Distribution of liabilities and ethical requirements among the manufacturer, the owner and the user of highly automated systems

Humanist Summer School - September 15th, 2017

Buongiorno!

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Damiano, PhD in Computer Science at University of Florence

Worked for 5 years in the IT industry, as software developer and then project manager in multimedia and traffic information services.

9 years as manager in International R&D projects, mainly in the transport domain (Air Traffic Management, Automotive, …)

Main working areas: Security, Safety, Human Factors and Legal aspects in highly automated socio-technical systems.

Certified trainer for:

- Theory courses for drones pilots;
- Drones operations and regulation at Eurocontrol (the European Organisation for the Safety of Air Navigation).

Who we are 1/2

- Deep Blue is a Human Factors and Safety consultancy providing solutions throughout safety-critical industries, with a focus on aviation

- We help organizations to improve their performance and safety by promoting a joint development of **people**, **procedures** and **technologies**, by applying a **user-centered approach**

- **Very strong** presence in **EU research**, both as consortium member and coordinator

- **Established supplier** of prominent European organisations in the air traffic industry like **EUROCONTROL**

- **Associate partner of SESAR JU**, the public-private partnership managing the **Single European Sky** research programme

Who we are 2/2

- Founded in 2001 in Rome.
- 2016 turnover around 2.3 million Euro.
- Around 25 qualified and young staff members, more than 50% with PhDs, plus a large network of professionals.
- Truly inter-disciplinary staff:
  - Cognitive psychology
  - Aerospace engineering
  - Mathematics
  - Computer Science
  - Communication Studies

Liability as showstopper: the Euro Hawk example


NATO
OTAN

The Euro Hawk is a surveillance drone

The Euro Hawk Programme is one of the most relevant contractual agreement ever stipulated by the German Government

Successful Test Flights in 2010 and 2011: Euro Hawk hailed as the beginning of a new era of surveillance

In May 2013 the German Defense Minister stopped the drone project because of massive problems in obtaining flight permits for European airspace

The Euro Hawk scandal demonstrated that the **LACK OF A CLEAR REGULATORY FRAMEWORK** can act as **SHOW STOPPER** for the deployment of a technology

Should we take care of it?

The Self Driving Car

The Self Driving Car

Unanswered questions over the legality of these systems have to be addressed

The lack of a clear liability attribution scheme may act (is acting?) as show stopper for the implementation of self-driving technology

Elon Musk says Tesla's fully autonomous cars will hit the road in 3 years

Cadie Thompson
Sep. 25, 2015, 2:21 PM 2,455

Tesla's self-driving vehicles are not far off.

During an interview earlier this week with the Danish news site Borsen, Tesla CEO Elon Musk said the company is rolling out its "Autopilot" feature to the masses next month and the company's fully autonomous vehicles will be ready in just a few short years.

Uber suspends self-driving car program after Arizona crash

Published 5:20 AM ET Sun, 26 March 2017

REUTERS

Uber Technologies Inc suspended its pilot program for driverless cars on Saturday after a vehicle equipped with the nascent technology crashed on an Arizona roadway, the ride-hailing company and local police said.

The accident, the latest involving a self-driving vehicle operated by one of several companies experimenting with autonomous vehicles, caused no serious injuries, Uber said.

Even so, the company said it was grounding driverless cars involved in a pilot program in Arizona, Pittsburgh and San Francisco pending the outcome of investigation into the crash on Friday evening in Tempe.

Fresco News
@fresconews

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BREAKING: Self-driving Uber vehicle on it's side after a collision in Tempe, AZ.

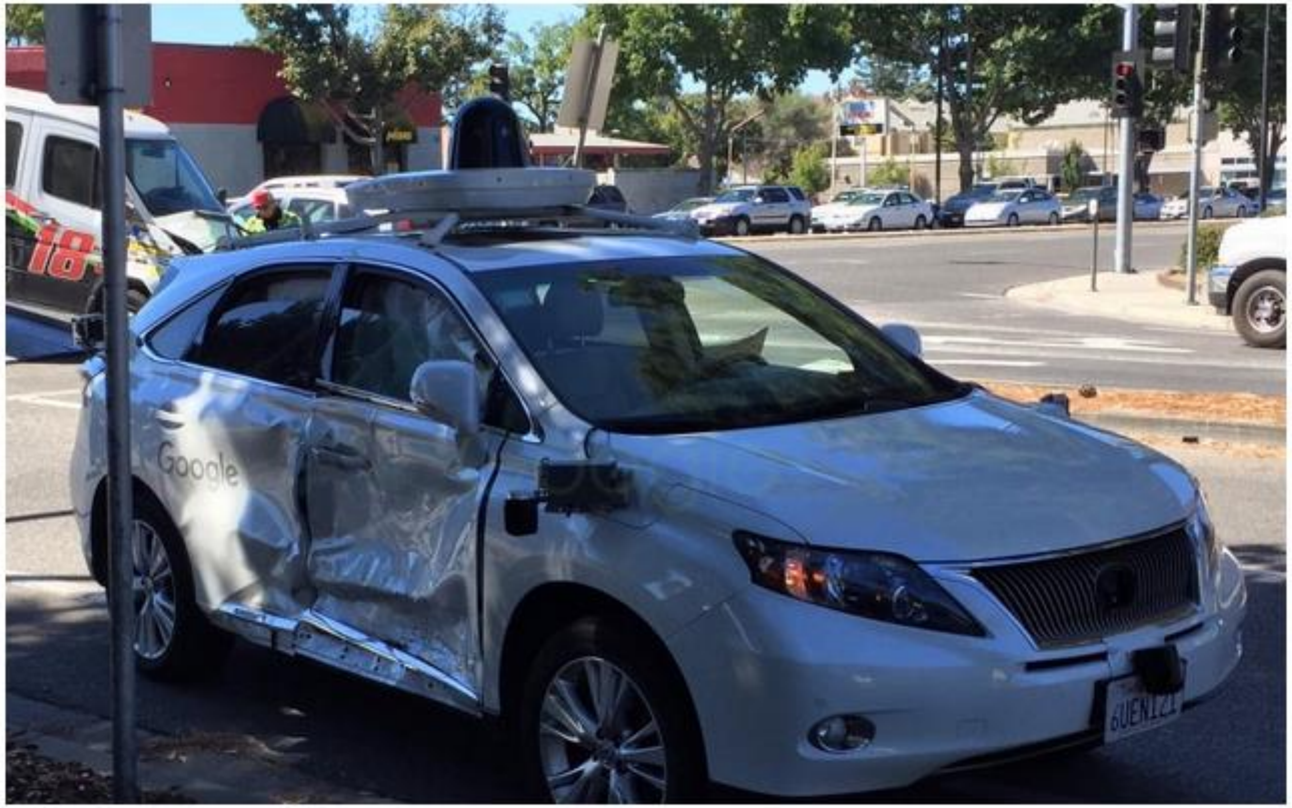
Photos by @fresconews user Mark Beach

5:21 AM - Mar 25, 2017

56 497 287

Google's self-driving car involved in serious crash after van jumps a red light

share



The crash is the worst for one of Google's self-driving cars to date CREDIT: RON VAN ZUYLEN/9TO5 GOOGLE

Can self-driving cars cope with illogical humans? Google car crashed because bus driver didn't do what it expected

- **National Highway Traffic Safety Administration is collecting information**
- **Said it wants to get a 'more detailed exploration of what exactly happened'**
- **Google vehicle struck side of a public bus in Mountain View**
- **Footage shows a Lexus SUV edging into the path of the bus at 15mph**

By MARK PRIGG FOR DAILYMAIL.COM
PUBLISHED: 18:57 BST, 14 March 2016 | **UPDATED:** 20:08 BST, 14 March 2016

Google has revealed that its self driving car hit a bus because it made an incorrect assumption about where it would go.

The firm admitted the crash would not be its last - while humans were allowed on the roads.

'Our car was making an assumption about what the other car was going to do,' said Chris Urmson, head of Google's self-driving project, speaking at the SXSW festival in Austin.

'This what driving is about.'

Scroll down for video of the crash

HOW DID IT HAPPEN?

The Lexus intended to turn right off a major boulevard but stopped after detecting sandbags around a storm drain near the intersection, according to an accident report Google filed with the California Department of Motor Vehicles.

Photos show two small, black sandbags on either side of a drain at the curb.

The right lane was wide enough to let some cars turn and others go straight, but to avoid driving over the sandbags, the Lexus needed to slide to its left within the lane.

The bus and several other cars that drove straight were to the left of the Lexus, in the same lane.

Though it was a low-speed collision, the impact crumpled the Lexus' front left side, flattened the tire and tore off the radar Google installed to help the SUV perceive its surroundings.

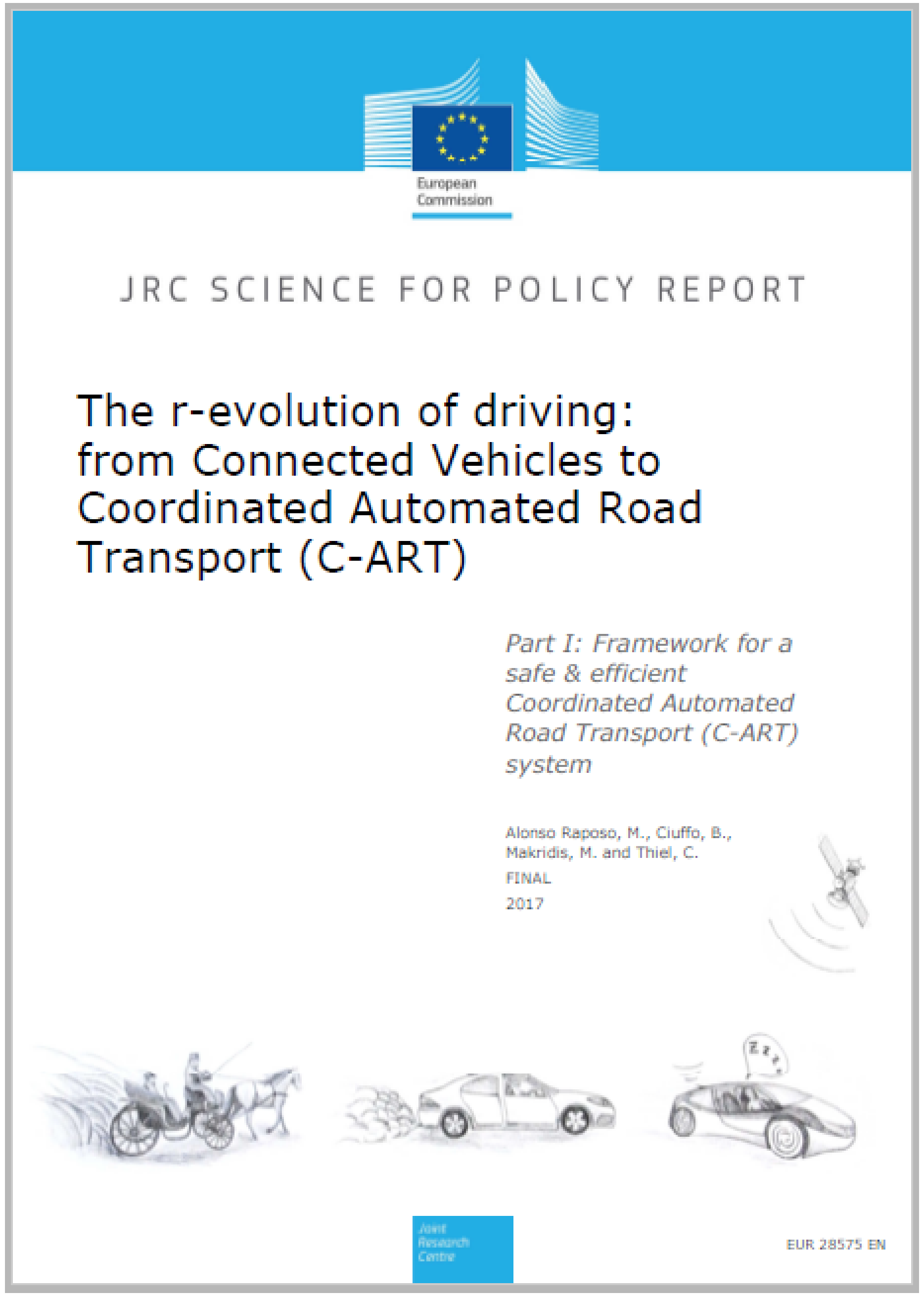
When the light turned green, several cars ahead of the bus passed the SUV.

Google has said that both the car's software and the person in the driver's seat thought the bus would let the Lexus into the flow of traffic.

The Google employee did not try to intervene before the crash.

'This is a classic example of the negotiation that's a normal part of driving — we're all trying to predict each other's movements.

'In this case, we clearly bear some responsibility, because if our car hadn't moved there wouldn't have been a collision,' Google wrote of the incident.


European Commission

JRC SCIENCE FOR POLICY REPORT

The r-evolution of driving: from Connected Vehicles to Coordinated Automated Road Transport (C-ART)

Part I: Framework for a safe & efficient Coordinated Automated Road Transport (C-ART) system

Alonso Raposo, M., Ciuffo, B., Makridis, M. and Thiel, C.

FINAL

2017

Joint Research Centre

EUR 28575 EN

Box 1. Summary of insurance and liability aspects of relevance for C-ART

The C-ART system would initially require:

— That an appropriate legal insurance and liability framework is adopted, relying on data recordings and storage to determine who was in control of the vehicle at a given point in time.

Key remaining open questions are:

— Could the C-ART manager be held liable in case of an accident or damage?

3.7.3 Insurance and liability

There is currently no harmonisation at EU level of the rules on liability in case of damages caused by accidents involving motor vehicles, but rather different liability regimes across EU Member States. Most of these regimes are based on the concept of causality of the accident to determine who is held liable. However, with more and more automation, it will be increasingly complicated to identify the exact cause of an accident (i.e. whether it is a hardware defect or a software malfunction or an inadequate driver's behaviour). On the


DER SPIEGEL

Berlin, Verteidigungsministerium, 08.02.2012

„Betreff Euro Hawk: Nicht abschätzbare technische, zeitliche und finanzielle Risiken“

The lack of a clear regulatory framework as well as of a liability attribution scheme accepted by all the involved stakeholders is a **serious risk**.

This can determine:

- the failure of a programme, even if the system is technically feasible!
- massive effort for late modifications

The crash is the worst for one of Google's self-driving cars to date CREDIT: RON VAN ZUYLEN/9TO5 GOOGLE

Problem: liabilities attribution in highly-automated socio-technical systems

Automation is not all-or-nothing

Automated systems do not fully supplant human activity but rather support and expand human capabilities

Rather than covering cases where an entire task is completely delegated to a machine, automation covers cases where humans and machines interact.

Some degree of cooperation is required, otherwise…

Bari, Italy, August 2014

SAE level	Name	Narrative Definition	Execution of Steering and Acceleration/ Deceleration	*Monitoring* of Driving Environment	Fallback Performance of *Dynamic Driving Task*	System Capability *(Driving Modes)*
***Human driver* monitors the driving environment**						
0	**No Automation**	the full-time performance by the *human driver* of all aspects of the *dynamic driving task*, even when enhanced by warning or intervention systems	Human driver	Human driver	Human driver	n/a
1	**Driver Assistance**	the *driving mode*-specific execution by a driver assistance system of either steering or acceleration/deceleration using information about the driving environment and with the expectation that the *human driver* perform all remaining aspects of the *dynamic driving task*	Human driver and system	Human driver	Human driver	Some driving modes
2	**Partial Automation**	the *driving mode*-specific execution by one or more driver assistance systems of both steering and acceleration/ deceleration using information about the driving environment and with the expectation that the *human driver* perform all remaining aspects of the *dynamic driving task*	**System**	Human driver	Human driver	Some driving modes
***Automated driving system* ("system") monitors the driving environment**						
3	**Conditional Automation**	the *driving mode*-specific performance by an *automated driving system* of all aspects of the dynamic driving task with the expectation that the *human driver* will respond appropriately to a *request to intervene*	System	**System**	Human driver	Some driving modes
4	**High Automation**	the *driving mode*-specific performance by an automated driving system of all aspects of the *dynamic driving task*, even if a *human driver* does not respond appropriately to a *request to intervene*	System	System	**System**	Some driving modes
5	**Full Automation**	the full-time performance by an *automated driving system* of all aspects of the *dynamic driving task* under all roadway and environmental conditions that can be managed by a *human driver*	System	System	System	**All driving modes**

Source: SAE International, 2014 (Copyright © 2014 SAE International).

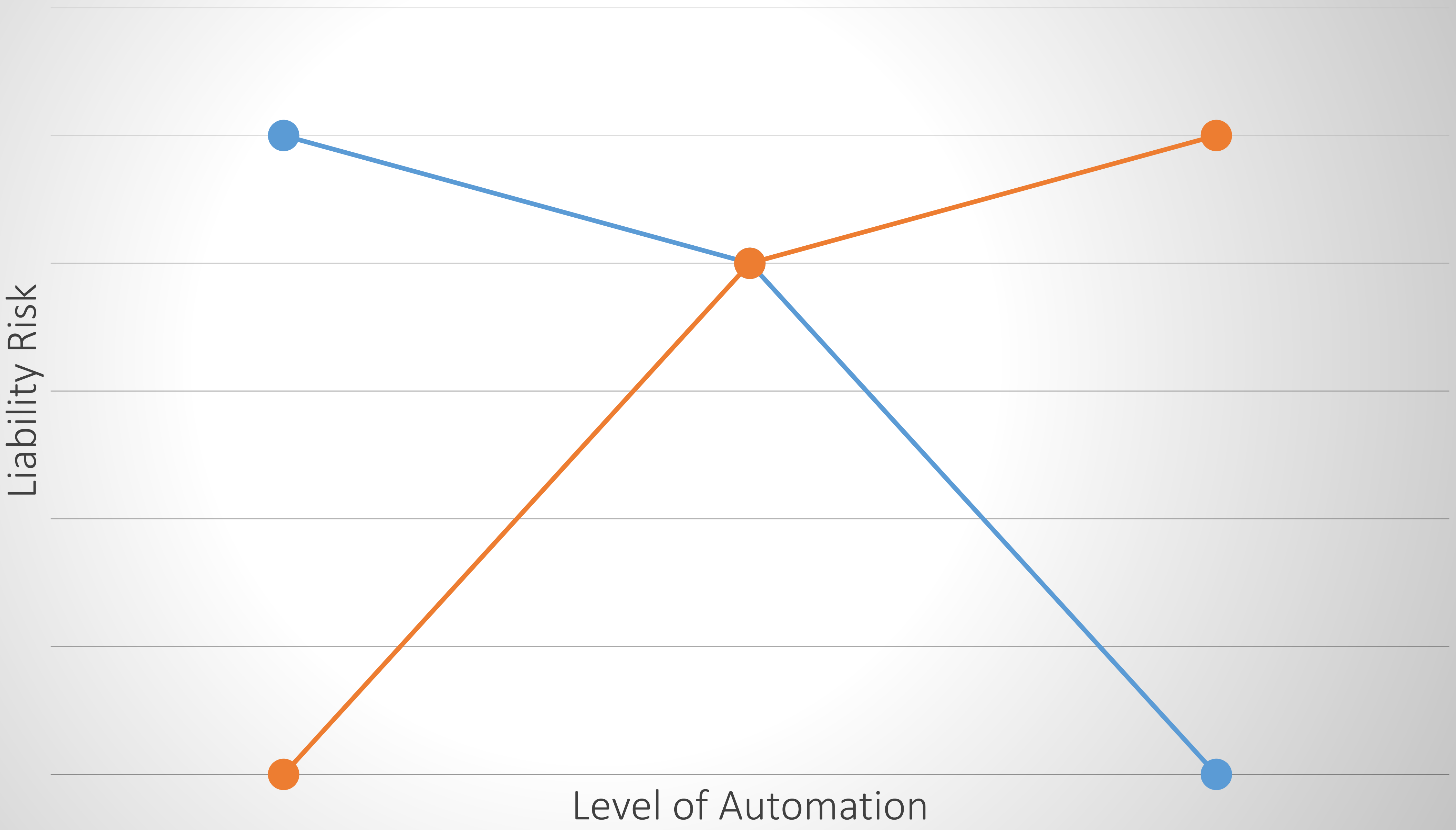
From INFORMATION to ACTION →

INCREASING AUTOMATION ↓

A INFORMATION ACQUISITION	B INFORMATION ANALYSIS	C DECISION AND ACTION SELECTION	D ACTION IMPLEMENTATION
A0 Manual Information Acquisition	**B0** Working memory based Information Analysis	**C0** Human Decsion Making	**D0** Manual Action and Control
A1 Artefact-Supported Information Acquisition	**B1** Artefact-Supported Information Analysis	**C1** Artefact-Supported Decsion Making	**D1** Artefact-Supported Action Implementation
A2 Low-Level Automation Support of Information Acquisition	**B2** Low-Level Automation Support of Information Analysis	**C2** Automated **Decsion Support**	**D2** Step-by-Step Action Support
A3 Medium-Level Automation Support of Information Acquisition	**B3** Medium-Level Automation Support of Information Analysis	**C3** Rigid Automated **Decsion Support**	**D3** Slow-Level **Support** of Action Sequence Execution
A4 High-Level Automation Support of Information Acquisition	**B4** High-Level Automation Support of Information Analysis	**C4** Low-Level Automatic **Decision Making**	**D4** High-Level **Support** of Action Sequence Execution
A5 Full Automation Support of Information Acquisition	**B5** Full Automation Support of Information Analysis	**C5** High-Level Automatic **Decision Making**	**D5** Low-Level **Automation** of Action Sequence Execution
		C6 Fulll Automatic **Decision Making**	**D6** Medium-Level **Automation** of Action Sequence Execution
			D7 High-Level **Automation** of Action Sequence Execution
			D8 Full **Automation** of Action Sequence Execution

http://www.skybrary.aero/bookshelf/books/2929.pdf

A condensed version of the LOAT matrix


Liability Risk
Level of Automation

Principle: victims must be compensated

Directive 2009/103/EC

All vehicles in the EU to be insured against third party liability and establishes minimum thresholds for personal injury and property damage coverage.

Directive 85/374/EEC

Liability for defective Products: manufacturers can be held liable for any damage caused by a defect in their product.

In case of an accident, either the driver/owner or the manufacturer or both of them may be considered liable by a judge, depending on the exact circumstances in which it takes place.

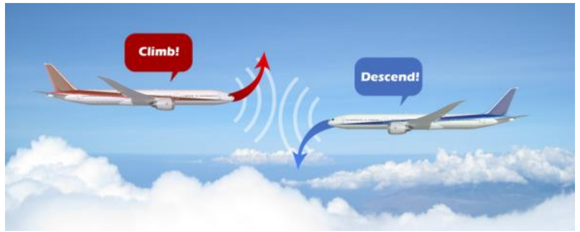
A possible solution: the Legal Case

Alias

www.aliasnetwork.eu

A novel methodology (standard process + supporting tools) **developed by and for a multi-disciplinary team** (legal experts, human factors, designer, engineers, insurers, policy makers, etc.)

ATM (Air Traffic Management) as main use case, but applicable to all the domains where automation has a strong impact



Already tested with two applications: drones integration in ATM and ACAS-X (anticollision system for airliners)

UNDERSTAND THE CONCEPT

- Collect background information
- Identify the level of automation
- Identify possible failures

IDENTIFY THE LIABILITY ISSUES

- Identify liability risks
- Examine the legal risk

PERFORM THE LEGAL ANALYSIS

- Perform the legal analysis and identify acceptable legal measures

COLLECT FINDINGS AND PRODUCE RESULTS

- Produce results of the analysis and recommendations

Liability-by-design:

- Identify hypothetical liability risks of the newly designed automated tools
- Find convenient technological adaptations or legal arrangements (re-design, different LoA, insurance, etc.)

Liability analysis (ex-post):

- Address the legal impact of specific accidents that have taken place
- Address possible legal issues arising in the future from potential accidents or malfunctions

Exercise: let’s apply the Legal Case to the automotive

Grazie!

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