



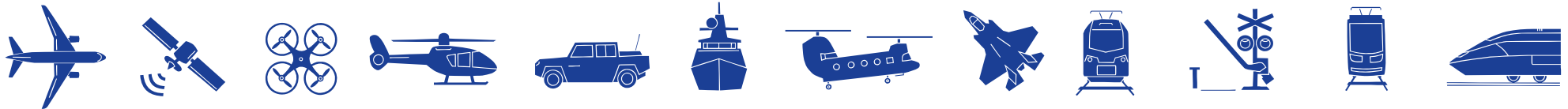
CONSULTING AND ENGINEERING

System Integration of Transportation Systems

INCOSE-NL Workshop 2024

3-10-2024

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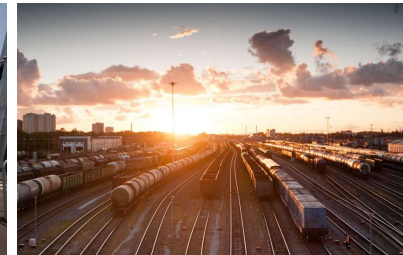
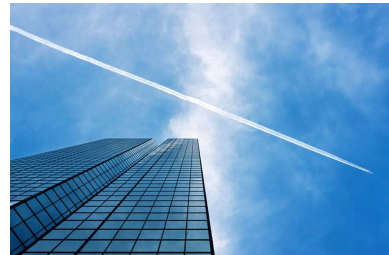


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3. Serious Game "Transport Innovators"	50 min
4. Plenary reflection	10 min
5. Examples from our experience	10 min



1. Introduction

Dennis de Koning

Team lead Systems Engineering | Senior Consultant | Rail and Aerospace

- Focus on bridging technical analysis with clear management decisions
- Experienced team lead and coach with technical and business school skills



Ilja Achterberg

Senior Consultant Systems Engineering | Rail and Aerospace

- Focusing op system Architecture and technical development processes
- Experienced consultant balancing attention for details with big-picture thinking



Jordy Houwen

Systems Engineering Consultant | Rail, Maritime and Aerospace

- Focusing on organizational change and tactical improvements
- Experienced consultant in brownfield system development



ADSE BV | Company Introduction

Company Overview



An independent Netherlands-based engineering consulting firm

WE **LOVE** TRANSPORT!

TRANSPORTATION SYSTEMS OF TODAY AND TOMORROW

SUSTAINABILITY | AUTONOMOUS OPERATIONS | DIGITIZATION



Hoofddorp
The Netherlands

INDUSTRIES SERVED



AEROSPACE

RAIL

MARITIME

DEFENCE

FACTS & FIGURES



1996
ESTABLISHED



75+ HIGHLY SKILLED
PROFESSIONALS



WORLDWIDE
CUSTOMER BASE

EASA

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CORE SERVICES

ENGINEERING

CERTIFICATION &
COMPLIANCE

TECHNICAL PROJECT
MANAGEMENT

CONSULTING

ADSE BV | Company Introduction

About us



Experts on transportation systems of today and tomorrow.

Our Passion. We are ADSE. An independent engineering and consulting firm, passionate about transportation systems and mobility solutions. Planes, trains, ships and automobiles, that's what we like!

Our Commitment. We embrace the United Nations Sustainability Goals and believe that efficient, safe, reliable, affordable and sustainable transportation systems are essential to achieve these goals.

Our Mission. To enable safe and sustainable transport for everyone. That is what we do. This is how we contribute!



We. Love. Transport.

ADSE BV | Company Introduction

Key markets

Markets with great similarities in requirements, technology, processes, organizations and challenges.
Markets where we support customers ranging over the total life cycle, from design to operations.



We are recognized for our pragmatic technical solutions, process improvements and ability to successfully manage technical projects, by offering four generic services.

Engineering Services

Product oriented services

To design and optimize physical products



Certification & Compliance Services

Safety oriented services

To ensure compliance to safety regulations



Technical Project Management Services

Project oriented services

To enable successful project completion



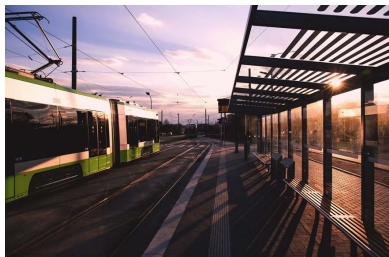
Consulting Services

Process & organization-oriented services

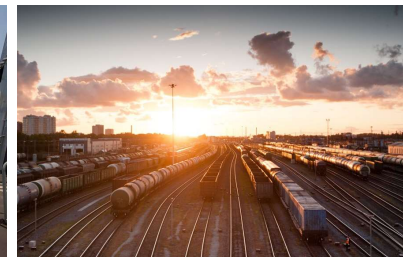
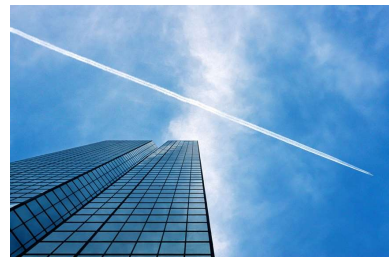
To define and improve technical processes and organizations



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2. System Integration SOS

System(s) of Systems (SoS)

Definition

- A System of Systems (SoS) consists of independent systems. that interact together to deliver unique capabilities.

Character

- Independent: the individual systems retain operational independence achieving individual objectives.
- Unique: none of the individual systems can achieve SoS-capabilities on their own.

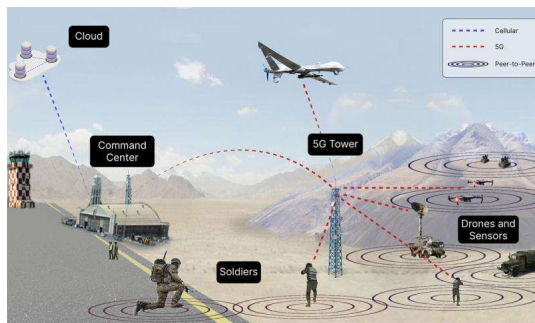
2. System Integration SOS

Examples: integrating systems, services, people, and organizations

Emergency response system



Military defense systems



Railway transport system



2. System Integration SOS

The importance of System of Systems (SoS)

Why is the concept of System of Systems (SoS) important?

- Many Systems Engineers work within an SoS context without realizing it, which brings unique challenges.
- Without understanding the broader SoS context, changes to systems may not meet long-term operational needs.
- By adopting an SoS approach, engineers can contribute more effectively to changes in their System of Interest (SOI).

Some of the challenges when making (large-scale) changes to an SoS

- Integrating legacy systems with new technologies (brownfield development).
- Ensuring interoperability between different systems (e.g., rail, aviation).
- Managing diverse stakeholder interests and collaboration.
- Balancing security and safety with real-time operations.

2. System Integration SOS

Key characteristics of System of Systems (SoS)

- Authority and Ownership: Each system in an SoS has its own local owner, stakeholders, and processes. SoS engineering relies on cross-system integration and a shared purpose to achieve collective goals, which may differ from individual systems' objectives.
- Leadership: In SoS environments, leadership is more about influence and incentives rather than structured control, due to the absence of common authority and funding.
- Individual Systems' Perspectives: SoS often utilize in-service systems developed for different purposes. These systems may have limitations in supporting SoS goals, leading to potential compatibility issues and challenges in aligning services or data with SoS needs.
- Capabilities and Requirements: Traditional SE processes focus on clear user requirements, while SoS SE must reconcile independent systems' requirements with broader capability goals, often requiring adjustments or new systems to meet SoS needs.
- Autonomy and Emergence: The independence and interdependencies of constituent systems add complexity to SoS, potentially leading to unpredictable outcomes, even if individual systems are well understood.
- Testing and Validation: Testing SoS is challenging due to independent development cycles, lack of funding, and difficulty in conducting end-to-end testing. Performance evaluation often relies on real operational data or simulations.

2. System Integration SOS

Challenges during System Integration (SI) in System of Systems (SoS)

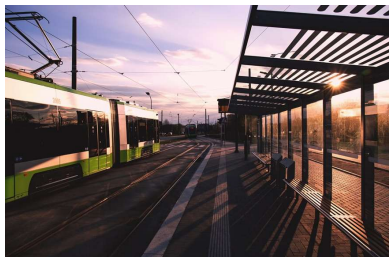
Typical issues and challenges

- Misaligned system interfaces and protocols.
- Breakdown in communication between technical and operational teams.
- Emergent behaviors due to unexpected system interactions.
- Challenges with large-scale design, testing in complex environments and planning for implementation.

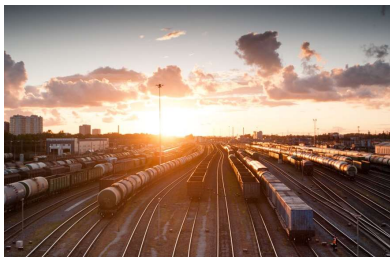
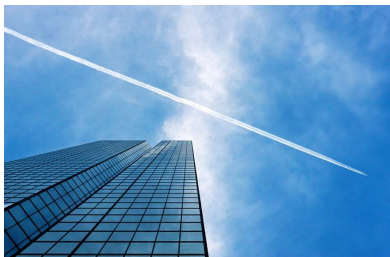
Possible approaches

- Early stakeholder involvement for goal alignment.
- Incremental integration strategy.
- Standardized protocols and system interfaces.
- Continuous testing and validation throughout the integration process.

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Serious Game "Transport Innovators"

THE PLAN



3. Serious Game – The Plan

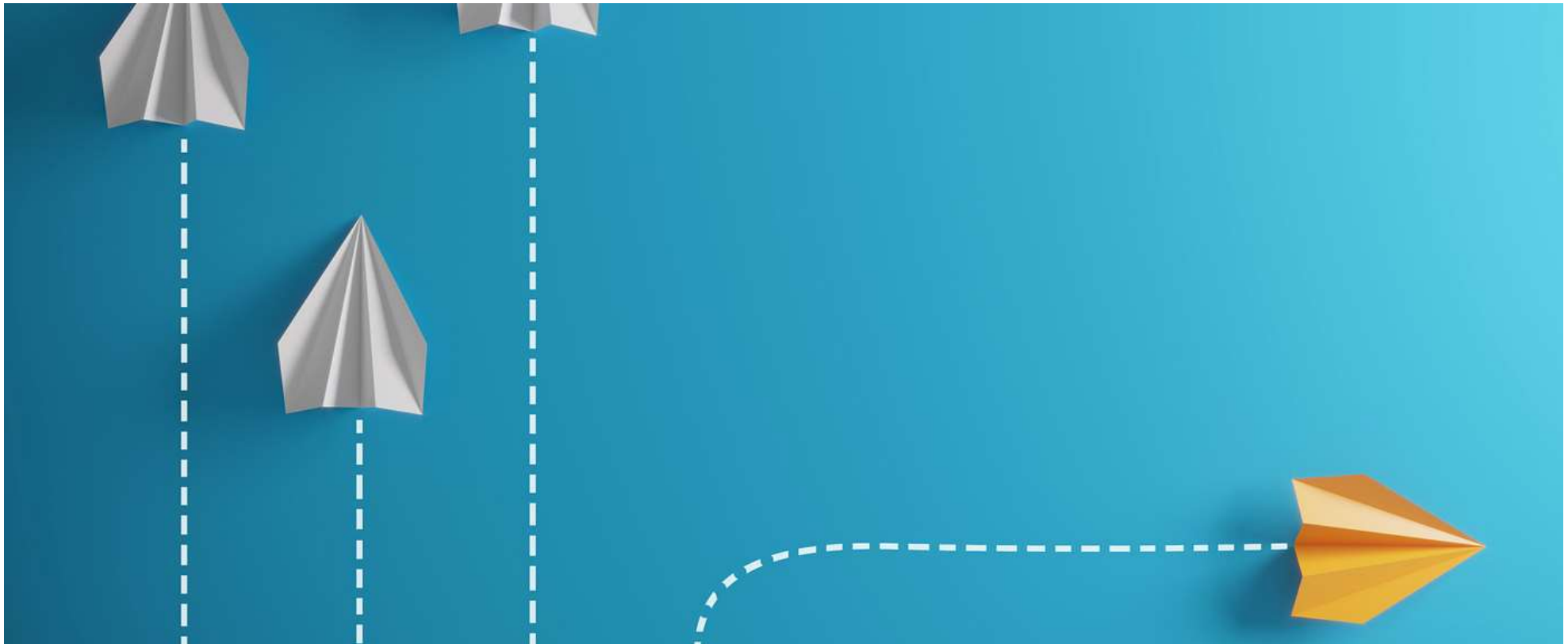
De case

Serious Game "Transport Innovators"

- We zetten jullie aan het werk met een serious game: een interactieve werkvorm met een serieuze ondertoon. Doel van het spel is om jullie wat gevoel en inzicht mee te geven over de dynamiek van ons werk aan complexe transportsystemen. En natuurlijk ook [om wat van elkaar te leren!](#)
- In deze game gaan jullie in teams aan de slag met de implementatie van [een innovatief transportsysteem in het land Systemanië](#). Systemanië is een dichtbevolkt land met een uitgebreid, druk en complex vervoersnetwerk. Jullie zijn ingenieurs en adviseurs bij het bedrijf “Transport Innovators (TI)” en zijn ingehuurd door het Ministerie van Transport om een algehele upgrade van het bestaande vervoersnetwerk te realiseren. Deze innovatieve upgrade zal de veiligheid verhogen, kortere reistijden mogelijk maken en de capaciteit van het netwerk vergroten.
- De kaders voor jullie opdracht worden vastgesteld door de Minister van Transport van Systemanië. De Minister zal samen met de Adviseur Generaal [het eindresultaat van jullie inspanningen](#) beoordelen. Zij besluiten samen of jullie in aanmerking voor vervolgoopdrachten.

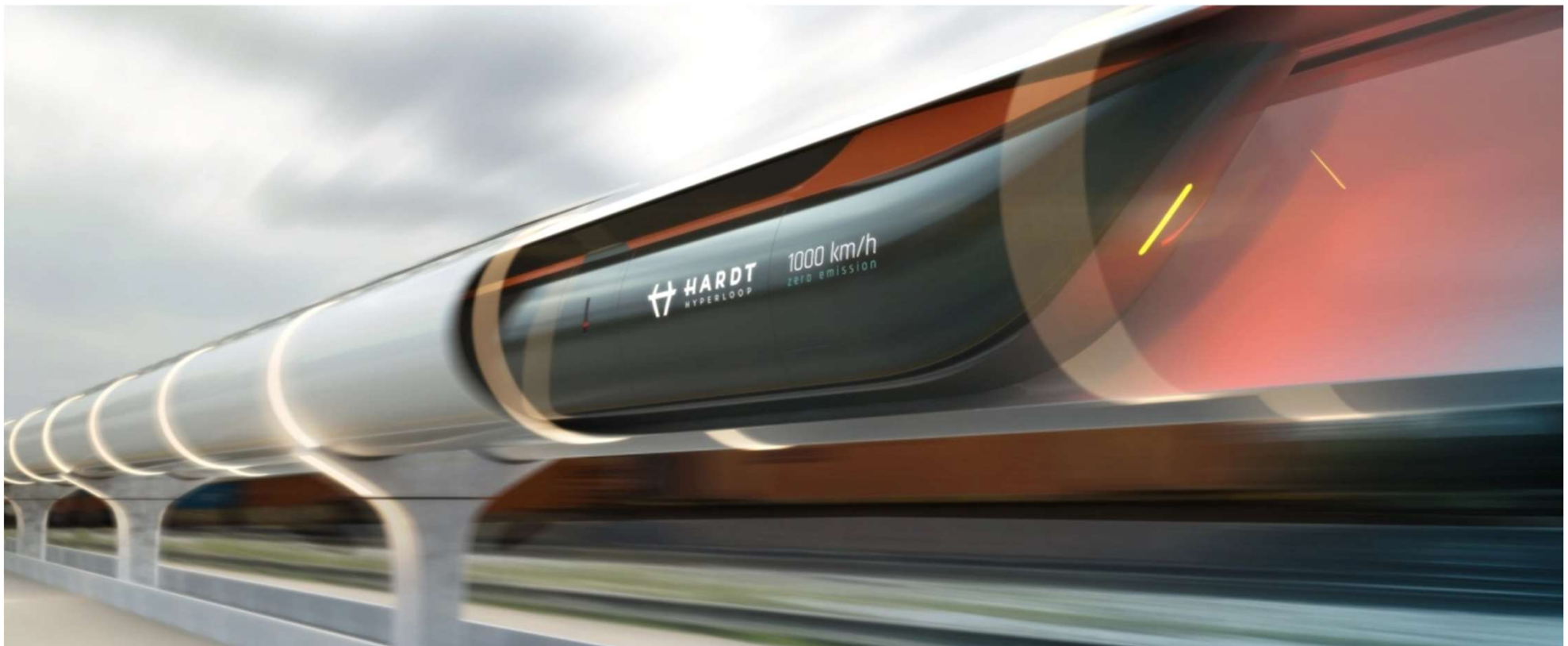
Serious Game "Transport Innovators"

THE CHANGE



Serious Game "Transport Innovators"

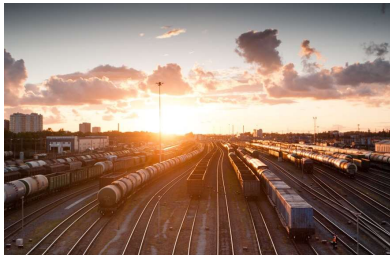
THE MIGRATION



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4. Plenary reflection

Questions

- What did you notice?
- What went smooth?
- What was difficult?

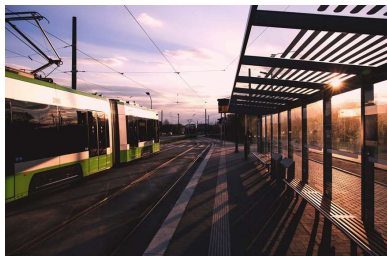
- Where do you see added value for SE?
- What role could MBSE play in this?
- How could AI contribute to this?
- Any other suggestions?

Subjects

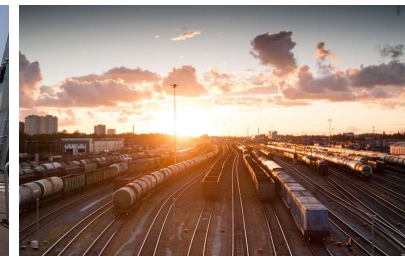
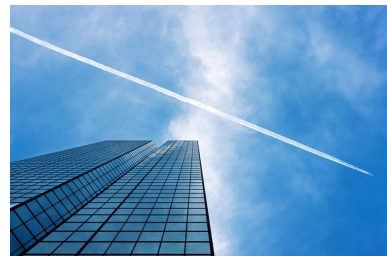
- Starting with common framework
- Making dependencies traceable
- Reasoning from technical content

- Agility of the project (organization)
- Complexity of the organization
- Migration of assets during operation
- Impact of changes on the whole system

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