizer AirTop with multi-criteria optimized trajectories, calculated with the TOolchain for Multicriteria Aircraft Trajectory Optimization TOMATO. A reference scenario of one hour of European’s air traffic is simulated and assessed with AirTop considering real weather input data. Coexistent, the simulated city pairs and the departure times are used to optimize and assess each trajectory in TOMATO with respect to minimum ecological costs due to engine emissions, minimum operating costs and a guaranty of today’s safety requirements.

Speaker: Dr Judith Rosenow, Postdoctoral Resercher, Institute of Logistics and Aviation

8) COLLABORATIVE AIRPORT PASSENGER MANAGEMENT WITH A VIRTUAL CONTROL
Speaker: TBC

9) A FRAMEWORK FOR INTEGRATED TERMINAL AIRSPACE DESIGN
Route planning and airspace sectorization are two central tasks in ATM. Traditionally, the routing and sectorization problems were considered separately, with aircraft trajectories serving as input to the sectorization problem and, reciprocally, sectors being part of the input to the path finding algorithms. In this paper we propose a simultaneous...
design of routes and sectors for a transition airspace. We compare two approaches for this integrated design: one based on mixed integer programming (MIP), and one Voronoi-based model that separates potential “hotspots” of controller activity resulting from the terminal routes. One of our main technical novelties is the suggestion to abandon the trajectories-to-complexity-to-sectors scheme (the golden standard for sectorization solutions) and instead directly build sectors around the potential conflicts on the routes themselves (eliminating the construction themselves (eliminating the construction of the complexity map). We apply our two approaches to the design of Stockholm TMA.

Speaker: Dr Christiane Schmidt, PostDoc, Linköping University

10) TOWARD THE CHARACTERISATION OF SEQUENCING ARRIVALS
This presentation focuses on a novel approach, essentially data driven, to understand and characterise the sequencing of arrivals in the approach area, assessing the level of similarity of controllers’ actions in response to given traffic situations.

A first case study is presented, applied to different sequencing techniques (a baseline and two new ones), using track data from humans to in the loop simulations, to demonstrate the approach capability in characterising the sequencing work, notably in terms of convergence speed toward the final sequence position, suggesting that the sequencing is anticipated and performed earlier for some of these techniques.

A second application to a series of selected busy European TMAs, using actual surveillance data over an extended time period, is presented, highlighting sequencing patterns and their level of similarity/dissimilarity.

Speaker: Raphaël Christien, Data Analysis Engineer, EUROCONTROL Experimental Centre

Networking Refreshment Break

11) MODELING THE IMPACT OF REDUCED SEPARATION ON PILOT ALTITUDE REQUEST BEHAVIOR IN OCEANIC AIRSPACE
The FAA is examining the benefits of reduced oceanic separation in US-controlled airspace. A primary benefit involves accommodation of pilot altitude requests. Input from the airlines indicated that reducing separation would also likely influence pilots to ask for more altitude requests. To test if such behavior change was reasonable, a study was performed to examine altitude request trends before and after previously approved separation reductions in US-controlled oceanic airspace. The results indicate that pilot altitude requests per flight from properly equipped flights increased by 10 to 15 percent depending on the airspace examined. The second part of the study examines how the pilot request behavior was used to tune parameters in the FAA NextGen Global Oceanic Model (GOM) and how those parameters impact the number of climb requests made and granted, as well as the resulting fuel burn and fuel burn savings produced by the model.

Speaker: Rob Dean, Operations Research Analyst, Regulus Group
12) ON-DEMAND ASSESSMENT OF AIR TRAFFIC IMPACT OF BLOCKING AIRSPACES

Demand for airspace access has been on the rise due to an increasing number of new entrants such as Space Operators, Unmanned Aircraft Systems (UAS), and Balloon Operators. To accommodate operations such as space launches in the National Airspace System (NAS), the Federal Aviation Administration (FAA) may block air traffic from strategically located airspaces to ensure operational safety. This briefing presents a prediction model coupled with a “what-if” analysis capability, whereby changes in airspace dimension, location and activation time are reflected instantaneously as measures of projected impact. There are three key components of this work: developing a model that uses historical data to predict air traffic demand, modelling air traffic impact from rerouting or delaying the affected traffic, and finally reducing this information to a data structure that can support on-demand analysis. The focus of this research is the new techniques developed to predict demand from a large set of historical track data and further encode these projections to support the quick assessment of the impact of blocking arbitrary airspaces.

Speaker: Amal Srivastava, Software Systems Engineer Lead, MITRE Corporation

16:30 PANEL DISCUSSION

17:00 CLOSING REMARKS

Speaker: John Cook MRAeS, Director, Parydon Limited and Conference Chairman, Royal Aeronautical Society

17:15 END OF DAY ONE

18:00 CAPT RAY JONES LECTURE

Speaker: Jeffery Schroeder FRAeS, Chief Scientific and Technical Advisor, Federal Aviation Administration