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Preparing planes for take-off: looking at what happens on the apron during turnarounds

Milena Studic

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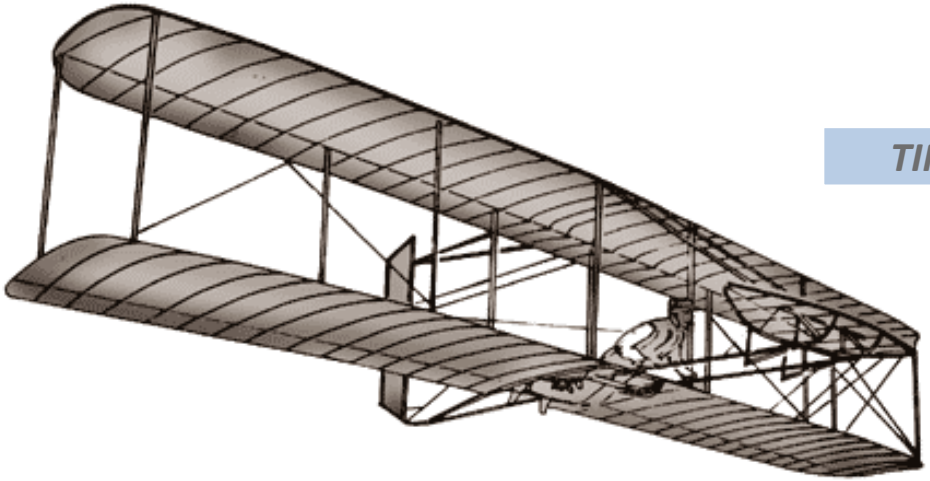
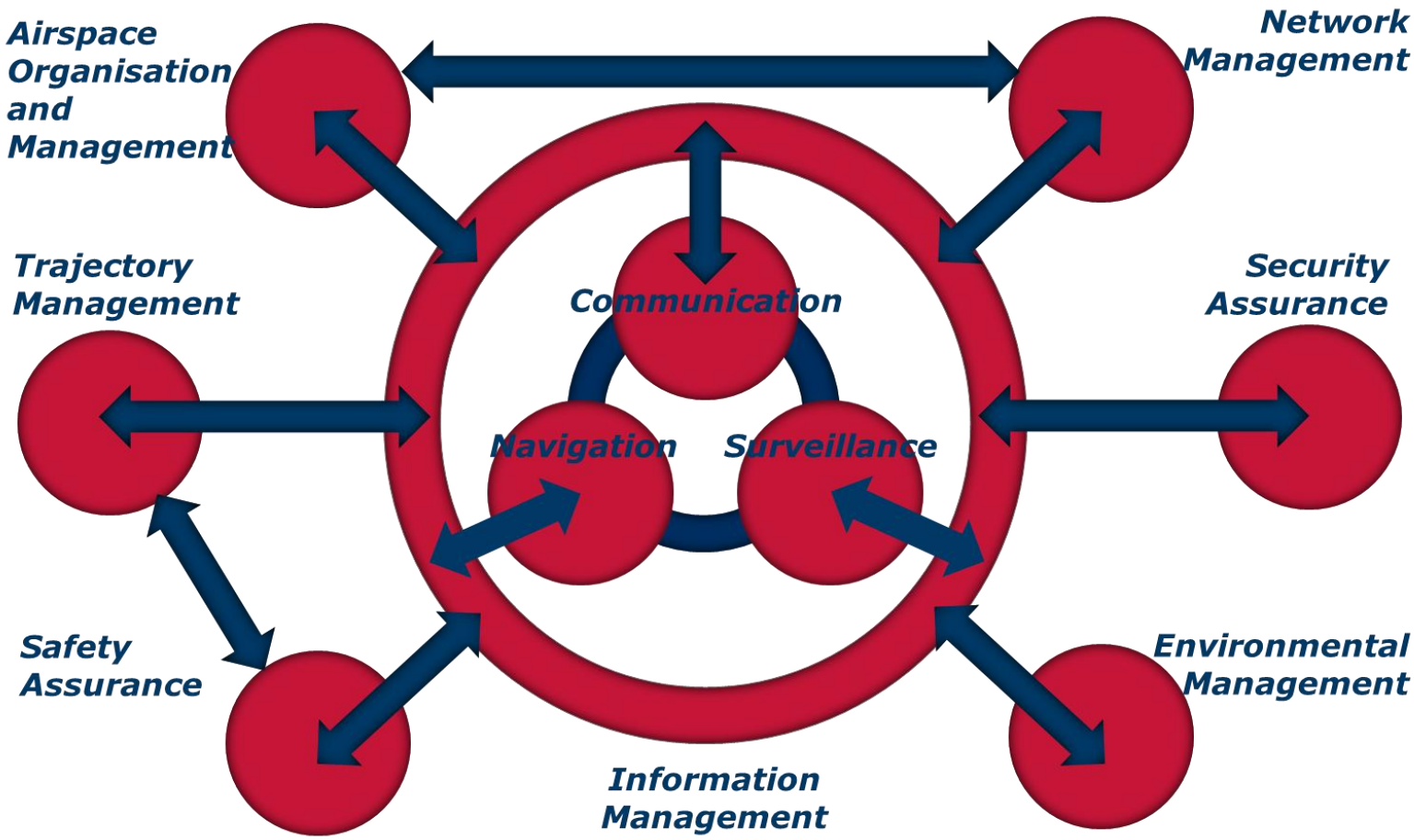
Historical review of the ATM CONOPS



TIME

ATM Functions Synopsis



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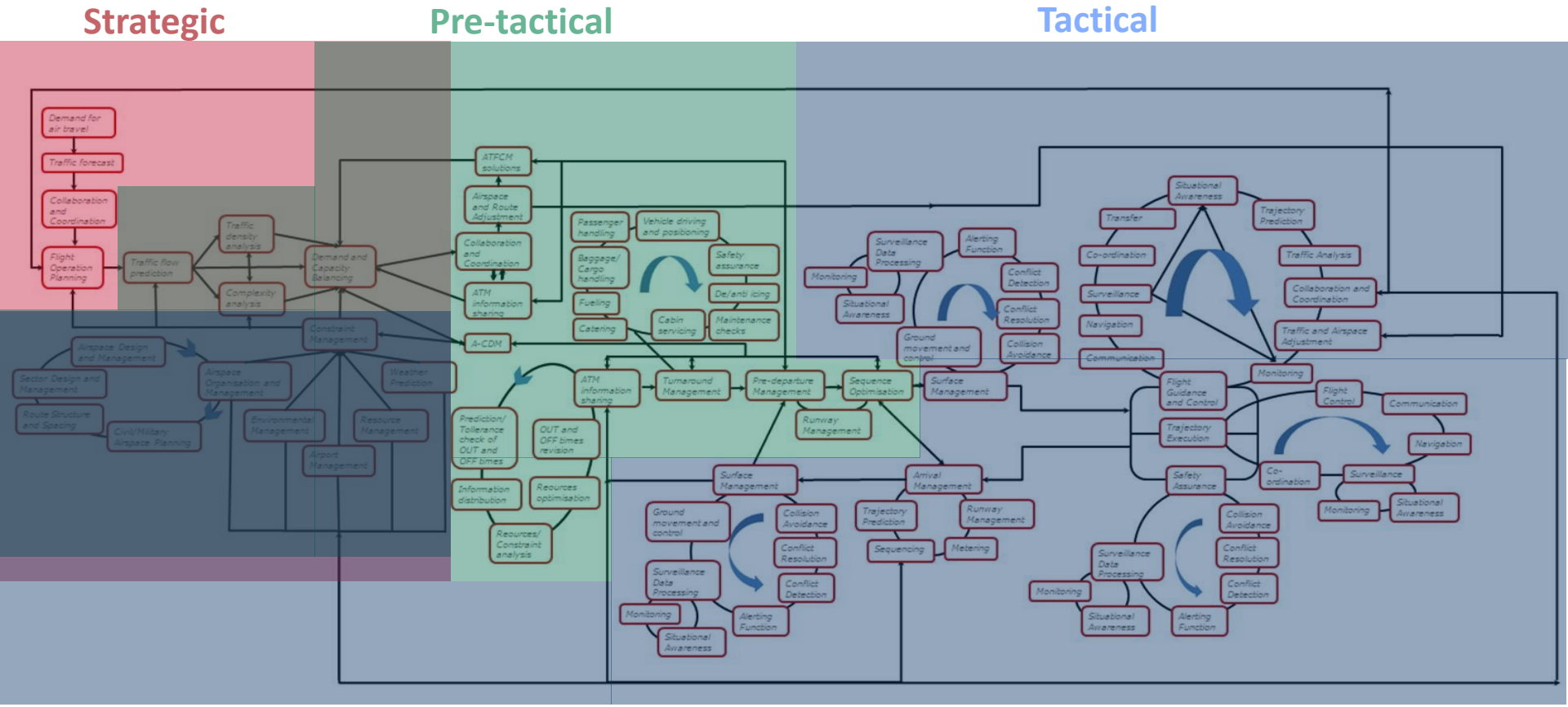
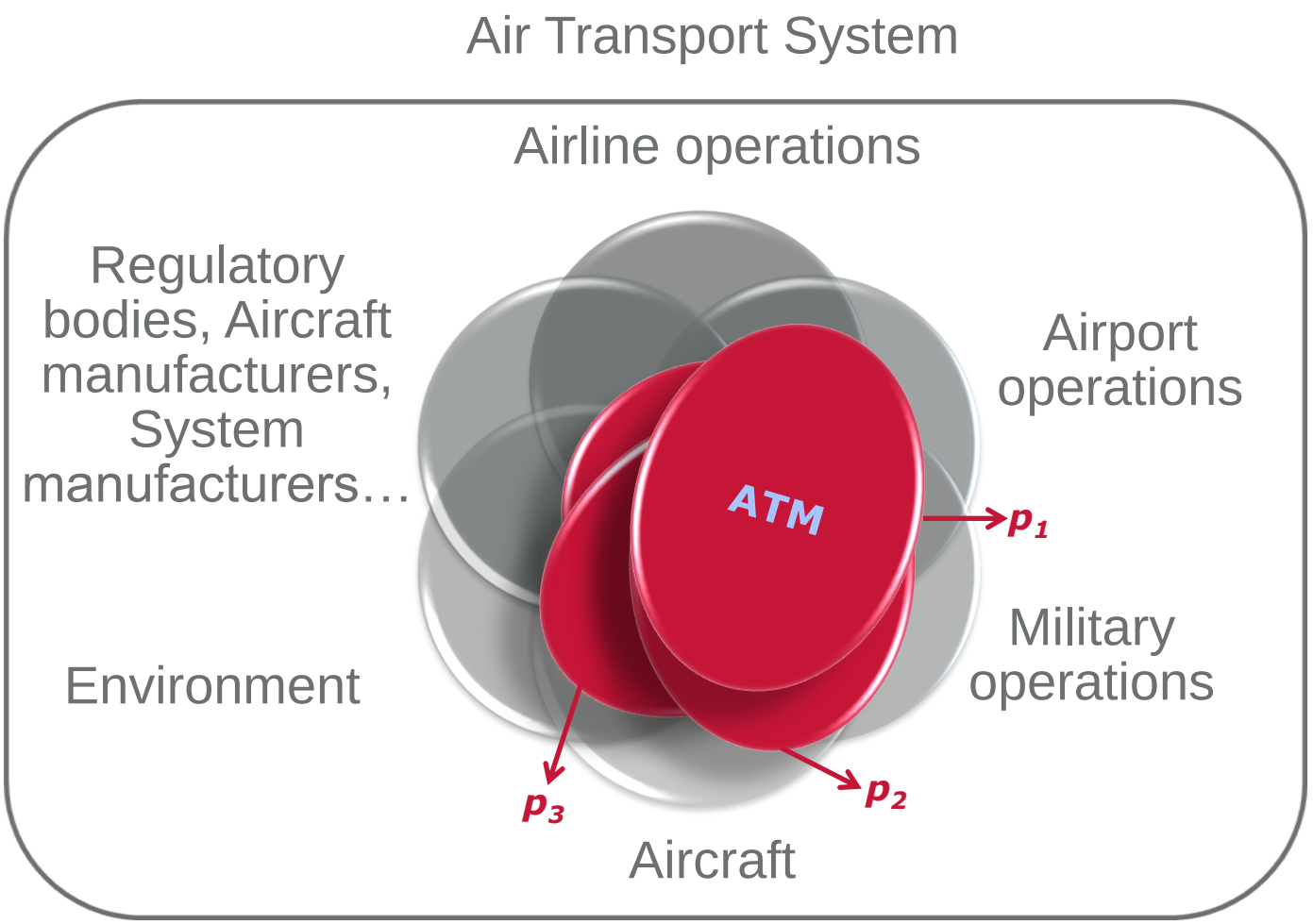
Process model of the ATM system



Shifting ATM system boundary



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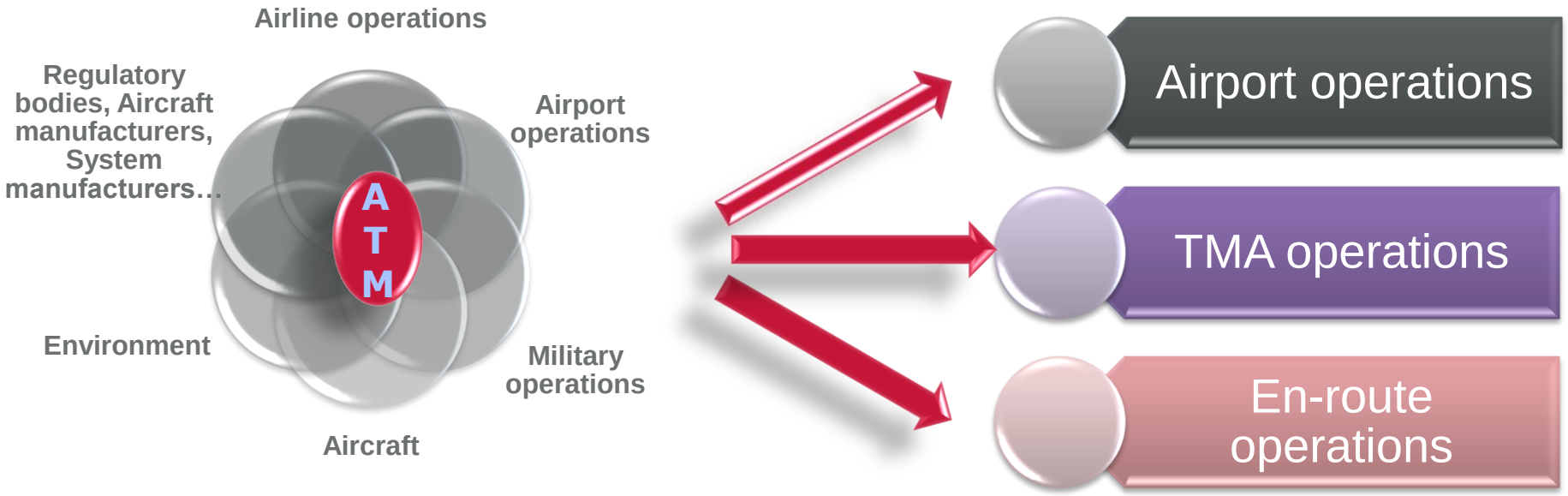
Analysis of the impact of the shifting boundary of the ATM system on different types of operations



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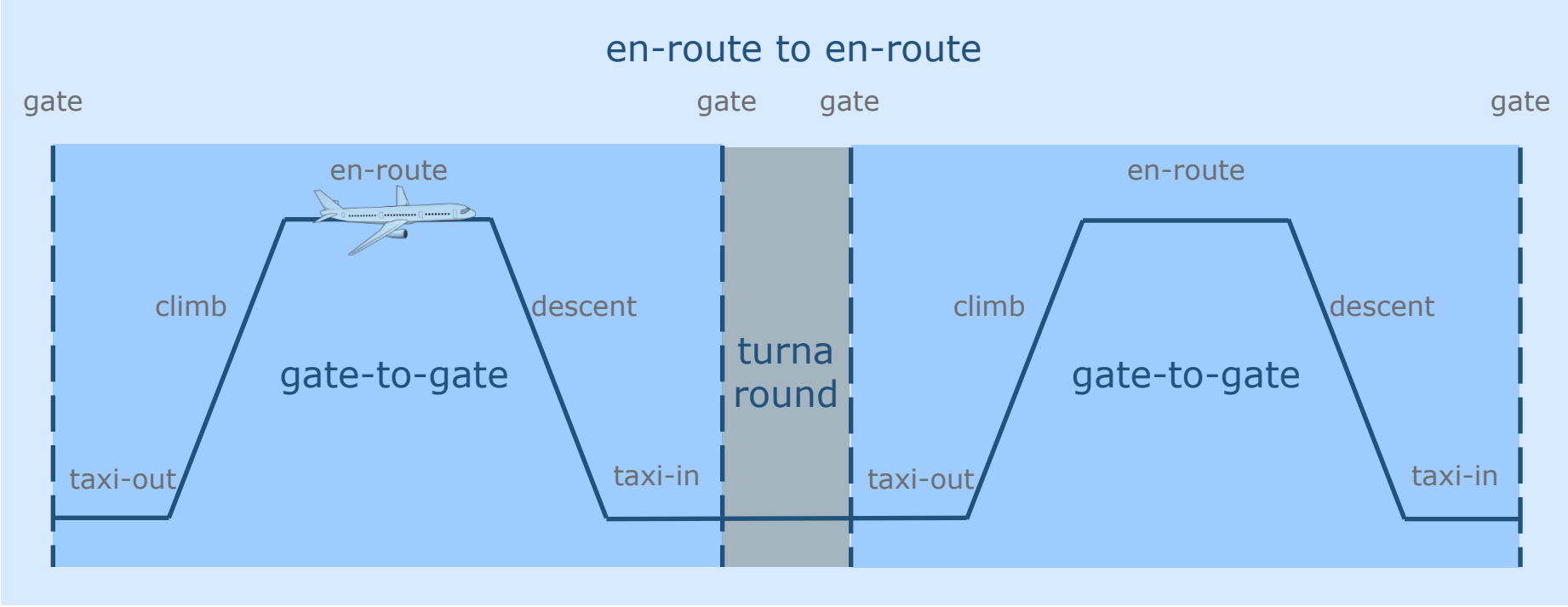
En-route-to-En-route VS. Gate-to-Gate Concept
Trajectory VS. Flight



Adapted from: SESAR, 2007

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SESAR CONOPS: Paradigm shift from a flight to a 4D trajectory!

4D trajectory: "A set of consecutive segments linking waypoints and/or points computed by FMS (airborne) or by TP (ground) to build the vertical profile and the lateral transitions; each point defined by a longitude, a latitude, a level and a time".

EUROCONTROL, 2008

"**Airports fully integrated into the ATM network**.

In SESAR, airports are fully integrated into the ATM network as nodes in the system.

The trajectory management focus of the ConOps extends to include the airports. **The trajectory is considered to continue unbroken after touchdown to the gate and from the gate to take-off. During turnaround, the trajectory is in an idle state in all but the time dimension** which means that even during the turn-round it is possible to establish milestones with which the progress of the turnaround process can be monitored and the impact of events on later parts of the trajectory established at an early stage. Trajectories in the vicinity and on the surface of airports are managed by a co-operating set of partners using shared information and collaborative decision making processes.

The airport can be considered as another, rather complex, "sector" through which the aircraft passes, where complementary processes work together in a fashion similar to a modern production facility. "

SESAR CONOPS, 2008

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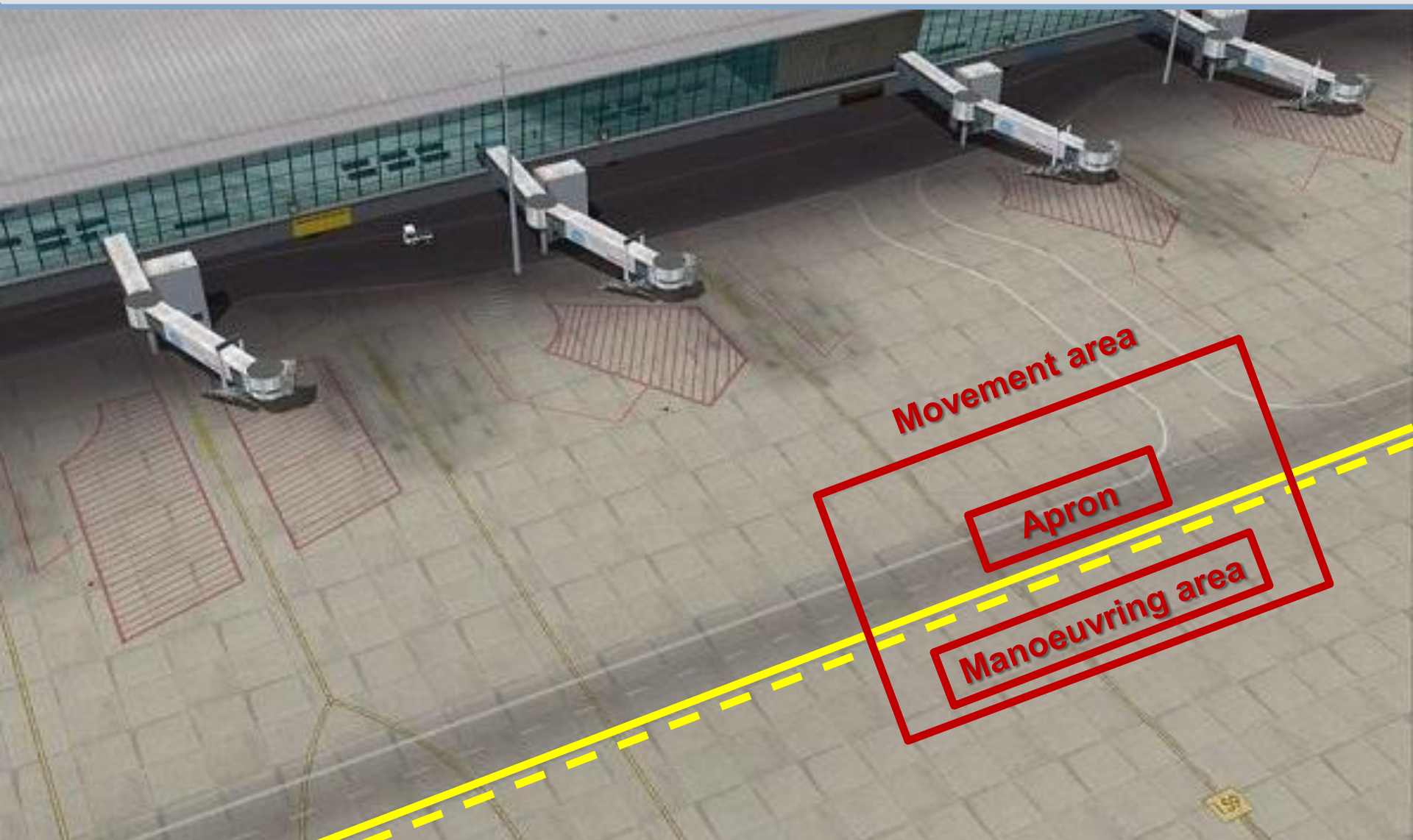
APRON – component of the current ATM system or not?



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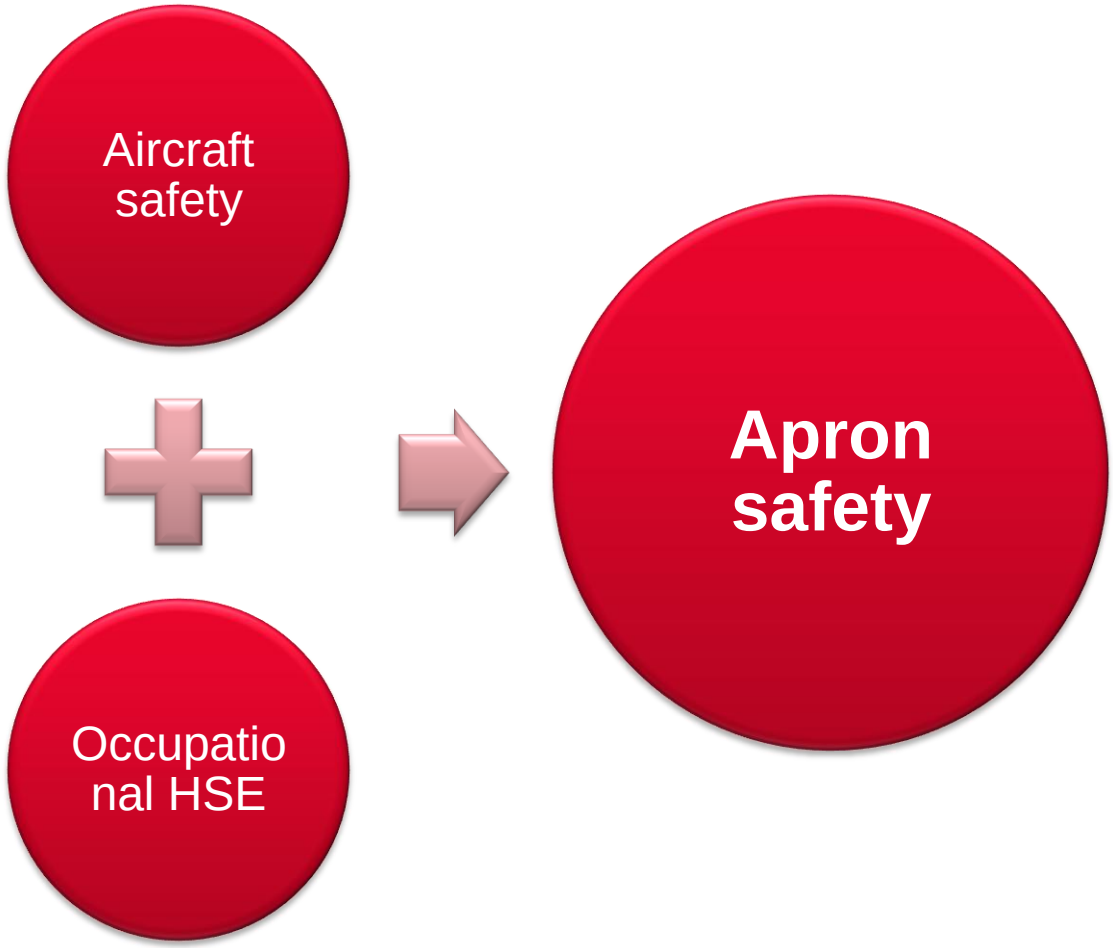
Apron Operations

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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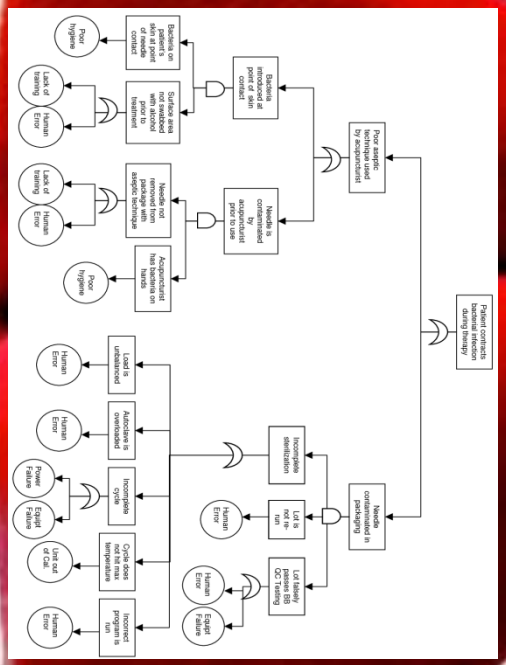
The existing approach to reactive safety management of operations on the apron

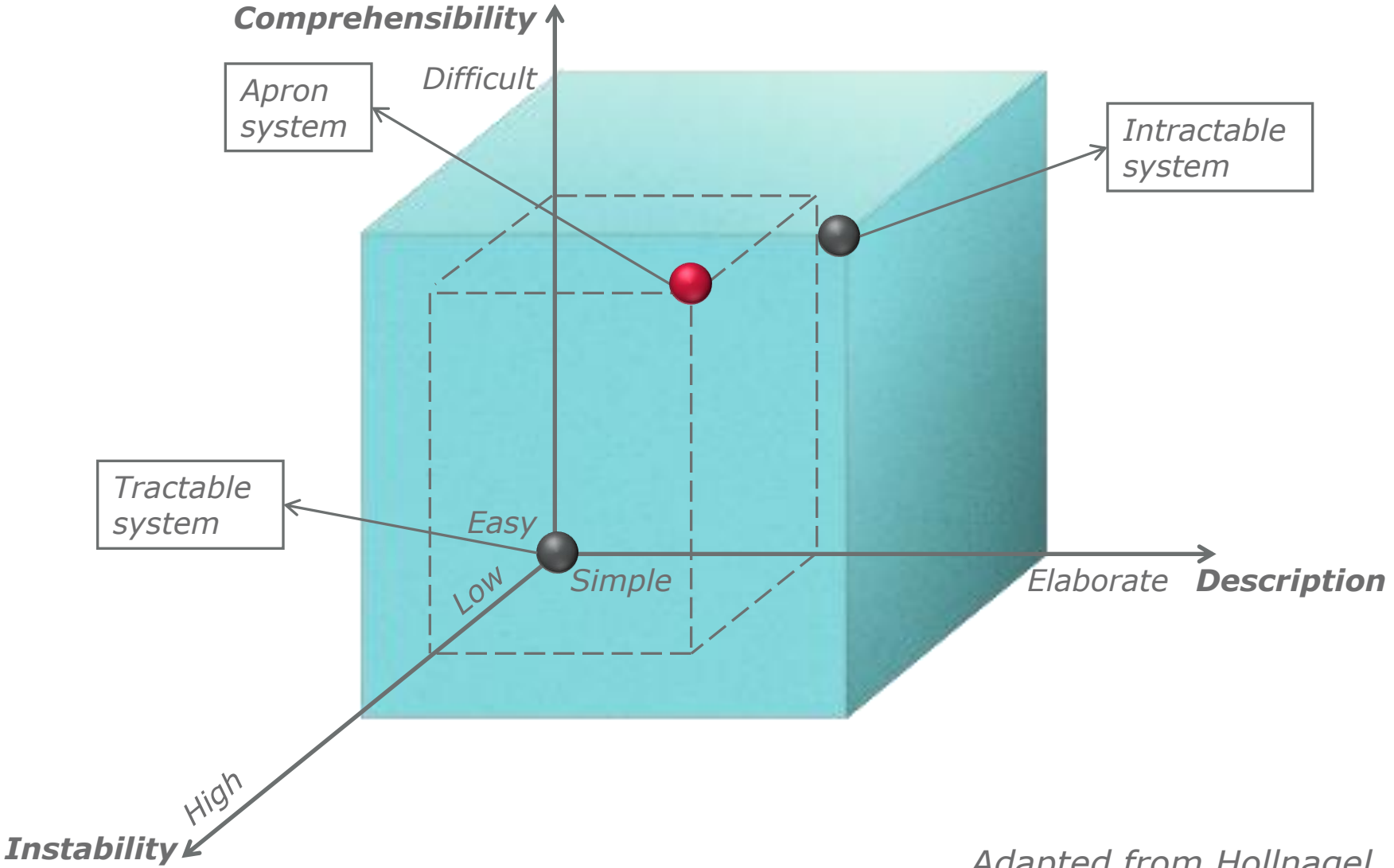


Unwanted event

- *Aircraft damage*
- *Human injury*
- *GSE damage*
- *Environmental impact*
- *Operational disruption*
- *All OK*

Is this approach appropriate for apron operations?

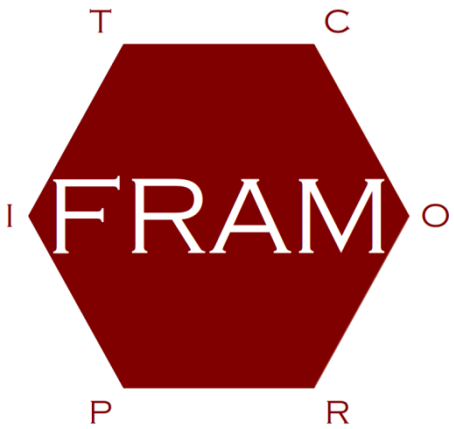
Apron system characterisation



Adapted from Hollnagel, 2012

Research objectives

- Justification of the need for a systemic approach to safety management on the apron
- Development of a “generic” FRAM for apron operations
- Identification of performance variability on the apron
- Application of the FRAM model on a specific occurrence scenario
- Provide a guidance for using FRAM in prospective analysis of apron operations
- Describe change in the variability of apron operations with the implementation of A-CDM concept



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Sources of variability contributing to incidents /accidents on the apron

- **Technological functions**
  - different a/c types
  - different GSE types
- **Human functions**
  - technical knowledge/ skills
  - experience
  - communication
  - workload
  - pressure/stress
  - situational awareness
  - team work
- **Organisational functions**
  - multiple organisation interactions
  - resource management
  - organisational climate
  - lack of standardisation
  - training variability
- **Contextual functions**
  - confined areas
  - high traffic density
  - meteorological conditions

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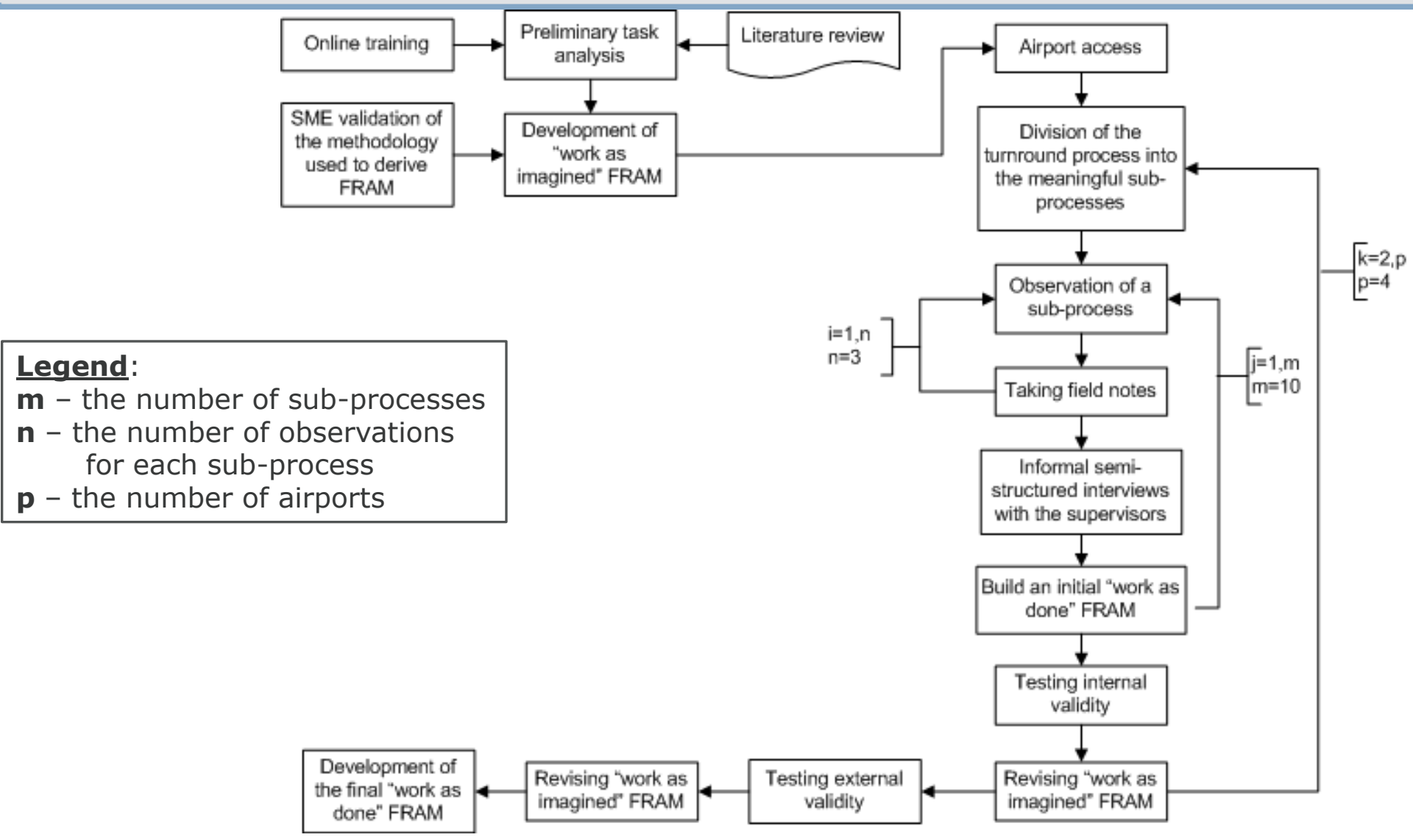
A proposed methodology for development of the FRAM model for analysis apron operations safety



Legend:
m – the number of sub-processes
n – the number of observations for each sub-process
p – the number of airports

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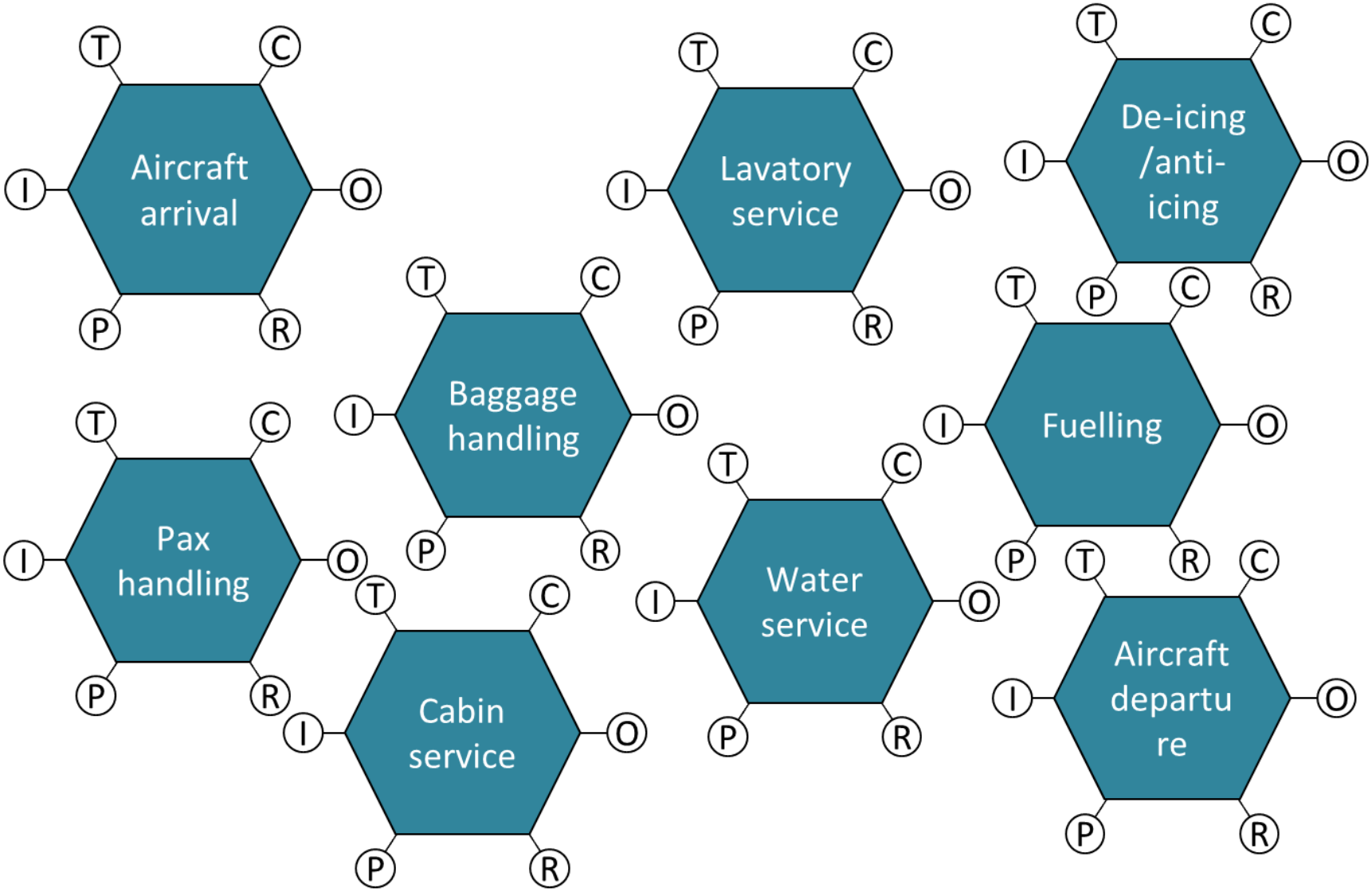
Development of a functional resonance analysis method (FRAM) for airport surface operations



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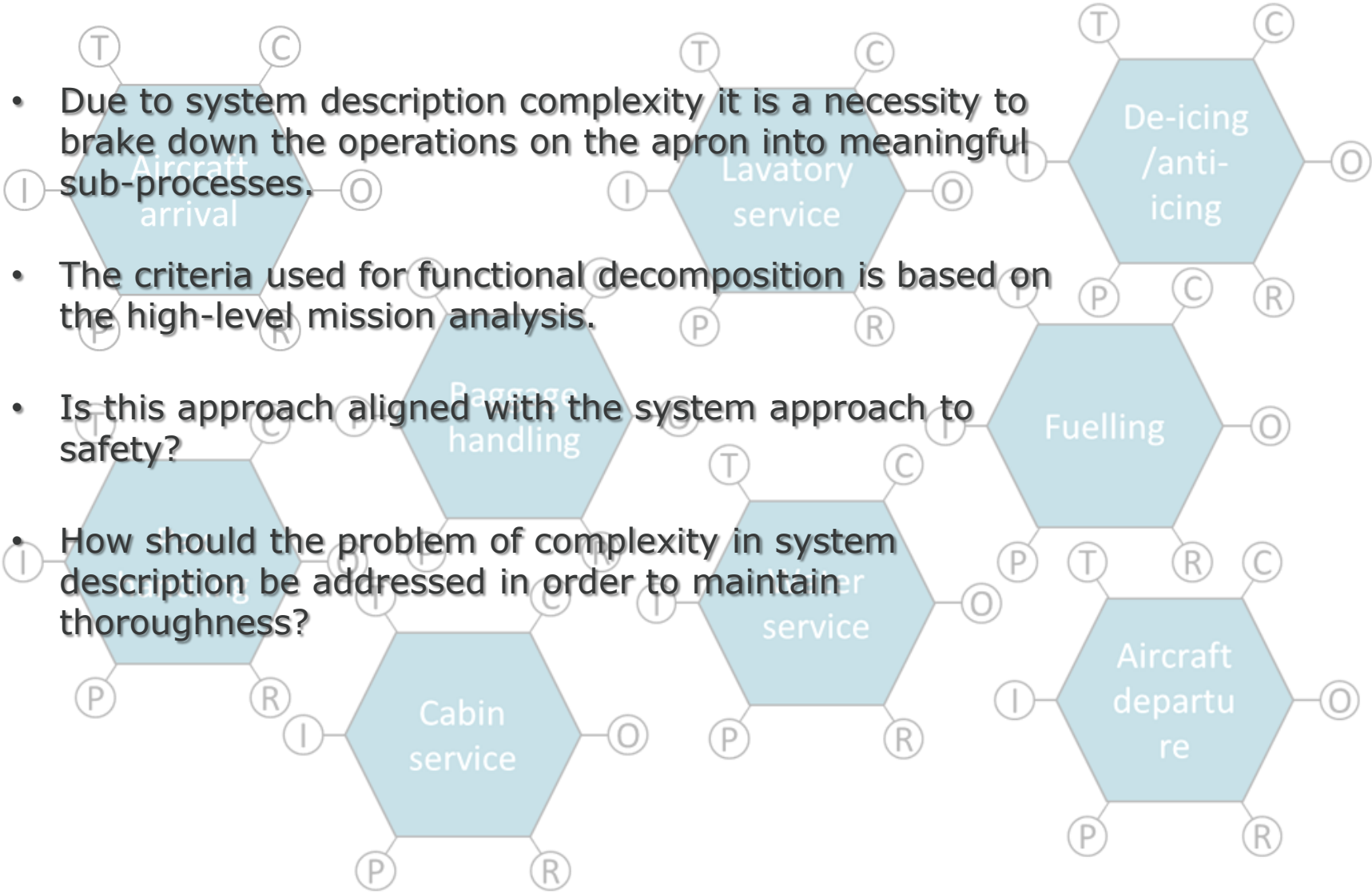
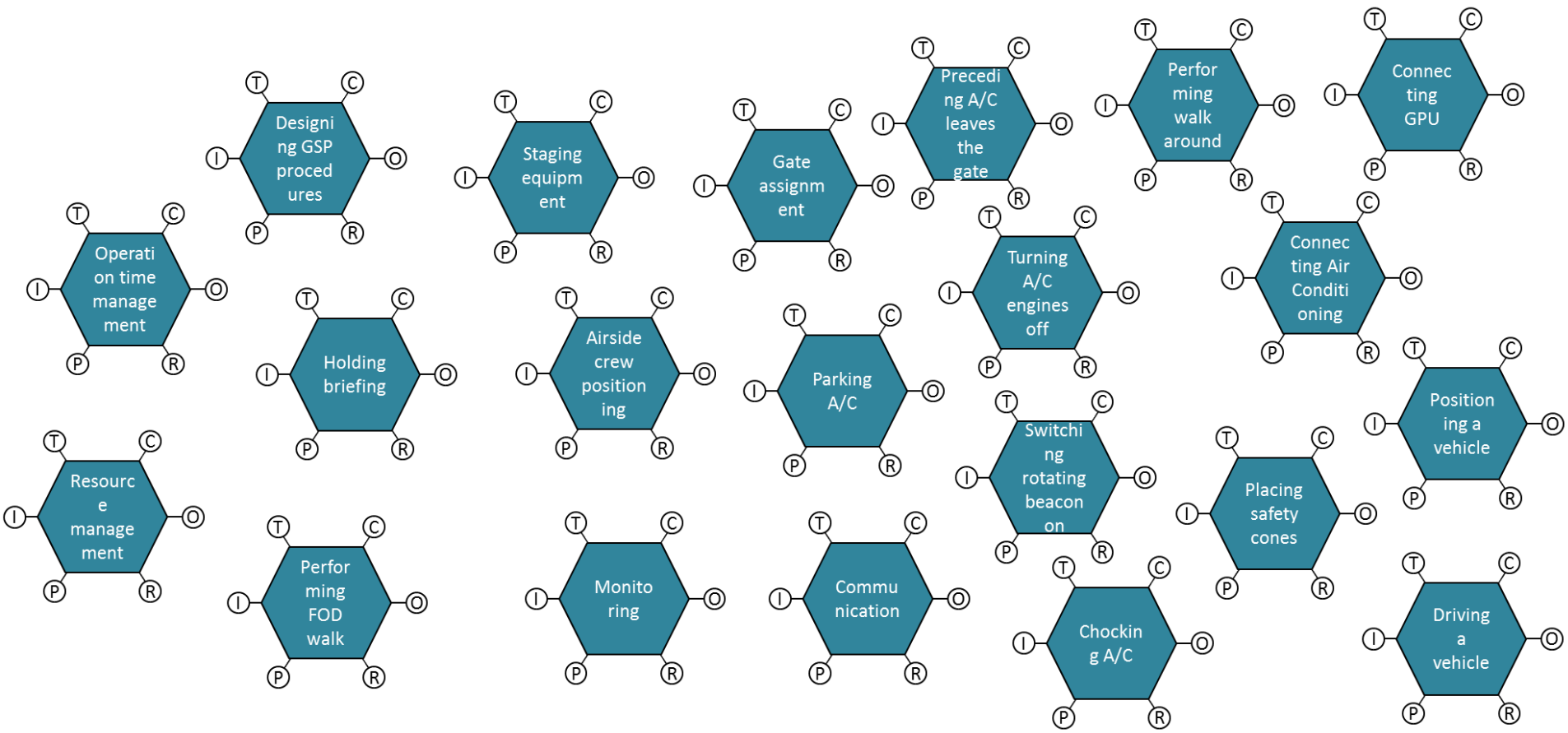
Development of a functional resonance analysis method (FRAM) for airport surface operations

- Due to system description complexity it is a necessity to brake down the operations on the apron into meaningful sub-processes.
- The criteria used for functional decomposition is based on the high-level mission analysis.
- Is this approach aligned with the system approach to safety?
- How should the problem of complexity in system description be addressed in order to maintain thoroughness?



21 functions describing aircraft arrival



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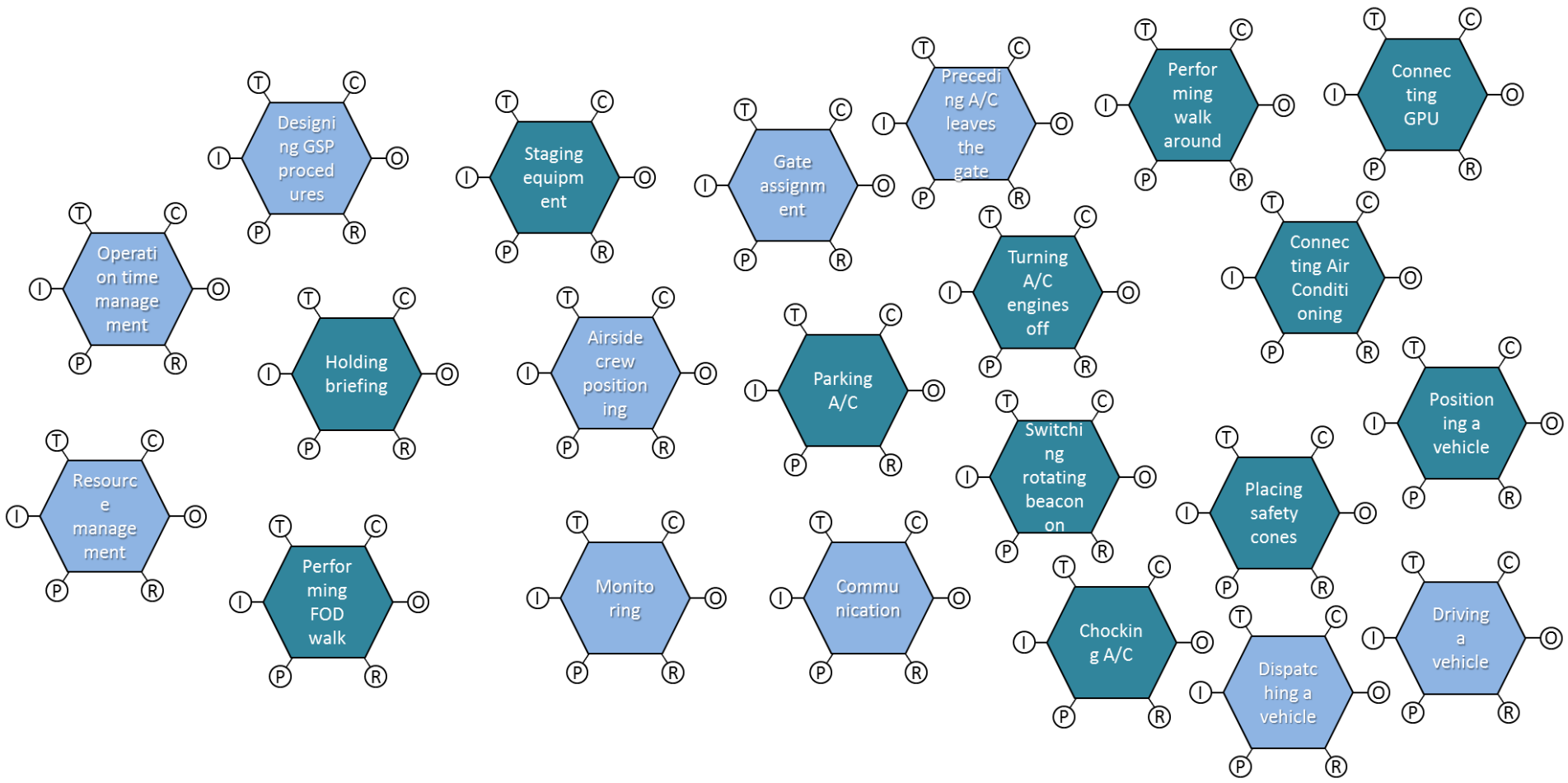
Division into foreground and background functions



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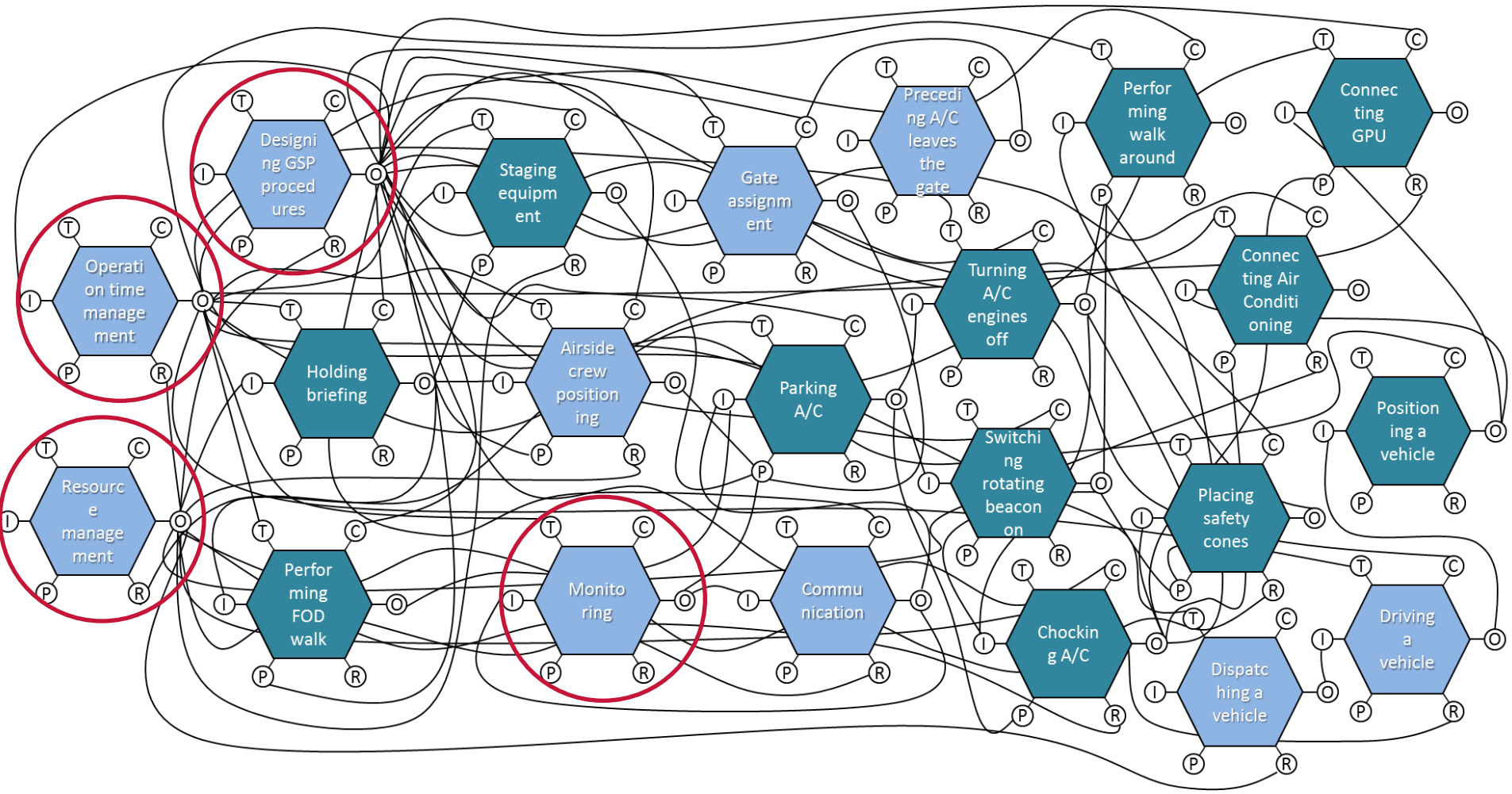
Instantiation for everyday operations



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Analysis of variability of apron operation with implementation of A-CDM on a case study of MUC

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Analysis of variability of apron operation with implementation of A-CDM on a case study of MUC

- ✓ *Reducing apron congestion*
- ✓ *Reduce a/c stand and gate changes*
- ✓ *Improve airline resource management*
- ✓ *Optimise turnround time*
- ✓ *Improve ground handler resource management*
- ✓ *Reduce delays related to fuelling services*
- ✓ *Reduce delays related to de-icing services*

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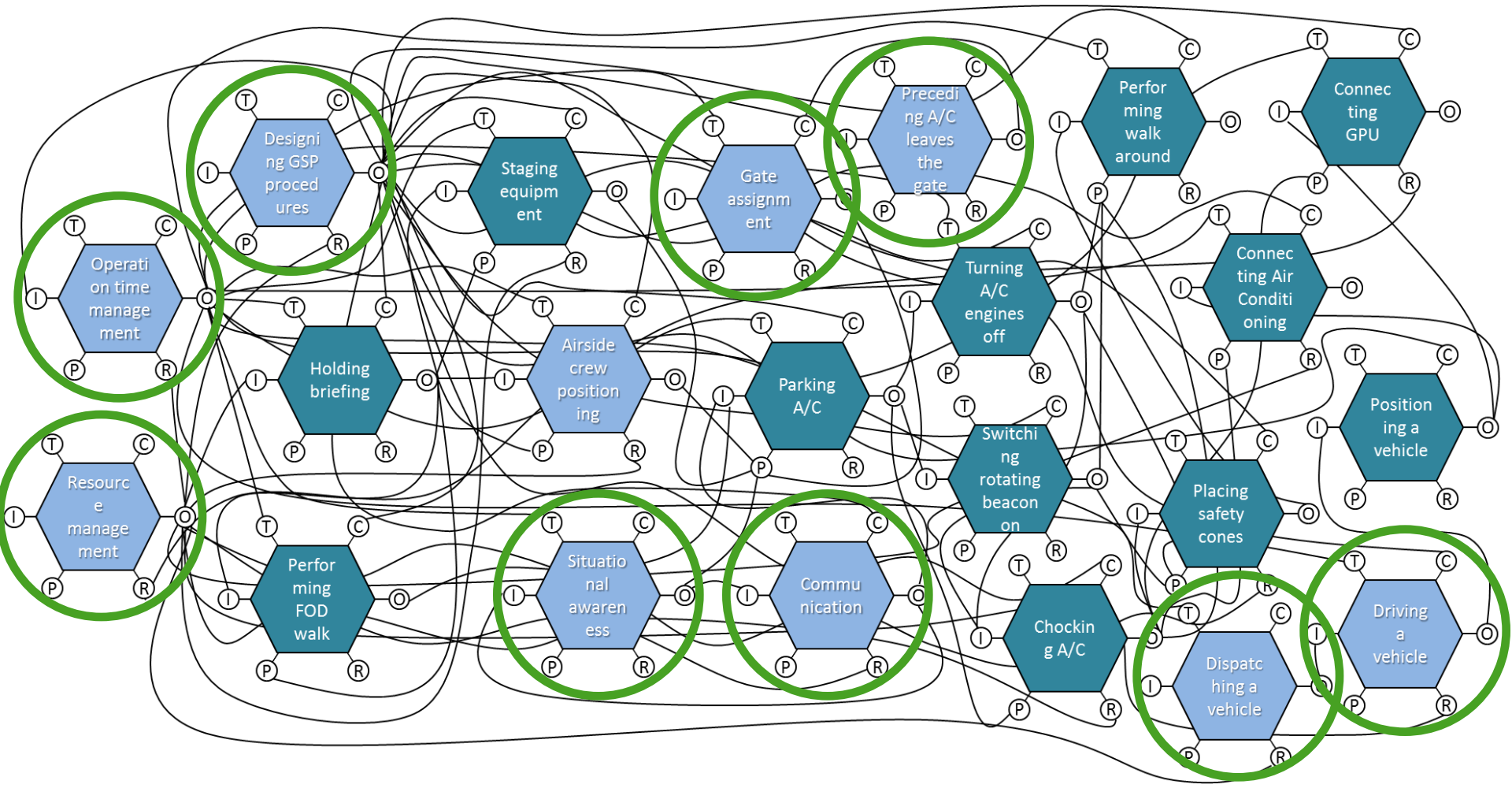
Instantiation for everyday operations with A-CDM



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Thank you very much for your attention!!!

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