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Autonomous driving

Submitted by FIA

This document, submitted by FIA, provides practical recommendations to the national bodies that consider authorizing trial tests of autonomous vehicles on open roads.

DRIVERLESS CARS and the REGULATORY FRAMEWORK

Recommendations for trials and tests on open public roads

Preliminary input

September 2015

Vehicle active safety technologies have made today's cars a lot safer than older models, and they are evolving all the time. These technologies are aimed at preventing crashes, particularly if the driver has, or is about to, lose control.

From an evolutionary perspective, the advanced sensing and connectivity technology will lead to autonomous vehicles: self-driving, driverless, automated, or autonomous, these vehicles are on the radar screen. Nearly all car manufacturers and important IT players have announced plans to deliver fully autonomous vehicles in their product line offer.

On the other side, national authorities in several parts of the world have been progressively given authorizations to tests on public roads (see ANNEX), under certain conditions, such vehicles. The FIA believes that the next years will be extremely important to design the most appropriate regulatory framework and to learn how to prepare for autonomous driving:

- How will authorities adapt existing rules?
- What is an acceptable liability chain the industry needs to agree upon? The technology will need to instil confidence and gain consumer's acceptance;
- What is the road map to achieve consumer trust on a next technology level?

The FIA and the motoring clubs encourage the rollout of testing and demonstration of autonomous vehicles on public roads to get feedback, improve technology, create user acceptance, and learn how automated vehicles successfully and safely will interact with all other types of road users.

In countries subject to type approved regulation, temporary deregulation should be implemented to allow the testing of such new vehicles on public roads, under the condition that they remain under the control of the manufacturers and/or organisation tests.

To make sure trial tests are conducted keeping the consumers at the heart of the process, the FIA suggests consideration of the following aspects:

Definition

The following recommendations apply to vehicles which fall under the Level 3 Limited Self-Driving Automation definition drafted by the NHSTA: "*Vehicles at this level of automation enable the driver to cede full control of all safety-critical functions under certain traffic or environmental conditions and in those conditions to rely heavily on the vehicle to monitor for changes in those conditions requiring transition back to driver control. The driver is expected to be available for occasional control, but with sufficiently comfortable transition time. The vehicle is designed to ensure safe operation during the automated driving mode*"[1].

Recommendations for testing driverless cars

Before authorizing operations on public roads, governments should consider a consultation process with key stakeholders in order to agree on the scale of the trials (vehicles involved; road network capillarity; timing of the test; etc).

A test driver should be in the driving seat to monitor execution of operations at any time. The test driver should be in the position of taking over from the automated system and take control back in case potential risks arise.

Considering that currently (and most likely for the next years) autonomous cars require a greater level of human judgment and skill to operate safely, any test driver should:

- Hold an appropriate full category of license, according to the national regime and the category of the vehicle in use;
- Possess a minimum number of years of experience on the wheels, with clear driving licence record;
- Complete a special training program for autonomous vehicles and should demonstrate knowledge of vehicle technology features, including potential limitation of the technology under test (advanced training proved skills; certifications; etc.).

Member States should consider introducing a database of test drivers, certificating skills and competencies and designing criteria for allowing a driver to be considered a test driver).

The local community and other road users need clear information on the network of roads in which the test is allowed (road signs) and on the vehicles (labels).

During the operation in automation mode, the test driver shouldn't be responsible for the way the vehicle operates and interacts with the environment (respecting road traffic law, adhering to speed limits, observing traffic signs):

[1] National Highway Traffic Safety Administration: Preliminary Statement of Policy Concerning Automated Vehicles, May 2013

- Liability should be either allocated to the car manufacturer or identified within the testing organization which, most of the time, gathers together several players.
- Liability should be restored to the driver, when a clear consent is given to the machine to operate in the conventional driving mode. Car manufacturers should remain liable for mechanical, systems and software failures. Sensors, cameras, and all data collected by the vehicle should be used to assess liability in the event of an accident.

The test should be used:

- To assess the need for regulation as to where it believes responsibility for the safe operation of highly and fully automated vehicles rests when in autonomous mode and to legislate for these different cases.
- To investigate behavioural aspects, specifically:
    - The requirements for the driver-vehicle interface, crucial for the safe transition between automated and non-automated vehicle operation;
    - The expectation of drivers of conventional vehicles with respect to autonomous vehicles: there will likely be a long period during which the two categories of vehicles will interact on the roads.
    - The factors leading to driver acceptance (false alarm rates, frequency of warnings, time-lapse to get control back from the vehicle).
    - The training requirements needed for progressive levels of automation.

- To learn about how to allocate liability (car manufacture; supplier; service provider; telecom operator; driver), when the automation is ensured through vehicle-to-vehicle and vehicle-to-infrastructure capability. Considering autonomous cars will carry an array of cameras, sensors, radar, GPS, and data tracking technologies, reconstruction of accident scenes likely will be easier to achieve: data collected should be made available to better study liability implications and design future regulations.

- To build consumers' trust, creating consumer information about functions, limitations and opportunities of the advanced systems.

- To get insights on user acceptance: many drivers are still resistant to change, might not trust technology to take over from them or just enjoy driving.

Further Considerations

In the event of an incident or collision the information collected by the vehicle (positioning, acceleration, braking, speed, data from sensor and cameras) should be made available to the relevant authorities in order to assess both responsibility and potential risks arising with a higher level of deployment of automated vehicles.

Any processing of data collected by an automated car should, where an individual can be identified (also 'outside' of the vehicle used in the test), comply with data protection rules.

Manufacturers should be invited to include in the manuals of the vehicle warnings about the attendant risks of using new features of vehicle automation. If vehicles are already commercialised, the issue of manufacture's post-sale responsibility to provide warnings regarding newly discovered risks should be addressed. This aspect is particularly relevant on the occasions of software updates. Users should be notified of the availability of software updates and should approve all changes to their vehicle's software.

Government can also support implementation of autonomous cars by using the trial tests to perform cost-benefit analysis of new technology and mandate the solutions which have positive ratio: new technologies typically penetrate the market faster when they are mandated. Considering that the benefits of connected technology depend largely by their penetration in the fleet, government support is key to accelerate their availability.

The regulatory framework of automated driving

Some EU countries, the US, Japan and Singapore are already acting within their own jurisdictions, allowing field operational tests, trials and demonstration on public roads. However, initiatives supporting an harmonised approach amending international regulations are required, preventing the fragmentation that some regions of the world (e.g. Europe) have experienced with deployment of ITS solutions. Global solutions would be important both for the industry and for consumers.

Ensure a standardized switching between automated and manual modes (displayed elements; warnings to drivers; timing of the transition; etc.), initially by considering promoting Code of Practice among car manufacturers.

In particular:

- System actions should be easy to override quickly at any time during normal driving situation (ON/OFF)
- Drivers should be informed of the conditions of the system (activation-deactivation; functioning-non functioning)
- Standardization of the warning symbols and system for the driver to re-take control in an automated vehicle is required

Engage the international community, through the European Union and the United Nations Economic Commission for Europe, to examine the vehicle type approval framework and its detailed technical standards to ensure suitability for automated vehicles. In particular, WP1 and WP29 should work closely on this issue, without separating the regulation of technical aspects (WP29) from the behavioural aspects (WP1).

Build on existing UN Regulation 116, formulated to ensure that vehicle manufacturers put in place measures to prevent unauthorised use, and improve regulations to ensure that cyber security issues are properly addressed.

Make sure manufacturers commit to making repairs information available on a non-discriminatory basis to independent repairers, allowing a right to repair to the consumers.

Consumers of Automated technology will likely have some concerns about the use and potential abuse of data collected from their personal travel. Legislation should consider privacy issues to balance these legitimate concerns against potential data-use benefits: what types of data should be shared, with whom it should be shared, in what way the data will be made available, and for what ends it may be used.

The path to Automation

- Building consumer awareness, through large scale demos on public roads;
- Getting regulatory support;
- Resolving the liability issue, also by learning during scaling-up of operations.

ANNEX

Country	Status
USA & Canada	The U.S. Department of Transportation (DOT) has announced a national 5-years automation program on vehicle automation, with research and development in the 5 level of automations defined by NHSTA. The State of California published in September 2014 a regulatory framework allowing car manufacturers to test autonomous vehicles on public roads. Similar legislation is being passed in Nevada, Florida, the District of Columbia, and Michigan, and further states will follow. There seems to be no coordination among the legislation produced by the different States and the National Highway Traffic Safety Administration (NHTSA) believes that further research is needed to fully understand the technical and human factors issues of self-driving vehicles. Also Canada intends to follow up this initiate.
Japan	Japan has focused on large scale deployment of V2I and V2V communication: 1600 “ITS spot” locations have now been installed with appropriate transmitters in Japan and more than 100,000 vehicles. In May 2014 the government announced the Automated Driving System Research Program, with the intention of showing concrete results during the 2020 Olympic Games in Tokyo.
South Korea	Demonstration and testing are led by Hyuday-Kia motor, which organises the “Future Autonomous Technology Contest”
Singapore	Within the Singapore Autonomous Vehicle Initiative, there are already several ongoing trials for automated driving on Singapore’s roads, including a project of the MIT and the National University of Singapore with a fleet of shared autonomous Golf Buggies.
Australia	Western Australia has a fleet of more than 50 trucks (expected 150 by 2015), known as an Autonomous Haulage System, which operate in self-mode.

	Recently, the government launched the C-ITS strategic Plan, to promote V2V and VTI.
Germany	German vehicle manufacturers have begun the testing of automation technology and the German Federal Ministry of Transport and Digital Infrastructure recently announced the establishment of a test field for connecting and automated driving on the A9 motorway in Bavaria
UK	On 30 July 2014, the Government launched a "driverless cars" competition inviting UK cities to join together with businesses and research organisations to host vehicle trials locally. The results were announced in December 2014 with Greenwich, Milton Keynes, Coventry and Bristol being selected, and £19 million being provided by the Government to allow testing of automated vehicle technology. This initiative follows previous projects, like the famous ULTRA driverless passenger transfer system at Heathrow Terminal 5.
Sweden	Driven by Volvo Car group and motivated by the traditional "vision zero in road safety", Sweden has launched the "Drive Me – Self driving cars for sustainable mobility" initiative: approximately 50 kilometres of the selected roads in the area of Gothenburg, 100 self-driving Volvo-cars will be tested. Volvo Truck has promoted and demonstrated over the last year, together with the European Commission, platooning function for long distance trips.
The Netherlands	Following years of field operational test, and under the pressure of many organisations involved in innovative mobility solutions, the Dutch government announced in June 2014 that it will introduce legislation to allow testing of self-driving vehicles on Dutch public roads. The Netherlands has always been in the frontline of ITS development, and the "Amsterdam group", coalition of transport and technology stakeholders, developed cross-countries standard for ITS architecture.
France	France published its roadmap for automated vehicles in July 2014, with the authorization of experimental on-road testing of highly automated vehicles expected to begin in 2015. The 5-year program will concern 3.000 vehicles on 2.000 kms. For now, the first tests have been announced for the end of the year, in Bordeaux, during the ITS World Congress (October 2015).
UNECE – Vienna Convention	The World Forum for the Harmonization of Vehicle Regulations (WP29), operating under the auspices of UNECE, is assessing proposals covering semi-automated driving functions (autopilot systems to be used in traffic jams, self-parking functions and highway autopilots) which will ultimately pave the way for more highly-automated vehicles. In 2014 the 1968 Vienna Convention, which stipulates that the driver must remain in control of the vehicle at all times, was amended to ensure that safety rules do not hamper the advancement of new technologies aimed at improving road safety.

	Under the chairmanship of the UK and JAP an informal working group on ITS and Automated driving has been set up (see the terms of reference), tasked to make a proposal to be adopted by WP29. At the last WP1 meeting (March 2015), delegates endorsed an informal document submitted by Belgium and Sweden (and supported by the FIA) to create more synergies between WP1 (dealing with behavioural aspects) and WP29 (dealing with technical regulation and technological aspects).