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Automated Cars and Insurance

ASTIN and AIDA Working Party

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CTICC

Joint working party

IAA NON-LIFE INSURANCE SECTION
SECTIONS ASSURANCE NON-VIE DE L'AAI

Association Internationale de Droit des Assurances

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Background

- The fourth industrial revolution (Industry 4.0) puts the system of driving vehicles to a new stage for which human factor may be substantially reduced or even eliminated.
- Ways we direct, possess and are responsible for driving vehicles may be very different from what we are accustomed to.
- The types of risk and the liability for adverse events can change so dramatically that it will need a new legal regulation and appropriate ways of risk management, including insurance.
- This working party is intended as a cooperation of lawyers from AIDA (International Insurance Law Association) and actuaries from ASTIN (Non-life section of International Actuarial Association).

Specific aims

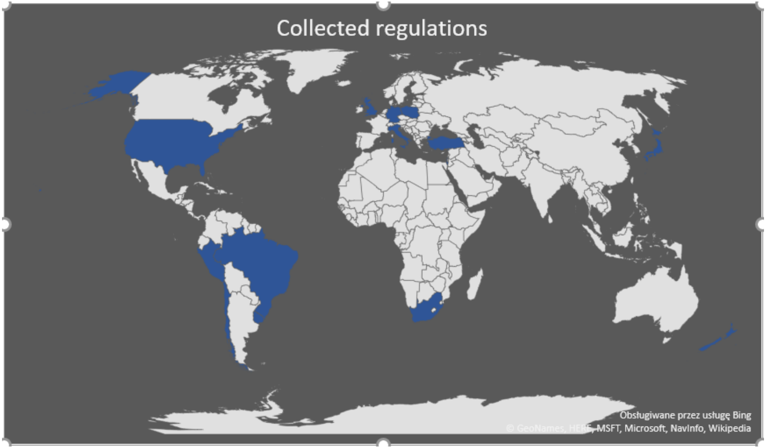
The aims of this working party are:

- to identify the risk structure and role of all the players in order to identify what are the ways to address various kinds of risk of automated cars;
- to consider possible regulations of motor insurance market and its influence for the business environment, including passengers, human drivers (if any), owners of vehicle, insurance companies, car makers, third party and others; and
- to consider possible changes in motor insurance contracts in terms of: exclusion clauses, pricing, possibility to realize form of smart insurance contracts (thanks to the data flow from vehicles to insurers).

AIDA

- Formed in 1960: International Insurance Law Association
- AIDA is a non-profit organization with the purpose of promoting and developing collaboration among its members to study and increase knowledge of international and national insurance laws and related matters.
- AIDA aims to propose measures, with a view to the insurance industry adopting them at a national and international level, leading to harmonization of insurance law or means for resolution of insurance disputes.
- Also forms Working Parties
- `http://www.aida.org.uk`

Current legal status quo



WP collected regulations from countries marked on this map. Many countries do not have regulations, except for advanced works in US, EU, Japan.

Car accidents in numbers

- According to WHO (World Health Organization), about 1.3 million people die on the world's roads and 20–50 million are injured every year.
- The risk of dying in a road traffic crash is more than 3 times higher in low-income countries than in high-income countries.
  - In the US, about 30,000 people die in traffic collisions every year, and 40,000 in Europe.
- Road traffic crashes are a major cause of death among all age groups and the leading cause of death for children and young adults aged 5–29 years.
- Human errors are believed to be responsible for over 90% of these accidents.

Reducing the risk of human error

- Automated vehicles (AVs) can be catalyst for improving road safety.
- It is believed that if 90% of passenger vehicles in the US were autonomous, traffic fatalities could be reduced by nearly two-thirds.
- For example, the following causes of accidents may be eliminated:
  - speeding
  - driving after drinking alcohol or under other influence
  - distractions caused by mobile phones and other sources
  - other human errors
- There is also much better **damage control** after accident, as rapid response saves lives and reduces disability among the injured.
- This is certainly a self-learning system, as every accident/risky situation could be analyzed in detail and the system could be improved.

Five stages of driving automation

	SAE Level	Name	Steering, acceleration, deceleration	Monitoring driving environment	Fallback performance of dynamic driving task	System capability (driving modes)
Human monitors 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]	[human]	[human]	n/a
Human monitors environment	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] [car]	[human]	[human]	Some driving modes
Human monitors environment	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	[car]	[human]	[human]	Some driving modes
Car monitors 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	[car]	[car]	[human]	Some driving modes
Car monitors environment	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	[car]	[car]	[car]	Some driving modes
Car monitors environment	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	[car]	[car]	[car]	All driving modes

Source: Automated vehicles in the EU – Briefing

Classes for our purposes

Source: Market Framework and Outlook for Automated Vehicle Systems, 2018, Society of Actuaries

System Class	Definition	Market Status
Safe	The driver is solely responsible, but technology can improve safety by giving alerts to risks or automating/improving the effectiveness of select driver actions, such as through automatic braking, electronic stability control, or blind-spot warning.	These technologies largely exist today and are offered in an increasing number of new vehicles today. Many have been proven to improve safety and/or reduce damage in the event of a collision.

System Class	Definition	Market Status
Self	The vehicle can assume responsibility for select driving tasks under specific road or weather conditions, but an alert driver who is ready to take control is still required.	These emerging technologies will increase penetration over the next decade. Because their performance is subject to driver intervention, their safety benefits are not yet well documented.

System Class	Definition	Market Status
Driverless	The vehicle is responsible for all driving tasks for the entirety of a journey. No driver is required at any phase. Current deployments may have geographic or weather limitations.	This technology has been implemented in low speed applications. Waymo's deployment in Phoenix was the first widely available, public commercial application. Systems that can operate without a driver are still in development, and those that can travel "on all roads, all the time" could be more than a decade away.

Risks after transition to self

- The shift from “safe” to “self” will not change much in a structure of responsibility (driver is still responsible), but can change the amount of risk attributed to driver and to manufacturer (and providers of system).

Risks after transition to driverless

- The hardware risk: sensors and controllers
- Software errors: wrong design, wrong implementation or other types of artificial intelligence errors
- The infrastructure risk: roads, data transmission, etc.
- The cyber risk in regard of privacy and data security
- The cyber terrorism risk
- Other risks including "the unavoidable"
  - For example, the Trolley Problem, often invoked with AVs, is a thought experiment in ethics and choice.

Other factors

- Autonomous technology so far is very expensive, mostly because of the cost of LIDAR (Light Detection and Ranging), but it allows and encourages to build shared-economy solutions.
- The risks would be attributed to different players on the market depending on who assumes responsibility for software, hardware, maintenance and infrastructure.
- The cost of insurance could be the function of telemetrics (specific route, weather, hours of day, number of passengers) besides the hardware and software used.
- Shift to “own damage” insurance product.

The cyber risks

- The cyber risk in regards to privacy and data security: illegal commercial use of data (for example, AVs could record a user's visits to psychiatry clinics, doctors, or liquor stores).
- AVs also present new types of vulnerabilities and technical uncertainties.
    - As objects connected to the Internet of Things, AVs will be connected to a network and thus more exposed to cybersecurity threats – such as vehicular systems hacking – resulting in safety vulnerabilities.
- In November 2017, the UNECEs (United Nations Economic Commission for Europe) group on AVs identified 86 threats to cybersecurity that could affect the safe operation of AVs, data integrity, and software updates.

Actuarial tools

- Actuarial tools to be used for pricing risk would be similar to those used for risks in regard to big software-hardware systems:
  - These are often not sophisticated loss models that are merely based on Bernoulli or Poisson distributions for frequency and Pareto for severity backed up with underwriting multipliers.

Future directions of research

- Actuarial models for system risks
- Methods of classification of risk
- Ways of transferring and risks (mutuals, pools)