EUROPEAN COMMISSION
Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs

GEAR 2030 DISCUSSION PAPER

Roadmap on Highly Automated and connected vehicles

Recent developments in vehicle automation technology (e.g. automatic braking, Lane keeping systems) are moving us closer to increasingly automated vehicles. This development complements the parallel development of connectivity in vehicles.

Automated and connected vehicles raise cross-cutting issues involving different departments within the Commission and Member States. The different issues on automated and connected vehicles mean that we will need to work closely with other DGs (mainly DG CONECT, DG GROW, DG FISMA, DG JUST, DG MOVE, DG RTD) in a coherent manner at EU level.

This is why some stakeholders have explicitly requested to consider an EU roadmap on highly automated vehicles in the framework of the GEAR 2030 (ex-CARS 2020 high level group) putting together all the automotive stakeholders (e.g. car industry, IT industry, insurers, interest groups etc) and policy makers (Ministers, Commissioners). It is important for Europe to overcome silos to be a competitive player on automated and connected vehicles.

This note first presents the main challenges and opportunities for highly automated vehicles and then suggests a way forward for the GEAR 2030 roadmap.

1. AUTOMATED VEHICLES: AN EVOLUTION THAT COULD MAKE A REVOLUTION

Automated vehicles should come step by step. While the term "driverless" is often used, the reality is that entirely removing the need for a driver is a longer term goal for most vehicle types (See Annex 1) as the technical challenges for fully automated vehicles in any traffic conditions are still very high for manufacturers.

The concept of "automated vehicles" is also often associated with "connected vehicles". However the two concepts are different. On the one hand, partially automated vehicles are already available on the market and are able to sense their environment without necessarily being connected to a network, a road infrastructure or to other vehicles. On the other hand, connected vehicles available on the market (internet surfing, info traffic, GPS, ecall, vehicle-to-vehicle and vehicle-to-infrastructure short-range communication, etc.) do not carry out driving tasks for the driver (like automated vehicles). Contrary to automated vehicles, connected vehicles do need an interoperable communication network that, depending on the application, can either be a dedicated network (see C-ITS platform from DG MOVE) or can use a commercially available network like the cellular communication network.

All in all, the development of connected vehicles and automated vehicles will follow parallel routes which will have to converge to make full use of all the potential benefits of fully autonomous/driverless cars (see Annex 2) and therefore need co-ordination.

The impact of automated and connected vehicles could be huge. It could help to drastically reduce road fatalities as 90% of road accidents come from human error. New transport services could also be provided especially when the vehicle is provided with connectivity in addition to automation, e.g traffic safety related warnings, traffic management, car sharing, new possibilities for elderly people or impaired people. Drivers can expect more individual comfort and convenience which is likely to be the major motivation for upcoming automated driving. In the long term, automation could have a revolutionary impact on travel behavior and urban development. It could also result in new business models, such as shared mobility which could lead to a strong decrease of vehicles on our roads. Connected and automated vehicles also bring new challenges for regulators concerning road safety, security, traffic law, access to data, protection of personal data, financing, etc which need to be adressed.

The competitiveness issue shall not be forgotten. Car manufacturers are competing in a worldwide race toward vehicle automation and connectivity with newcomers from the IT sector (e.g. Google, Apple, Tesla). The value is being reshuffled across the value chains. According to some studies, 30 to 40 per cent of the value in the automotive value chain will pass through digital platforms, in the near future. Whilst the market behaviour of digital platform providers is subject to the existing competition policy instruments, it will be important to assess in addition what role the EU could have in ensuring the free flow of data and undistorted access to the relevant platforms. Dependence on a reliable IT infrastructure and its maintenance adds complexity to the value chain, and is an important issue to consider in order to realise the expected benefits of automation.

2. THE GEAR 2030 ROADMAP WILL PROVIDE A COHERENT EU FRAMEWORK FOR AUTOMATED VEHICLES

The work has already started on automated vehicles within the different Commission departments (especially on research, data, standardisation and vehicle approval). However a coherent approach on the industrial deployment of connected and automated vehicles is missing. This is the purpose of the GEAR 2030 roadmap. This roadmap should cover:

a. A shared vision of increasingly automated vehicles which should come step by step focusing first on very well defined and safe traffic conditions, e.g. automated driving on motorways with no crossroads, and including connectivity aspects as appropriate along the way (See Annex 1). The shared vision should also address issues of societal acceptance early on, in an inclusive process.

b. A list of actions covering:1) the review of the existing legal and policy framework for highly automated and connected driving 2) Coordinated research, innovation, large scale tests and other financing tools 3) international co-operation action and competitiveness.

As part of the shared vision, automation requires a broader view beyond the vehicle aspect, including the requirements for the physical and digital road infrastructure, links to connectivity aspects and traffic management and aspects linked to the road users, not least the road safety dimension. The societal (e.g. driver acceptance, data issues, interaction driver/vehicle/other users, ethical issues, environmental issues, social inclusion) and economic issues (impact on economic activities) should also be looked at. The needs at European level should be identified.

At this stage, no big legal obstacle can be identified in the EU legislation (see Annex 2) for upcoming partially automated vehicles ('level 3' BAST levels). For higher levels of automation and for car connectivity, EU legislation changes may be needed (e.g. traffic rules, connectivity, driving licence, road worthiness, liability framework, road signs, insurance, theft and cybersecurity, privacy and data protection, compliance assessment, etc). Existing platforms shall be used where relevant. For example it was that relevant connectivity aspects presently being discussed by the "C-ITS platform" will feed into the GEAR 2030 process. DG CNECTs policy areas related to connectivity such as spectrum management, mobile broadband coverage, 5G, cyber security, net neutrality, roaming, are also relevant for connected and automated driving. The Digital Single Market in particular is aiming to provide a data framework which will be relevant for connected mobility in general.

A lot has been done in the past on feasibility tests on automated vehicles in lab conditions and on test tracks (see Annex 3). The Commission has co-funded a large number of research projects in the areas of connectivity, advanced driver assistance systems and automated driving through the multi-annual framework programmes for research and development.

It is now time to gain experience on real traffic conditions with large scale testing on EU roads. The experience from some Member States shall be used (e.g. France Germany, Netherlands, UK, Sweden) and test data should be exchanged. In Horizon 2020 the Commission will be expanding the funding for research on connected and automated driving. "Automated Road Transport" is seen as a key priority in the Horizon 2020 Transport Research programme with a budget of more than 114 million euros (more details in Annex 3). There is a strong need for a coordinated approach and priority setting for funding research, demonstration and deployment activities at European and National levels in order to maximise synergies and avoid fragmentation between different programmes (e.g. Horizon 2020, Connecting Europe facility).

Other financing tools could be mobilized such as the Junker plan, Galileo services or important projects of common European interest (IPCEI), etc. One of the concrete potential IPCEI projects initiated by members of the KETs High-Level Group relates to Connected & Automated Driving[1]. EU GNSS (EGNOS & GALILEO) could be an important technology component to enable both automated and connected vehicles, repeating the fruitful work done with e-Call. In particular, GNSS could significantly assist in

[1] Final report 'KETs: Time to Act', High-Level Group on Key Enabling Technologies, June 2015, p.63

improving road management, which will be beneficial both in economic and environmental terms, but also for road safety.

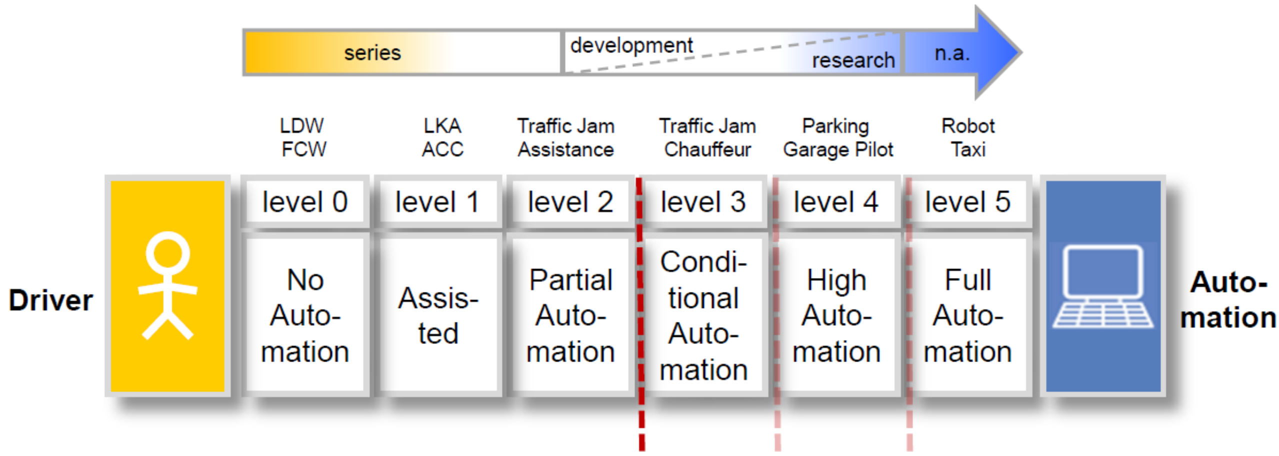
On international issues, a framework exists at the United Nations (UNECE). The work shall continue on vehicle approval and on traffic rules. Bilateral relations with Japan and the USA could also be used. International cooperation can also be of huge benefit for research. There are great opportunities to use world-wide knowledge to tackle the challenges of connected, automated road transport and share expertise, data and facilities. For example, the Commission intends to "twin" EU-funded projects with similar ones funded by the US Department of Transportation.

On competiveness, we have to ensure that the international work serves the EU interests. Also there is a need to develop our understanding on the economic and social impact of the rise of automated vehicles and digital platforms in the European automotive value chain. In particular, the Strategic Policy Forum on Digital Transformation is working on a report to analyse the transformation of the automotive value chain, the shift of value along the value-chain, new business opportunities, the role of B2B digital industrial platforms, the uptake of big data solutions and competition issues.

To carry out the work, GEAR 2030 will need the support of a dedicated working group on automated vehicles. Some detailed discussion will be needed and it is not possible to tackle all the issues above in the High level group. It is also the intention of the Commission services to rely on existing frameworks (e.g. UNECE, C-ITS platform) for some of the issues.

<u>Annex 1</u>: Level of Automation - Timeline for automated /connected vehicles

<u>Bast/VDA classification:</u>



	level 0	level 1	level 2	level 3	level 4	level 5
driver “in the Loop”	*yes (must!)*			*no (optional)*		
secondary tasks	*none*			*specific*	*all (incl. sleeping)*	
min. risk condition	*none*			*some*	*always (must!)*	
final fallback level	*driver*				*automation*	
from origin to destin.	*no (specific use case)*					*yes*

ACC: Automatic Cruise control
FCW: Forward collision warning
LDW: Lane departure warning
LKA: Line keeping assist

<u>Timelines for automated /connected vehicles (source: Netherlands)</u>

Annex 2: Preliminary review of the EU legislation

This preliminary review of the EU legislation is based the review carried out by the UK for the testing of autonomous vehicles in the UK and published on 11 Februry 2015: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/401565/pathway-driverless-cars-main.pdf

The main elements (adpated to the EU context) are as follows:

I -LARGE SCALE TESTING OF HIGHLY AUTOMATED VEHICLES:

The applicable legislation is mainly national (traffic rules). Derogations to the 'normal' traffic rules are generally possible. The 1968 Vienna convention on international traffic applied by most EU Member States allows to have specific national rules. In most of the cases a trained test driver will be required to monitor the operations (as it was the case for the 'Google car' in the US) as well as an event data recorder.

II- UPCOMING INCREASINGLY AUTOMATED VEHICLES

Road safety, traffic rules, driver behaviour and other users, driving licence,

Legislation: National traffic rules
1968 Vienna Convention on international road traffic (Member states)
Directive 2006/126/EC on driving licence (DG MOVE)

In most of the Member States, the driver behaviour is covered by traffic rules, civil and criminal law, in particular for ensuring road safety. Generally road users owe a duty of care to other road users and will be liable in negligence if breach of that duty causes damage. The current law is based on the assumption that when a vehicle is used on the roads there is a natural person who is the driver of that vehicle. Therefore as long as a driver is present in the car, he will be considered responsible for the safe operation of the test vehicle whilst on public roads. The traffic rules of Member States will need to be updated in due course to take into account the use of highly automated vehicles on the roads. It may be necessary to wait until experience has been gained with these vehicles and possibly research has been conducted into the interactions between such vehicles and other road users.

The 1968 Vienna Convention on Road Traffic as well as it predecessor the 1949 Geneva Convention on Road Traffic are international treaties designed to facilitate international road traffic and enhance road safety. The convention sets minimum standards that shall be recognized recognised by all the Contracting Parties for international traffic: common principles for traffic rules, distinguishing sign of the state of registration (country codes), recognition of the technical conditions for vehicles, recognition of driving licences. The main obligation is to accept foreign drivers/vehicles which are in conformity with the convention. The Convention does not prevent Contracting parties to test fully automated vehicles through specific national traffic rules. In addition, the Vienna Convention was recently amended to allow the international traffic of partially automated vehicles (a similar amendment to the Geneva Convention is being prepared).

The discussion on further amendments to remove obstacles to fully automated vehicles is on-going.

Automation technology is intended to partially or completely replace the driver; this has created a new situation, where the requirements for car automation systems overlap with the rules for driver behaviour. Close coordination is therefore needed between the work on the two, until now separate domains, of road traffic legislation: the vehicle and the driver.

Directive 2006/126/EC sets out minimum requirements for driving licences and is supplemented by national legisaltion. This framework does not prevent new automated systems to come into the market. However, it will be important to ensure drivers have an understanding of the limitations of automated vehicles and the situations in which they may need to take back control of the car. The scenario in which automated vehicles are interacting with conventional cars does not, at first glance, raise any additional competence requirements for their drivers. It seems reasonable to assume that automated systems will be optimised to react appropriately to other vehicles.

For automated vehicles to be used in freight or passenger transport, it could also become necessary to update Directive 2003/59/EC on training and initial qualifications of professional drivers.

Insurance, liability and defects

Legislation: Directive 2009/103/EC ('Motor Insurance Directive' -DG FISMA) and national rules
Product Liability Directive 85/374/EEC (DG GROW) and national rules

Directive 2009/103/EC obliges the use of all vehicles in the EU to be insured against third party liability and sets minimum thresholds for personal injury and property damage cover. In the case of highly automated vehicles being operated autonomously, the question arises whether a compulsory insurance cover requirement on manufacturers for their liabilities would be needed.

Product liability is covered by Directive 85/374/EEC and national rules. It is anticipated that at least in the short run the legal position for liability in relation to features on vehicles which incorporate higher levels of automation would not be significantly different to those presently assisting the driver. In case of accident, each of the parties involved (manufacturer, driver, etc) may be found to be civilly (or in some cases criminally) liable to a greater or lesser extent depending on the exact circumstances of the situation. A judge would assess whether each party is liable in law and the extent to which their fault had contributed to the loss. He will have to consider the criteria for determining liability. Due to the number of participants there is also the question whether each individual is liable or whether there should be a kind of joint liability, perhaps depending on contributions to the risk which materialised in the damage. Other questions relate to the reason and legal nature of liability: Can there be at all a somehow fault-based liability approach if actions are determined by software and algorithms? Should liability be based on a principle that somebody running an autonomous system has created a risk and should therefore be liable for possible damage when this risk has materialised? Should liability be strict? Should there be caps or the possibility to take into account external factors? Should liability be coupled with a - possibly mandatory - insurance solution? As an answer to these questions, there is a strong case for event recorders (‘black boxes’) to establish the exact circumstances and liabilities in case of an accident. Devices that would be fitted to the vehicle during production would fall under the European type approval system.

Questions about liability become even more pertinent for completely autonomous systems like self-driving cars. It is worth noting that the Commission's Digital Single Market strategy recognises the importance of clarifying liability issues for the roll-out of Internet of Things (IoT) which is relevant in the context of connected and even more automated cars[2]. Liability and compensation issues concerning the processing of personal data are provided for in the EU Data Protection Directive 95/46/EC[3] and further detailed in the proposed General Data Protection Regulation[4]. Further, to this the Commission committed to launch in 2016 a Free flow of data initiative (FFD) to address *inter alia* liability issues in relation to IoT technologies together with emerging issues of non-personal 'data ownership', interoperability, (re)usability and access to data, with a view to remove possible barriers that prevent the free flow of data in the Member States[5]. In this context DG JUST will launch a major study in cooperation with DG CNECT and DG GROW to analyse emerging issues linked to FFD, in particular possible restrictions also stemming from contractual arrangements, and also to carry out an analysis of various legal issues arising in the context of the IoT (e.g. non-contractual and contractual liability, contract law implications relating to machine-to-machine-to contracts, etc.). The data gathered from the study will feed into the FFD initiative, scheduled for Q3 2016.

Whilst the question of legal liability for defects may remain as it is currently at least for the short run, the question of what legally constitutes a ‘defect’ in a vehicle may be much more difficult to resolve due to the increasingly complexity of automated vehicles. As automated vehicles gain market share, issues concerning liability and defects may need to be monitored to ensure that existing legislation is working correctly to protect consumers and the general public.

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2 There is a need to clarify liability issues in the context of IoT, in particular extra-contractual liability. For example in case of bodily injury, death, damage to property and other type of losses, identifying the primary cause of the damage, establishing the causation link and finally establishing the liability between various participants in the IoT ecosystem (i.e. between product manufacturers, sensor manufacturers, software producers, data analytics companies and other actors involved in the supply of different services) can be difficult.

3 See Article 23 of Directive 95/46/EC of the European Parliament and of the Council of 24 October 1995 on the protection of individuals with regard to the processing of personal data and on the free movement of such data, Official Journal L 281 , 23/11/1995, p 31 – 50.

4 COM (2012) 11 final.

5 The free flow of personal data in the EU is provided for under Directive 95/46/EC. The free flow of personal data in the EU will also be provided for in the proposed data protection reform package, which is currently in the final stage of the legislative process.

Vehicle approval legislation, vehicle roadworthiness and maintenance

Legislation: Directive 2007/46/EC on vehicle approval (DG GROW)
Roadworthiness Directive 2014/45 (DG MOVE) and national legislation.

Directive 2007/46/EC sets up a fully harmonised EU-wide framework for the approval of motor vehicles. This directive may refer to international regulations, such as Regulations from United Nations (UN) and allow derogations to limited national approvals. Highly automated vehicles could comply with type approval, with the exception of UN Regulation 79 (Steering systems), which does not permit "Automatically Commanded Steering" (or automated steering) above speeds of 10km/h. In addition, UN Regulation 13 (Braking systems) does cater for "Automatically Commanded Braking" but may require some examination to confirm its suitability. Discussions to amend these regulations are on-going in the UN. Type approval rules could also be revised to include appropriate levels of ambient lighting at which lights may or must be switched on.

Turning to vehicle ergonomics, it may be necessary to standardise matters such as the warning tone or tell-tale which would be used on highly automated vehicles to inform the driver that he needs to take back control, to avoid confusion amongst the public when moving between different vehicle. Other user interfaces could also be subject of standardisation.

For fully autonomous vehicles, the vehicle would need to be fully programmed to respect all the specific obligations and safety considerations that are set out in the different traffic laws. This includes guarantees for the safety both of those inside and of those outside of the vehicle and in all scenarios including interaction between manually driven and automated vehicles and between automated vehicles and vulnerable road users. It would be for the type approval system to impose the required specific standards on the vehicle, although given different in-use rules in different countries, there may need to be some harmonisation and adjustment of domestic legislation to obtain an EU-wide approval standard. Information on those obligations that were not harmonised across the EU could be made available to the vehicle so that it could modify its behaviour based on its geographic location and the rules that applied in that jurisdiction.

Before highly automated vehicles can enter mass production it is anticipated that EU type approval standards would need to be updated to cover the new technologies and vehicle capabilities and that these would flow through to updated roadworthiness requirements. It would be expected that the EU Roadworthiness Directive 2014/45 would be updated. Development of type approval standards should ensure that the performance of automated systems within vehicles can be easily and cheaply verified at the roadworthiness test. It may be that the current roadworthiness test format would be insufficiently sophisticated to cater for highly or fully automated vehicles.

As vehicles become more complex, there is increasing concern as to the ability of parties other than franchised dealers to repair them, and this is likely to have an impact on the costs of repair. In addition an automated vehicle is likely to be particularly complex and utilise proprietary technology extensively so manufacturers may not wish to permit or enable repair by other parties.

Connected vehicles, data protection and security

Legislation: ITS directive 2010/40/EU (DG MOVE) and national law
Directive 95/46/EC on data protection, and national rules (DG JUST),
Directive 2002/58/EC on privacy in electronic communications (DG CNECT)
Directive 2007/46/EC on vehicle approval and UN regulation 116 on anti –theft devices (DG GROW)

Connectivity exists today mainly for driver assistance (internet surfing, phone, info traffic, e-call) or fleet management (heavy duty vehicles, taxis). In addition connected services making use of direct vehicle-to-vehicle and vehicle-to-infrastructure short-range communication for traffic safety services are already on the market in Japan - and Europe and the US are about to follow in deploying them. Based on this introduced connectivity it is expected that vehicles will also make use of information (i.e. react automatically) that is received both from the infrastructure and other vehicles.

With the increasingly amount of data generated by automated and connected vehicles there may be a need for additional road and telecom infrastructure capacities. In addition, interoperability is key to maximise the information exchange between vehicles and infrastructures and to dramatically improve road safety or develop new services like traffic management, mobility as a service, etc. In this respect, the work on connectivity already ahead within e.g. the structured dialogue Telecom/Car industry from DG CNECT or the C-ITS platform from DG MOVE could provide an important basis for more connectivity towards high automation and fully autonomous vehicles.

Any processing of personal data by an automated car will need to comply with data protection rules. These are provided in Directive 95/46/EC on personal data and Directive 2002/58/EC on the processing of personal data and the protection of privacy in the electronic communication sector. These laws are designed to ensure that personal data and privacy are protected and that the processing of personal data is for lawful, legitimate and specific purpose(s). Individuals should be provided with information when personal data about them is collected. This information should include who is collecting the personal data (i.e. identity of the controller, and of his representative, if any), the purposes of the processing and any other further information necessary, having regard to the specific circumstances in which the data are collected, to guarantee fair processing in respect of the data subject. The data should not be used for other processing purposes which are incompatible with the original purposes. In 2016, in the framework of the Digital Single Market, the free flow of data initiative will further complete a European data framework aimed at developing the data economy whilst ensuring data protection and data security.

There are various devices capable of recording data that relate to an identified or identifiable individual. The vehicle’s own electronic control units (ECUs) or event Data Recorders (EDR) may provide this possibility. The increasing number of sensors on a vehicle means that a wide range of different datasets could be collected which can provide information about how and where the vehicle was driven. This information can potentially be sent from the vehicle via the internet to remote server storage. Other actors may be interested by this data (e.g. IT service provider, traffic manager). So the issue of non-personal data sharing is also important, but is not regulated at the moment except repair and maintenance information (Regulation (EC) 715/2007). Sharing of personal data will need to be done in compliance with the data protection rules; in particular, comply with the data protection principles, and have a lawful and legitimate basis for the sharing as set out in Articles 6 and 7 of Directive 95/46/EC.

To comply with the fair processing requirements of data protection legislation, drivers and the registered keepers (and potentially passengers) of vehicles should be provided with sufficient and clear information about who is collecting the data, the intended purposes of processing and any other necessary information to guarantee that they are made aware of the data that their vehicle is collecting, purposes for the data which are intended. Individuals may expect that their personal data will not be shared or used for other purposes unless there is an accident, which might require the sending of certain data to emergency services (see e-call). Manufacturers and insurance companies (among others) have an interest in obtaining data which is not limited to a short period prior to a collision, any such sharing or further processing of personal data will need to comply with the data protection rules.

As an enabler of the DSM strategy, the EU data protection laws are undergoing a reform (currently in the final stage of the legislative process with anticipated agreement by the end of 2015), which will end the silos of national data protection laws implemented under Directive 95/46/EC. Under the new General Data Protection Regulation there will be one data protection law applicable across the EU. This will assist the initiative for automated vehicles as manufacturers and others (such as traffic management providers) will no longer have to ensure compliance with 28 different national data protection laws.

In addition, data produced by the sensors on a vehicle may also be classified as non-personal data or machine-generated data in so far as they do not relate to an identified or identifiable individual, which are not covered by data protection legislation insofar as the principle of free flow of data is concerned. To this end, the Free Flow of Data initiative mentioned in the DSM strategy will, *inter alia*, tackle emerging issues e.g. 'ownership', (re)usability, access linked to such non-personal data. DG JUST in cooperation with DG CNECT and DG GROW is planning to launch a study to carry out a thorough analysis of these issues with a view to determine what are the problems that need to be solved though EU action.

The introduction of greater connectivity into vehicles, accompanied by increasing levels of electronic control and automated operation capabilities, leads to potentially more complex security issues. Today all new cars must be approved in accordance with UN Regulation 116 (Protection of motor vehicles against unauthorised use), which requires both a mechanical anti-theft device (in practice normally a steering lock and an electronic immobiliser. UN Regulation 116 is formulated to ensure that vehicle manufacturers put in place measures to prevent unauthorised use. If it is felt that further regulation is required to ensure that manufacturers adequately address cyber security issues then it may be appropriate to update this Regulation.

Infrastructure requirements

Legislation: Directive 2008/96/EC on infrastructure safety management
National law

Minimum requirements for the road infrastructure could be needed for the deployment of partially and fully automated vehicles. This could include e.g. minimum standards for road signs and markings, digital mapping of speed limits, digital infrastructure for connectivity, common agreement for readability of temporary structures e.g. around road works, etc.

Annex 3: Research projects/large scale testing

European Union

The EU has initiated a number of research projects examining the potential for automated vehicles. These include for example:

Platooning

SARTRE (SAfe Road TRains for the Environment) – a FP7 (Seventh Framework Programme for Research and Technological Development) project which ran from 2009-2012 and aimed to develop strategies and technologies to allow vehicle platoons to operate on normal public highways. The 'road trains' are made up of a lead vehicle with a human driver, followed by a convoy of automated vehicles. A conclusion was that technology for platooning is close to mature, even if further testing and improvement is required. Regulatory aspects are a remaining a challenge.

COMPANION – Cooperative dynamic formation of platoons for safe and energy-optimized goods transportation. The FP& project started in 2013 for the development of off-board system for optimal platoon coordination, and the on-board system for coordinated platooning. Led by Scania it aims at addressing freight logistics through a technology that allows platoons to be created dynamically on the road, by merging vehicles (or sub-platoons). With the help of a real-time ccordination system the project enables to dynamically create, maintain and dissolve platoons according to an online decision-making mechanism.

Cooperative driving

Drive C2X - The FP7 project, completed in 2014, provided a comprehensive, Europe-wide assessment of cooperative systems through field operational tests**.** The field trials involving seven test sites all across Europe proved the safety and efficiency benefits of cooperative systems**.** More than 750 drivers successfully tested eight safety-related functions of cooperative systems. Technically the systems tested showed faultless performance during the extensive field trials in seven European countries. User acceptance evaluations, safety and efficiency benefits, and business studies were also undertaken for the functions.

Assessment of advanced driver assistance systems (ADAS)

EuroFOT (European Field Operational Test) was a FP7 project which ran from 2008 to 2012. The project involved over one thousand cars and trucks that were equipped with existing advanced driver assistance systems. They travelled European roads during one year. The potential to both enhance safety and reduce environmental impact was evaluated. EuroFOT also revealed a link between these systems and improvements in driver behaviour, fuel efficiency and traffic safety, as well as overall cost savings.

Human-Machine-Interface (HMI)

HAVE-it – Highly Automated Vehicles for Intelligent Transport (HAVE-it) was a FP7 project which was aimed at realising highly automated driving for intelligent transport. The project began in February 2008 and ran until June 2011 and involved Continental, Haldex, Volkswagen and Volvo as well as SMEs, research institutes and universities. Driver awareness, optimised task repartition between the driver and the system and misuse are examples of focus areas of the study. The HMI concept developed in the project was considered as an enabler for integration of highly automated driving functions with then existing driver assistance systems. The final event included seven demonstration vehicles.

ADAS (Advanced Driver Assistance Systems) adapted to driver

AdaptIVe (Automated Driving Applications and Technologies for Intelligent Vehicles). The FP7 project began in January 2014 and will run until the end of June 2017. The consortium, led by Volkswagen, consists of ten major automotive manufacturers, suppliers, research institutes and universities and small and medium-sized businesses. The project develops various automated driving functions for daily traffic by dynamically adapting the level of automation to situation and driver status. Furthermore the project defines and validates evaluation methodologies, including assessment of impact of automated driving applications, and legal issues that might impact successful market introduction. Demonstrators are planned to take place during 2016.

Urban environment, implementation aspects

Citymobil. The FP7 ran till December 2011 and examined the integration of automated transport systems in the urban environment. The project focused on real-life implementations of automated transport systems in three sites: a Personal Rapid Transit (PRT) system at Heathrow Terminal 5 in the UK; a hybrid guided bus/tramway in Castellon in Spain; and a Cybernetic Transport System in Rome. The most important barrier to implementation was found to be safety, and a set of generally accepted certification guidelines were considered necessary. It was also concluded that the automated transport solution needs to be tailored to the type of city.

Citymobil 2 – This is a follow-up project of Citymobil. It started in September 2012 and runs for four years. Citymobil 2 is setting up a pilot platform for automated road transport systems. In May 2014, seven European towns and cities were selected to be sites to run large and small-scale demonstrations and showcases of automated road transport systems. Six vehicles will operate on each site for at least six months. Several small-scale demonstrations will also be carried out.
The research looks at the technical, financial, cultural and behavioural features and consequences for land-use policies and how new systems can be integrated in current infrastructures in various cities.

Infrastructure

FOTsis (European Field Operational Test on Safe, Intelligent and Sustainable Road Operation) -- This FP7 large-scale field testing studies the road infrastructure's capability to incorporate seven close-to-market services (Emergency Management, Safety Incident Management, Intelligent Congestion Control, Dynamic Route Planning, Special Vehicle Tracking, Advanced Enforcement and Infrastructure Safety Assessment) in four separate test communities in Spain, Portugal, Germany and Greece. The processing of the data collected led to a series of conclusions concerning the market potential of the seven FOTsis services in terms of effects on safety and environmental factors.

Horizon 2020: Specific Call on Automated Road Transport and internet of things

In Horizon 2020 the Commission will be expanding the funding for research on connected and automated driving. "Automated Road Transport" is seen as a key priority in the Horizon 2020 Transport Research programme. For the first time a Specific Call in this area has been included in the 2016/17 Work Programme, with a budget of more than 114 million euros. The emphasis of this call is placed on large scale demonstration pilots to test the reliability and safety of automation technologies for cars, trucks and fully automated urban road transport systems in real traffic situations. This call will also focus on issues such as ICT infrastructure needed to attain advanced levels of road vehicle automation, safe human-machine interface, road infrastructure to facilitate automated transport or aspects of driver and road user behaviour.

Horizon 2020 provides also another funding stream for automated road transport from DG CNCT. Within the call on "Internet of Things" a demonstration pilot will test the added value and potential of IoT technologies for automated vehicles in a connected environment.

France

President Francois Hollande included driverless cars in a 10-year “roadmap for the future”. The CEO of Renault-Nissan, Carlos Ghosn has been named as leader of the automated vehicles project. In July 2014, his roadmap for automated vehicles was published. This included the identification of pilot zones for automated vehicles, R&D projects on intelligence, human factors, connectivity, security, provision of suitable test facilities.

An inter-ministerial team has been established to examine the regulatory issues which may inhibit testing of automated vehicles.

Renault’s Next Two automated vehicle demonstrator allows the driver to delegate driving functions in congested traffic up to 30kph on main roads.

Germany

In January 2014, BMW announced it intended to conduct a fleet trial of its ‘highly automated driving’ technology in 2015. Some current production BMW vehicles feature ‘Traffic Jam Assist’ capable of automated steering, acceleration and braking up to 25 mph.

In January 2015, Germany’s transport minister announced that the A9 autobahn between Munich and Berlin would be fitted with technology to allow driverless cars to use the road and communicate with other vehicles and the road infrastructure. It is also worth noting that Audi is amongst the most advanced of the OEMs in offering driver assistance technologies on its range of vehicle

Italy

The University of Parma is heavily involved in automated vehicles. In 2013, it ran a test specifically aimed at demonstrating their technology on public urban roads – the PROUD (Public ROad Urban Driverless car test). The test utilised an open road route with a mix of rural, freeway, and urban traffic. The test was carried out with a police escort at all times and a passenger ready to use the brake pedal in case of any emergency situations.

Italy is also involved with the European FP7 project Citymobil 2.

Netherlands

In June 2014 the Dutch Minister for Infrastructure and the Environment announced the desire to allow large-scale testing of self-driving on Dutch roads, In January 2015 a proposal to extend exemption rules to allow 'large-scale' testing of self-driving cars and trucks was approved. A spokesperson stated that testing would start in summer 2015 once parliament approved the necessary legislative changes.

Spain

In 2012, Spain allowed an open road platooning test of three Volvos and a semitrailer on a highway near Barcelona under the FP7 project SARTRE.

Scania is working in collaboration with IDIADA (Spanish proving grounds and research laboratory) to test their entire platooning system on Spanish roads during the autumn of 2016.

Sweden

Testing of highly automated vehicles on public roads has already commenced in and around Gothenburg as part of the Volvo 'Drive Me' project. The vehicles are currently being driven and developed by test engineers, but it is planned to provide members of the public with 100 driverless cars for use on public roads in Gothenburg in 2017. According to one report, the use of automated operation will be limited to a specific region within Gothenburg, which will be mapped for the trial.

USA

America is generally considered to be leading the way in terms of legislating for driverless vehicles. To date, four states in America including Nevada, Florida, California and Michigan have already passed laws concerning driverless cars. However, as of january 2015, 15 states had bills on automated driving which have failed.

In May 2013 NHTSA issued a 'preliminary statement of policy concerning automated vehicles' including recommendations for states wishing to proceed with tests of automated vehicles.

Perhaps the most well-known and influential proponent of automated vehicles is Google. In 2014 Google introduced their own design for a self-driving vehicle – a small, two-seat, low speed device with no steering wheel or other controls other than a stop button. However, due to California's requirement for an individual to be able to "immediately take control of the vehicle's movements", Google has been forced to redesign the vehicle to include driver controls prior to public road testing in California. Other American companies involved in developing the technology include Intel, General Motors and Autoliv Inc.

Japan

The first public road test of an automated vehicle on a Japanese highway was conducted in November 2013. The vehicle was a Nissan Leaf equipped with lane keeping and adaptive cruise control, automatic exit, automatic lane change, automatic overtaking slower or stopped vehicles and automatic stopping at red lights

In March 2014 the Japanese Ministry of Economy, Trade and Industry published an information journal setting out the current situation for automated driving. This included a four-step definition of levels of autonomy. However, Japan does not appear to have plans to review or introduce new regulations regarding automated vehicles. Some Japanese manufacturers seem to have a less enthusiastic view of fully automated vehicle technologies than appears to be prevalent in Europe. Nissan appears to be more positive with an aim to be a leader in the introduction of automated features. In 2016 it has stated it will introduce fully automated parking systems as well as traffic-jam pilot across much of its range and in 2018 this will be augmented by more advanced features allowing the automation of complicated manoeuvres on multi-lane highways.