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A framework to assess the impact of airport integration into the Air Traffic Management (ATM) system safety

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Background

Education and Training:

2004-2009 Master in Transport and Traffic Engineering (specialisation in Air Transport), University of Belgrade Faculty of Transport and Traffic Engineering, Serbia

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

2011-2014 PhD in Safety of the future ATM system, Centre for Transport Studies, Imperial College London, 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

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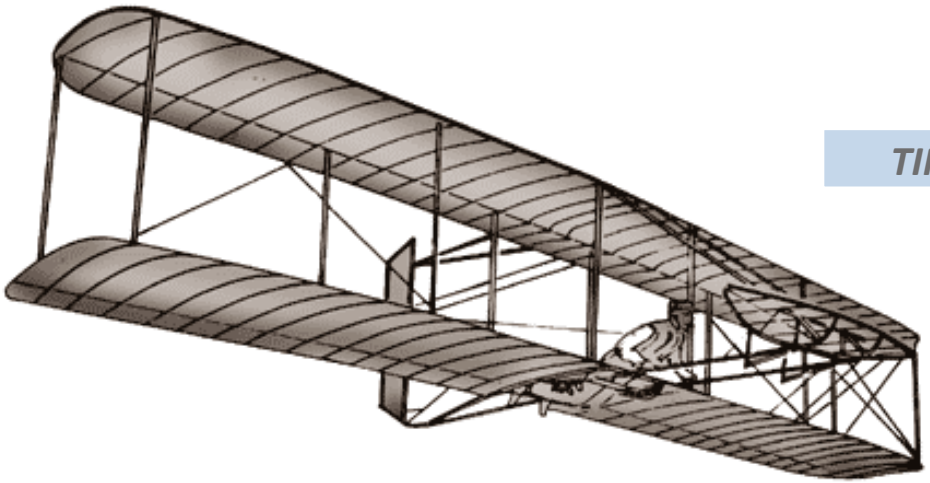
Historical review of the ATM CONOPS



TIME

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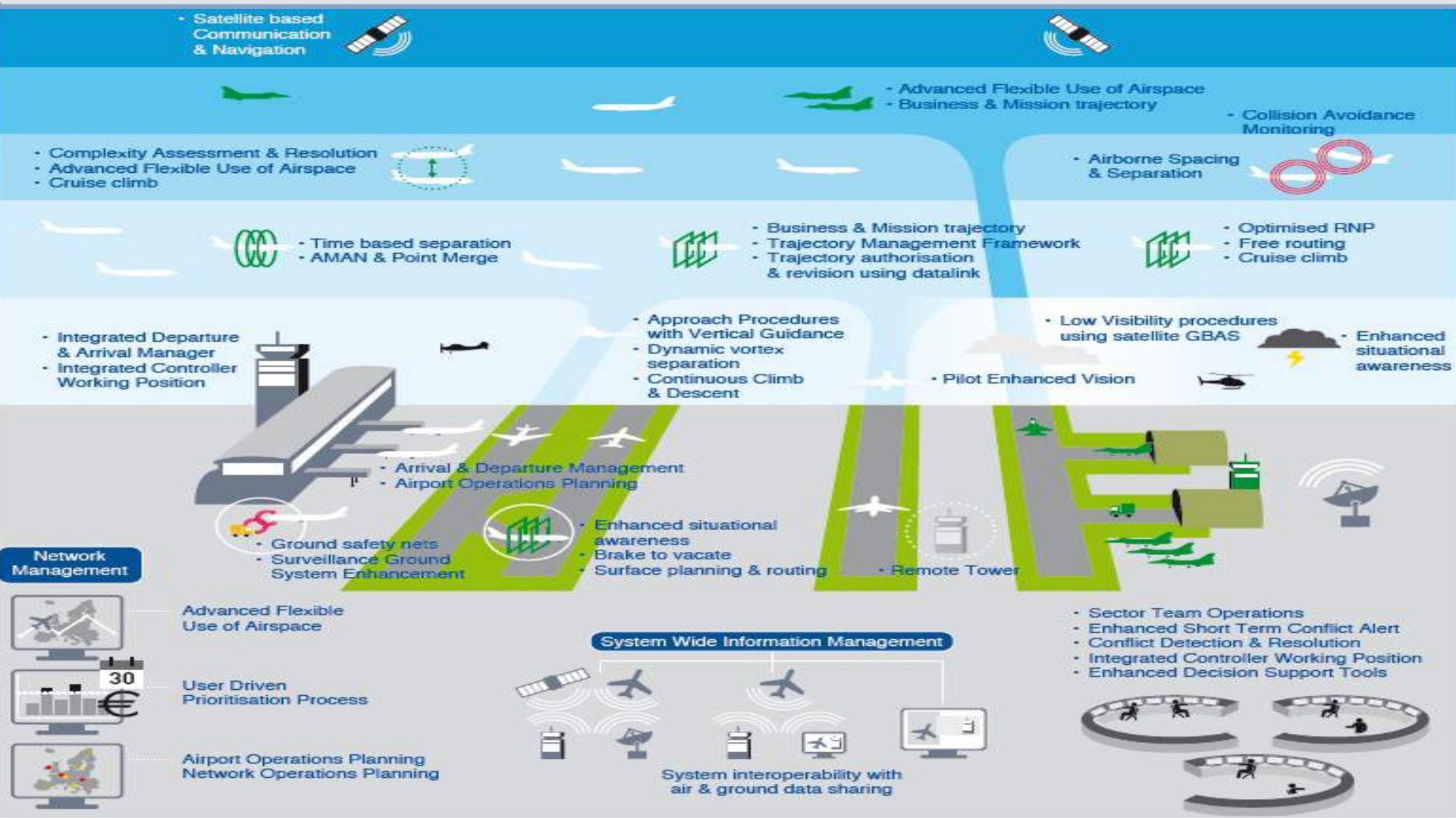
The SESAR ConOps



SESAR, 2011

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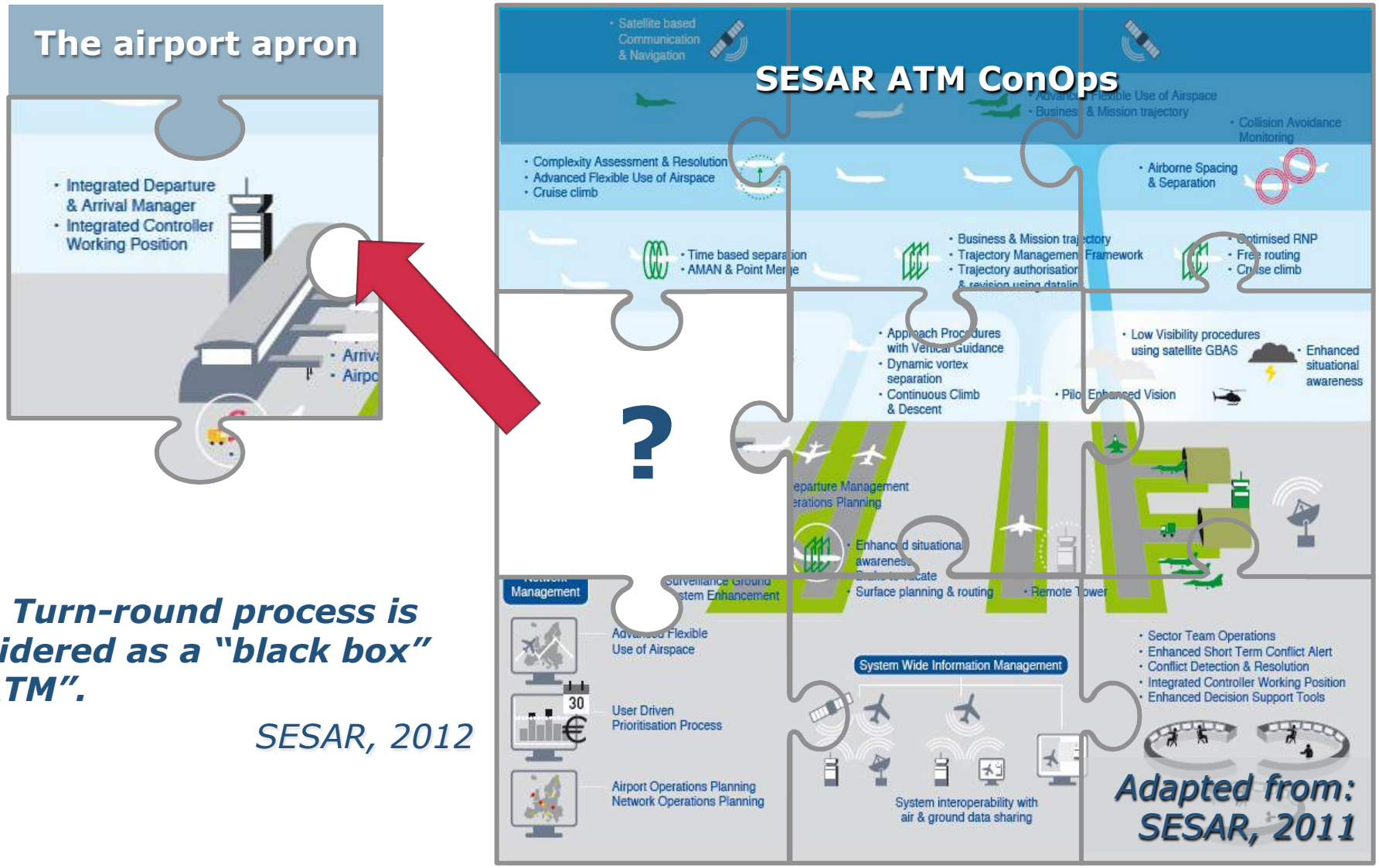
The missing piece of the SESAR ConOps...



"The Turn-round process is considered as a "black box" for ATM".

SESAR, 2012

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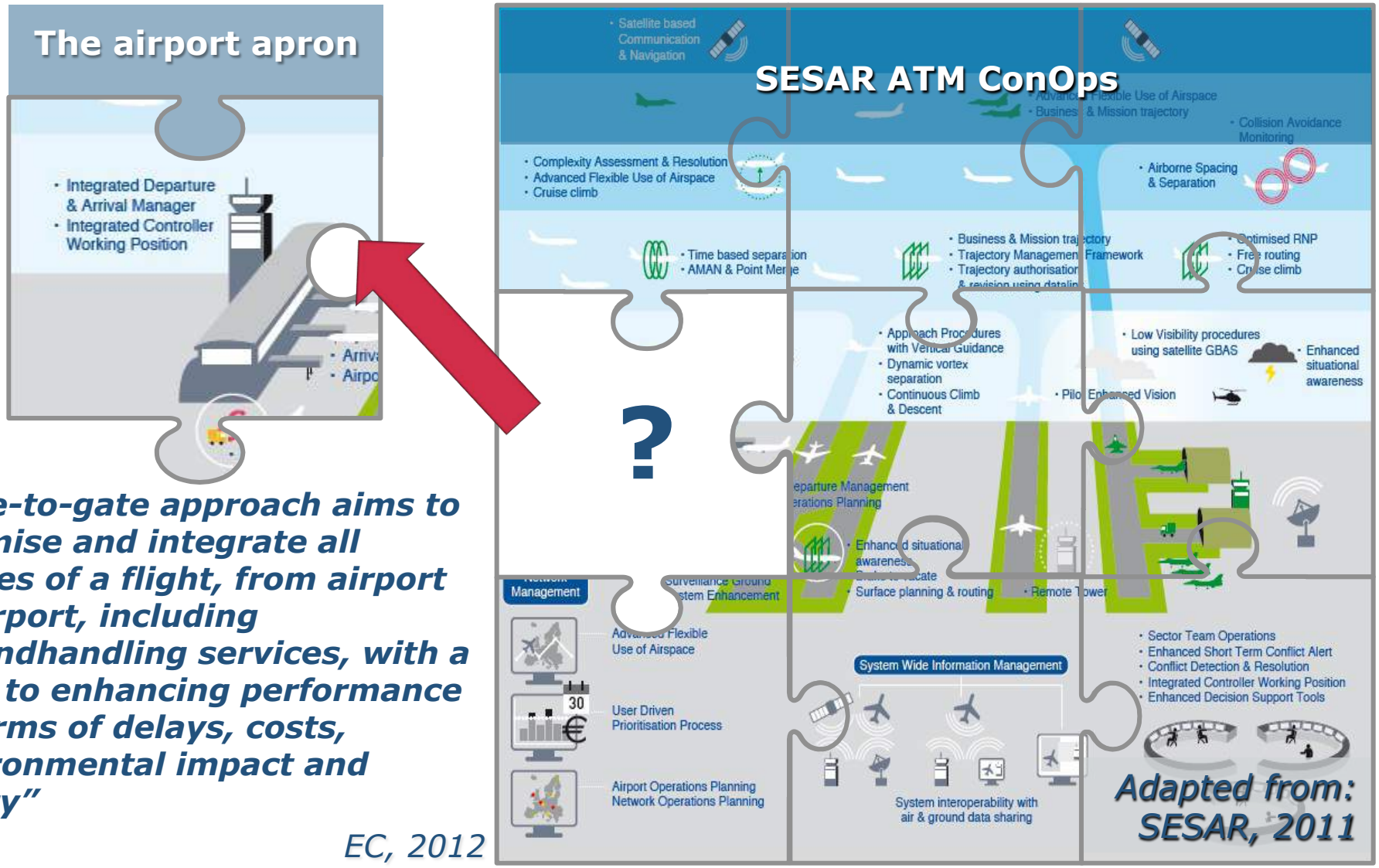
The missing piece of the SESAR ConOps…



"gate-to-gate approach aims to optimise and integrate all phases of a flight, from airport to airport, including groundhandling services, with a view to enhancing performance in terms of delays, costs, environmental impact and safety"

EC, 2012

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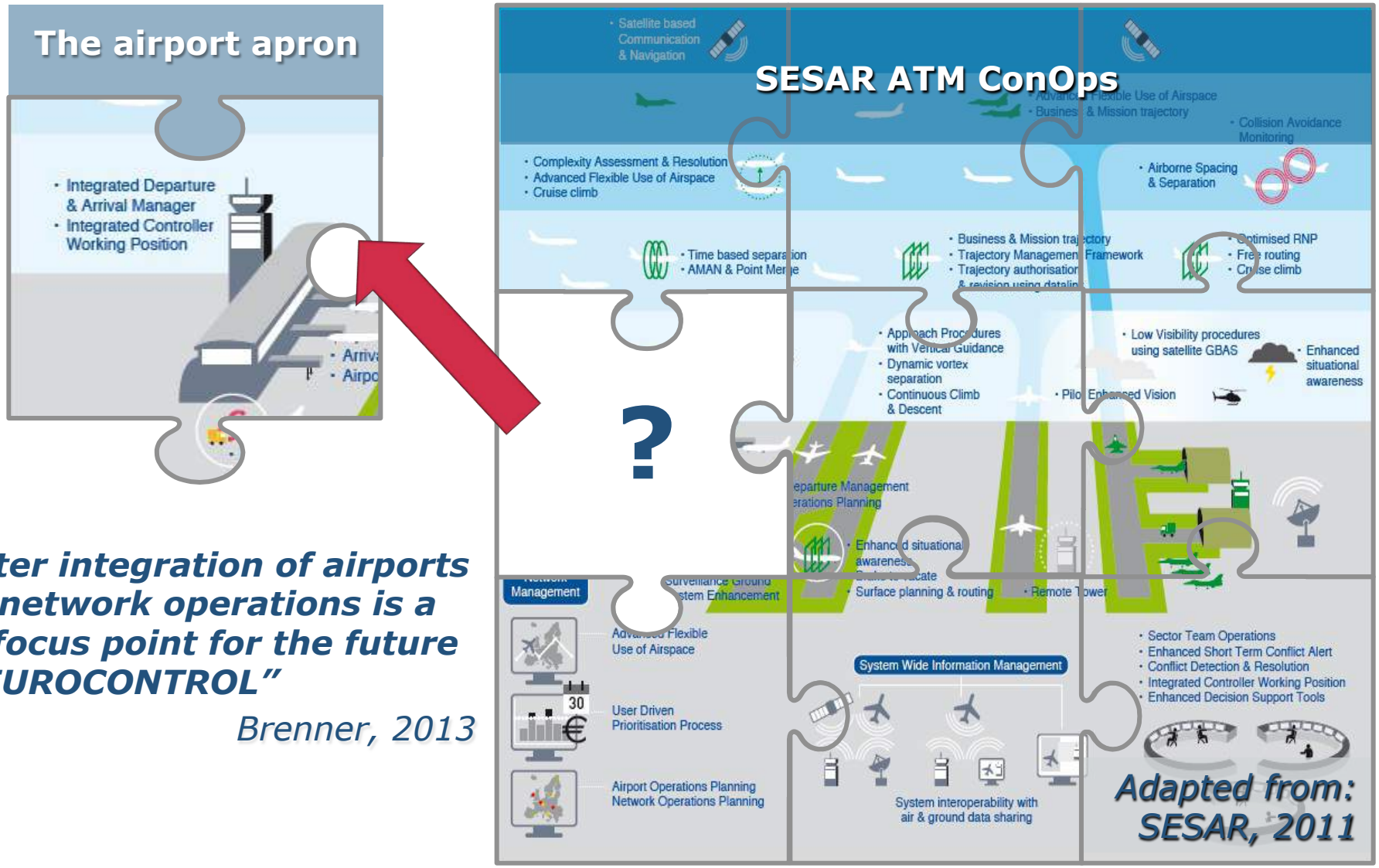
The missing piece of the SESAR ConOps...



"better integration of airports into network operations is a key focus point for the future for EUROCONTROL"

Brenner, 2013

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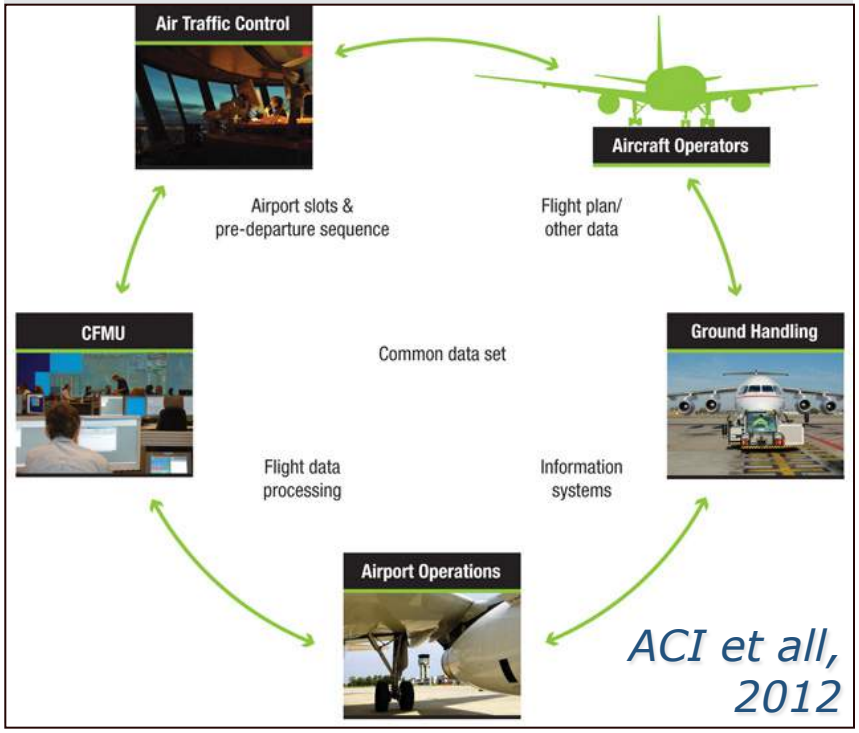
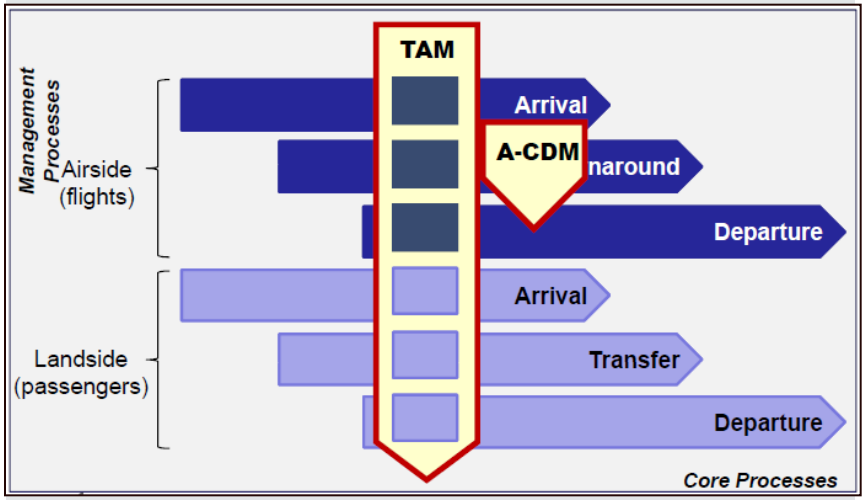
Concepts looking into airport integration into the ATM system

A-CDM



ACI et all, 2012

TAM



DLR, 2013

Focus on punctuality, capacity and efficiency improvements...
What about safety?

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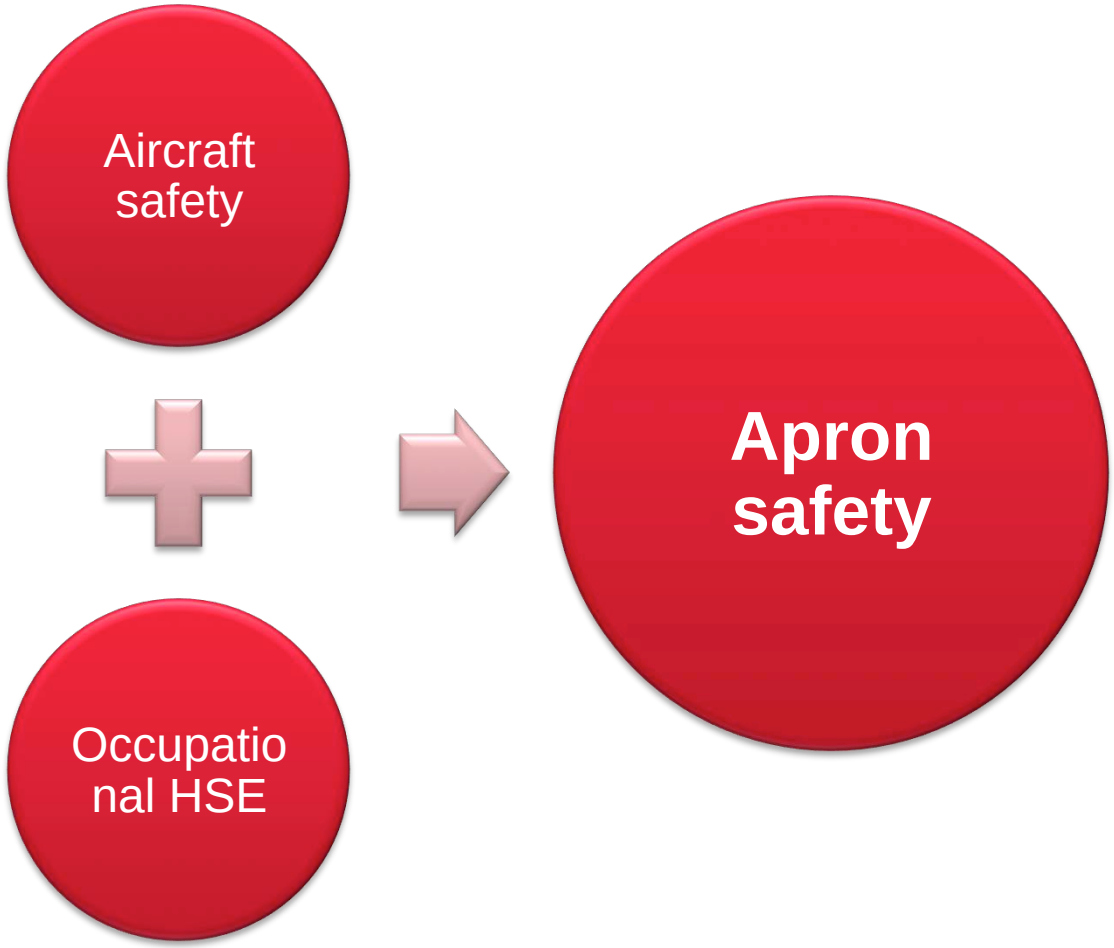
Apron Operations

Aircraft safety VS occupational safety



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Organisations participating in the apron operations

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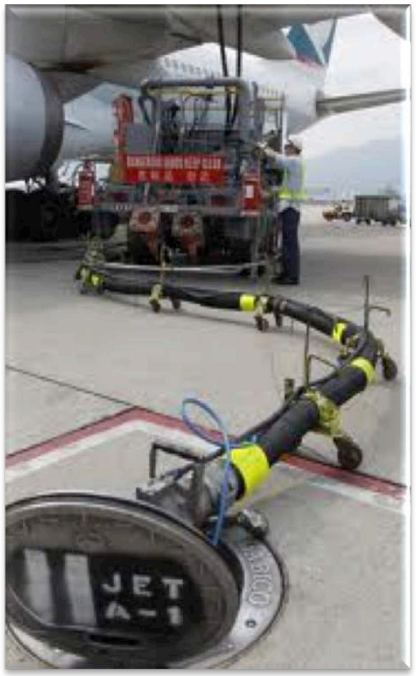
Characteristics of the tasks operated on the apron

Manual



Automated

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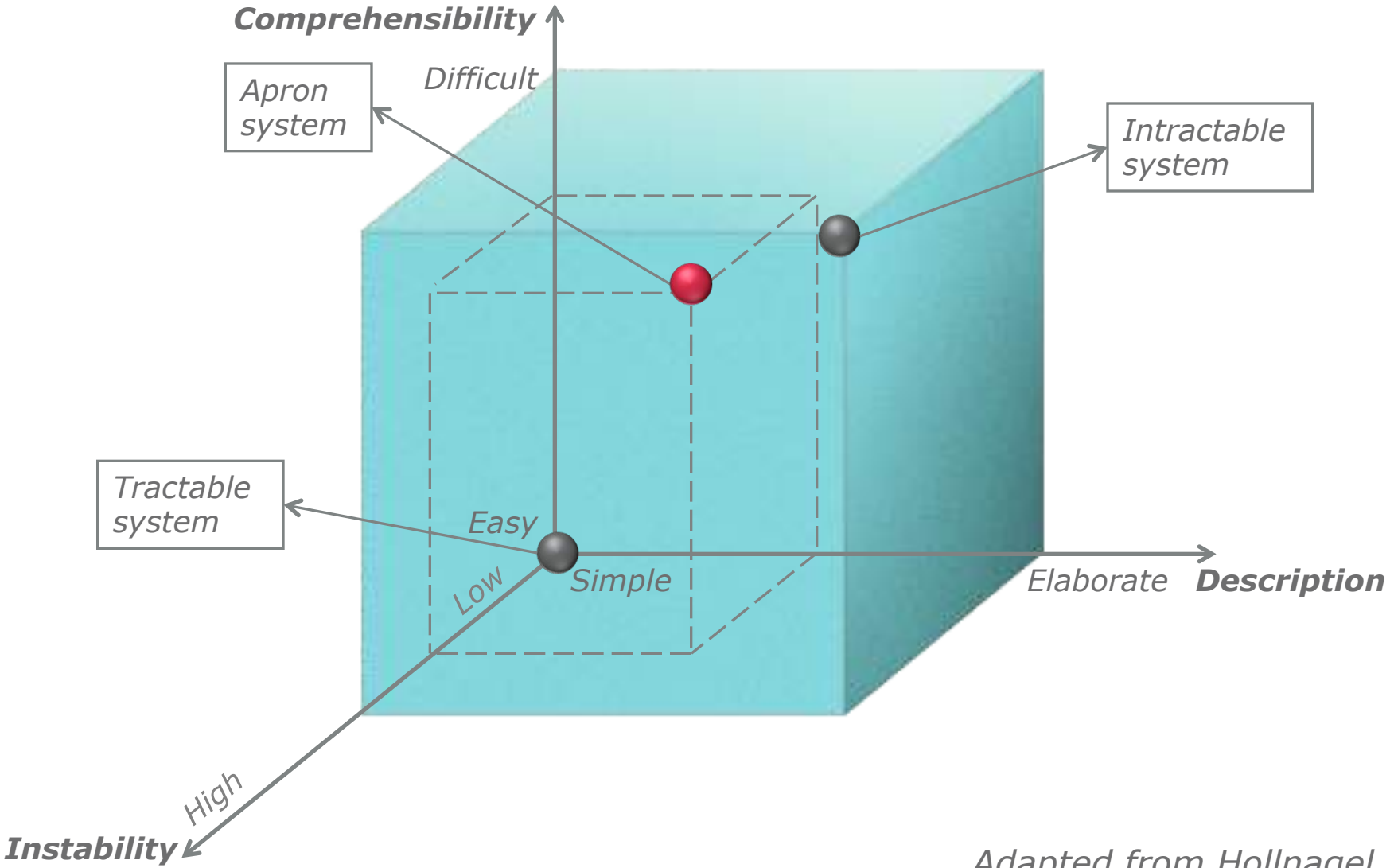
Apron system characterisation



Adapted from Hollnagel, 2012

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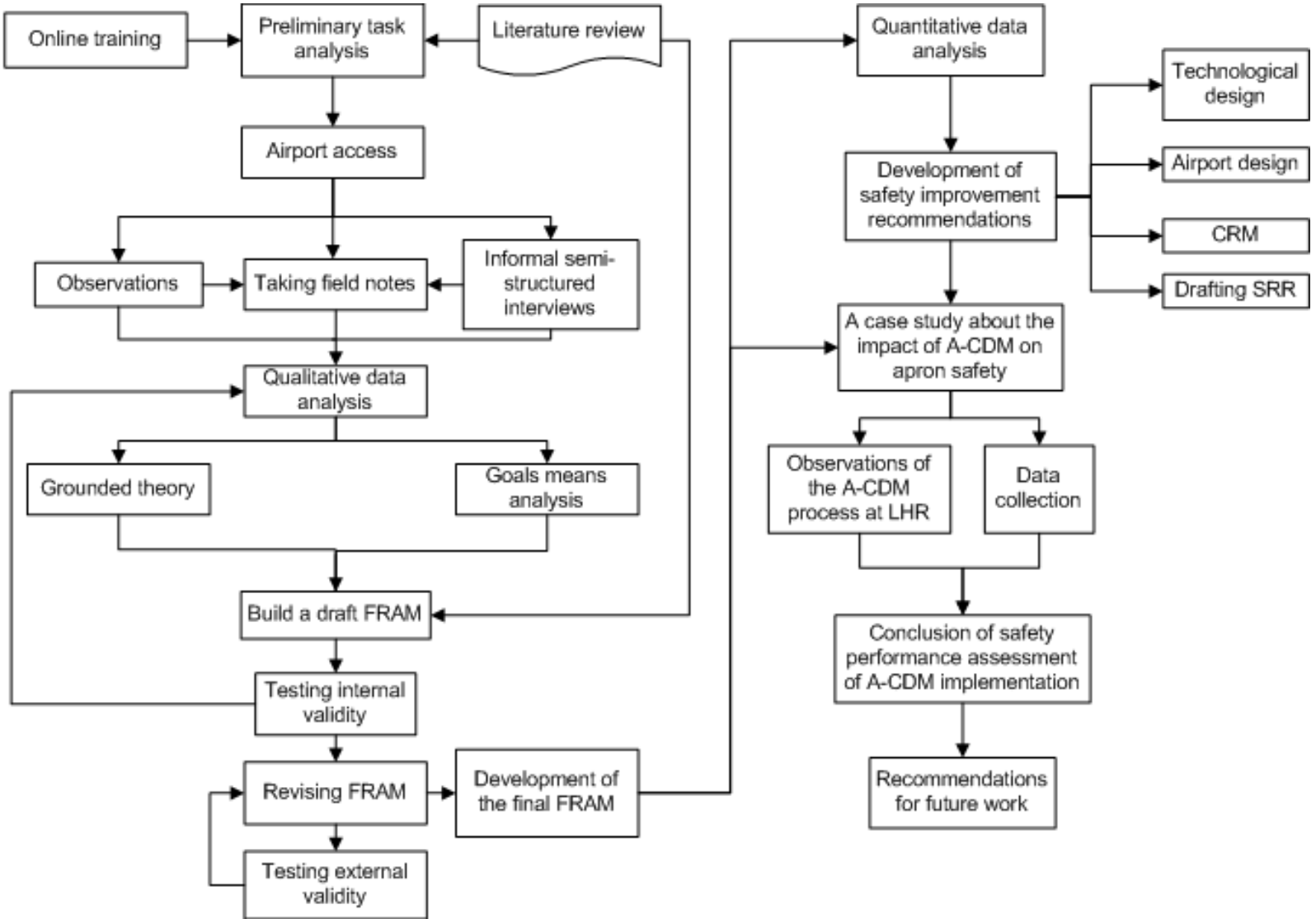
Limitations of existing studies in apron safety

1. There is no standardised definition that describes all the operations taking place on the apron.
2. There is no regulation that require other organisation present at on the airport to have a SMS or meet minimum safety standard
3. ICAO definitions for an accident/incident is not applicable on the apron. There is no standardised definitions for terms accident, incident and occurrence on the apron. Consequently, the terms are used interchangeably
4. No standardised procedure for reporting accidents and incidents
5. Aircraft-centric approach to safety management
6. Safety thinking based on root-cause analysis
7. Non-existence of operational safety assessment of the SESAR deployment steps for the apron

Research objectives

- Develop safety regulatory requirements for the apron
- Provide proposals for standardisation of operations on the apron based on best practices
- Develop a tool for retrospective and prospective analysis of apron operations safety based on FRAM
- Augment the existing literature on factors that affect apron safety
- Develop leading safety indicators
- Assess the safety impact of A-CDM implementation
- Provide recommendations for worldwide A-CDM implementation
- Identify future work that will create further apron safety improvements

Research methodology



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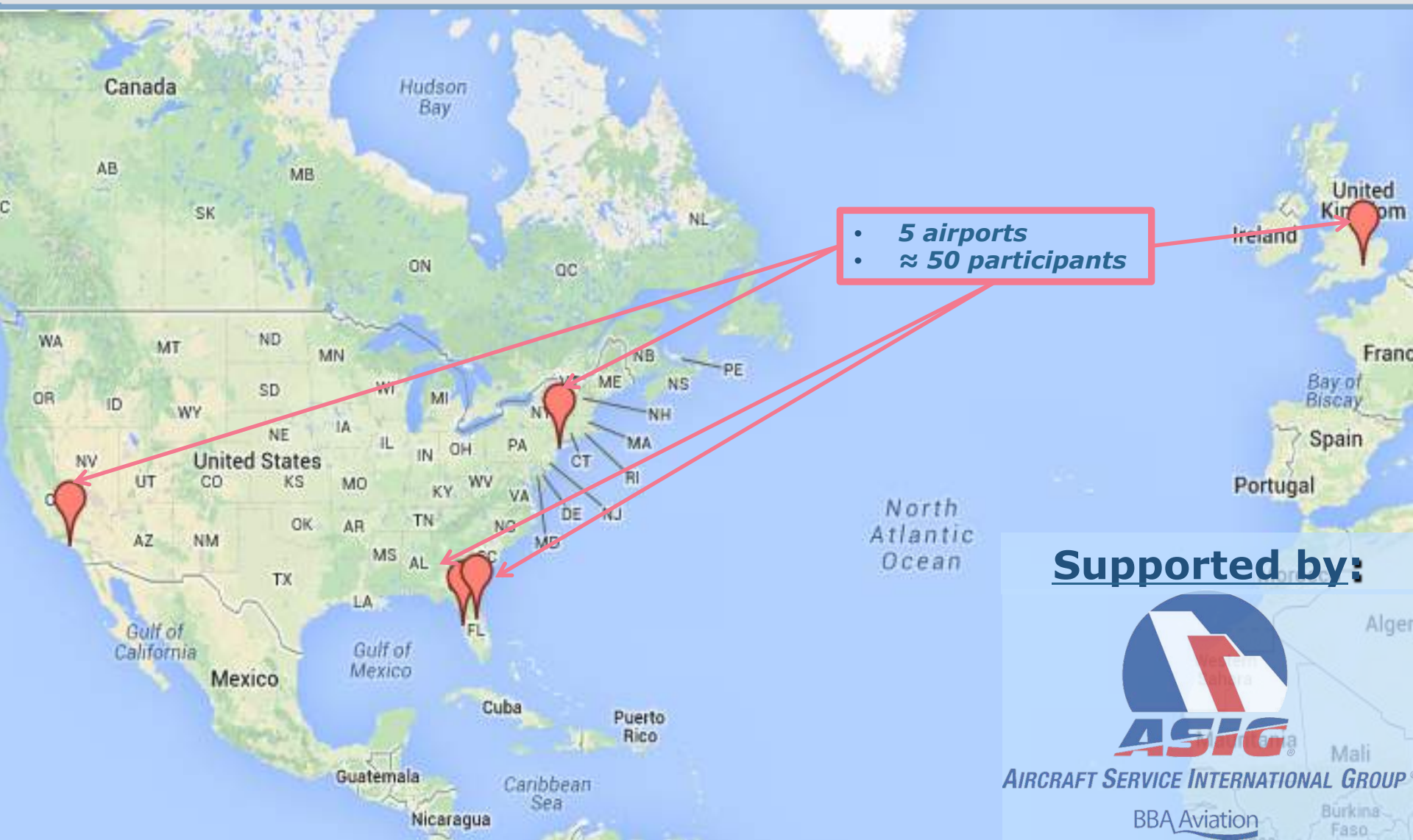
Participating Airports



Supported by:

ASIG
AIRCRAFT SERVICE INTERNATIONAL GROUP

BBA Aviation

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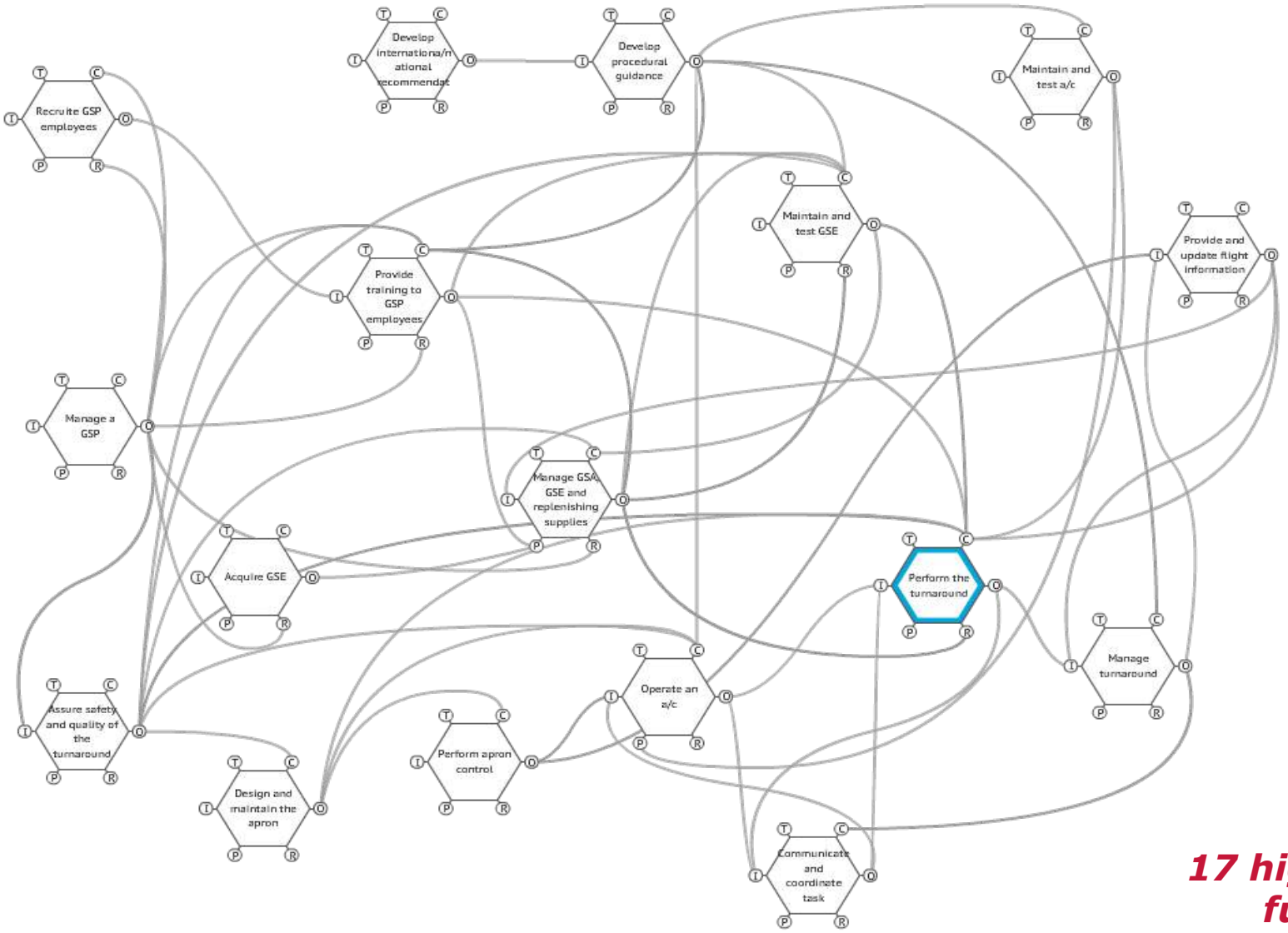
High-level FRAM model of apron operations



17 high-level functions

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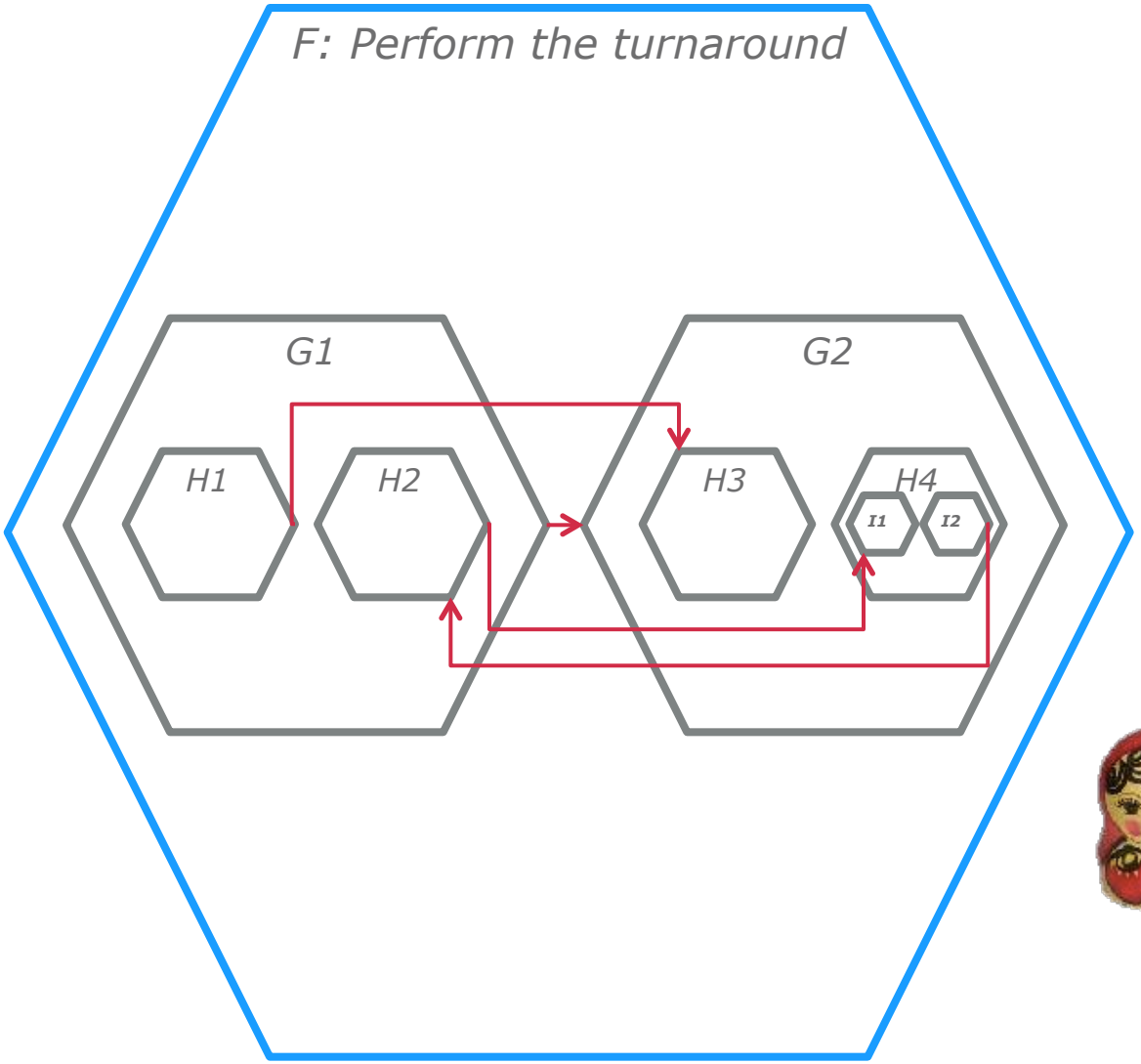
How to decompose a FRAM model?



How to account for the nesting of functions following a model decomposition?

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A FRAM for Retrospective Analysis Case Study

Incident description

"At approximately 1710 EST, November 5, 2013, Three employees were pushing a pallet into the forward cargo compartment. The foot of the employee slipped backward into an opening inside the aircraft cargo hold as he was pushing the pallet forward. His foot made contact with the water pipe and dislodged the clamp that connects two pipes together. EE had to push the PMCs due to the A/C load system being INOP. Airline management and TOGA were notified about the incident".

Root cause: *Broken seal on water pipe inside forward hold compartment.*
Corrective Action: *Brief EE's to be aware of work area.*

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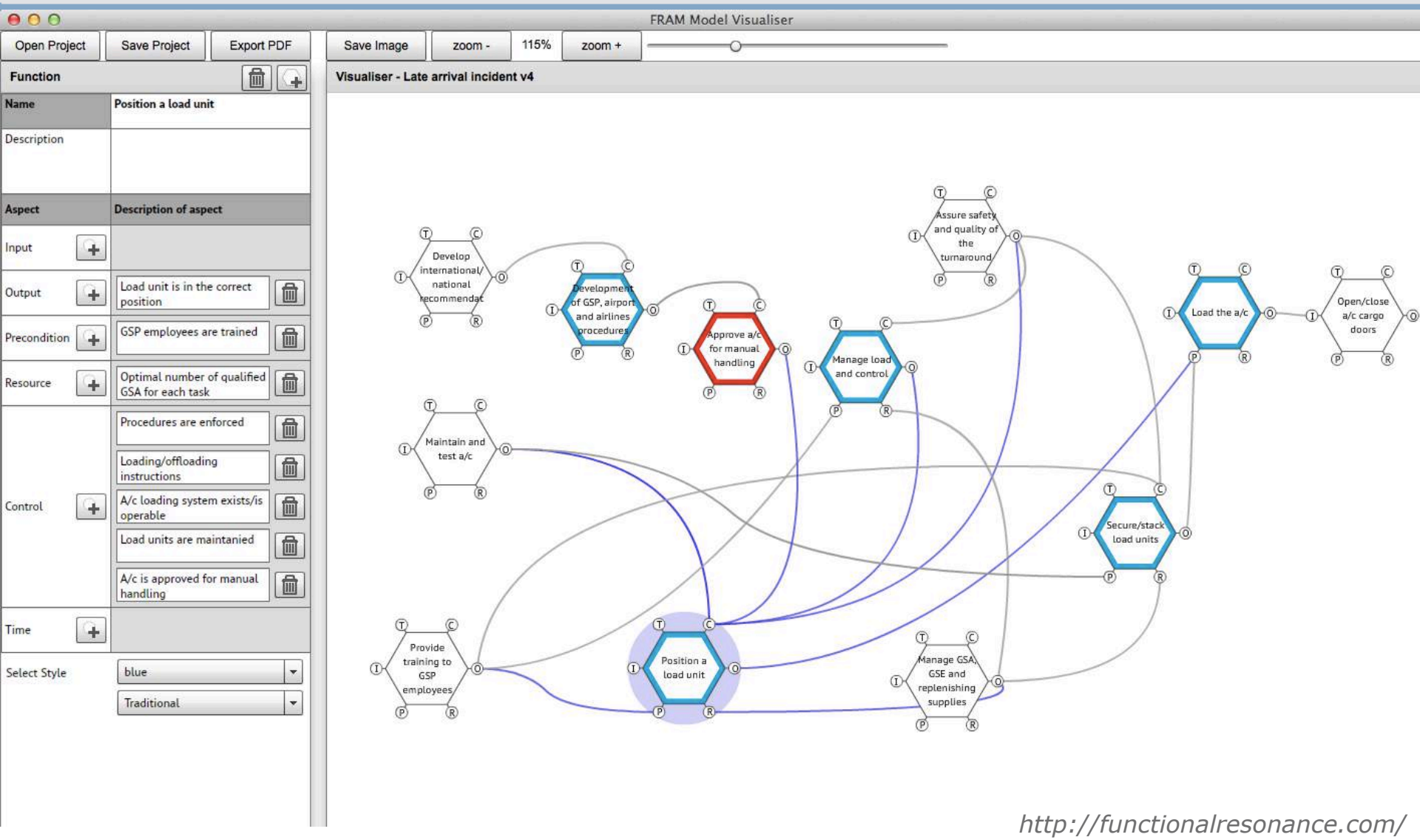
Instantiation of the incident



http://functionalresonance.com/

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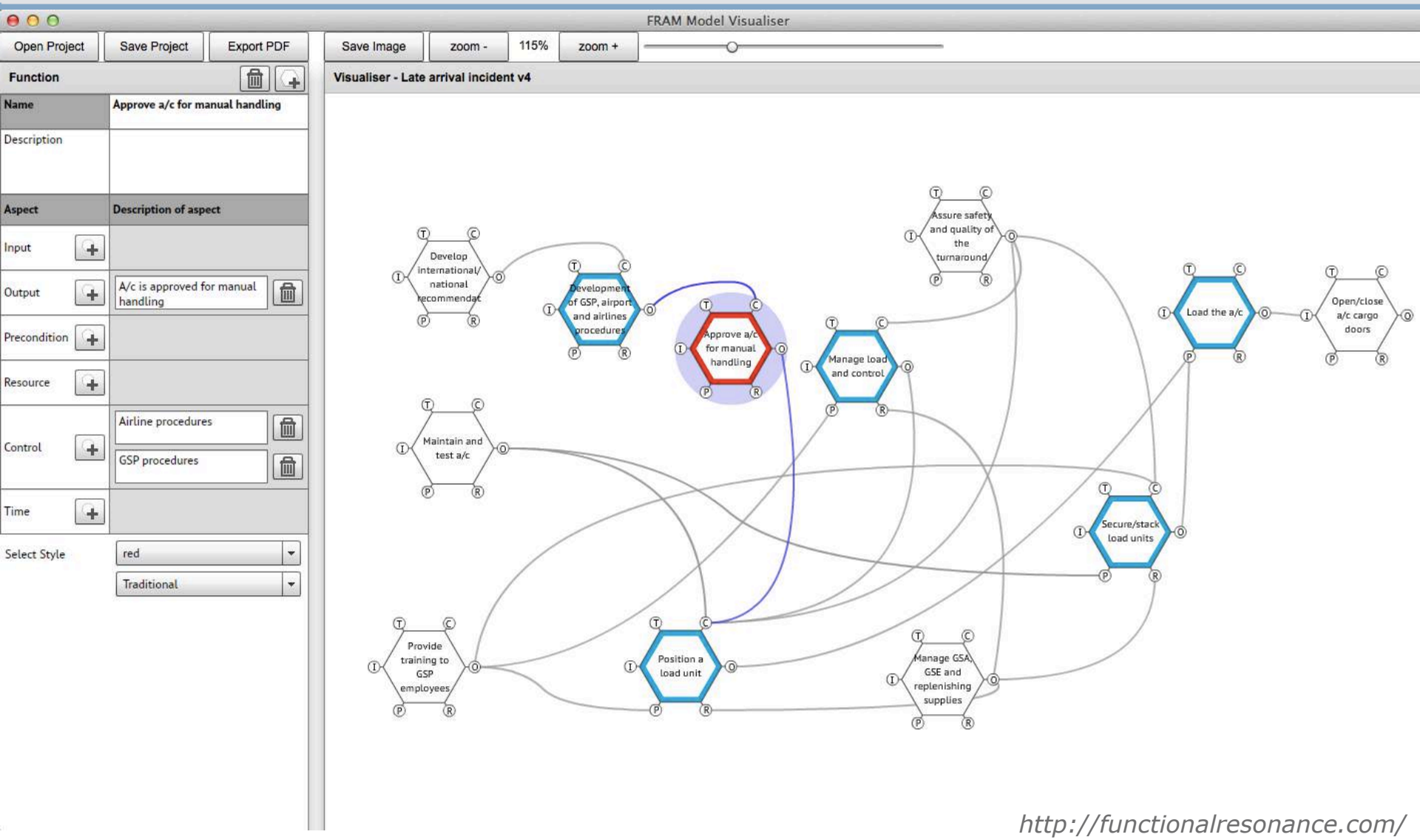
Instantiation of the incident



http://functionalresonance.com/

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Provide recommendations

Amend Aircraft Minimum Equipment List (MEL)

Airline XYZ

767-300F Minimum Equipment List

Section 2 MEL					ATA 25 Equipment / Furnishings
ITEM		REPAIR CATEGORY	NUMBER INSTALLED	NUMBER REQUIRED FOR DISPATCH	REMARKS OR EXCEPTIONS
25-53-1	Cargo Loading Systems (Main Deck and Lower Cargo Compartments)	D	3	0	May be inoperative. NOTE: Any portion of system(s) that operates normally may be used.

EICAS STATUS MESSAGES

None

PLACARD

Airplane Flight Log

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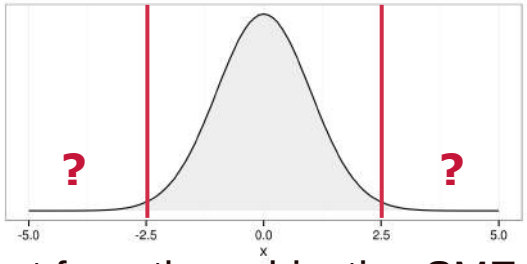
FRAM in Prospective Analysis - Discussion

Steps in FRAM risk analysis (Hollangel, 2014):

1. Build a FRAM model of the system
2. Analyse a number of scenarios (intantiations) of that model
3. Characterise the (possible) actual variability for a set of instantiations of the model
4. Identify the dynamic couplings (functional resonance) that likely will play a role during and event
5. Propose ways to monitor and dampen performance variability (indicators, barriers, design/ modifications, etc.)

Points for discussion:

- Completeness and rigor of the existing approach to scenario (intantiation) generation and analysis?
- Should actual variability be focusing only on 'everyday' (failure-free) operations or should it capture all the outcomes (aligned with the Safety II approach)?



- Apart from the subjective SME judgment, can any there approach be used to asses when and where 'resonance' could occur?

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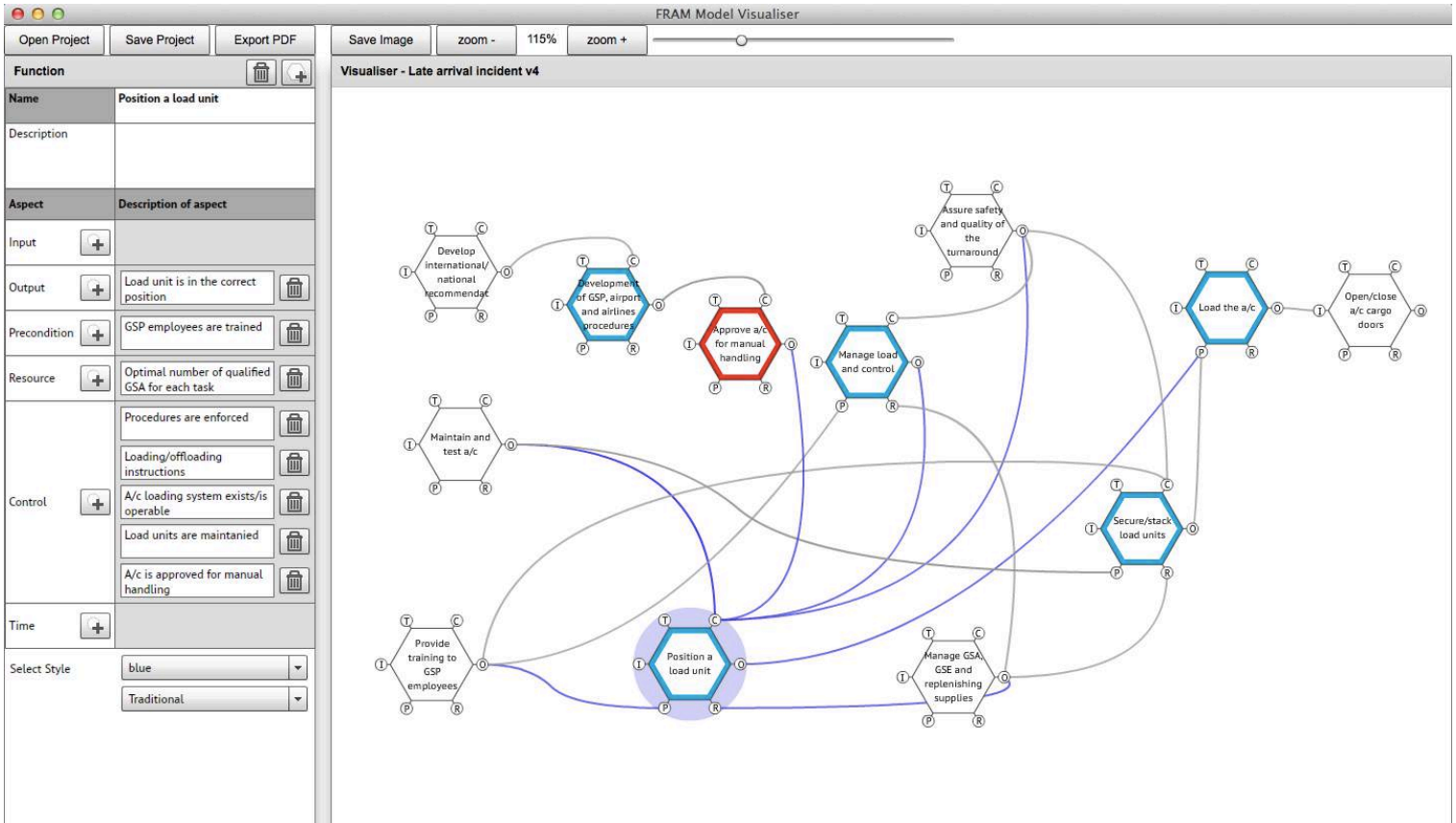
Adaptation of a STPA approach to hazard identification/ risk analysis in FRAM risk assessment

Proposed approach (adapted from Leveson (2013) and Thomas (2013)):

1. the FRAM model of the system captures all the potential and actual couplings.
2. Couplings between the functions account, not only for 'everyday' Outputs but, for all the potential Outputs (according to the Safety II approach) of an upstream function in the continuous set of Outcomes of a function.
3. For the purpose of reducing the complexity of analysis, Outputs need to be carefully discreticised.
4. For every function, a 'context table' is derived so that the context of a function execution captures all the potential combinations of couplings with all the directly linked upstream functions. For each context, timeliness of function execution is considered.
5. For each function and every combination of couplings and a discrete category of the execution time, a discrete value of the function Output is assigned.
6. The method establishes the links between every function execution context and a discrete value of the function Output.
7. Couplings (identified under 1.) create a complex network of potential influences between the functions.
8. Model dynamics is achieved by simulating different combinations of function Outputs and observing its propagation in the non-linear system.

Limitation of the proposed approach

- It only considers the couplings between the functions, it does not account for internal and external variability which affect Outputs of every function.



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PSFs in FRAM

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