Human Authority and Systems Autonomy in Systems of Systems

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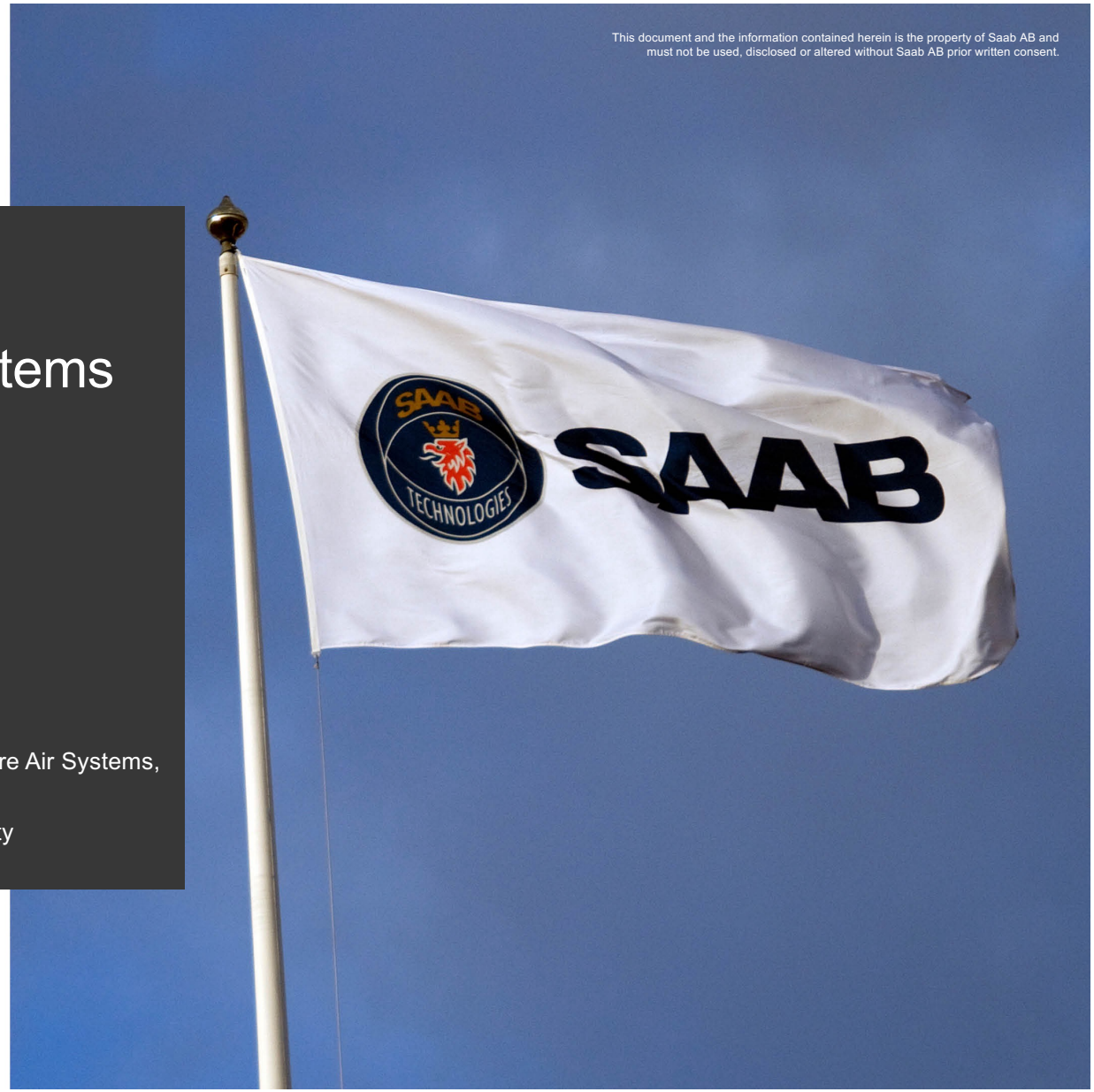
Gunnar Holmberg

Director Business Development, Future Air Systems, Saab Aeronautics

Adjunct professor, Linköping University



System of systems

Definition: a set of systems that interact to provide a unique capability t… of its constituent systems (technical, human or organizational) can a… own (ISO 21841)

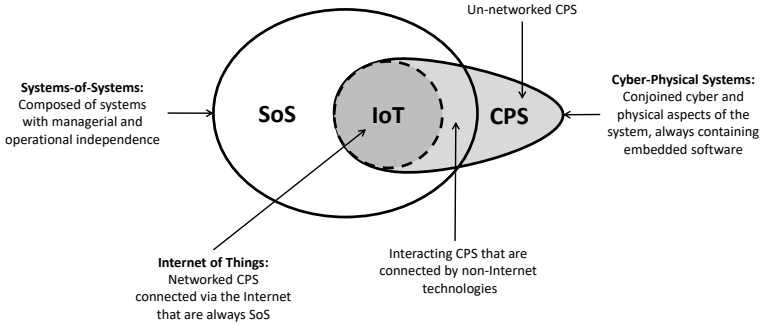
Characterisation: Operational inde… ary development, Emergent beh…

Related t…
IoT (Hens…
Complex i…

”This paper … cyber-physic… originating fr… considerable c… (Henshaw 2016)

- … ems,
- … things. Although … and perspectives, there is … ence of the three concepts…”

System of systems is an approach that compared to a System with the same scope Strive to allow more rapid response to new needs and context dynamics Make better use of resources



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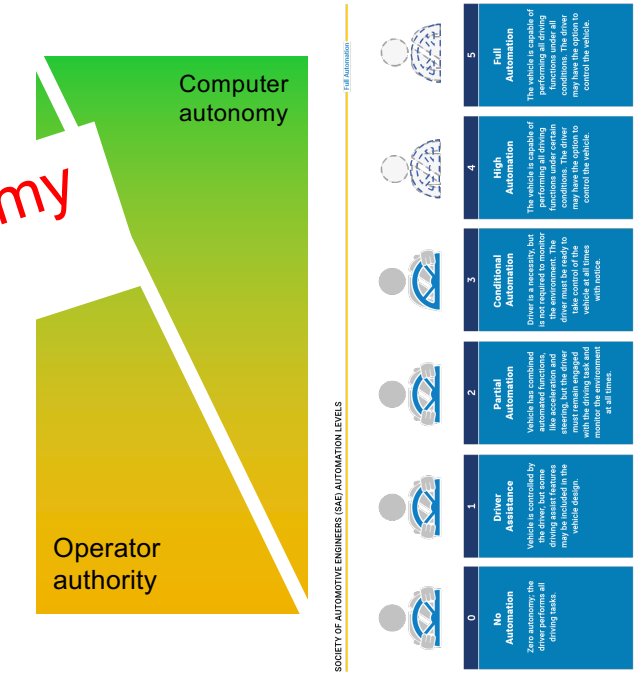
Human authority and Systems autonomy

	Operator authority		Computer autonomy
Automatic	Interrupt	5	Full computer autonomy
Direct support	Revoke action	4	Acti…
In support	Accept adv… Auth…		
Advisory			Advice
At call	…nly on request	1	Advice only if requested
Commanded	Operator full authority (action)	0	Support action

Could the use of systems autonomy increase human authority?



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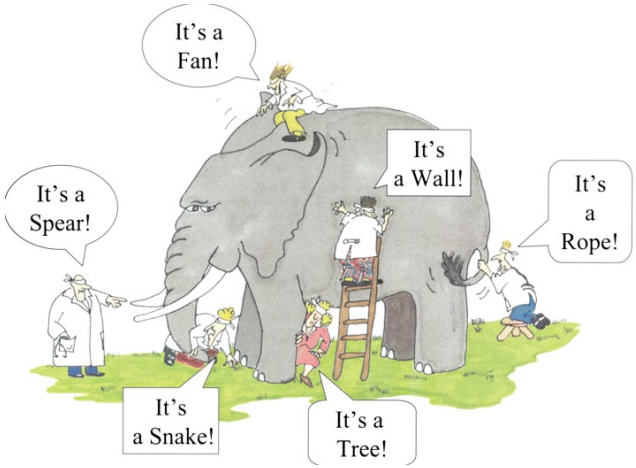
www.sae.org Taxonomy and Definitions for Terms Related to Driving Automation Systems for On-Road Motor VehiclesJ3016_202104

Presentation outline

Context



Temporality

Incompleteness

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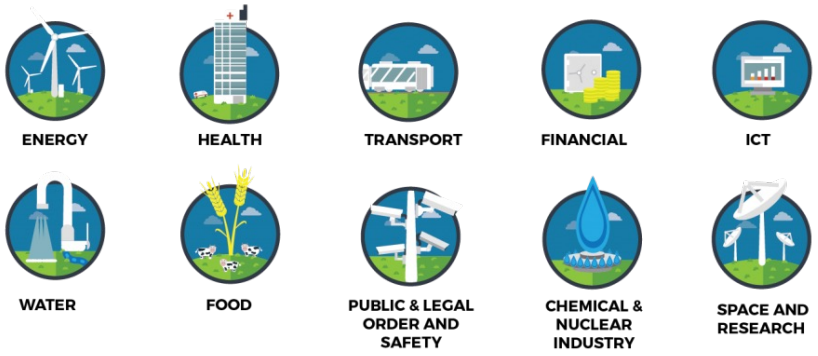
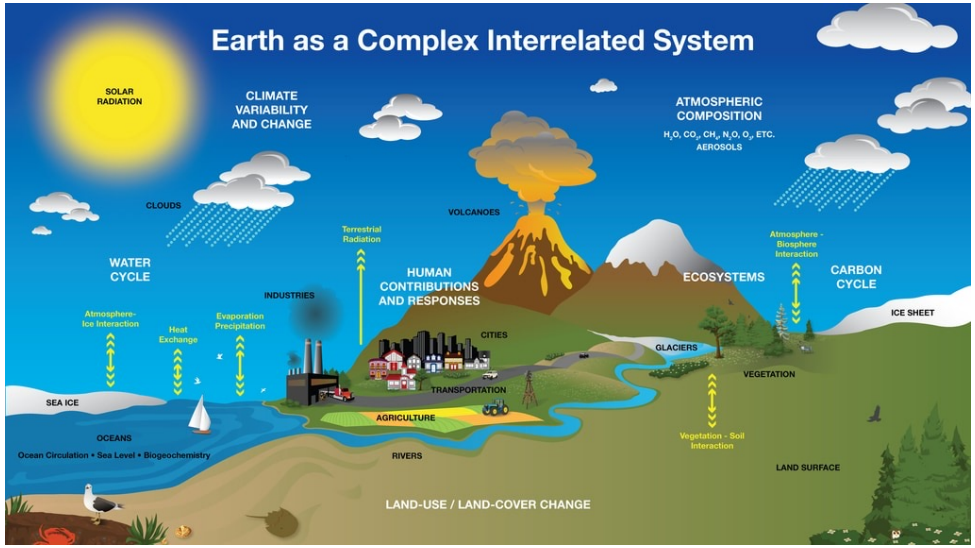
Shaping a future with AI-
Benefits from AI are mainly expected in complex settings of complex products and systems





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The example of Air Traffic management

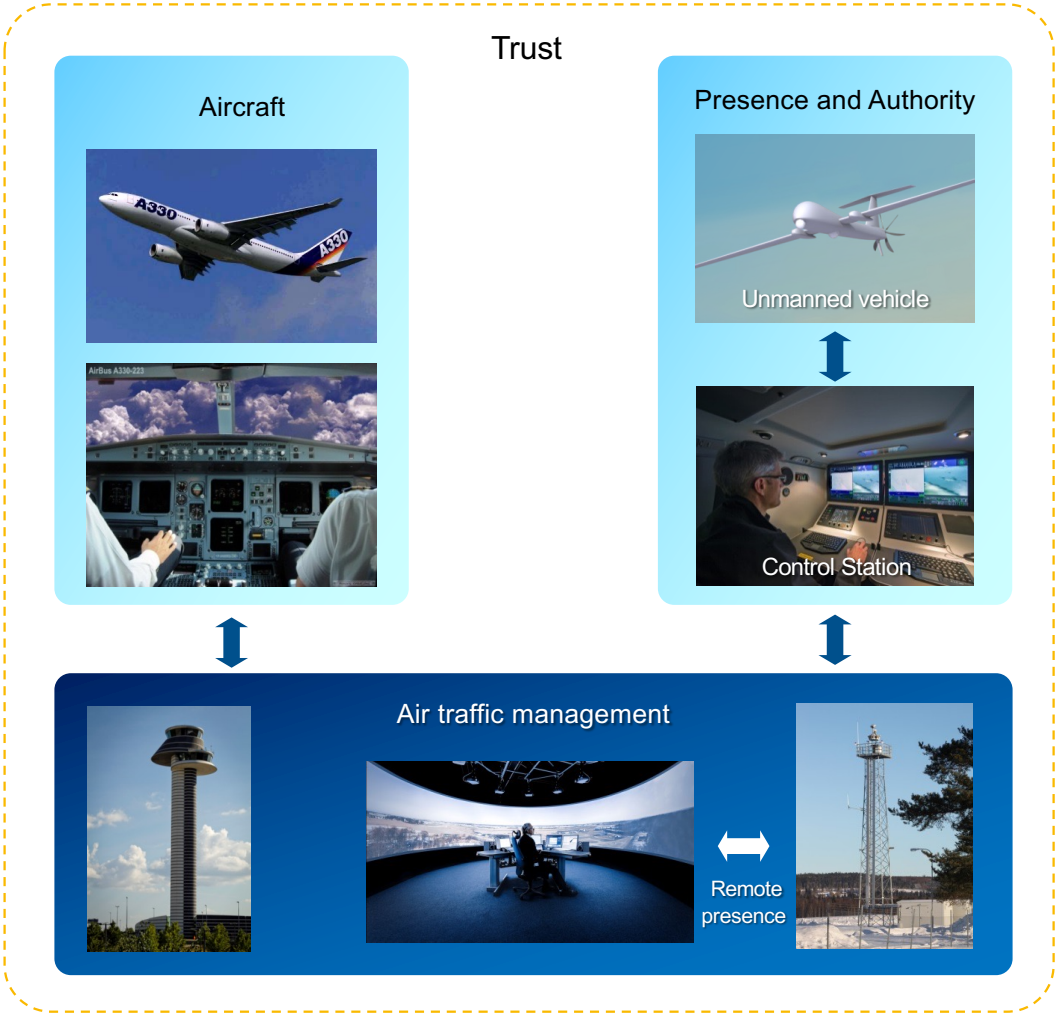
Authority and Autonomy

Both manned and unmanned systems could benefit from autonomy. Remotely operated systems could use remote presence together with various degree of autonomy support:

- Remote tower is based on remote presence and has potential for improvements using autonomy, e.g. enhanced reality
- RPAS needs autonomy for e.g. Sense and Avoid in order to operate safely without exhausting operator quickly

Key aspects include:

- Trust
- Presence
- Authority
- Safety
- Security
- Liability

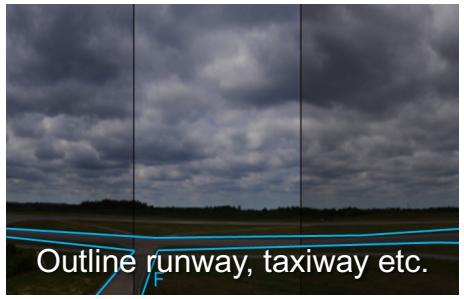


The example of Air Traffic management

Remote tower

Enables air traffic services to be provided more efficiently for any airport, from any location. ”Be where you want, act where you are needed”

Certified for remote presence, with possibility to augment capability.



Everyone has the Right to be Safe

Future Public Safety Systems

- Challenge to master complexity of systems of systems and diversity of potential missions
- Intelligent systems with a high degree of autonomy interacting with humans
- A mix of heterogeneous manned and unmanned systems
- Situation awareness and readiness based on networking systems
- Use of resources developed for other purposes
    - Monitor situation
    - React for unusual situations and alarms
    - Start to act quickly on limited info with limited resources
    - Adjust collaborative reaction as situation understanding grows and resources are added
    - Prioritize among many urgent missions

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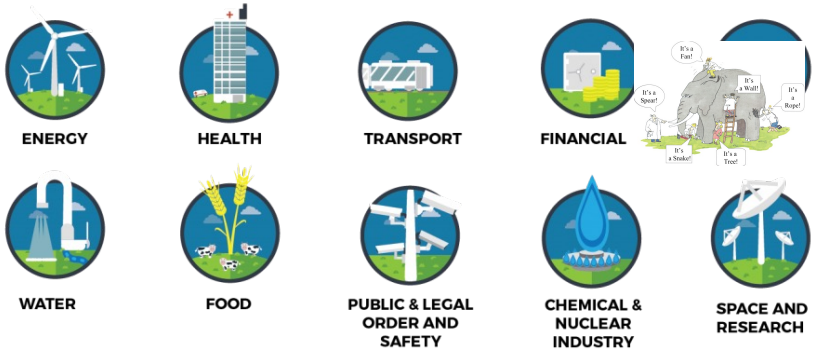
WASP Demo Arena WARA-PS

Collaborating humans and autonomous systems of systems with intense interactions and sliding combinations of human authority and systems autonomy



Represents needed solutions and challenges for future systems of systems

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Three time horizons of design-car transport

	Design Space	Context	Characteristics	Authority- Autonomy
Real time to minutes	Drive 	roads, traffic, weather, obstactles	Reactive and evolutionary Time critical, intuitive, rapid and bounded	Role of driver dependent on degree of automation and complexity of situation
Minutes to hours	A to B transport 	time, experience and data on routes, weather, traffic	Planning and replanning, Evolutionary	Driver often selects among options
Years to decades	Mode of transport- having a car available 	Selecting car type and ownership	Strategic and planned Design decisions continuously adapted	N/A Mainly potential contribution from analysis data during selection
	Long term design spaces, e.g. cars, road and transport system, regulations..		Designing a partly unknown future	N/A

Design spaces and incompleteness

- Incompleteness: the remaining design needed to perform a task with the system
- A possible typology for incompleteness for complex systems with AI
  - System incompleteness- complemented by human authority
  - Task incompleteness- lacking definition of what is to be performed
  - Contextual understanding incompleteness- limited definition or understanding of the context
  - Human authority incompleteness- variation and unpredictability of human behaviour

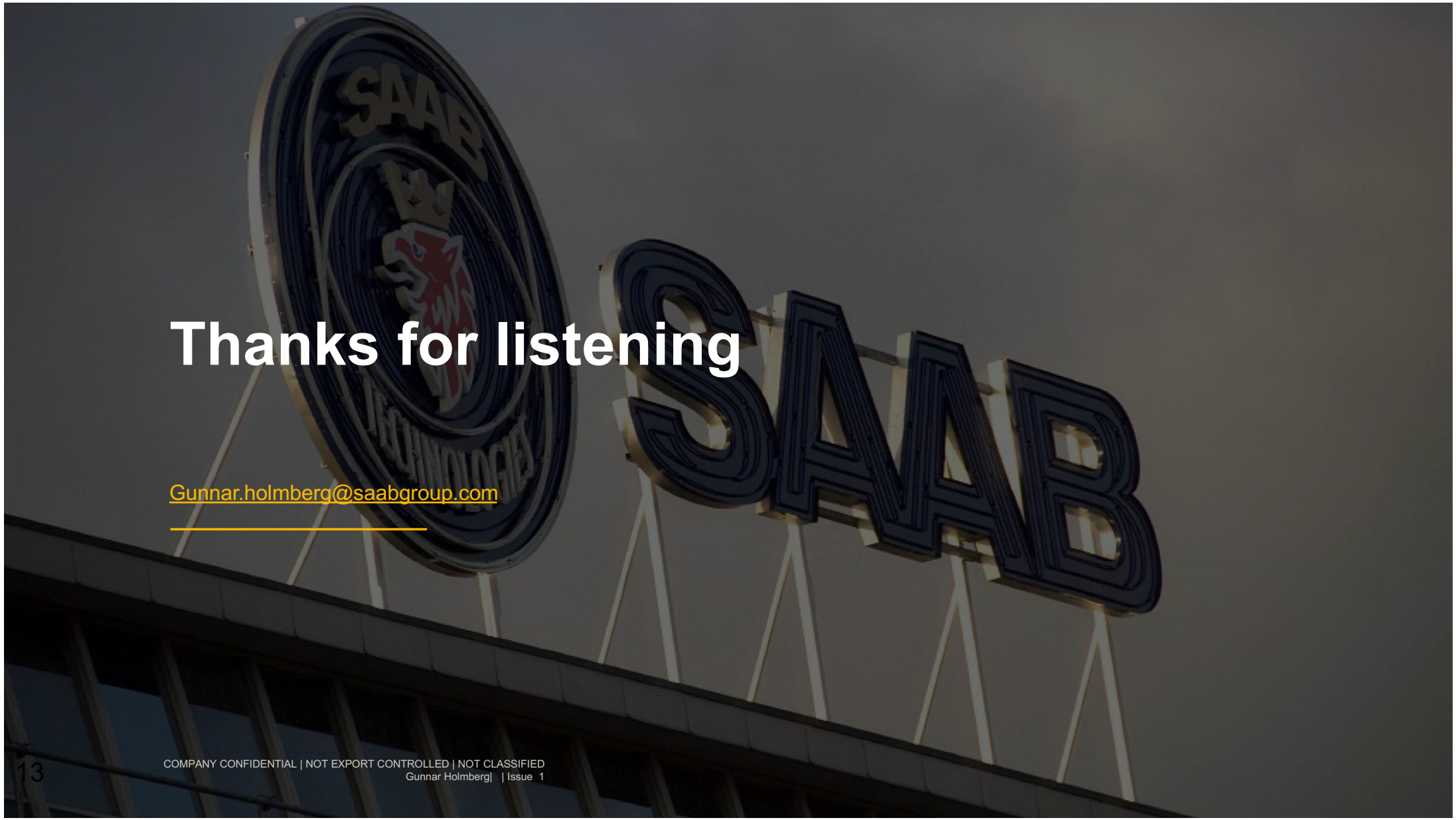
Human Authority and Systems Autonomy in SoS

- Complex systems are becoming increasingly intelligent and require considerations of a dynamic context
- System of systems has the potential to enable more efficient responses to context dynamics

- Temporality and evolution offer challenges like time for development, maturity of technology and context evolution
- System of Systems enable strategies for dealing temporality, allocating functions to constituent systems vs SoS level combining novel and legacy systems

- Incompleteness reflects the remaining design needed to perform a task with a system.
- System of Systems enable preparing the use of a system in a partly unknown scenario by combining human authority and systems autonomy adaptively

SAAB TECHNOLOGIES SAAB



Thanks for listening

Gunnar.holmberg@saabgroup.com