A framework for Total Apron Safety Management (TASM)
**Personal background**

**EDUCATION AND TRAINING:**

2004-2009  **MSc in Air Transport and Traffic Engineering, University of Belgrade Faculty of Transport and Traffic Engineering, Serbia**

2010-2011  **Trainee at the Forecasting and Traffic Analysis Section at EUROCONTROL, Belgium**

2011-2015  **PhD in Safety of Apron Operations, Centre for Transport Studies, Imperial College London, UK**

2015-PRESENT  **Research Associate, Centre for Transport Studies, Imperial College London, UK**

**RESEARCH INTERESTS:**

- **Air Traffic Management**
- **Safety in complex socio-technical systems**
- **Risk Identification and Analysis**
- **Automation**
- **Pilot Workload Analysis**
- **Airport Surface Safety Analysis**
- **Delay Analysis**
- **Airframe Utilisation**

**LANGUAGES:**

**Serbian, English, French, understanding of Spanish**

**OTHER:**

**Travel, Photography, Fitness**
Outline

- Research Background
  - The impact of trajectory-based operations on ATM system boundary
  - Existing SESAR conceptual improvements on the apron
- Research Aim
- Methodology
- Findings and Recommendations
- Industry Applications
Functional invariance of the ATM system

- Airspace Organisation and Management
- Trajectory Management
- Information Management
- Communication
- Navigation
- Surveillance
- Network Management
- Security Assurance
- Environmental Management
Shifting boundary of the ATM system

Air Transport System

Airline operations

Regulatory bodies, Aircraft manufacturers, System manufacturers...

Airport operations

Military operations

Environment

Aircraft

ATM
ATM boundary at the airport level
Transition from a gate-to-gate to an en-route to en-route concept

Adapted from SESAR (2007)
Focus on punctuality, capacity and efficiency improvements...

What about safety?
The missing piece of the SESAR ConOps...
Aircraft safety VS occupational safety

Aircraft safety

Occupational HSE

Apron safety
Motivation

“accident rates for ground handling and airport workers exceed those of the construction industry and the agricultural sector” (HSE, 2000)

“one accident occurs per 5,000 movements” (ACI, 2007)

“accident risk induced by the operations on the apron is around 6 times higher than the risk induced by the ATM system” (Studic et al., 2013)

“safety occurrences on the apron cost the aviation industry in excess of “$10 billion every year “ (Flight International, 2005)
Aim of research

Develop a novel generic framework for a robust, systemic, systematic, retrospective, prospective and system design analysis to improve safety management and efficiency in apron operations.
Research methodology

- Critical review of the literature
- Observations
- Interviews
- Qualitative data analysis
- Quantitative data analysis
Derivation of the best theoretical approach for the TASM framework

<table>
<thead>
<tr>
<th></th>
<th>Tractable system</th>
<th>Intractable system</th>
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</thead>
<tbody>
<tr>
<td><strong>Number of details</strong></td>
<td>Description are simple with few details</td>
<td>Description are elaborate with many details</td>
</tr>
<tr>
<td><strong>Comprehensibility</strong></td>
<td>Principles of functioning are known</td>
<td>Principles of functioning are partly unknown</td>
</tr>
<tr>
<td><strong>Stability</strong></td>
<td>System does not change while being described</td>
<td>System changes before description is completed</td>
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<td><strong>Relation to other systems</strong></td>
<td>Independence</td>
<td>Interdependence</td>
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<tr>
<td><strong>Metaphor</strong></td>
<td>Clockwork</td>
<td>Teamwork</td>
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*EUROCONTROL (2009)*

*Adapted from Hollnagel (2012)*
Research methodology

Critical review of the literature

Observations

Interviews

Qualitative data analysis

Quantitative data analysis
Data collection

- 5 airports
- 20 days
- 15 observations
- 43 participants
Research methodology

1. Critical review of the literature
2. Observations
3. Interviews
4. Qualitative data analysis
5. Quantitative data analysis
Qualitative data analysis

- Goals Means Analysis
- Grounded Theory
- Template Analysis
- FRAM
- STPA
- Expert input
Research methodology

1. Critical review of the literature
2. Observations
3. Interviews
4. Qualitative data analysis
5. Quantitative data analysis
Quantitative data analysis

Descriptive statistics

Pattern discovery

1. Technological characteristics
2. Physiological characteristics
3. Psychological characteristics
4. Apron characteristics
5. Social environment

6,322 USD
The outputs of the TASM framework

1. Functional Model (31 functions)
2. Taxonomy of Variability (≈440 factors at the lowest level)
3. Storyline description of variability of apron operations
4. Development of the recommendations
Develop national and international safety regulatory frameworks for Ground Handling Services (GHS).
Finding and recommendations [2/4]

Improve the design of Ground Service Equipment (GSE), aircraft and aprons.
Finding and recommendations [3/4]

Improve communication practices on the apron at all levels.
Finding and recommendations [4/4]

Improve working conditions for Ground Service Agents (GSAs).
Industry applications

- Use the definitions, taxonomy and the severity classification scheme to develop safety regulatory requirements.
- Implement the protocol for systemic hazard identification at MUAC.
- Consider extending the Annex 19 applicability to ground handling.
- Implement the framework for systemic safety modeling of everyday operations.
- Implement the framework as a systemic planning tool.
Publications – Conferences – Workshops

- 5 papers in conference proceedings
- 1 ICAO information paper
- 2 workshop presentations
- 2 workshop tutorial
- 1 journal paper in review
- 2 journal papers in preparations
THANK YOU

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