

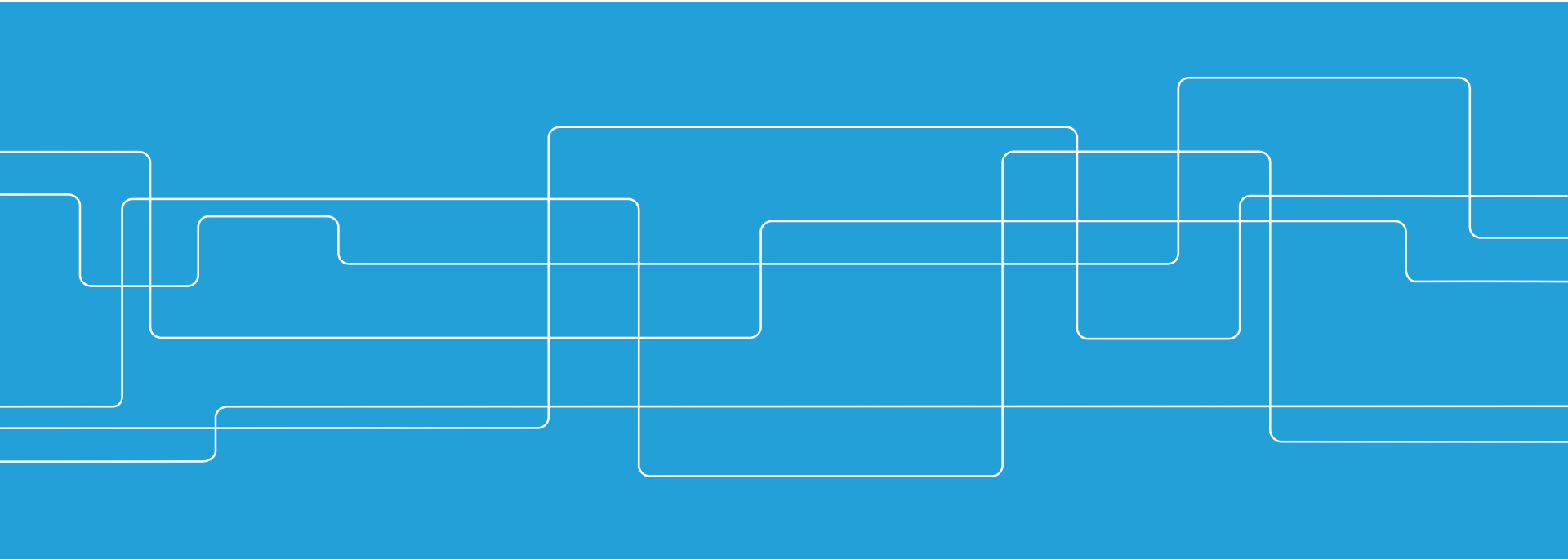


Safety management

**-practice and compliance in safety critical
product development and service production**

Pernilla Ulfvengren, INDEK, ITM, KTH

Docent – Industrial engineering - sociotechnical systems





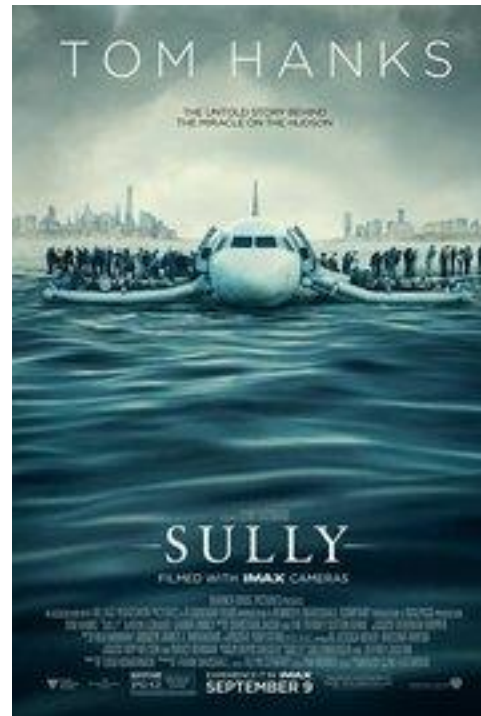
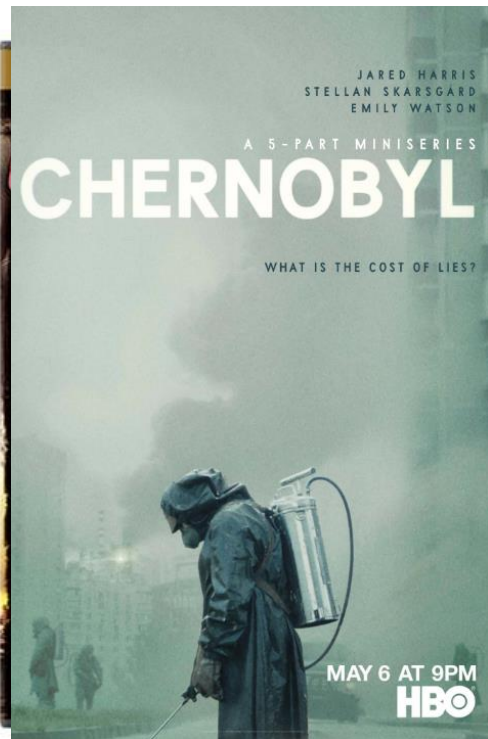
Introduction

Pernilla Ulfvengren – Industrial engineering and management, INDEK, KTH

- Mechanical engineer
 - PhD in Human-Machine systems
 - Industrial management – safety management
 - Docent Industrial engineering and sociotechnical systems
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- KTH partner in HILAS, MASCA, PROSPERO and ORION
Centre for Innovative Human Systems, TCD- Coordinating partner



Safety in socio-technical systems at the movies...





Assurance of system safety

- Identify risk and needs for improvement
 - be responsive to these indications and change system accordingly
- Assure that this change actually was implemented and had intentional effect,
 - as well as assure that change did not introduce new unanticipated risks.
- Increase safety in socio-technical systems
 - Or Socio-cyber physical systems



Human factors

- What is "human factors"?
- Good? Bad? Profession? Field or science?
- Why is it relevant for product developers and/or service providers?
 - Or CEO or chairman of the board...

We care about the small people...

<https://www.youtube.com/watch?v=th3LtLx0IEM>



Obligation to act?

Human factors arguments and evidence lacking?



What are Human factors fundamentals?

- A systemic view of the system of interest.
- Systems are sociotechnical.
- Assumption- a relation exist between humans and technology when they interact.
 - Effect on the overall system performance.
 - Undesired system performance results from the lack human factors integration in systems design.
- Relations and dependences between system components may only be possible to validate in part, but still verifiable.
- System performance data/operational data is used to validate design.



So, why is it relevant for product developers and/or service providers?

Because...

- 70% of (aviation) accidents are still claimed to be caused by human erroneous actions...?
- Time to change figure into 100%
 - if you look at a broader picture!
- Systemically and along the life cycle



Where is human factors in industry?

Wherever there is people...

People being not only users and operators:

Head of safety, engineers, risk analysts, auditing people, business people etc.

Organisations being not only service providers:

Manufacturers, tech developers, regulators, international organisations etc.



System of interest?

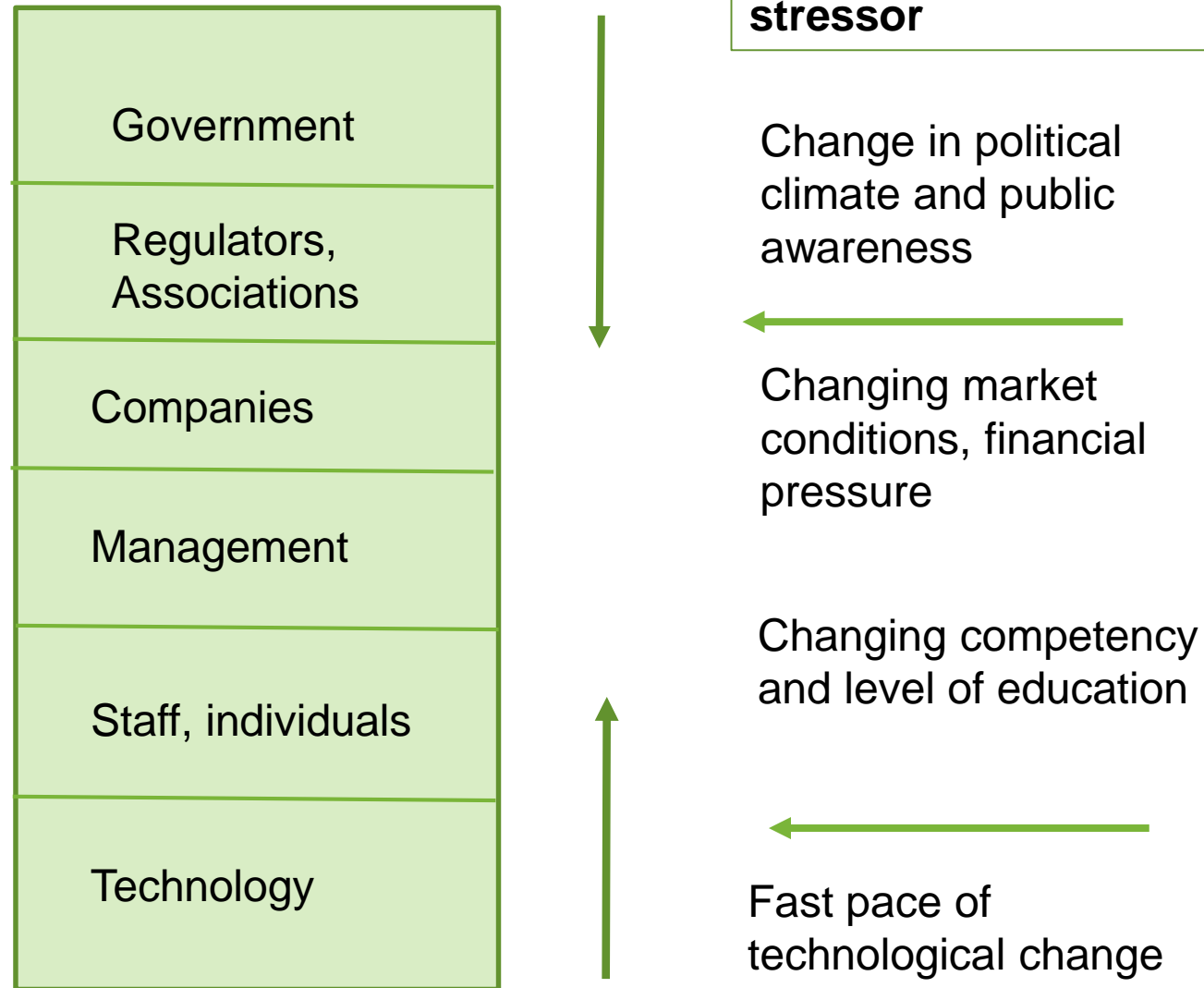
All system levels from individuals to system of systems

All life cycle stages.



System of interest continues...

- Human-technology systems
- Work systems
- Organizational design and management (ODAM)
- Single firms:
 - technology developers or service providers and users
- Firms in the same life cycle:
 - technology developers **and** service providers
 - engineers and operators
- Network of actors, inter- and intra organisational
 - Airline groups, or air transport system
- Regulators, policy makers
- Politicians



SYSTEM LEVEL MODEL (source Rasmussen, 1986)
Socio-technical system involved in risk management



Research discipline

Political science,
economics, sociology,
law

Economics,
organizational sociology

Industrial engineering,
management,
organization

Psychology, human
factors, human-
machine interaction

Mechanical-
electrical-, chemical
engineering etc...



Environmental stressor

Change in political
climate and public
awareness



Changing market
conditions, financial
pressure



Changing competency
and level of education



Fast pace of
technological change



SYSTEM LEVEL MODEL (source Rasmussen, 1986)
Socio-technical system



Research in EU-projects

All coordinated by Trinity College Dublin

Centre for Innovative Human Systems, School of psychology



HILAS (EU-FP6) 2005-2009

- Human Integration into the Lifecycle of Aviation Systems



MASCA (EU-FP7) 2010-2013

- MAnaging System Change in Aviation



PROSPERO (EU-FP7) 2012-2014

- Proactive safety performance in operations



ORION (Erasmus) 2019-2020

- Operational risk: Implementing open norms



The Human Role in Aviation – An overview of the HILAS project



Human Integration into the Lifecycle of Aviation Systems

The HILAS Project



- Large scale research and development project funded (in part) by European Commission
- 39 partners in 13 European countries + Israel & China
 - Manufacturers
 - Airlines
 - Maintenance organisations
 - Research institutes, universities
 - RTD companies
- Critical mass to **transform** HF capacity in aviation
- Initiated 1st. June 2005 to last 4 years

Why do HILAS?



- Operations (flight and maintenance)
 - Improvement in safety and operational efficiency
 - Organisational processes to manage change
- Design
 - New systems meet human needs
- Regulation
 - More effective oversight over aviation system
 - Promote learning between organisations
- Science
 - Data on how the operational system really works
 - Organisations comprise both cultures and functional social systems

What is HILAS?



Airline Flight
Operations



Aircraft
Maintenance

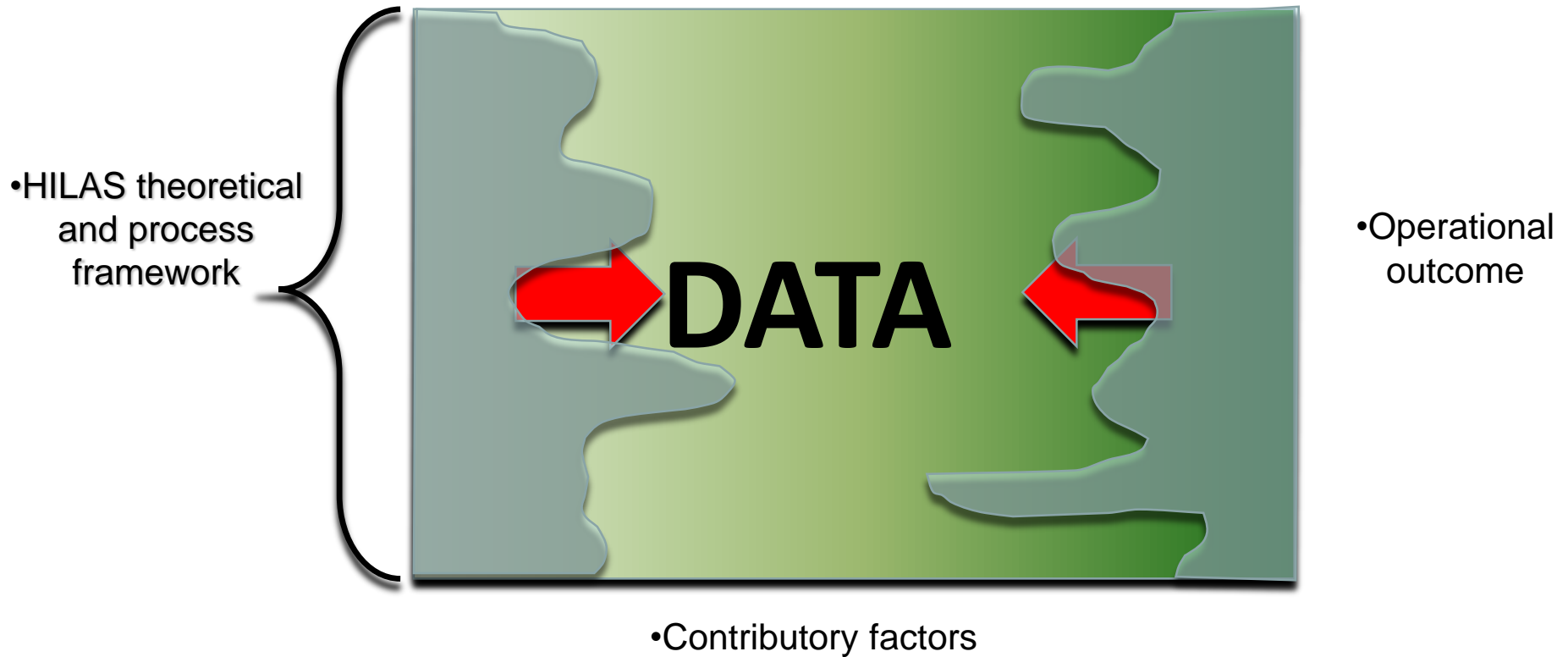


Aviation Systems
Design

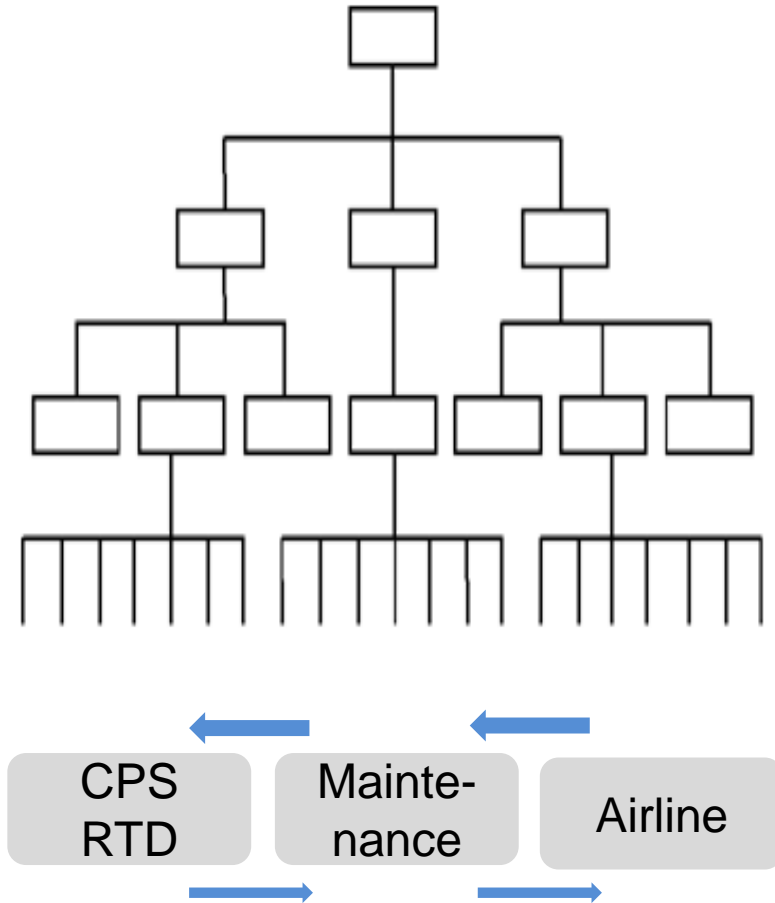
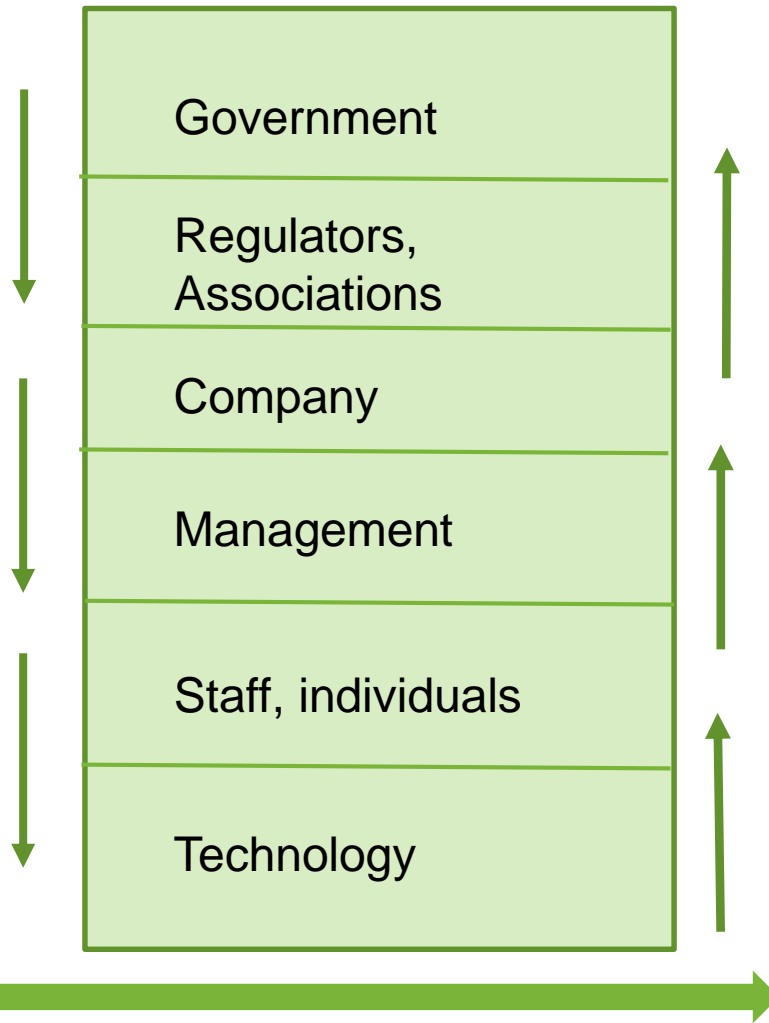
Three sets of processes:

- Managing performance, risk and change in flight operations and aircraft maintenance
- Human factors evaluation of new technologies and applications
- Inter-organisational learning and innovation

Data and key indicators



Feedback and support – Risk information flow





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- **MANaging System Change in Aviation**



PROSPERO (EU-FP7) 2012-2014

- Proactive safety performance in operations



ORION (Erasmus) 2019-2020

- Operational risk: Implementing open norms



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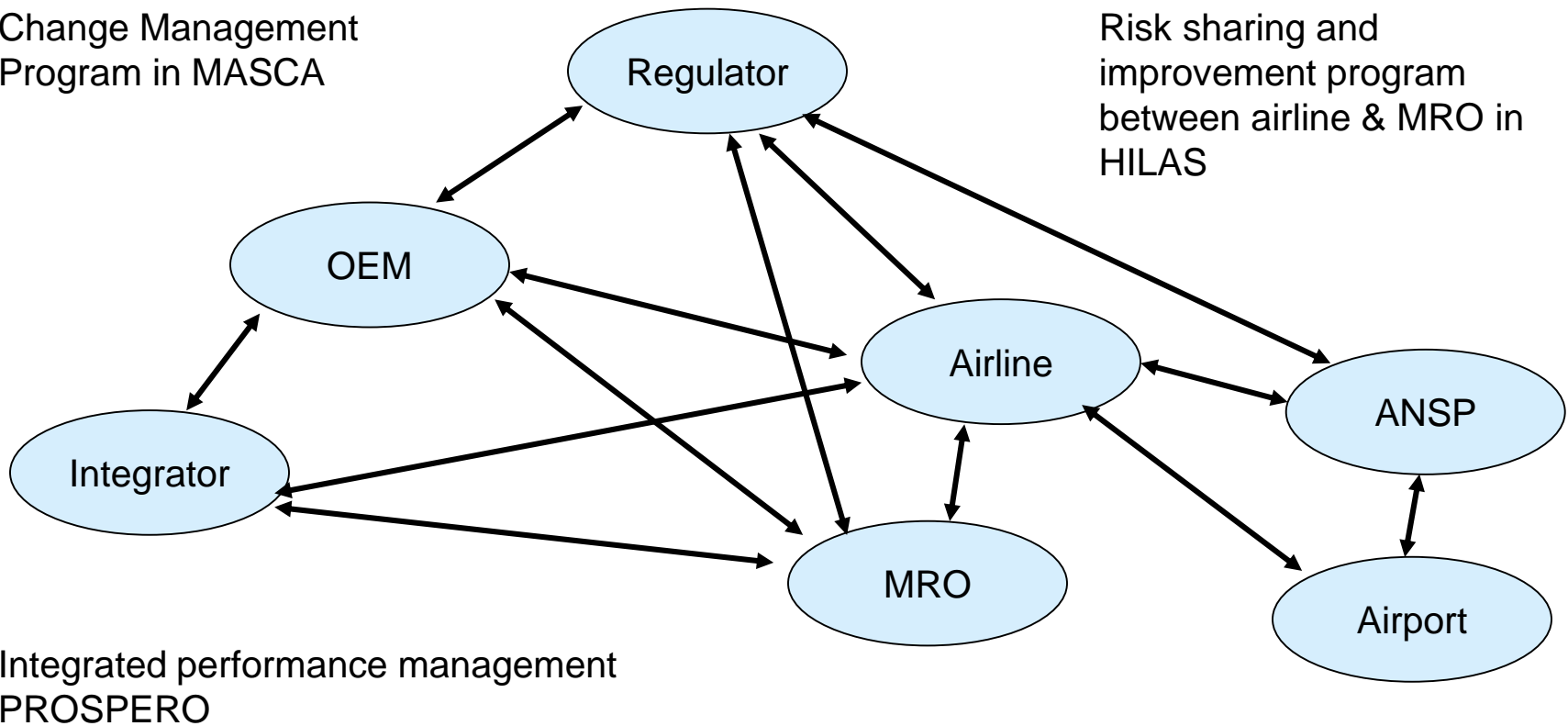
- Operational risk: Implementing open norms



Managing Knowledge about operational risk across the Lifecycle in a Network?

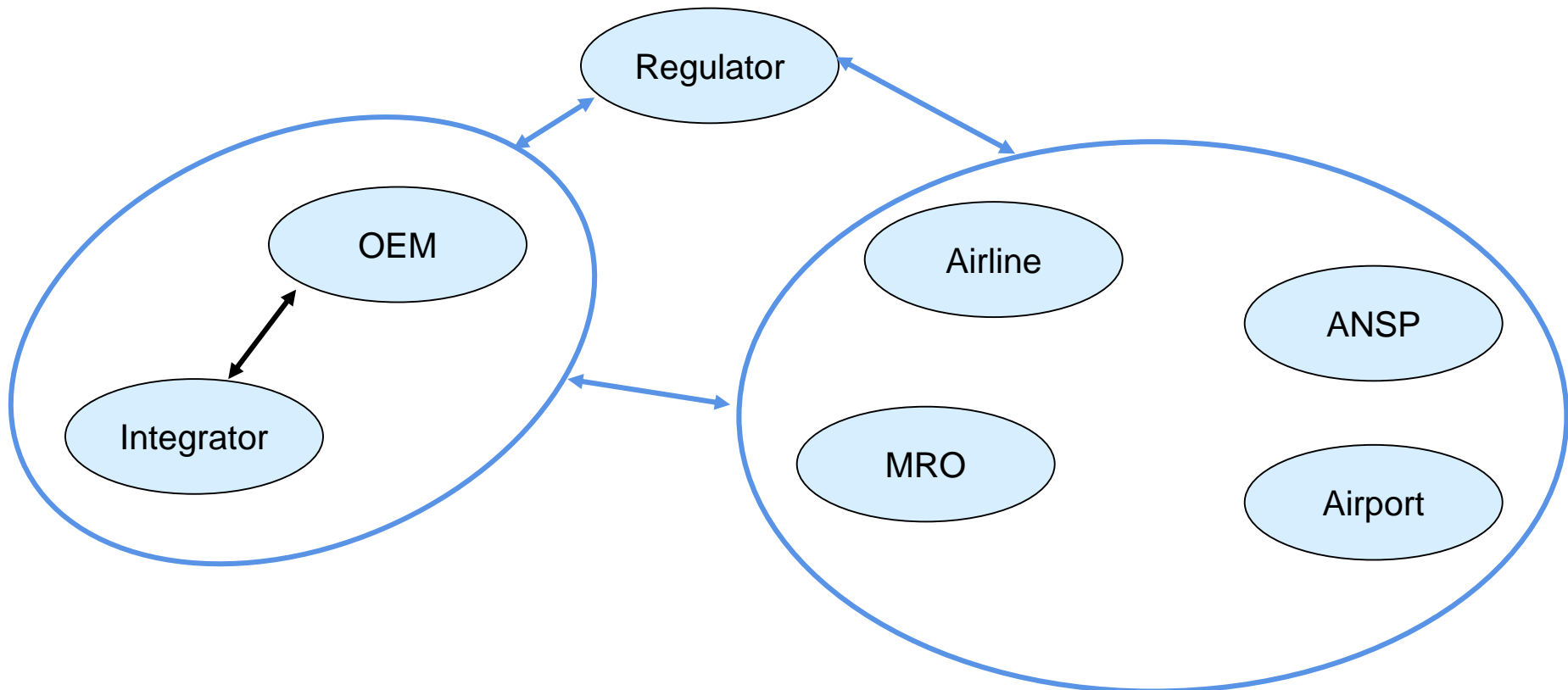
Change Management Program in MASCA

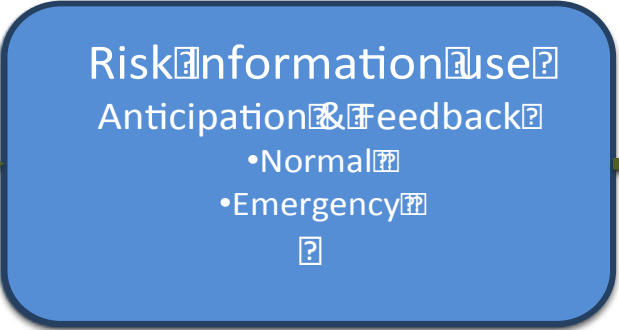
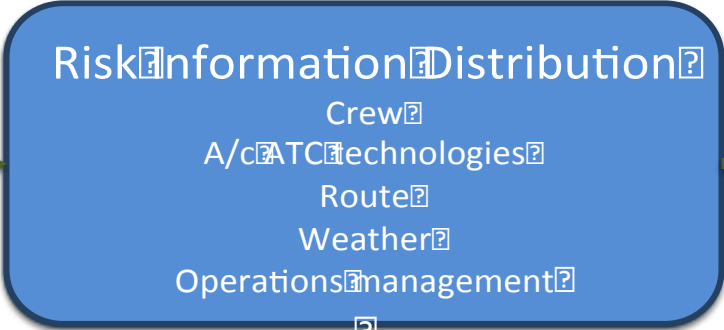
Risk sharing and improvement program between airline & MRO in HILAS



Integrated Lifecycle Concept

Design, operate, manage, maintain and regulate an integrated aviation system

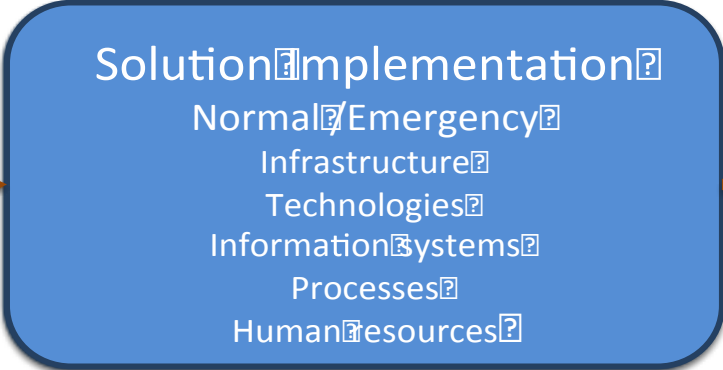
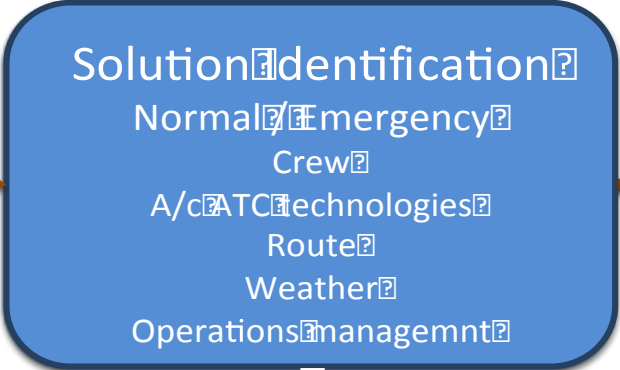


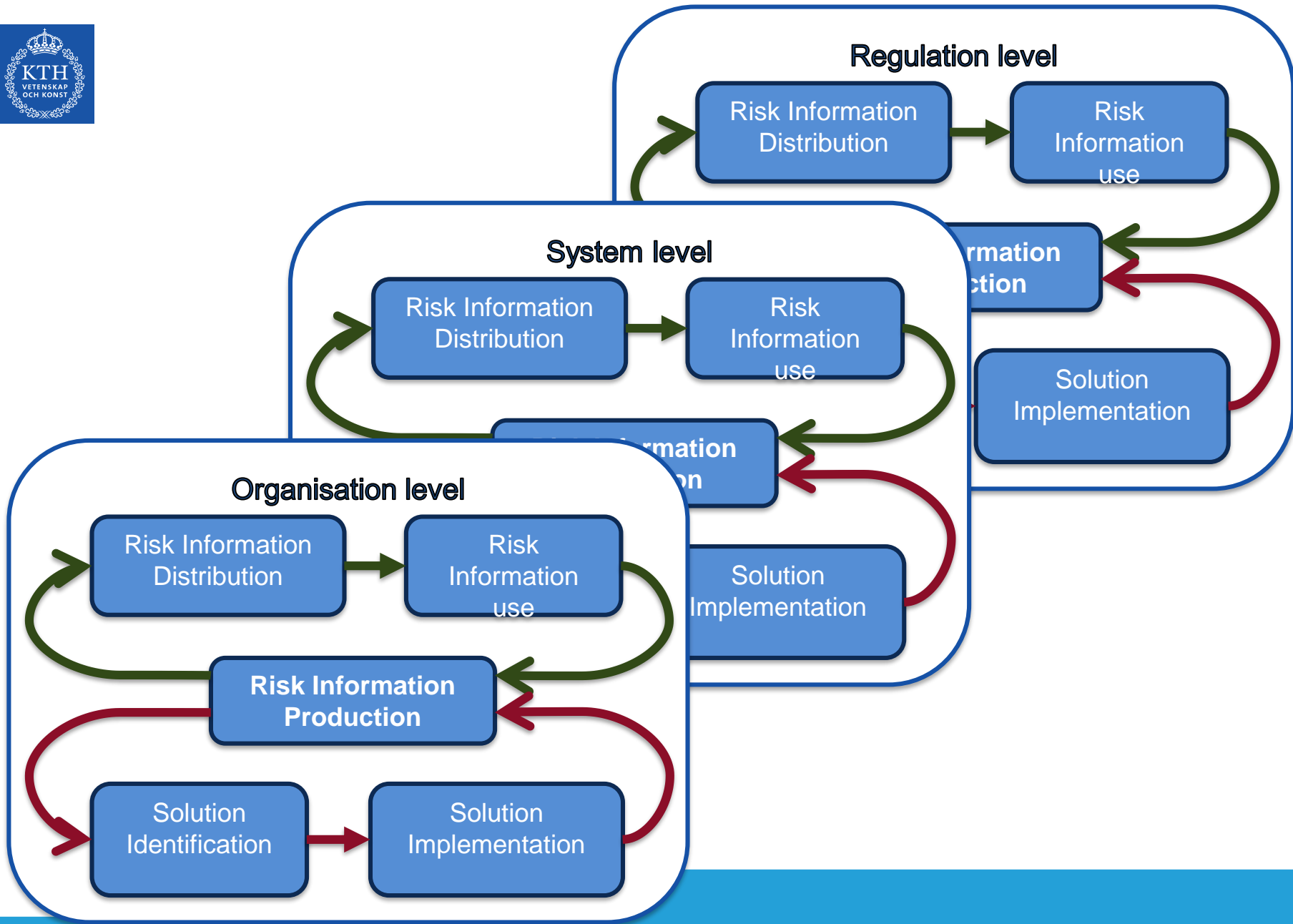


Operational Risk Management Loop



System Change Loop







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SMS standard terminology (ICAO, 2014)

Safety policy and objectives:

- Management commitment and responsibilities;
- Safety accountabilities;
- Co-ordination of emergency response planning;
- SMS documentation

Safety risk management

- Hazard identification
- Risk assessment and mitigation

Safety assurance:

- Safety performance monitoring and measurement;
- Management of change;
- Continuous improvement of the SMS

Safety promotion:

- Training and education;
- Safety communication

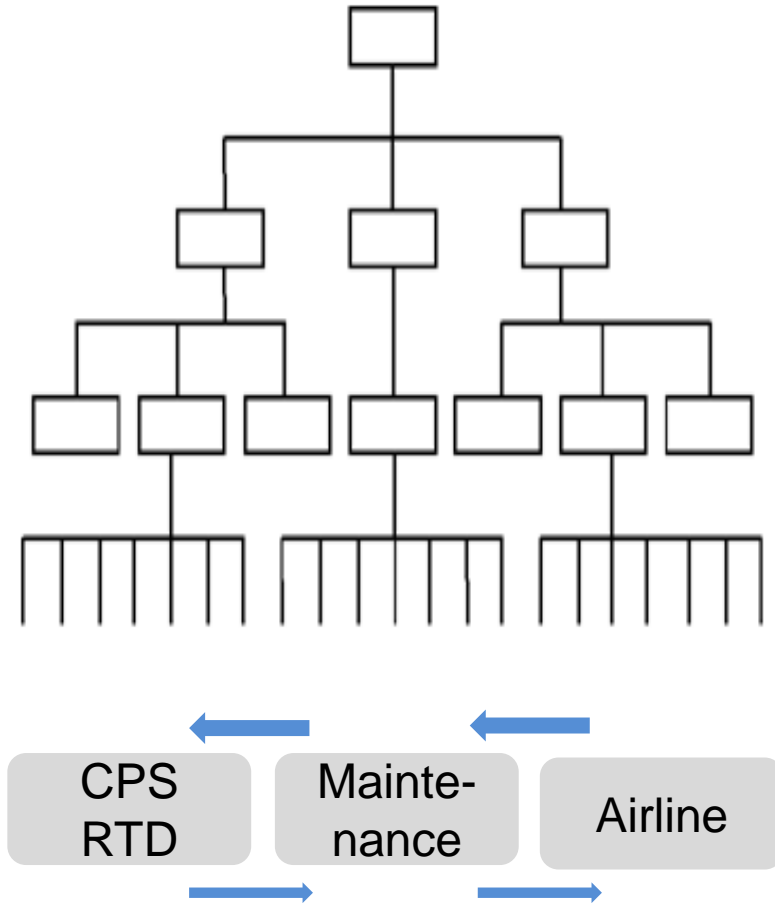
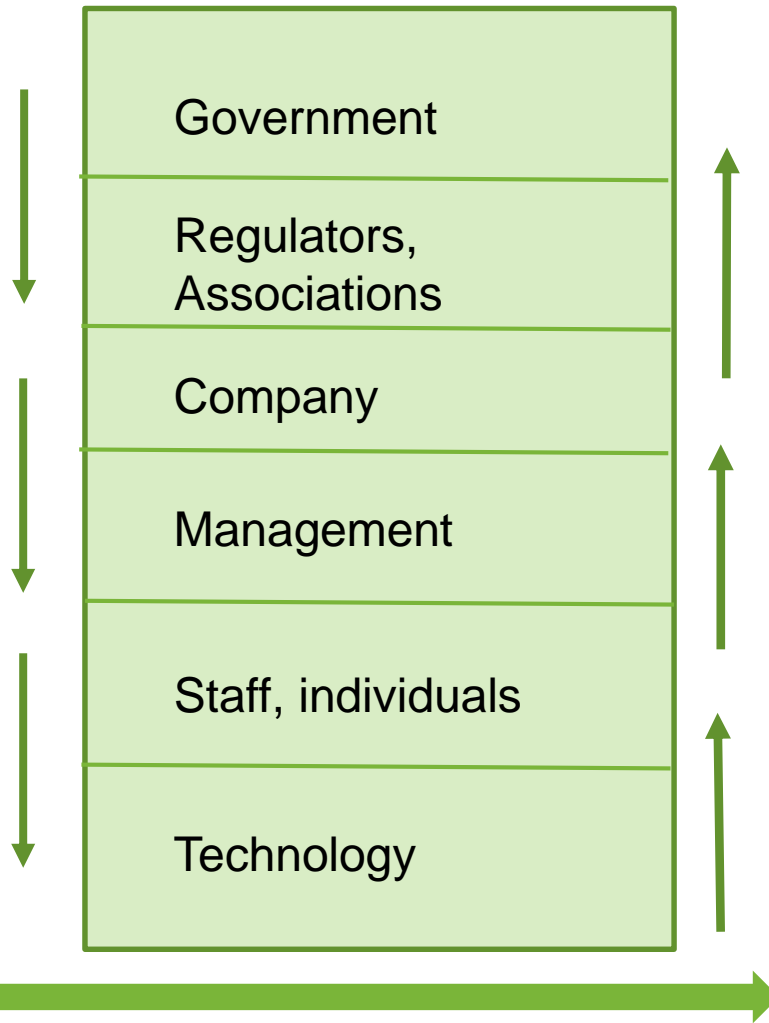


Approach – training of human system

Fully implementing safety management system (SMS) that demonstrate safety performance.

- Challenge to make the transition from SMS ‘on paper’ to living it on day-to-day basis.
- This does not happen spontaneously and requires focused attention on the ‘soft’ side of managing people and fostering organisational culture.

Feedback and support – Risk information flow





Move up in the life cycle of operational risk

HILAS – Human integration into the life cycle of aviation systems

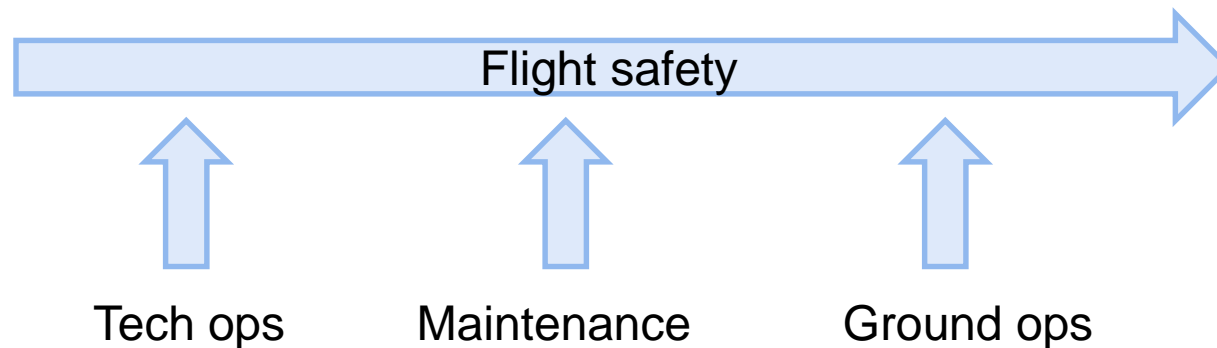
Airline operational areas

Flight operations – flying and supervisory control

Ground operations – cargo, loading, interacting with a/c

Technical operations – developing individual service handbook

Maintenance operations – delivering service accordingly





New system boundaries – new people

Engineers in technical operations

- Not commonly targeted as operators in the system?
- Reporting systems?
- Risk management? (events analysis in their work)

- Today mistakes are captured reactively from flight ops data or from maintenance.

- To move up in life cycle and include more people is a more proactive approach.



Include new people (add to the 70%)

- Operational process as a sociotechnical system
- Management processes as a sociotechnical system
- Operators as a source for know-how and performance and managing operational risk (managing the ...they got)
- Engineers in technology firms the same?



Engineering systems

Re-thinking about system

Re-visioning perspective

- Levels of analysis
- Life cycle perspectives
- Angles of analysis

Scale – Function – Structure - Temporality

Think bigger and further?





Thank you!

