



Liability and automation in ATM

Giuseppe Contissa



ALIAS Project (addressing liability impact of automated systems)

- Who is responsible for accidents in highly automated systems?
- How do we apportion liability among the various participants in complex socio-technical organisations?
- How can different liability regulations at different levels (supranational, national, local) be harmonized?



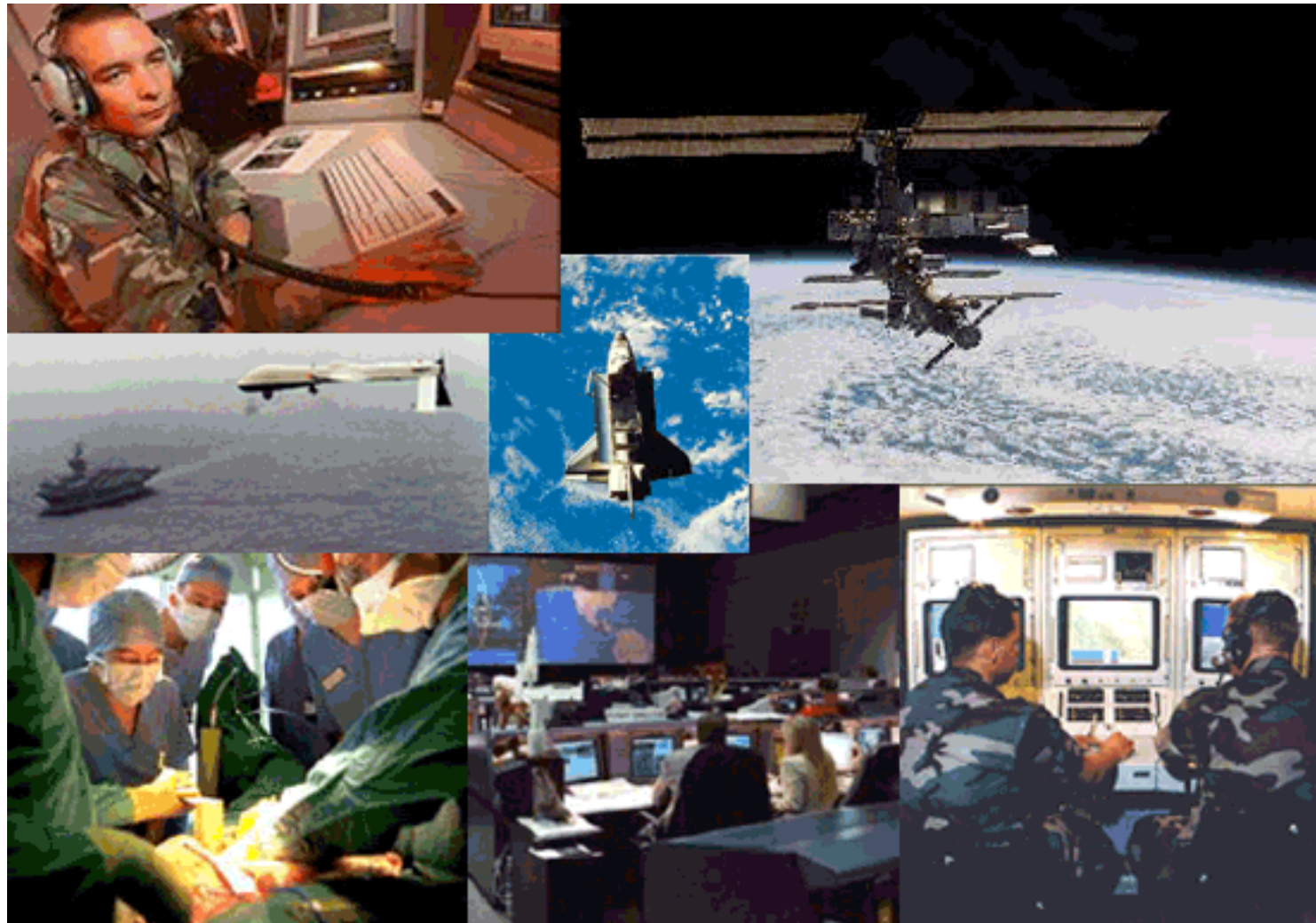
The future of ATM

- In the current operational scenario of Air Traffic Management (ATM), liability is mainly allocated to the operators
- In the time horizon of SESAR, that is over the next 30 years, a new generation of air traffic management systems will be developed.
- Such systems will be highly automated. They will make choices and engage in actions with some level of human supervision, or even without any such supervision.



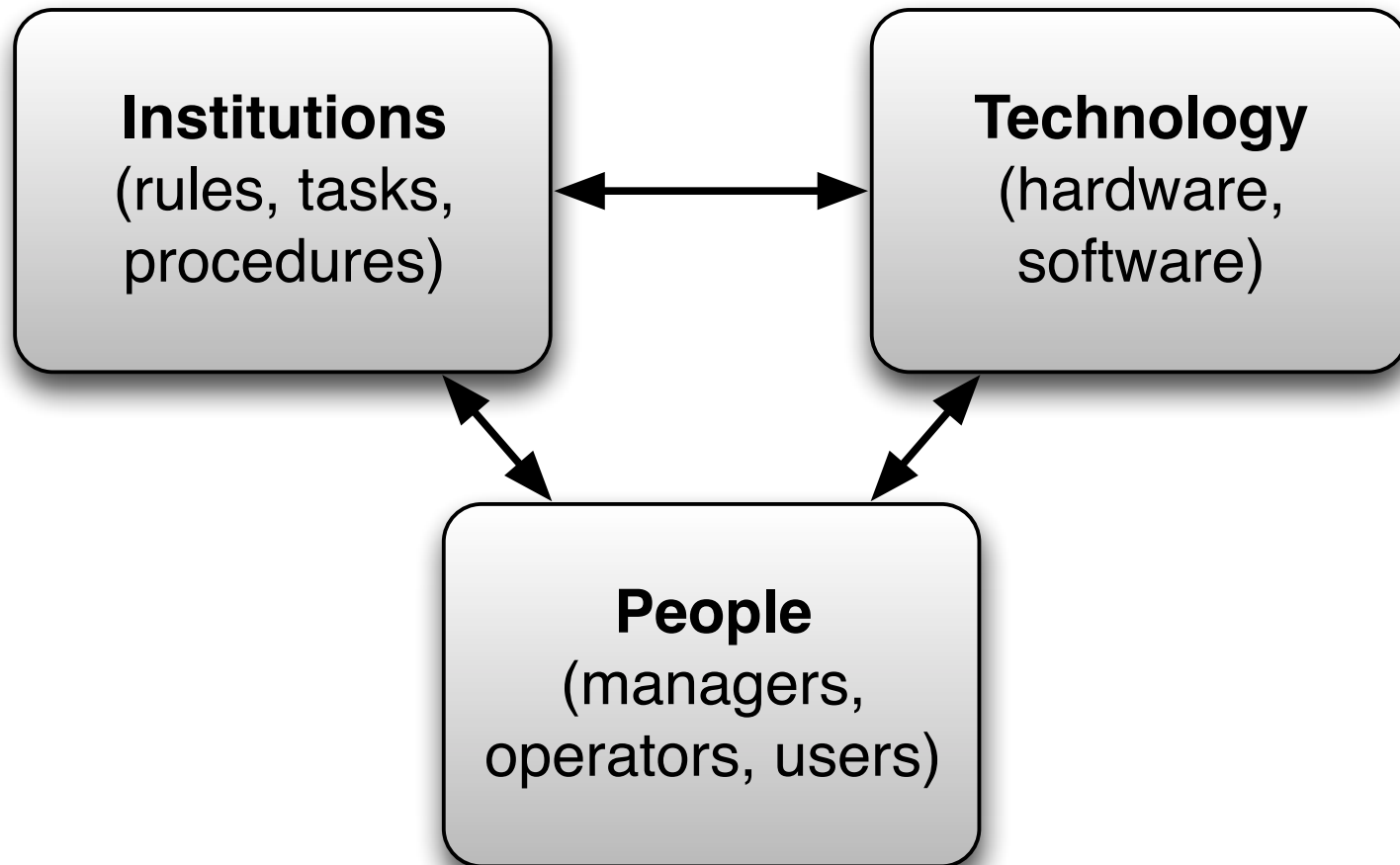


Socio-technical systems





Socio-technical systems: basic structure





“responsibility”

As captain of the ship, X was **responsible** for the safety of his passengers and crew. But on his last voyage he got drunk every night and was **responsible** for the loss of the ship with all aboard. It was rumoured that he was insane, but the doctors considered that he was **responsible** for his actions. Through out the voyage he behaved quite **irresponsibly**, and various incidents in his career showed that he was not a **responsible** person. He always maintained that the exceptional winter storms were **responsible** for the loss of the ship, but in the legal proceedings brought against him he was found criminally **responsible** for his negligent conduct, and in separate civil proceedings he was held legally **responsible** for the loss of life and property. He is still alive and he is morally **responsible** for the deaths of many women and children.

(Hart, H.L.A., Punishment and Responsibility: Essays in the Philosophy of Law, 1970)



Different senses of “responsibility”

- **Task-responsibility.** An agent *x* is task-responsible for an outcome *O*, when *x*, given his role or task, has the duty to ensure that *O* is achieved.
- **Aretaic-responsibility.** An agent *x* is an aretaically-responsible agent of a certain type, if *x* devotes the required care to the task for which he is task-responsible.
- **Causal-responsibility.** An entity or event *x* is causally responsible for a harmful event *H*, if *x* has caused *H*. For instance a hurricane can be causally responsible for the delay of an airplane, as a controller can be causally responsible for an accident.
- **Accountability-responsibility.** An agent *x* is accountable for a harmful event *H*, if, under given *x*'s position, *x* may be requested to explain the happening of *H*, and may be possibly (if his explanation is inadequate to exclude blame/liability) be subject to the moral-socio-legal consequences related to *H*.



Different senses of “responsibility”

- **Blameworthiness-responsibility.** x is blameworthy for a damage H, when x caused (determined) H, and x’s action causing H represent a fault, namely the culpable violation of a standard of behaviour
- **Capacity-responsibility.** An agent x is capacity-responsible or capable if x satisfies the mental conditions which are required for liability
- **Liability-responsibility (liability).** An agent x is liable for a harmful event H, if, given x’s connection to H, x is to be subject to the sanction (punishment or obligation to repair) connected to H.

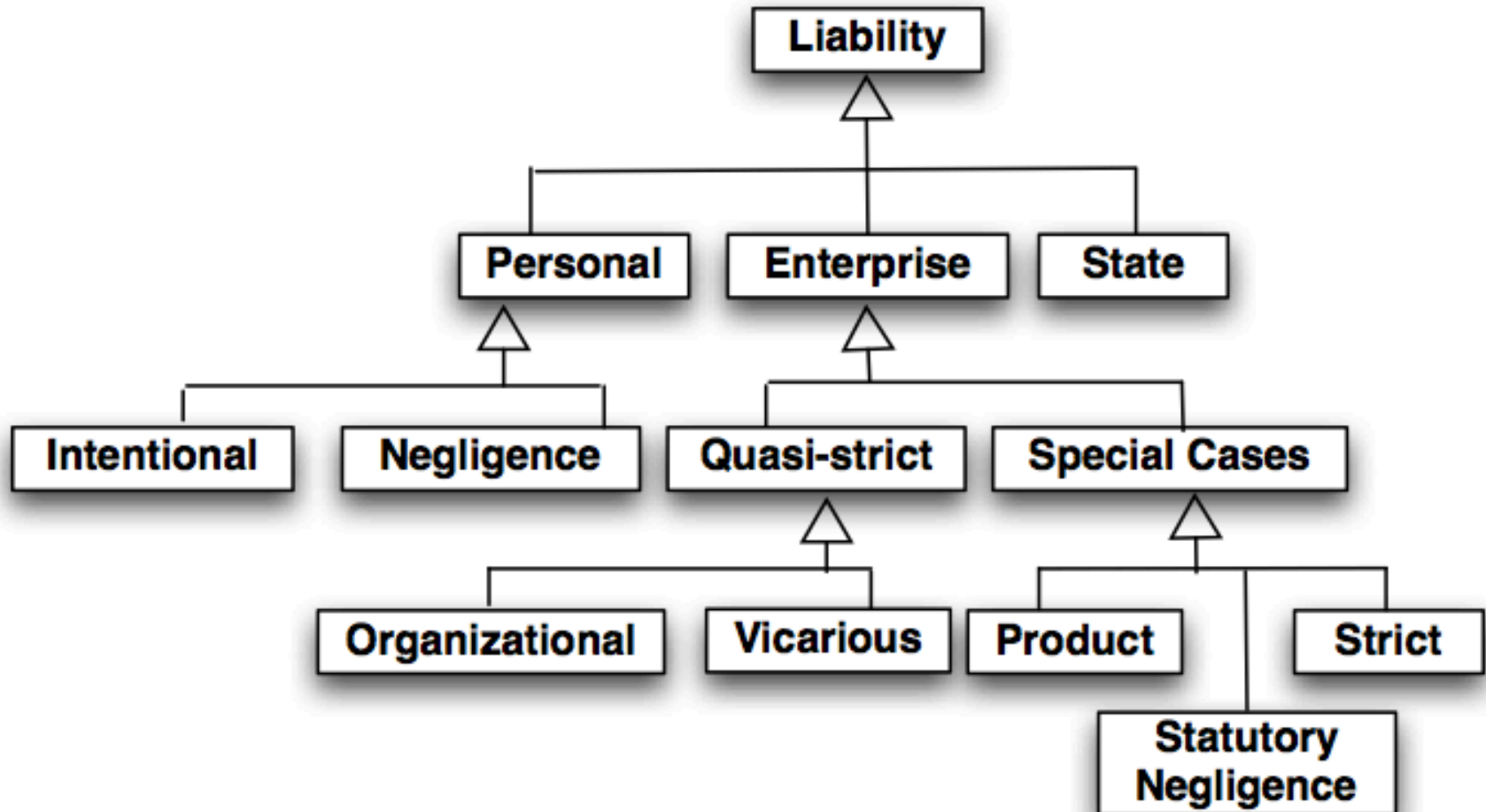


Liability

- **criminal liability**, which presupposes a crime and involves the subjection to imprisonment or to a fine (plus reparation);
- **civil liability**, which presupposes a wrongful act (delict/tort) or in cases of strict liability the materialisation of risk, triggers the obligation to repair the damage (economic loss and moral damage/pain and suffering);
- **contractual liability**, which presupposes a breach of contract and leads to compensation of damage;
- **administrative liability**, which presupposes the violation of a statutory rule or regulation, is enforced by a civil or administrative court or by a regulator and involves a penalty (fine or withdrawal of privileges);
- **disciplinary liability**, which applies within an employer-employee relationship for violations of task responsibilities, and which may consist in the subjection of sanctions such as reprimands, reduction of salaries or dismissal.

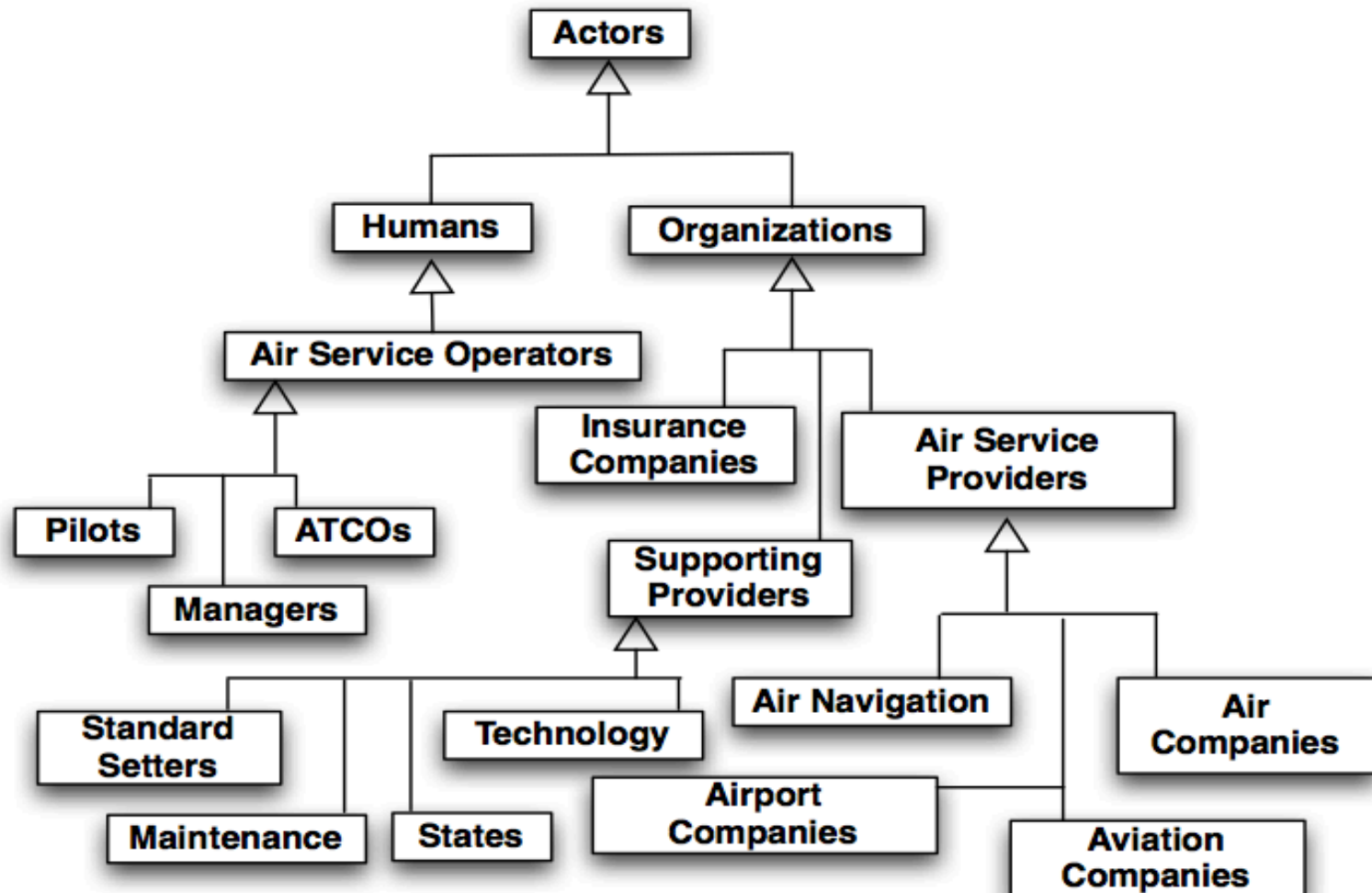


Civil liability



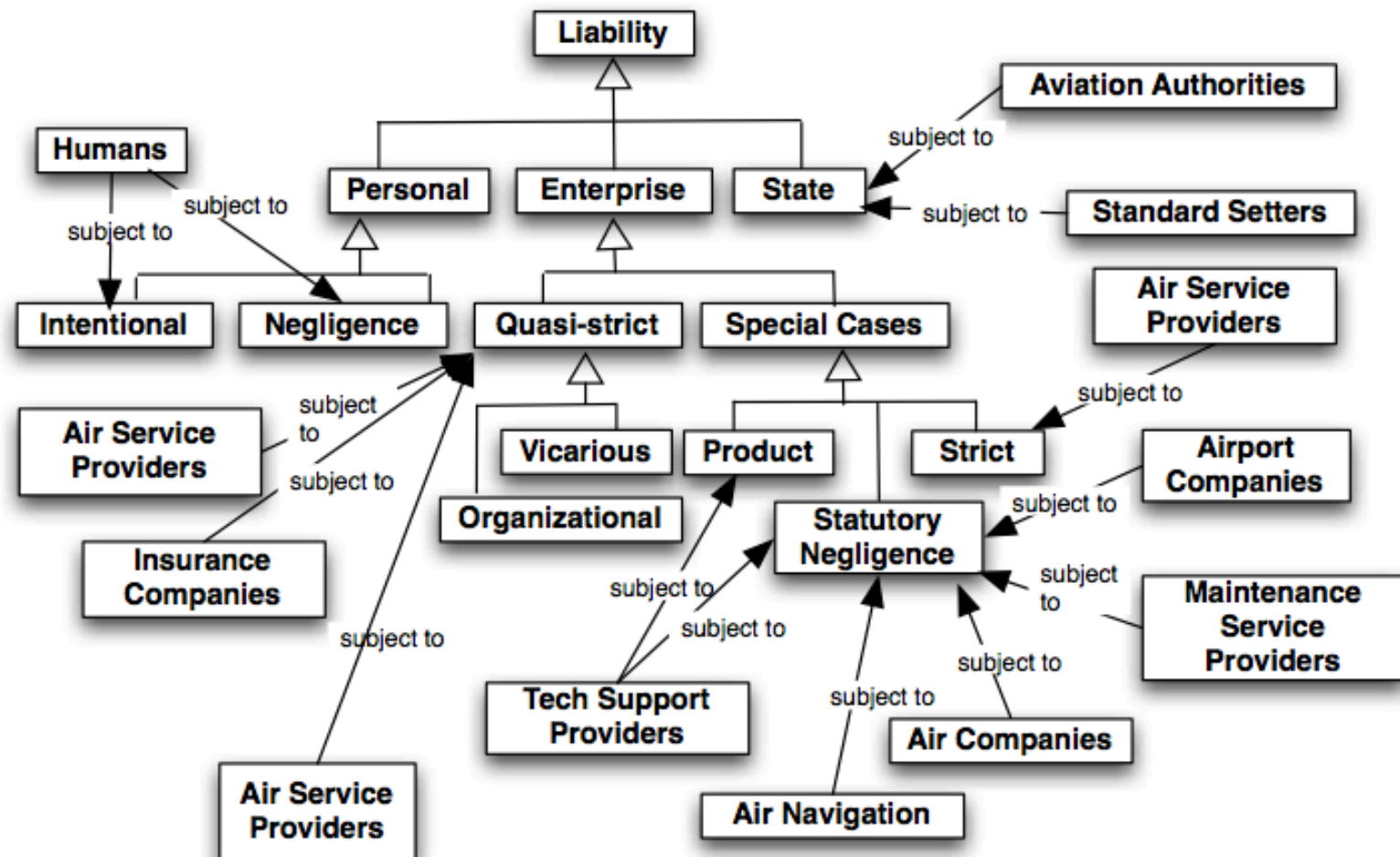


Actors in ATM





Actors and (civil) liability in ATM



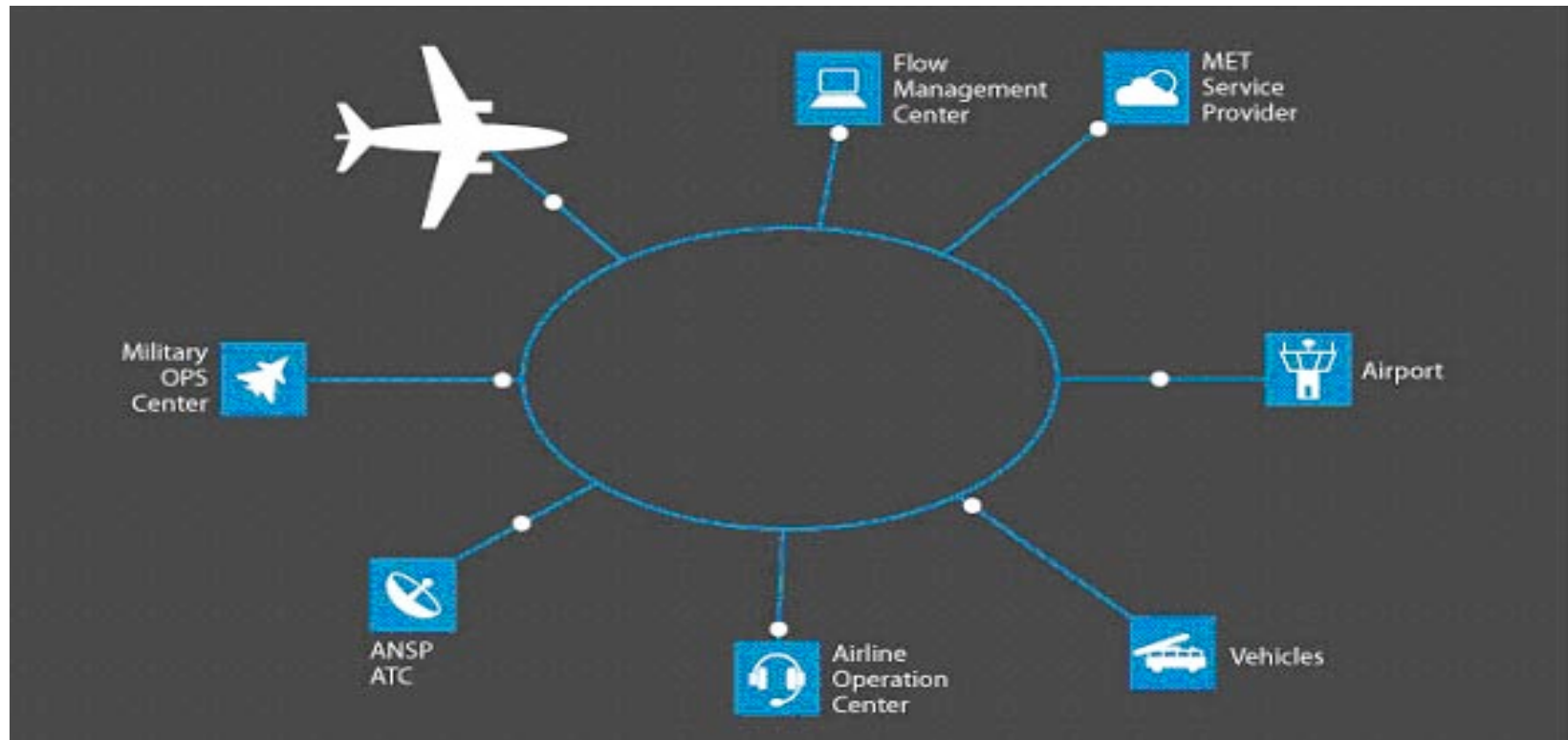


Rot





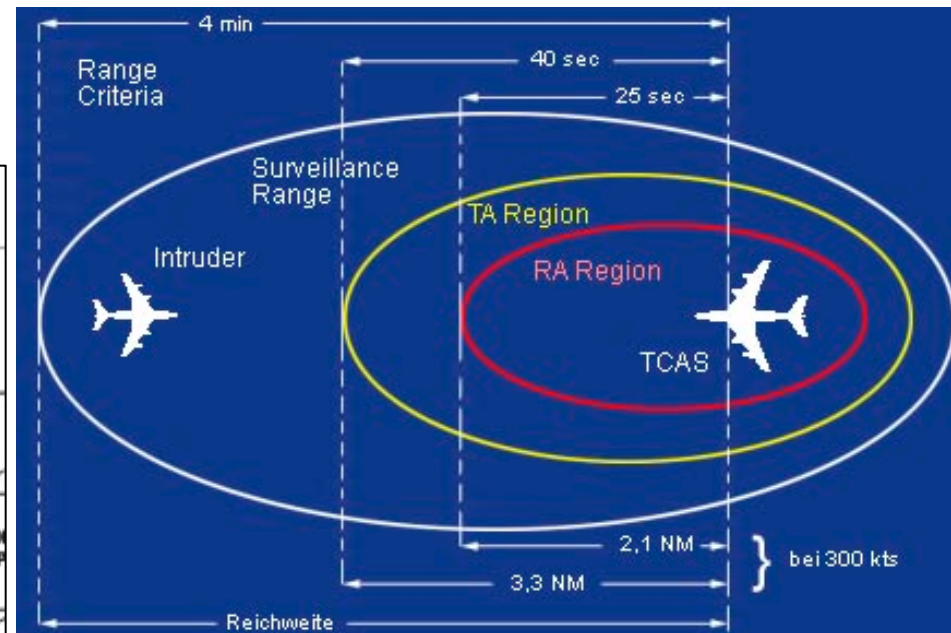
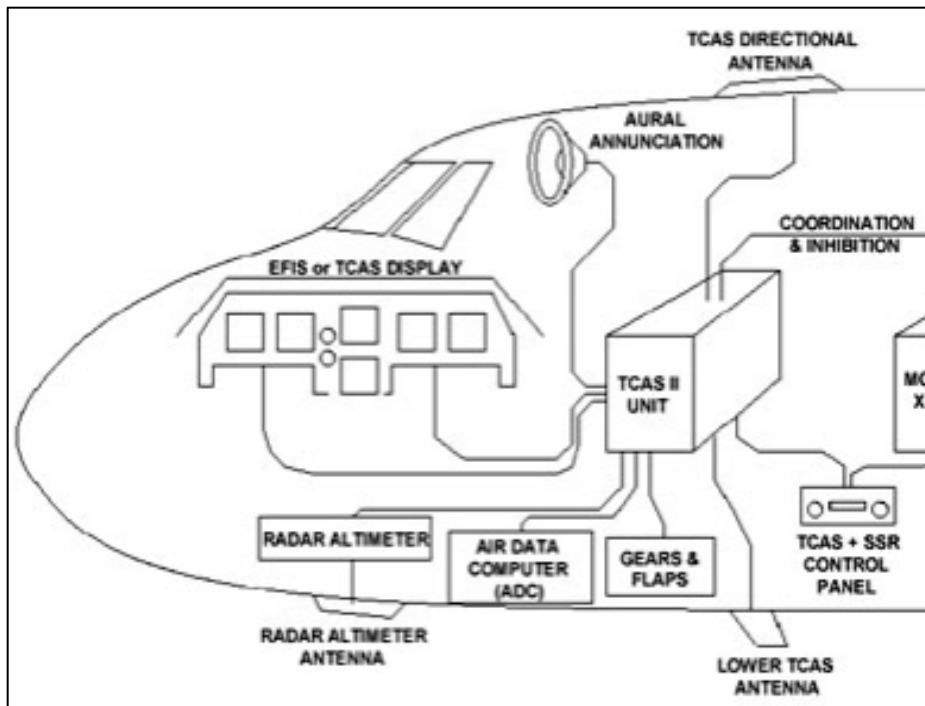
SWIM







TCAS/ACAS X



Altitude
Criteria





Drones (or UAV,UAS,RPAS)





Implications of automation

- Delegation of task from operators to technology
- Hybrid agency (designing man-machine symbiosis/coagency)
- Humans as controllers and supervisors
- Machine intelligence and autonomy
- The challenge of complexity





Some questions (1)

- How automation transforms operators' roles and tasks? What impact on liability?
- Who is responsible for the behaviour of systems that humans cannot fully monitor and control?
- Who is responsible for information supplied by automated systems that the human cannot verify?
- Who is responsible for harms resulting from defective design of human-machine interaction?



Some questions (2)

- Who is responsible when operators fail to cope with emergencies involving degraded automation?
- Who is responsible when operators defectively make up for a non-performing automated systems? Will these be treated as organizational, automation or human failures?
- Does compliance with current technical standards and regulation exonerate from liability?
- Does strict liability constrains innovation?
- How can insurance systems complement the liability system? Can insurance fully protect from liabilities?



Liability Framework: impacts of automation

- liability for damage caused by technological failure transferred to
 - the organisation developing the technology
 - the organisation using the technology
 - the organisation maintaining the technology
- Grounds for the attribution
 - generation of risks and ability to prevent them (and possibility to distribute losses)
 - vicarious liability (for faults of employees)
- individual liability of the individual operator would persist only when the operator acted
 - with an intention to cause harm or damages or
 - with recklessness



Liability Framework: impacts of automation

- Strict (no-fault) liability? Yes, but with limitations
 - Caps
 - “state of the art” defence
 - Force majeure defence
- Recourse. Who will pay in the end?
 - Liability may be channeled (i.e. towards the air carriers in aviation) , but
 - Recourse against the one who had control over the malfunctioning component of the system
- New grounds for liability
 - Liability for inadequate technology (including inadequate man-machine interaction)
 - Liability for failing in introducing a useful technology

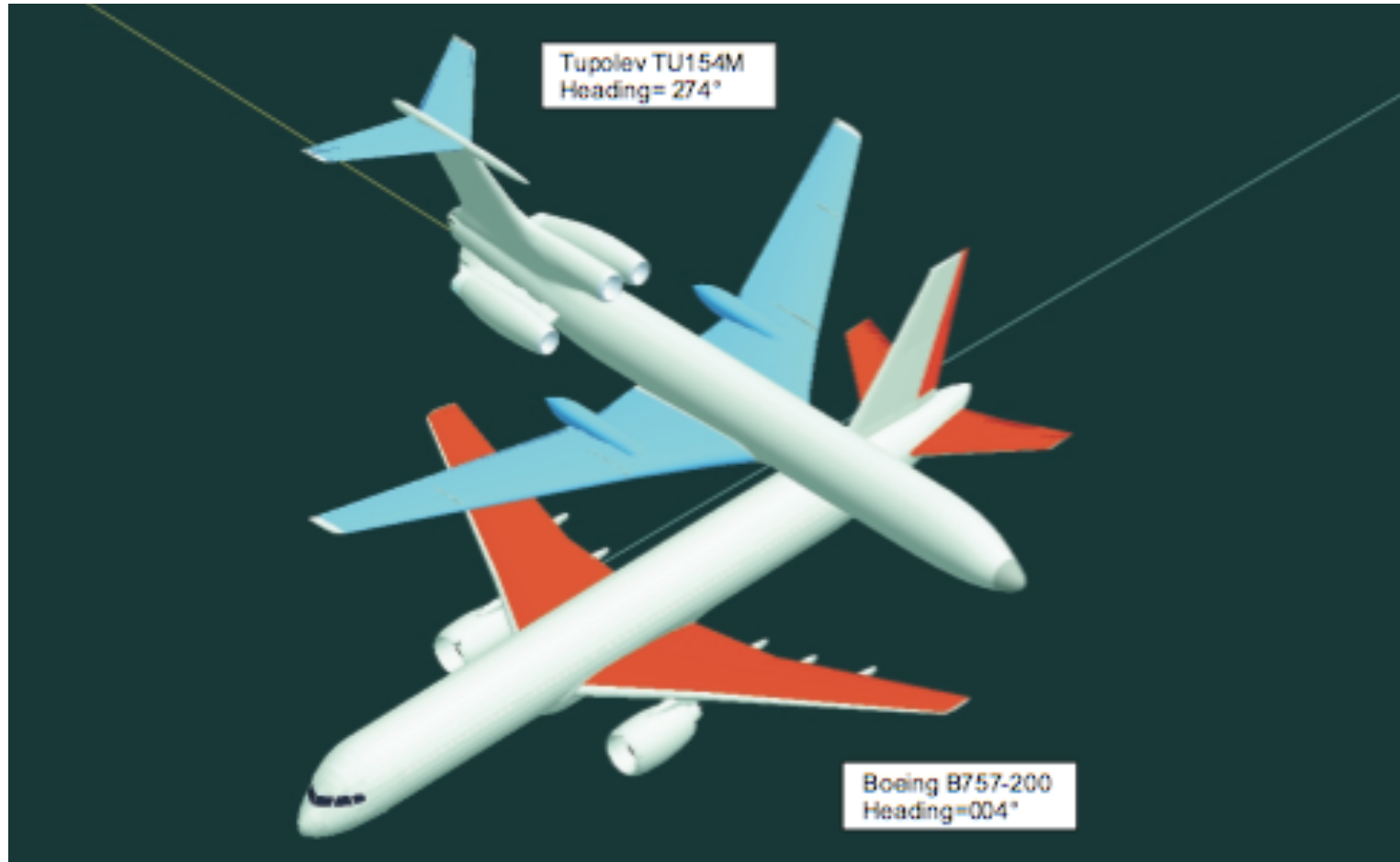


Liability and software

- What kind of software liability?
 - Service liability vs product liability
 - Strict vs fault liability
 - Limited vs unlimited liability
- Who is liable?
 - Software producers vs software users
 - Could damage be mitigated?
 - Was the software acting autonomously?
- Other issues
 - Burden of proof
 - Open source software



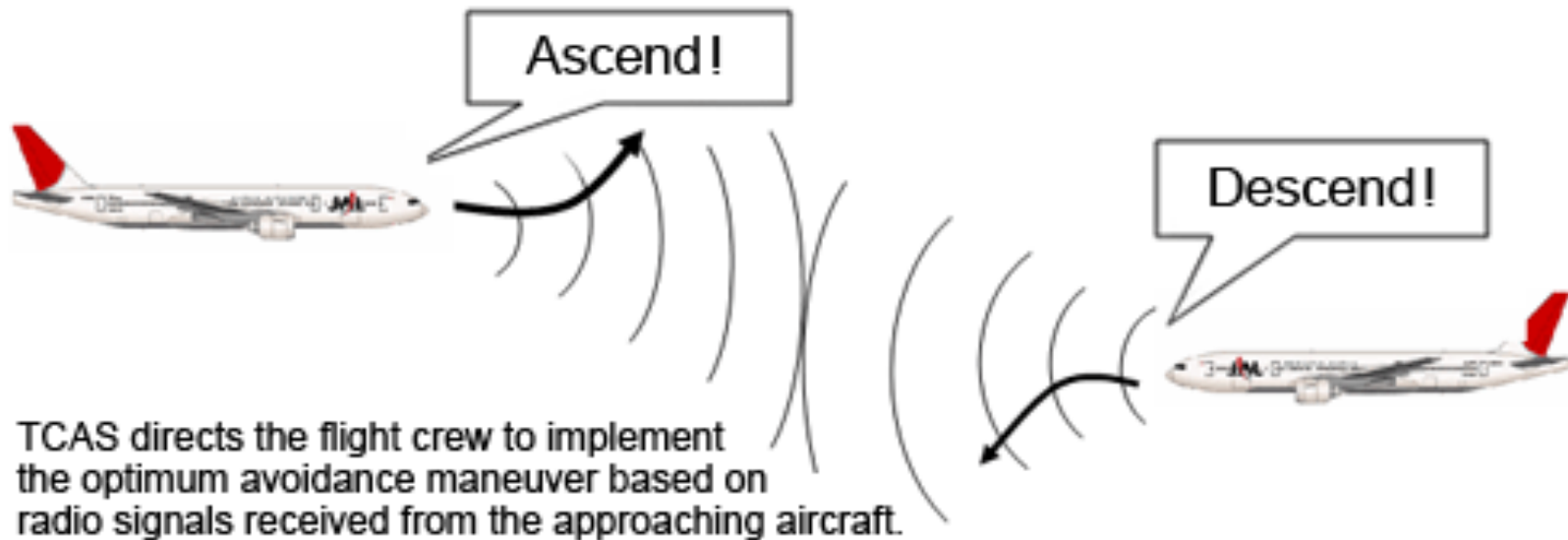
Überlingen (2002)



Human error, organizational failure, technical failure



Tcas





Automated technologies and liability

- in Überlingen, liability for producers of automated technologies (Barcelona Court of Appeal decision of 2012)
- After Überlingen, studies have been made to improve TCAS II capabilities. As a result, in 2008 a new standard has been adopted