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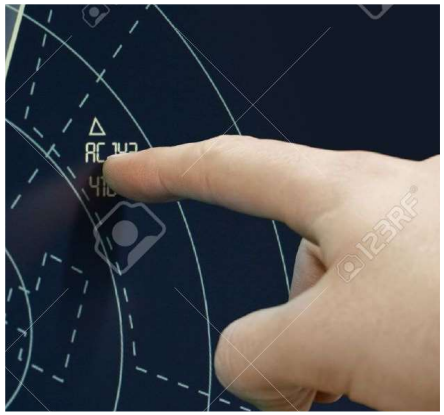


Human Factors in the Design of Air Traffic Control Systems: A Practitioner's View

Agenda

1. Best practice: the application of design principles and standards
2. Effective implementation of automation
3. The design of alerts
4. A broader approach to system design
5. Conclusions

1. Best practice: the application of design principles and standards

"Product usability is a key concept within human factors and more broadly within design. Despite the vast amount of research on usability, the process of designing human factors into computer systems remains something of an art ".

HF Integration in future ATM systems, Eurocontrol (1)

1. Best practice: the application of design principles and standards

- Challenge 1: The pursuit of consistency

Cockpit of Airbus A380

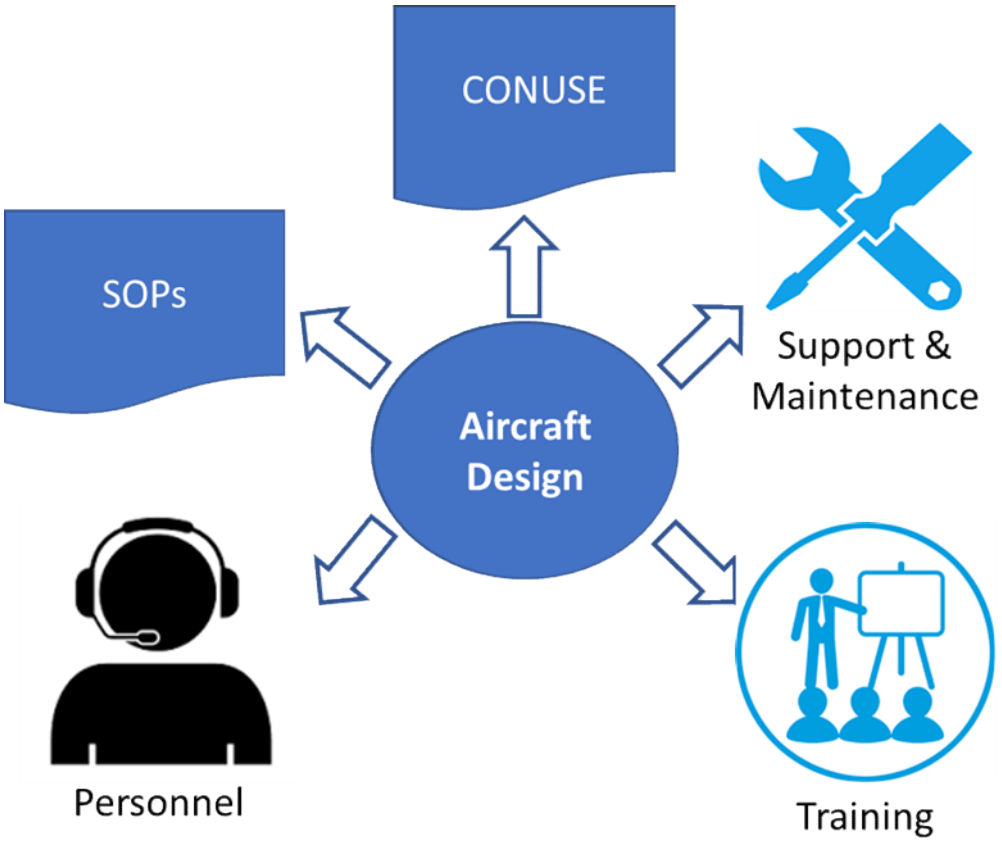
Cockpit of Boeing 787 (Dreamliner)

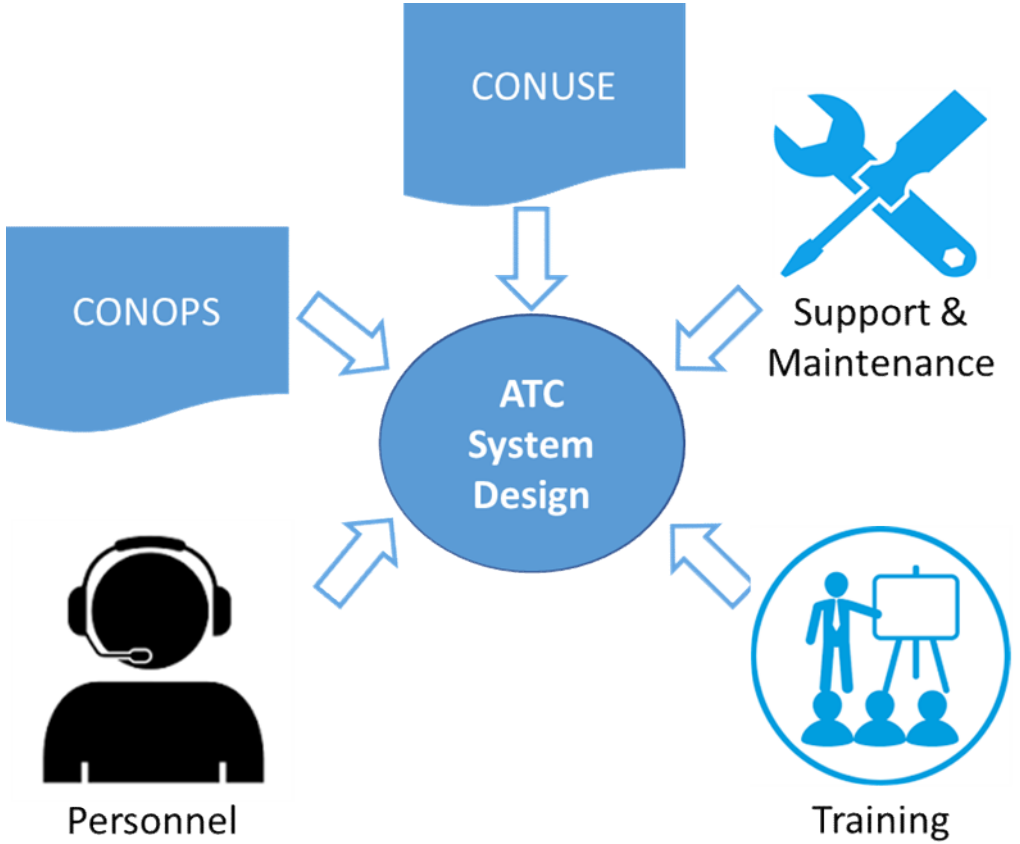
TopSKY (Thales)

ITEC (Indra)

1. Best practice: the application of design principles and standards

- Challenge 2: “Constraining System” vs. “Constrained System”





1. Best practice: the application of design principles and standards

- **Challenge 3**: The proliferation of COTS

Impacts

- Consistency
- Competition for users' attentional resources
- Commercial strategy & product roadmap

★ Configuration capabilities

2. Effective implementation of automation

Systemisation

Adaptability

Efficiency

Safety targets

Cost savings

System resilience

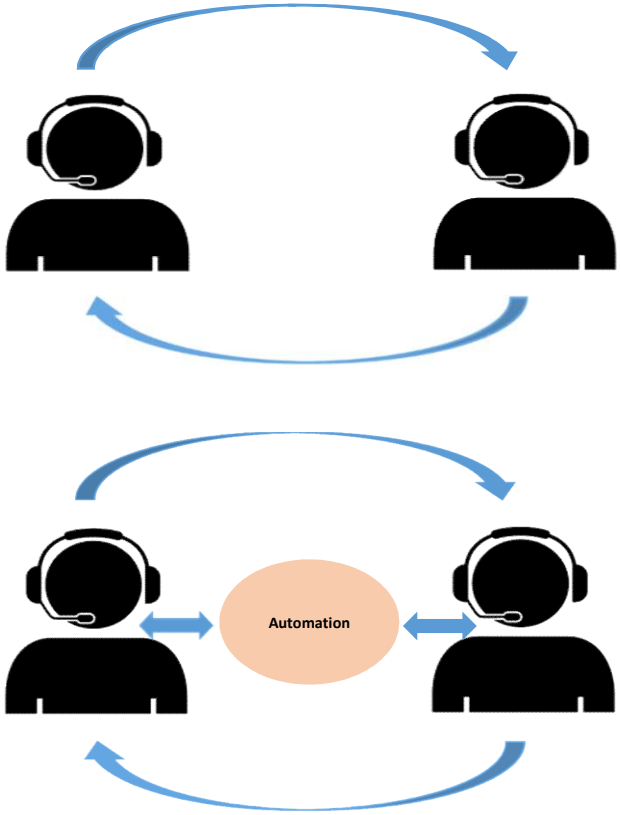
2. Effective implementation of automation

Transformation of the information acquisition process	The importance of subtle cues…and the impact of their loss	Methodological controlling vs intuitive controlling
Needs serious consideration during the system design	So, can we offer different cues or new memory aids?	Requires system flexibility!

2. Effective implementation of automation

Human-Agent Interaction
for joint activity

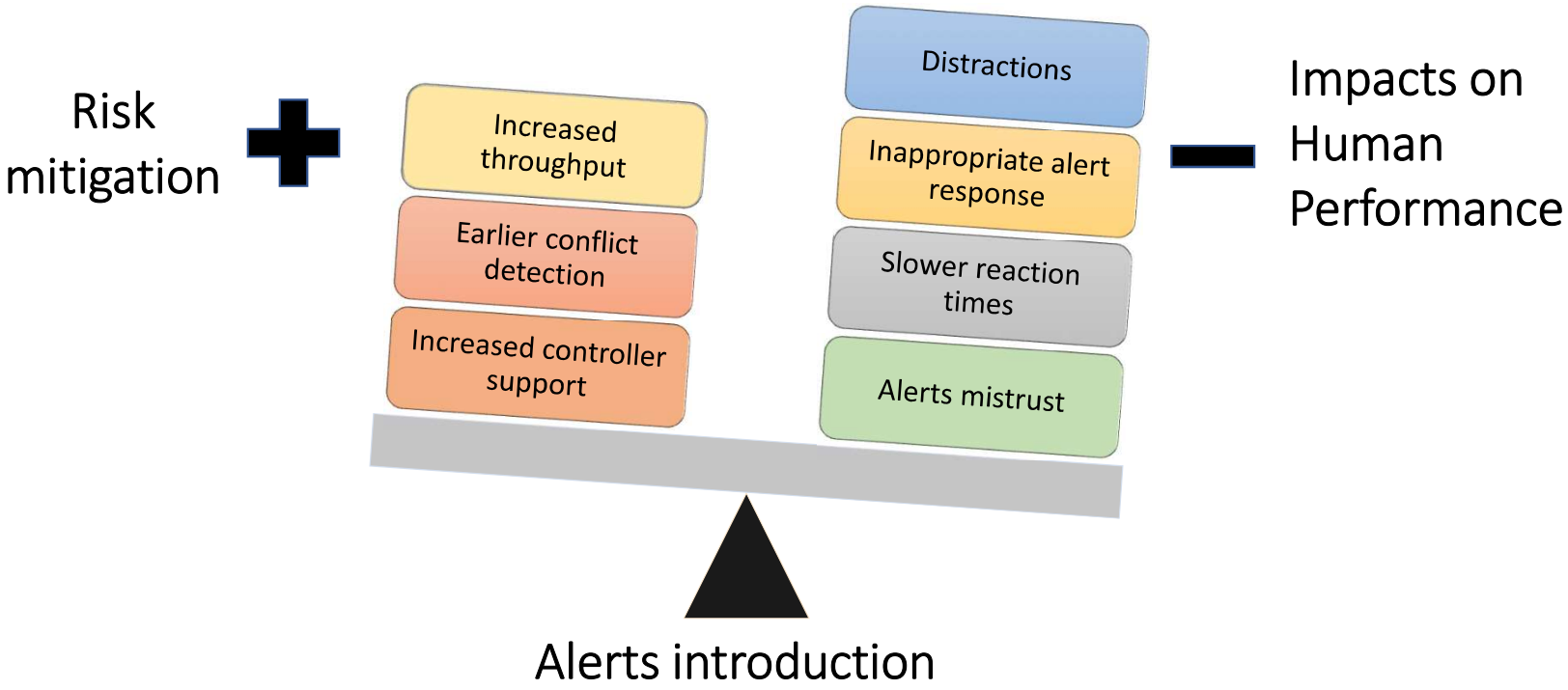
Transparency as a
system design goal



"People and machines have to communicate, co-ordinate, play together in intricate ways to meet the challenges or their domain"

Endsley, From here to autonomy: lessons learned from human –automation research (2)

3. The design of alerts



3. The design of alerts

Alerting Philosophy

A key element of the system design philosophy

Benefits:

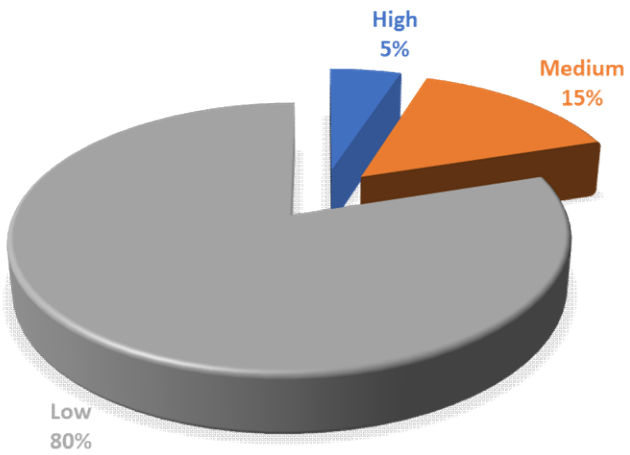
- Holistic perspective
- Governance
- Consistency
- Identification of latent issues
- Roadmap for future developments

Essential components:

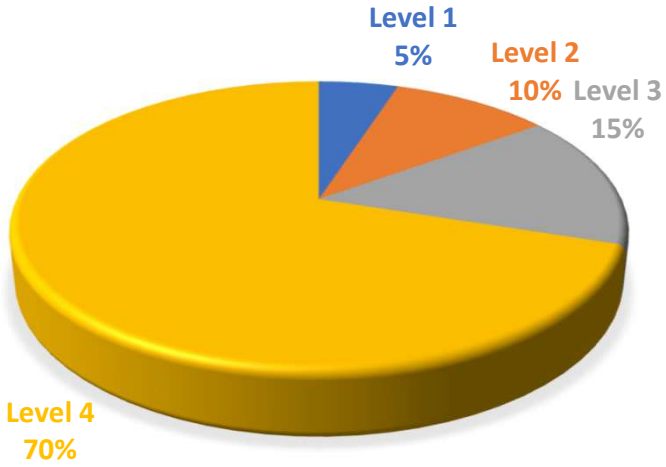
- Defining and bounding the scope
- Considering all different typologies
- Deciding on the classification criteria for their prioritisation.
- Considering systems technical performance.

Alerts distribution- From theory to practice

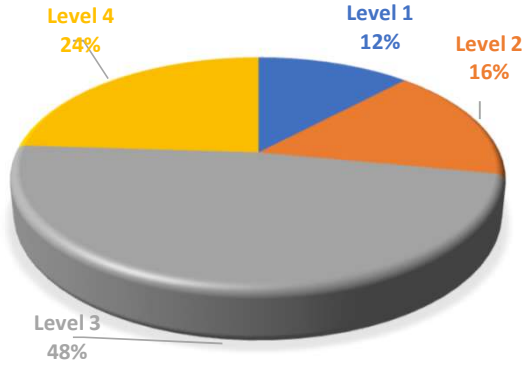
- Prioritisation guidelines from Alarm Design in Air Traffic Management, 2008, Eurocontrol

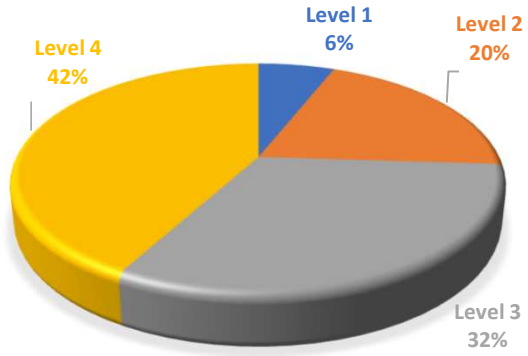


- Tailored prioritisation guideline



- Some real distribution results…





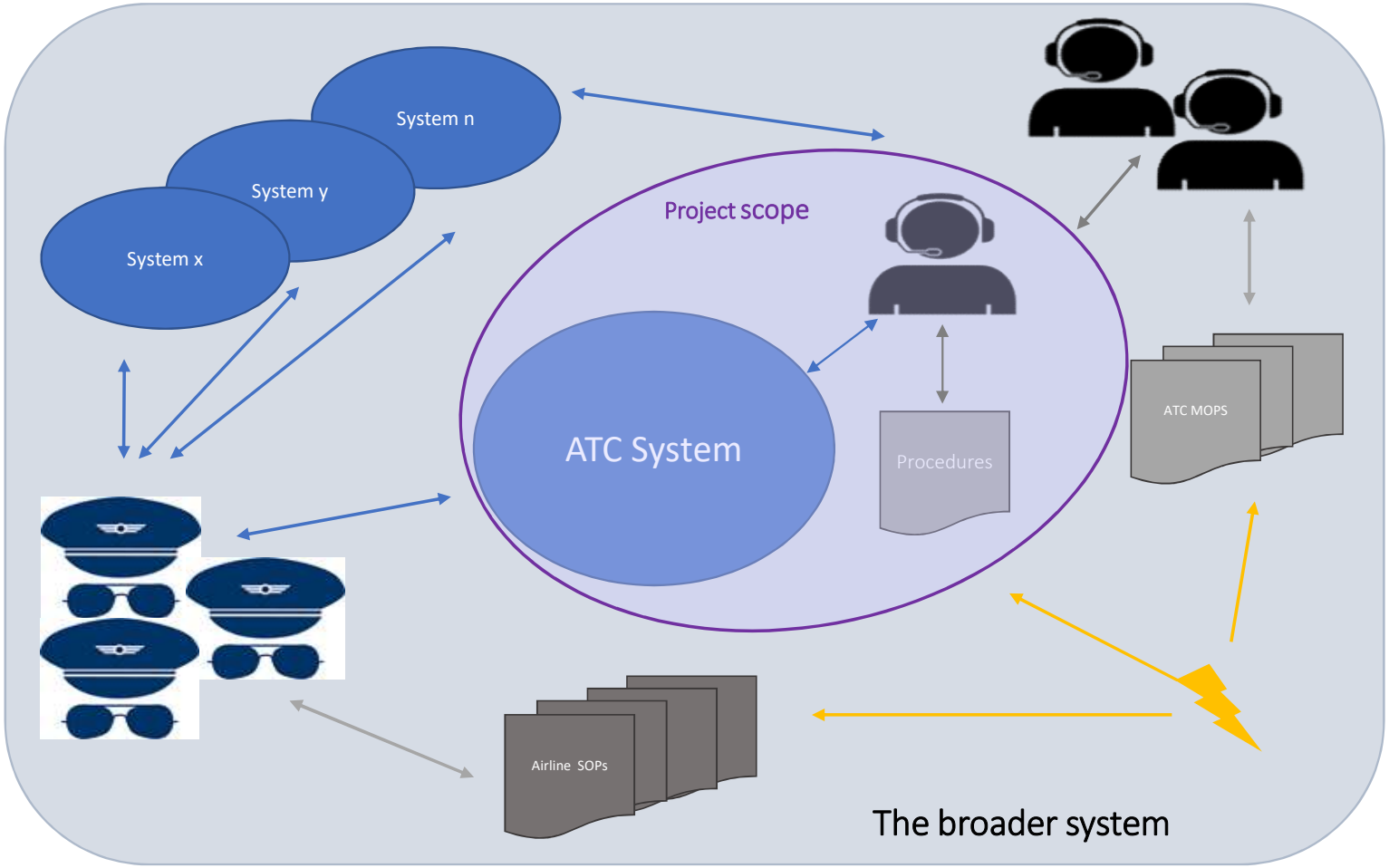
4. A broader approach to systems design

"Complex socio-technical systems are integrated human and machine entities that, when functioning as an integrated, coordinated unit, can address a wide range of problems that are too complex to be addressed by individuals or machines working alone"

Gorman, Cooke & Salas, Preface to the special issue on collaboration, coordination and adaptation in complex sociotechnical settings (3)

Systems Thinking for Safety: Ten Principles A White Paper Moving towards Safety-II, Eurocontrol (4)

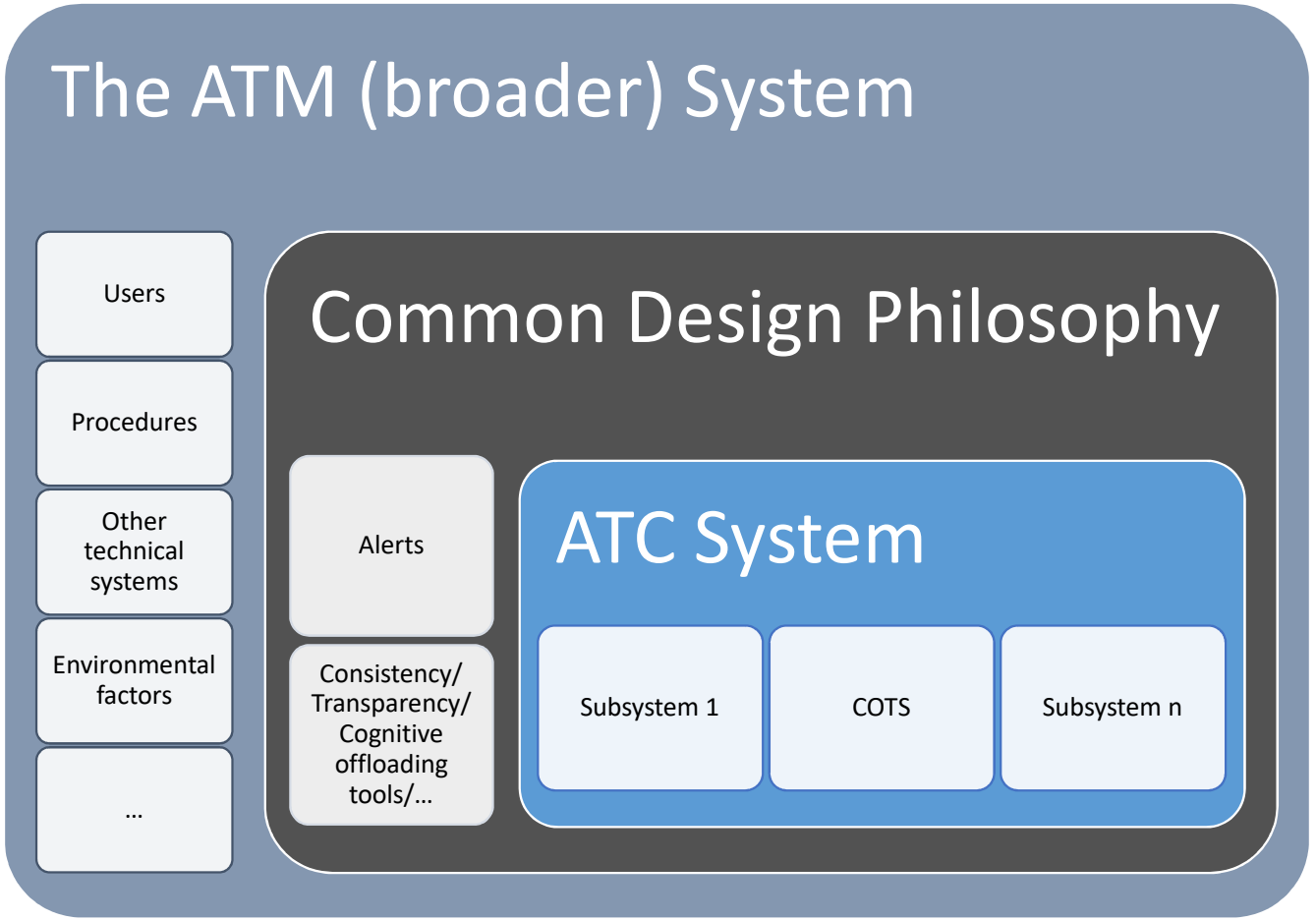
A real world example- The added value of applying Systems Thinking



5. Conclusions

*"For any interface to be effective, it must be implemented as part of an **integrated approach to systems design**. The **interface, decision support, automation**, training, selection, **alarms**, procedures and team collaboration all need to be designed in a coordinated manner using a **common philosophy**"*

Vicente, 2002, Ecological Interface design: Progress and Challenges (5)



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Thank you

Q&A session

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2. Endsley, Creating effective autonomous systems is thus dependent on the development of a successful approach to human-autonomy teaming - From here to autonomy: lessons learned from human –automation research, Human Factors, 59, 2017
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