SID 2017 - Posters

A Model for Evaluating the Human Life in Aircraft Accidents
Ivana Cavka
Although considered as being exceptional, aviation accidents have the potential to result in large property damages and losses of human life. Attempting to reduce such catastrophic events is a legitimate goal of air transportation policies and practices. The optimization of safety targets across the air transport system has to be based on a number of criteria, one of which is the balance between safety benefits and costs. Therefore, in order to make efficient allocation of resources in means of safety investments that would enable the risk reduction, one should ask: at what cost? The answer to such a question requires an estimate of the value of statistical life. The cost per life saved is always the most valuable basis for understanding relation between productivity and protection in aviation, an equilibrium based on which a well-organized and cost-effective Safety Management System ultimately relies. This research proposes a useful metric for assessing these trade-offs, a model that can provide a starting point for cost-benefit analysis and perhaps more detailed and complex analysis of how to manage the often conflicting preferences associated with assessments of risks, costs and benefits.

Project F AUTO – Let the System Get to Know You!
Magnus Nylin
Modern ATM systems use a lot of input from the technical part of the system; radar tracks, flight plans, etc., but know nothing about the users' situation. The aim for project F AUTO, performed by LFV and Linköping University in cooperation, is to change this. The project will use information from biometrical sensors to make the (automated) technical systems flexible and adaptive. The starting point will be eye tracking in current tower environment, continuing with other sensors and more advanced human-automation collaboration further on. There will also be cooperation with other transport domains (train and sea) facing similar problems.

APACHE: Measuring Performance of the European Air Traffic Management System: Review of Current Performance Indicators and Proposal for New Ones
Fedja Netjasov
In order to assess ATM performances of future SESAR CONOPS, past reports and guidance materials are reviewed in order to determine which KPAs are covered and specific KPIs/PIs used in Europe. Additionally, relevant ICAO and CANSO documents are also reviewed. Special attention is given to SESAR Performance Framework which aims to estimate the performance benefits of SESAR solutions before the execution phase of operations, which is in line with the APACHE project. A set of novel PIs which could be measured using APACHE framework are proposed in collaboration with the SJU and the PRB considering their valuable feedback.

TBO-Met: Efficiency/Predictability of 4D Trajectories at Tactical Level Considering Meteorological Uncertainty
Daniel Sacher
A better understanding of the elements introducing uncertainty in traffic management is key when optimizing, planning, executing, monitoring and synchronizing trajectories with ground systems and aircrafts. In TBO-Met (call H2020-SESAR-2015-1), the focus is on meteorological uncertainty for trajectory based operations in ATM. We ambition to develop algorithms capable to improve the predictability of aircraft trajectories when subject to meteorological uncertainty while keeping acceptable levels of efficiency. Here we present results on robust trajectory planning at the tactical level (short-term planning and execution) considering uncertainty associated to the evolution of thunderstorms. Short-term forecasts (Nowcasts) are used as input data for the uncertain evolution of thunderstorms.

Data Science in ATM: Results from BigData4ATM and INTUIT projects
Ricardo Herranz

ATM, due to its inherent complexity, has all the ingredients to become a Big Data success case. The amount of data involved in a typical flight (route data, weather data, passenger data, etc.) is immense and virtually impossible to analyse through traditional approaches. This poster presents the latest results from BigData4ATM and INTUIT, two SESAR 2020 Exploratory Research projects that aim to provide a deeper knowledge of the ATM system and develop new decision support tools through the use of data-driven techniques.

The overall goal of BigData4ATM is to investigate how different passenger-centric geolocated data can be analysed and combined with more traditional databases to extract relevant information about passengers' behaviour. In this poster we will present a methodology to reconstruct door to door itineraries which allows the assessment of airport catchment areas, access/egress times, and door-to-door delays.

INTUIT aims to model and assess performance trade-offs through visual analysis and machine learning. In this poster we will present the route choice predictor developed in the project. This predictor allows to evaluate the trade-off between cost-efficiency, environment and capacity arising from airline route choices.

New Approaches to ATM Performance Analysis: Overview of the APACHE, AURORA and INTUIT Projects
Ricardo Herranz

The SESAR Exploratory Research projects APACHE, AURORA and INTUIT are investigating new indicators and methodologies for ATM performance analysis, capable of capturing the performance impact of ATM operations and the interdependencies between different KPAs. In this poster, we summarise the new indicators, methods and tools and proposed by each project, and the way they can complement each other to improve our understanding of ATM performance drivers.

APACHE is developing a performance simulation and analysis tool to evaluate future SESAR2020 solutions, including an enhanced Performance Framework. We will present some application examples showing the benefits of the new proposed KPA/KPIs and what-if analysis tools for the long-term improvement of the SESAR Performance Framework.

AURORA aims to create new user-centric metrics, calibrated with actual, non-confidential airlines' data, to capture airspace users' view on flight efficiency and equity. We will present the first outcomes of the project: (i) development of advanced user-centric efficiency indicators based on optimal user-preferred trajectories; (ii) quantification of how equitably are inefficiencies distributed between the airspace users; and (iii) online calculation of the new indicators to support network tactical decision-making processes.

INTUIT aims to apply data-driven techniques to model and assess performance trade-offs in a series of case studies. We will present the first results of the ongoing case studies, including: (i) characterisation of the trade-off between cost-efficiency, environment and capacity arising from airline route choices; (ii) disaggregation of efficiency metrics at finer spatial and temporal granularity; and (iii) identification and assessment of route inefficiencies.

Reporting and Collecting Bird Strike Data as a Contribution to Aviation Safety
Aleksandra Nesic

Safe operations in the air traffic have always been priority and all parties in the aviation should strive constant safety improvement. One of the ever-present hazard in the aviation is BASH (Bird Aircraft Strike Hazard). Beside safety impact bird strikes are causing disruptions and additional costs to the airlines. Effective bird strike risk management requires valid information about bird strike events in order to properly evaluate risk level and undertake mitigation measures. It is known that the first bird strike was reported by Orville Wright in 1905. So how far we've come in 2017?

Airport Interoperability
Hans-Christian Schmitz
Airports comprise various stakeholders, among them airport operators, ground handlers, airlines, air traffic management and other service providers, e.g. police and fire fighters. The stakeholders use diverse information systems resulting in a highly heterogeneous systems landscape at the airport. The stakeholders use their systems to execute their own tasks, but they also have to exchange information in order to coordinate their activities and inter-operate. To this end, an interoperability solution is needed that facilitates the exchange and processing of structured data with a high volume, velocity and complexity.
In essence, an interoperability solution implies three elements: firstly, trained operators, i.e., operational Subject Matter Experts; secondly, information systems and exchange mechanisms for transferring information among the systems; and, thirdly, information to be exchanged. To define the technical aspects of an interoperability solution, exchange mechanisms and semantically well-defined message formats have to be specified. The latter can leverage on existing information models in the aviation domain, e.g. the A-CDM semantic reference, SWIM and AIDM, among other models.
We will describe a concise process for the design and implementation of an interoperability solution and we will introduce tools for supporting the execution of this process. The process starts with the capturing and statement of requirements and expectations. This step includes a high-level overview on the operational concept, a description of the operational activities involved, a specification of the logic of exchanges, an operational view on the necessary information model and, finally, a formal specification of all requirements. The next step comprises the technical design of the solution. To this belong the analysis of existing information models, the extension of these models according to the given requirements, the generation of specific (sub-) models, the creation of message formats from the (sub-) models and, finally, the specification of adequate exchange mechanisms. The last step is the implementation of user interfaces.
The process and its tool support enable the fast development of interoperability solutions for dedicated capabilities (incl. demonstrators). We build upon work from the military domain, in particular the Multilateral Interoperability Programme (MIP).

Back to Basics, or Is Less More?
Åsa Svensson
With more advanced en-route control, remote towers, demands on higher fuel efficiency, increasing traffic density, and to still maintain or increase safety, the need for optimisation is high. More and more functions, tools and visualizations are being introduced in the air traffic control systems. Functions are built on each other and are often based on previous versions. The need is high for decision support to handle the more complex situations, but with more functions comes the uncertainty of too much information. More complex systems may introduce the risk of reduced system knowledge and the occurrence of automation surprise. Sarter and Woods discovered, over 20 years ago, that many pilots had a gap in their understanding of the automation in the FMS system, which was especially prominent in non-nominal situations. Do air traffic controllers suffer from the same problem, and if so, has it increased or decreased with the increase of total system complexity? There is a lot of research within ATM regarding situational awareness, mode awareness, communication between operator and system, etc.. However, it seems that the equivalent of Sarter's and Wood's study from 1994, where they investigated the understanding of the automation, is lacking within the ATM domain. We argue that, in the described situation, more research should be performed within this area, to make sure the user understands the automation and that information is not getting lost, e.g. a study similar to Sarter's and Woods's but in the ATM context We also argue that design research should be initiated where the approach is to step back a little bit, and instead of adding new functions to existing systems, look at what is really needed to do the job of an ATCO. Start with a blank paper and work from the very

basics with just two basic requirements – the aircraft shall not conflict with each other and they shall fly as efficient as possible. In other words, go back to basics and challenge the paradigms of today's systems! Hopefully, new design choices can be found that are not limited to legacy limitations that are no longer relevant, compare e.g. the digitalization of the paper strips. Whether this means fewer screens, less information on the screens, other information, introduction of new modalities, or whatever solutions one can come up with is to be seen, we are convinced that there are a lot of exciting findings and opportunities out there to be explored!

EVAA: Observe the Real World to teach our Simulation
Aurelie Abert
EVAA [EnVironment with self-AdAptability] is an original trajectory generator using machine learning and Adaptive Multi-Agent Systems and Machine Learning on real flights.
In Adaptive Multi-Agent System, each agent is trying to reach its local goal while helping its neighbours. If any of them is judged to be in a more critical situation it will devote its resources to helping it reach its own local goal. The cooperation between agents to accomplish their respective local goal is what lead the system to the accomplishment of its global goal.
In EVAA, every point of the trajectory is created in real time by virtual agents according to a set of learned behaviours. Those behaviours guide the aircraft on a trajectory matching its criteria (airline, destination, wind, time…)
Benefits: Real time control, enhanced realism, interoperability
Next Step: conflicts management
EVAA is the result of a thesis (2013-2016) by Sopra Steria and IRIT.

Keeping the Human in the Loop in the Digital ATM Era
Ana Ferreira
The aim of the present work is to show how multimodal solutions, artificial intelligence and human performance indexes can act as enablers to support human performance in the digital ATM future. The poster explores three different operational scenarios, including tower and en route Air Traffic Control, coming from MOTO, TACO and STRESS SJU projects. Each scenario illustrates how future operations can impact the human role and how it will be possible to keep humans at the centre of operations with dedicated enablers.

Towards Using Semantic Web Technologies in Air Traffic Management
Christoph Schuetz
In project BEST we investigate the bene ts of using semantic web technologies for realizing the upcoming System Wide Information Management (SWIM) in Air Tra c Management (ATM). The main goal of SWIM is to ensure common situational awareness among ATM stakeholders, such as pilots, air tra c controllers, airport operation centers, and meteorology service providers, all of which act as information providers and information consumers. Ontology Development and Governance. Standardized information exchange models like the Aeronautical Information Exchange Model (AIXM), the Flight Information Exchange Model (FIXM), the Weather Information Exchange Model (WXXM) |all aligned with the ATM Information Reference Model (AIRM)| should facilitate seamless information exchange among stakeholders. These models are developed in the Uni ed Modeling Language (UML). The consistency management and governance of these models, however, has proven di cult due to UML's lack of automatic reasoning support, the size of the models, and the number of stakeholders involved in the maintenance of the models. To overcome the lack of automatic reasoning support, the UML models are transformed into OWL ontologies in accordance with OMG's Ontology De nition Metamodel [3]. The resulting ATM ontologies are lightweight ontologies without logical class constructors and form the basis for further developments. To cope with the models' size as well as establish a varied set of ontologies for our

experimentation, BEST employs di erent ontology modularization techniques, ranging from manual modularisation to fully automated techniques based on principles of syntactic locality [1]. To ensure alignment between the di erent exchange models and AIRM, BEST develops a compliance validator application based on various ontology matching techniques [2]. This application provides tool support for detecting semantic discrepancy as well as equality and will support both the modeling{ and the compliance assurance process.
Ontology-based Data Description and Discovery. SWIM should eventually facilitate a marketplace of value-added data services. Developing such services will encompass finding and selecting data from di erent sources. In order to support and partially automate this task, BEST develops techniques for ontology-based data description and discovery. The contents of data containers are described by OWL class expressions using concepts of the developed ATM ontologies. These semantic container descriptions are managed in a decentralized SWIM knowledge base. Information needs are similarly described by OWL class expressions. Matching information needs with data containers is based on subsumption checking as provided by o -the-shelf OWL reasoners.

Using Optimization and Simulation to Improve the Quality of the Solution for the Airport Conflict Detection and Resolution Problem
Paolo Scala
In this work, the problem that has been tackled, involves the optimization of airport operations such as landing aircraft sequencing, runway operations, taxiway and terminals capacity loads, with the objective of avoiding ground congestion and ensuring a smooth flow of aircraft in the airspace. A methodology that combines optimization and simulation is proposed. In particular, simulation is employed for evaluating the objective function of a solution provided by an optimization model. By doing so, it is possible to assess the feasibility of the optimized solution. Furthermore, the methodology, iteratively applied, shows that it is possible to improve the quality of the solution.

Exposing Trajectory Execution Variability via Adaptive Partition
Krzysztof Rutkowski
The aircraft trajectory is a complex confluence of various factors, such as state of the atmosphere, flight plans, ATC control or unexpected conditions, including diverts, emergencies, faults or traffic disruptions. When given the trajectory data, investigation of any of this factors alone is a very hard task.
In our SESAR effort we aim at identifying subtle disruptions in the air traffic to highlight factors connected to their occurrence. In this pilot work, we utilise the dynamic time warping technique to map incoming flights to the Warsaw Chopin and Gdańsk Wałęsa Airport into a metric space, and clustering or community detection methods as a help to achieve the aforementioned purpose.

Operationalizing Resilience for Crisis Management in Critical Infrastructures Experiences in Air Traffic Management and Healthcare
Matthieu Branlat
Critical infrastructures (CI) occasionally experience crises, which are characterized by high impact, cascading effects, and surprises. These characteristics challenge traditional risk management, requiring approaches that emphasize crises' systemic nature and low predictability. Horizon 2020 project DARWIN is finalizing the development of resilience management guidelines that aim to support CIs in enhancing their resilience in the face of crises. The guidelines support the adoption of new practices as well as of a critical perspective on the processes and tools organisations already implement (e.g., preparation activities, contingency plans). The guidelines are grounded in research and practice on resilience management, especially from the fields of Resilience Engineering and Community Resilience.

The project is developing generic guidelines that aim to be used in any sector. In addition, the guidelines are adapted in two domains: air traffic management (ATM), and healthcare. The development and evaluation of the guidelines involves:
- Investigation of concepts, practices and tools of resilience management through a review of scientific literature, standards and operational documentation, and through practitioners' interviews, leading to the identification of requirements capturing capabilities the guidelines should address.
- Definition of a process for the collaborative and iterative development of the guidelines, and for their adaptation to the domains of ATM and healthcare.
- Participation of end-user practitioners and experts from ATM, healthcare and other CIs as co-creators throughout the development life-cycle.
- Development of a wiki application to support collaborative development, access and multiple formats.

The proposed poster will describe the project's approach to operationalizing resilience concepts, and resilience-inspired practices, methods and tools. It will highlight insights gained from the adaptation of these guidelines to the domains of ATM and healthcare, drawing on the differences or similarities between the two sectors when relevant.
These results will inform efforts aimed at further reducing the gap between theoretical or empirical descriptions of resilience and its adoption in critical infrastructure practices.

Analysis on Future Automation Scenarios in the Framework of 2050 ATC
Francesca Lucchi
The proposed research activity has been developed in the context of AUTOPACE (Automation Pace) project, funded within the SESAR Joint Undertaking research and innovation programme. AUTOPACE objectives are related to the definition of a psychological model to assess the effects on ATCo performances and workload in a highly automated scenario, with the final aim to define new training strategies and procedures for future ATCs and to evaluate the effects on the safety. AUTOPACE starts from the definition of 2050 ConOps and automation scenarios, as pillars for project research, defining user / system role and responsibility in 2050 time horizon.

Pre-tactical Concurrence Event Detection Tailored for STAM Application: A Study Case of London TMA
Nina Rebecca Schefers
PARTAKE is a project funded by the European Commission and SESAR programme that introduces a novel method to 1-Detect, 2-Analyse and 3-Mitigate aircraft trajectories interdependences by making use of Short-Term ATFCM Measures (STAM). The methodology presented focuses on the first module of a three-step process that starts by making use of the TBO Concept to Detect Concurrence Events in the airspace. A case study was given that makes use of the London Terminal Manoeuvring Area (LTMA), more specifically the high-density Capital (EGTTCAP) and Compton (EGTTCPT) sectors to demonstrate the benefits of PARTAKE Mapping & Detection Functionalities.

Reskilling Challenges of Air traffic Controllers for Remote Tower Operations
Carl Westin
The digital and increasingly automation dependent working environments in transportation domains affect the nature of work for operators with less tactical hands-on work and more supervision and monitoring of system functions and parameters. In air traffic control (ATC) this development is evident in Remote Tower Operations (RTO), whereby the analog and conventional tower is digitalized, transmitted, and controlled from a remote location to the reference aerodrome. How do we educate and train controllers to cope with the digitalized

and increasingly automated environment of these remote towers? How should automation for remote towers be designed in order to avoid known human factors issues of complacency and automation surprises? As a way forward, this poster presents ongoing research in the RESKILL project exploring three research areas pertaining to the needs deemed essential for attaining the necessary knowledge and skills required of controllers in remote tower operations. The three research areas comprise exploring self-explanatory automation effectively explaining its workings to the controller (RESKILL-A), identifying tower controllers' tacit knowledge (RESKILL-T), and in real-time simulation training provide instructors with a visualization of tower controller's visual behavior (RESKILL-I).

RETINA - Resilient Synthetic Vision for Advanced Control Tower Air Navigation Service Provision
Mohamed Ellejimi
One of the major problems faced by the growth of air traffic in the last decade is the limited capacity of the runway especially during low visibility procedures (LVP) due to fog and bad weather. To solve this issue, the project "Resilient Synthetic Vision for Advanced Control Tower Air Navigation Service Provision" (RETINA) project, a two-years exploratory research project, under SESAR2020 program, proposes to use new Synthetic Vision (SV) and Augmented Reality (AR) technologies for the tower controllers to allow them to conduct safe operations under any Meteorological Conditions while maintaining a high runway throughput equal to good visibility.

Findings on how to Mitigate Negative Impacts of Monitoring High Levels of Automation
Francesca De Crescenzio

A Method to Identify Blind Spots in Incident Investigation Process to Prevent Build-up of Latent Conditions in Ultra Safe Organizations
Billy Josefsson
The pressure on Air Navigation Service Providers (ANSP) has never been higher or more demanding as the European Commission put strict performance metrics that limit the cost for provision of ATS including incident investigation and related activities.
In this poster we present a method, and its first application at the Swedish ANSP LFV, for uncovering "blind spots" in investigation process. Incident investigators were involved in a series of semi-structured workshops to find out about eventual "blind spots" (weak areas) in their own investigation process. This resulted in a methods description (for repeating this work), as well as a set of "blind spots" for the LFV to address in their recurring safety work.

Winter Weather - Probabilistic Nowcasting to Increase Airport Safety and Capacity
Ari-Matti Harri

Increasing of En-Route Airspace Capacity by Automating Air Traffic Control System
Zoran Jakšić
This poster deals with the introduction of automation in the En-Route ATC system. The conventional, non-automated ATC system has generally required higher ATCO workload resulting in lower ATC system capacity. Workload of ATCO is a limiting factor in determining the capacity of the ATC system. Automating ATC system promises to reduce controller workload substantially which may lead to an increase in system capacity. The present paper compared the workload of ATCO handling simulated air traffic using a conventional, and an automated ATC system and used these workload measurements to estimate air traffic capacity. The results suggest that an automated ATC system reduce controller workload and thereby increase sustainable capacity while maintaining or even increasing safety.
No teaser is required.