

Proposal for Special Session: "Incremental Rollout of New Technologies in Railway Systems Engineering"

Session Title:

"Incremental Approaches to Technology Implementation: Systems Engineering in the Railway Sector"

Session Format:

- **Special Session & Roundtable**

This session will combine presentations followed by an interactive roundtable discussion, allowing participants to share insights and debate key challenges. We propose a hybrid format:

- **First part:** Presentations from industry experts, academic researchers, and practitioners.
- **Second part:** Roundtable discussion focused on exchanging perspectives, potentially integrating pitches based on submitted papers.

Key Themes and Focus Areas:

1. **Integration of New Technologies in Railway Systems**

This session will focus on strategies for introducing new technologies into railway systems, particularly in secondary railway networks (Nebenstrecken). We aim to explore both the technical and regulatory challenges faced by industries and academia as they collaborate on designing, testing, and implementing these new technologies.

- **Key Topics:**
 - Safety assurance in railway systems with a focus on secondary railway lines.
 - Model-based design and verification methodologies.
 - Managing the complexities of regulatory overreach and finding balanced, efficient approaches to compliance.

2. **Conflicts in Systems Engineering and Design Processes**

A crucial element of systems engineering in the railway sector is managing conflicting goals. This session will discuss the following challenges:

- **Design Process Conflicts:** How to balance business objectives, ethical considerations, and regulatory requirements in the design process.
- **Regulatory Hurdles:** The impact of stringent regulations on the systems engineering process and how overregulation can inhibit innovation and flexibility.

3. **Scenario-based Design, Testing, and Verification**

The session will introduce and evaluate scenario-based methods as an effective tool for the design, testing, and verification of complex railway systems. These methods

can help address the safety and reliability concerns associated with the introduction of new technologies in operational systems.

Target Domains:

While the primary focus is on the **railway sector**, we will also draw insights from parallel domains where similar systems engineering and regulatory challenges are present, such as:

- Automotive (road transportation)
- Maritime (shipping)

Panel Participants:

To foster a comprehensive and diverse discussion, we aim to bring together experts from various fields, including:

- **Legal experts** with a deep understanding of transportation regulations and safety standards.
- **Sociologists** specializing in the socio-technical aspects of transportation and infrastructure.
- **Engineers and Technicians** from disciplines such as mathematics, computer science, and engineering, who are directly involved in the technological development and implementation process.

Session Objectives:

1. **Foster Collaboration:** This roundtable will create a platform where industry professionals and academics can meet and exchange ideas, fostering collaboration between the two communities.
2. **Identify Solutions:** Through presentations and discussions, we hope to identify practical strategies for overcoming conflicts in the design and regulatory process, especially in scenarios where business goals and safety regulations clash.
3. **Cross-Domain Learning:** The session will offer a space for cross-domain learning, where insights from the automotive and maritime sectors can provide fresh perspectives on challenges faced in the railway industry.

Why this Special Session?

- **Timeliness and Relevance:** As railway systems undergo modernization efforts, it is critical to address the challenges of introducing new technologies in a safe, reliable, and efficient manner. The session's focus on secondary railway lines, where modernization efforts can often be hindered by overregulation, makes this a particularly relevant topic.
- **Interdisciplinary Dialogue:** By engaging participants from various fields such as law, sociology, and engineering, this session will provide a holistic view of the issues at hand, offering more nuanced solutions.
- **Impact:** The outcome of this special session will provide a roadmap for how the railway industry can approach incremental technology rollout, offering both theoretical insights and practical strategies for addressing regulatory, economic and

societal challenges in the design process. The modernization measures must be viable for the company. Economic aspects and effects on the customer base must therefore be considered and a holistic development approach must be found.

Conclusion:

This special session seeks to address some of the most pressing issues in modernizing railway systems engineering, particularly in the context of safety, regulatory compliance, and the introduction of new technologies. We anticipate that this session will spark meaningful dialogue, foster collaboration between academia and industry, and lead to actionable solutions that can be applied across transportation domains.