Responsibility for Causing Harm as a Result of a Road Accident Involving a Highly Automated Vehicle

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Abstract: The development and implementation of highly automated transport (unmanned vehicles) is accompanied by a number of problems, including problems related to liability for accidents and causing harm involving unmanned vehicles. The indicated problem faces the legislators and the public of all countries where highly automated transport is produced, tested and introduced. A number of countries have already made an attempt to legislatively regulate issues related to the production of highly automated and unmanned vehicles, their operation and liability for damage. In the presented article, an analysis of the current legislation of the regulatory framework and the conditions for prosecution for damage caused by a highly automated vehicle as a result of a traffic accident, as well as an analysis of the positions of the authors on the topic under study, is carried out. Based on the study, the author formulates proposals on the need for amendments and additions to the current legislation of the Russian Federation related to fixing the grounds and conditions for holding liable, as well as determining the range of subjects to be liable for damage caused by a highly automated vehicle.

1 INTRODUCTION

In recent decades, there has been growing interest in whom as intellectualization and automation will change the future of transport systems. Despite the assurances of experts that highly automated vehicles are the most intelligent and safe cars that do not know what absent-mindedness or fatigue, poor visibility or the human factor on the roads, the development of artificial intelligence has not yet reached the level where errors are reduced to zero.

It should be noted that in a number of countries that are actively introducing highly automated transport into operation in one form or another, regulatory documents have already been developed that regulate the operation of unmanned vehicles, while others are being actively developed.

The press publishes hundreds of notes, paying attention to the smallest details related to unmanned vehicles, in connection with which news about road accidents (hereinafter - accidents) with unmanned vehicles simply cannot go unnoticed.

In 2017, Allen & Overy International Law Firm published Navigation on Legal Issues Related to Unmanned Vehicles (Allen & Overy, 2017). In October 2019, the World Congress ADAS & AV legal issues, implications and liabilities (ADAS & AV legal …, 2019) was held, which focused exclusively on the differing legal issues brought about by different levels of vehicles autonomy.

In the Russian Federation, as in a number of other countries, work is underway to create, test and put into operation highly automated vehicles. Unfortunately, Russia has progressed less than other countries in developing legislation in the field of their use. As early as March 2016, the Committee on Science and High Technologies of the State Duma of the Russian Federation organized a round table on the topic "Normative and legal regulation of the use of unmanned systems in the Russian Federation." Based on the results of the discussion, proposals were prepared, in particular, on amendments to the current legislation addressed to the State Duma of the Russian Federation (On the Experimental Operation…, 2020), which were ignored by the

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legislator. In 2018, by an order of the Government of the Russian Federation, the Strategy for Road Safety in the Russian Federation for 2018-2024 was approved (On Approval of the Road…, 2018), in which there is no mention of unmanned vehicles.

The periodicals of recent years actively discuss the legal aspects of the introduction of unmanned vehicles on public roads. Among the most discussed problems are the questions of terminology, the issues of using an autonomous vehicle, the legal regime of such vehicles, and questions of liability.

There are still many unresolved legal issues, and one of them is who will be to blame and be liable in the event of an accident.

2 SAFETY ISSUES OF HIGH-AUTOMATED VEHICLES

Increased attention to the development and use of highly automated transport is understandable. Due to the operation of an unmanned vehicle, first of all, the solution of the problem of road safety, as well as economic, organizational and social issues, is achieved.

As practice shows, as well as a number of studies in this area, if there are advantages, the appearance of such vehicles on public roads raises a number of questions, primarily related to its safety, and in particular to determining the subjects of responsibility for possible traffic accidents involving of such vehicles and compensation for harm (Makarova et al., 2018).

Autonomous vehicle, like any other device with a network connection, can be subjected to hacker attacks. Anyone who hacked into a vehicle's software can gain access to its vehicle security systems and personal data (Fafoutellis, P., Mantouka, E.G., 2018). For this reason, a malfunction of equipment or software should not lead to loss of vehicle's control, that is, vehicle should have protection to prevent such situations (Yağdereli, E. et.al., 2015).

Experts draw attention to the unreliability of software, which is vulnerable to hacking and snooping, and due to the latter circumstance, loss of privacy (Korobeev, A.I., Chuchaev, A.I., 2019). Unmanned technologies are in a special risk zone, as a result of cyber-terrorist actions people will die. Theoretically, it looks like this - a hacker breaks into the network, turns off the brakes, or vice versa - stops the car on a busy highway. Back in 2015, Uber engineers discovered weaknesses in the software of a

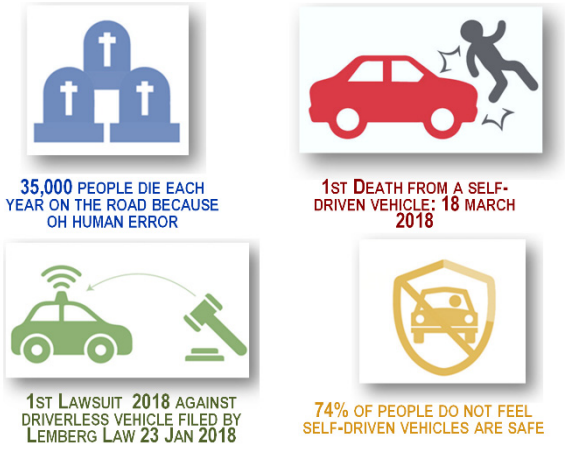

Figure 1: Autonomous vehicle market dynamics by automation levels.

car with an autopilot system. As part of the experiment, they managed to gain access to the brake system.

Engine stopping, disabled brakes and locked doors are some examples of possible cyberattacks on car systems (Eiza, M.H., Ni, Q., 2017). Hackers can infiltrate any targeted vehicle system, steal the owner's personal information, and endanger vehicle safety (Some, E. et.al., 2019).

The CEO of General Motors calls cyber threats the main problem of automakers and the issue of international security today. Some companies, such as Tesla, Fiat Chrysler, and GM specifically encourage individuals who find vulnerabilities in the security systems of automated machines. The number of startups is increasing, the purpose of which is to create the latest cyber defense technologies for cars.

Argus, a company specializing in the development of cyber defense tools for automobiles, believes that a single product cannot be suitable for these purposes: different solutions designed for different parts of an unmanned vehicle should be integrated with each other in order to ensure full protection of the latter (Korobeev, A.I., Chuchaev, A.I., 2019).

An article McAllister (McAllister, R. et.al., 2017) states that improving security alone is not enough. Passengers also need to feel safe and trust autonomous vehicles. In the study (Kalra, N., Paddock, S.M., 2016), one of the proposed methods for assessing safety is to test autonomous vehicles in real traffic, monitor their performance and make statistical comparisons with the characteristics of a human driver, which showed that fully autonomous vehicles should to drive hundreds of millions of miles to demonstrate their reliability in terms of fatalities and injuries.

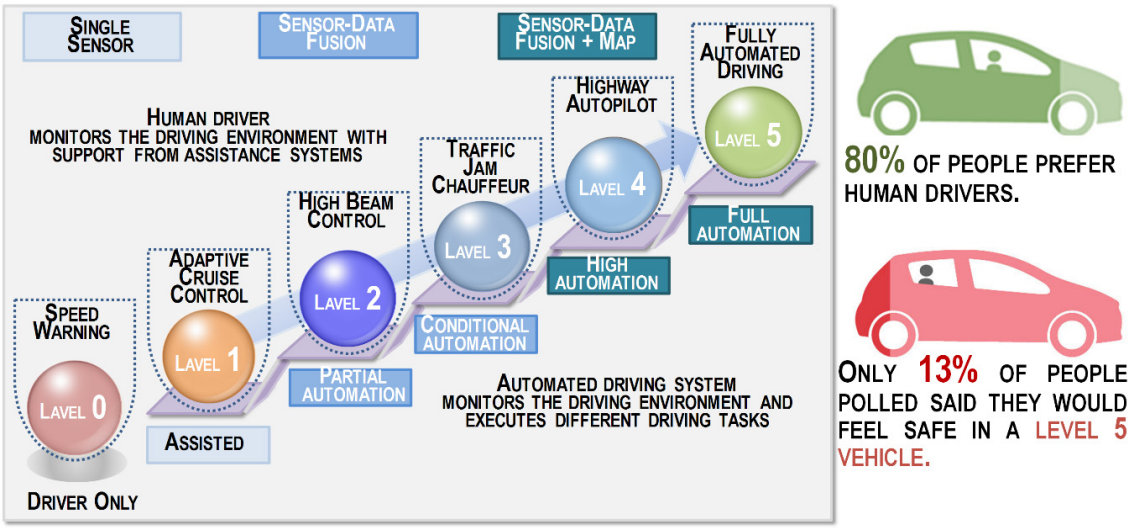

Figure 2: Vehicles automation levels according to the SAE classification and citizens belief degree to robot-driver.

Autonomous vehicles are not ready for wide distribution, their safety problems must be addressed in terms of building trust in these vehicles, legislative regulation of issues related to accidents, solving software vulnerability issues.

3 RESPONSIBILITY ISSUES FOR THE RESULTS OF AN ACCIDENT WITH THE PARTICIPATION OF HIGHLY AUTOMATED VEHICLES

The lack of understanding among the population of the difference between an autonomous vehicle and a car equipped with computer technologies that help the driver is a serious problem with the ensuing consequences. This situation leads not only to violations of traffic rules and causing property damage, but also to deaths on the roads. It is also worrying that some drivers, having yielded to the promises associated with autonomous cars, are completely irresponsible to use existing assistive technologies. The above confirms the analysis of existing practice.

So, in 2015 in California, an unmanned Google car was stopped by a policeman for violating the standard speed limit, and not for speeding, but for driving too slow. An unmanned google car was traveling at a speed of 40 km / h, which created some interference with other participants in the movement. When the officer stopped the car, there was no driver at the wheel — there simply was no steering wheel in the cabin. A policeman warned a passenger - a Google employee - that driving too slow is also a violation of the rules of the road (Martynov, A.V., 2019). The officer did not write a fine and spoil the statistics of Google, because for all the time of the test drones have never been fined.

In the UK, a Tesla electric car driver was convicted of having climbed into the back passenger seat while driving on a busy highway at a speed of about 64 km per hour. The driver used the Tesla autopilot system, which independently brakes, accelerates and keeps the car in a lane on major roads, not considering that this system is not designed to completely replace the driver. Similar technologies are used by other manufacturers, for example, Volvo, Mercedes-Benz and Cadillac. But, none of these systems is completely autonomous. In this connection, some experts in the field of road safety consider it necessary to increase the responsibility of car manufacturers for the correct use of modern autopilot technologies by drivers so that they do not make tragic mistakes.

Sports competition is the only place where unmanned vehicles will have to demonstrate their high-speed driving capabilities. The Roborace brand plans to create a series of unmanned vehicles that will race on the track. The company has already managed to test its fireballs, and one of them even suffered an accident. During a show event between two DevBots, a small incident occurred. When racing drones made maneuvers (sometimes speed reached 185 km/h), one of them did not fit into the turn and flew into the fence. But the second car did the job 100% and was even able to go around the dog, which suddenly ran out onto the track.

Protests from three teams, 73 penalty minutes for violation of traffic rules and one accident - with such results the Up Great “Winter City” unmanned vehicles contest ended, the final of which was held at Dmitrovsky training ground. The technological barrier has not been taken: not a single drone could travel the entire distance in the allotted time. But there is reason for pride: the participants of the “Winter City” staged the world's first traffic jam on the landfill roads.

The developers have been assuring for several years that unmanned vehicles strictly abide by the rules of the road. However, more recently, the exclusive human rights to violate traffic rules have been challenged by the Uber drone, which drove into the red light of a traffic light. During testing of drones, six such cases were recorded.

In foreign traffic practice, accidents involving unmanned vehicles, including accidents involving the death of participants, have already been recorded.

In December 2017, the Chevrolet Bolt, regulated by an automatic control system, collided with a motorcycle while rebuilding from one lane to another. According to the incident report filed by General Motors ’with the California Department of Motor Vehicles, the car saw the motorcycle with" side vision. " The injured motorcyclist filed a lawsuit against the American corporation - this is the first lawsuit involving an unmanned vehicle. The incident itself was only recently announced.

The first fatal accident with an unmanned vehicle occurred in the US state of Florida in 2016. The Tesla Model S Robocar, driven by an autopilot, rammed a truck with a trailer crossing the intersection. According to the press service of the company Tesla, the cause of the accident was a coincidence. As a result, the drone drove under the trailer, demolished the roof, rammed 2 fences and flew into the pole without leaving a chance to the driver.

Experts in this case put forward two versions:

1. The computer could not identify the trailer because of the white color and confused it with the sky, and the driver did not have time to respond in time and take control. Too bright sun rays could also blind the driver.

2. The on-board computer was mistaken due to the long length of the truck and the increased clearance under the trailer. This prevented the sensors from seeing and recognizing dangerous obstacles in time.

It is worth noting that the company hid information about the tragic accident with a fatal outcome of 8 weeks, during which it managed to sell shares in the amount of $ 2 billion. According to the results of an investigation conducted by the USA National Transportation Security Council, the autopilot system was justified, and part of the blame was blamed on the driver himself - he was not careful enough on the road.

Another tragedy was recorded in Tempe (USA, Arizona) on March 21, 2018. Participants in the accident were a “Uber” sports utility vehicle and a cyclist. At the same time, an operator was provided in the cabin of the “autonomously controlled machine”, which was designed just in case of emergency situations (Korobeev, A.I., Chuchaev, A.I., 2019). "... It would be very difficult to avoid this collision in any mode - standalone or with the driver - based on how she (the cyclist) jumped out of the shadows right onto the road ... Uber is hardly to blame for this incident," the chief said Tempe S. Moir Police Department - Neither the camera, nor the person sitting in the cab of the tested car noticed the bike before the collision. In particular, the driver realized that the collision only heard his sound. A car equipped with two cameras also made no attempt to brake. rate of 38 miles per hour (61 km/h) in a zone with a velocity of 35 miles per hour limitation ".

The U.S.A. National Council for Transport Safety has identified the likely causes of an accident in 2018. The company is guilty of a deadly drone accident, but not only Uber is to blame. Federal investigators admitted that 4 parties were to blame for the accident of an unmanned vehicle: Uber, a driver (a safety engineer who was sitting in the driver’s chair during the accident), the victim of the accident and the state of Arizona, where the accident occurred. In an official federal report, the US government also claimed responsibility for improperly regulating the drone industry. The Council also found that the company's unmanned vehicles were not properly programmed to respond to pedestrians crossing the street at non-pedestrian crossings. In addition, Uber said that the company's drone got into more than three dozen accidents before the fatal accident in Tempe.

Thus, in both cases, there were no defects in the equipment that could provoke an emergency. The issue of liability for harm caused, primarily due to gaps in the law, has not been resolved (Zabrodina, E., 2018).

Although these cases are far from the first when an autopilot car is involved in an accident, they again exacerbated the question that has been asked for a long time: who is the responsible party? A driver or an auto company designing an autonomous driving system?

It should be noted that the process of forming requirements for the introduction of autonomous cars on public roads is currently only starting, the main of

which are the mandatory presence of a driver in the cabin, the ability to switch drones to manual control (Chuchaev, A.I., Malikov S.V., 2019). Therefore, in order to ensure safety and minimize the risks of harming a highly automated vehicle, most countries developing unmanned vehicles are moving towards legislatively securing the need for a person in the cabin of an unmanned vehicle to take over the vehicle in case of emergency. This approach is based on the provisions of the 1968 Vienna Convention on Road Traffic, which established that each vehicle or composition of vehicles that are in motion must have a driver (Art. 8) (The Vienna Convention…, 1999).

Along with this, foreign legislation, as a rule, does not regulate the procedure for obtaining rights to drive unmanned vehicles, does not contain rules providing for liability for road traffic crimes involving them (Chuchaev, A.I., Malikov S.V., 2019). However, this situation is not observed in all states introducing highly automated cars on public roads.

For example, in U.S. law, the following statutory provisions for unmanned vehicles can be noted:

- To test an unmanned vehicle on the road, you must obtain the appropriate permit - license. For example, in California, where Google cars were first tested, they were issued to 7 companies;
- insurance - a prerequisite for the operation of an autonomous car. The amount of insurance coverage in the United States is quite serious - $ 5 million;
- According to the law, a driver must be present in the driver's seat who, in case of emergency, can take control;
- a mandatory requirement for drones.
- recording and storage of telemetry 30 seconds before the accident. Moreover, all incidents involving such vehicles must be reported to the USA Department of Transportation.

German experts have enshrined ethical standards for unmanned vehicles, prohibiting artificial intelligence from making decisions that can save the lives of some people, causing damage to others. They echo the three laws of robotics Isaac Asimov (Korobeev, A.I., Chuchaev, A.I., 2019). Based on the established ethical standards, a law was developed and approved by the Bundesrat that defines the legal basis for the use of unmanned vehicles on public roads. The main condition provided for by this law is the mandatory presence of a driver at the wheel who is ready at any time to take control of the vehicle in his hands. In addition, the so-called black box should be installed in the unmanned vehicle, the data of which, in the event of an accident, will show who was to blame for the accident - the driver or the autopilot (Nigmatullin, I., 2016).

In the UK, they are actively discussing the topic of liability and are considering the Vehicle Technology and Aviation Bill project, which defines the main postulates of future legal standards regarding unmanned vehicles:

- if at the time of registration of the insurance policy the insurance company was informed that the vehicle will be used in autopilot mode, then it bears full responsibility for the insured car;
- if the unmanned vehicle is not insured, then in the event of an accident the car owner will be liable;
- in the event that an emergency occurred due to a malfunction in software or equipment, the fault lies with the manufacturer;
- if the accident was the result of a car owner's intervention in the software or the owner did not follow the manufacturer's instructions (for example, did not update the software on time), then the insurer can collect insurance payment from the car owner.

Based on the foregoing, the following conclusion can be made - insurance for self-driving machines with artificial intelligence will not differ much from ordinary OSAGO. In this case, car owners will need to monitor all software updates, to prevent third-party interference in the technique.

So far, only one plus is obvious - the cost of insurance for an unmanned vehicle will be significantly lower than the cost of an ordinary policy for a classic car. A high level of safety and a low probability of getting into an accident will have a key impact on pricing in the field of unmanned vehicle insurance.

In the Russian Federation, the first attempt to regulate relations in the field of the use of unmanned vehicles, including affecting liability issues, is Decree of the Government of the Russian Federation of November 26, 2018 No. 1415 "On conducting an experiment on the pilot operation of highly automated vehicles on public roads" (On conducting an experiment…, 2018) The specified regulatory act defines the subjects of emerging legal relations with the distribution of responsibility in the event of Damage to life and health of people, as well as property damage. These include: the owner of a highly automated vehicle - a legal entity that owns a highly automated vehicle on the basis of ownership and which participates in the experiment on a voluntary basis; driver of a highly automated vehicle - an individual who is in the place of the driver of a highly automated vehicle during an experiment, activates an automated driving system of a highly automated vehicle and controls the movement of this vehicle in an automated control mode, as well as controls a highly automated vehicle in manual control

mode. The driver of a highly automated vehicle is a driver in accordance with the provisions of the Rules of the Road of the Russian Federation, approved by Decree of the Government of the Russian Federation of October 23, 1993 No. 1090 (On the Rules of the Road…, 1993).

According to p.18 of the Decree of the Russian Federation Government No. 1415 (On conducting an experiment…, 2018), the vehicle owner bears responsibility for road traffic and other accidents on the roads of Russia that occurred with the highly automated vehicle participation. It is also necessary to establish a responsibility traffic accident measure in event of the autonomous vehicle's theft.

Interpretation of this norm and other provisions of the analyzed Decision allows us to state that the driver is understood as a participant in traffic, whose guilty actions can also lead to traffic accidents causing damage to property, health and life of others, since he is obliged to activate the automated driving system of a highly automated transport means, control its movement in an automated control mode, as well as carry out highly automated control vehicle in manual mode. At the same time, this approach leaves the question of what is meant by the guilty actions of the driver. Difficulties are caused by the lack of a legislative definition of the concept of "driving a vehicle," which makes it difficult to assess the driver's "contribution" to the process of driving autopilot vehicles, determining their guilt, and the nature of their influence on the onset of road traffic consequences.

The approach laid down in Decree of the Government of the Russian Federation No. 1415 testifies to a greater responsibility of the driver than the owner, since the first is entrusted with the duty of monitoring compliance with traffic rules and preventing traffic accidents. The owner of a highly automated vehicle in the framework of the experiment is more likely to be responsible for failures in software and hardware that cannot be eliminated by the driver. This statement also argues in favor of the fact that prosecution of car manufacturers, organizations responsible for the proper condition of the road network in the framework of the current Russian criminal law is impossible due to the absence of criminal liability of legal entities (Chuchaev, A.I., Malikov S.V., 2019).

This circumstance is indicated, in particular, by the fact that, prior to the day of filing an application for a conclusion regarding a highly automated vehicle, the vehicle's compliance with the amendments to its design with safety requirements, the applicant (owner) must insure and maintain the risk for the insured during the trial operation liability for obligations arising from harm to life, health or property of others in favor of third parties in the amount of 10 ml RUB in relation to each highly automated vehicle, i.e. it is only a civil liability.

Regarding criminal liability for harming an unmanned vehicle, the following should be noted.

In Russia, when a driver is involved to one degree or another in a vehicle, the existing norms of the Criminal Code of the Russian Federation apply. Another thing is with the complete autonomy of the vehicle. The resolution of criminal liability in this case is particularly difficult for a number of reasons. Firstly, the norm should be blank by definition, however, to date, there are no rules that should be referred to in the criminal law. Secondly, it should be decided what lies at the basis of the etiology of a traffic accident when using a highly automated vehicle: disruption of the system or violation of traffic rules as such (a combination of these factors is possible). This is necessary to determine the legal nature of a possible crime: transport or some other (for example, technological), and therefore, determine the object of crime and the place of the latter in the system of the Special Part of the Criminal Code of the Russian Federation. There is no clarity regarding the subject of responsibility: should such be the operator, system designer or manufacturer?

In addition, it is necessary to resolve the issue of liability for external interference in the operation of an unmanned vehicle; it must be noted that none of the norms of the Criminal Code of the Russian Federation covers such actions.

It should be borne in mind that the development of unmanned vehicles will lead to their complete autonomy (Chuchaev, A.I., Malikov S.V., 2019). According to the classification of SAE International (community of automotive engineers) of driver assistance systems, or ADAS (Advanced Driver Assistance System), there are six classes of autonomy (Standard SAE J3016, 2020).

According to this classification, in the case of highly automated and fully automated cars, manufacturers are at a higher risk of being held accountable than in the case of cars driven by people.

In the case of partially automated vehicles, the driver is responsible under the same conditions as in traditional vehicles, which only the driver drives.

It should also be noted that there is a problem with the minimum standard of an unmanned vehicle: it is difficult to determine whether a vehicle meets this standard. This can only be verified through statistics based on the widespread use of such vehicles.

Therefore, it cannot be ruled out that in legal practice a standard will be put forward that is easier to apply in the case of individual responsibility. Such a standard may be that an automated car should be at least as reliable as an average or good driver. Regarding specific accidents, a simple question to ask would be: could an average / good driver prevent this accident? The problem with this non-statistical, human factor-based standard is that an automated car is different from a human. In this connection, it is very difficult to meet such a standard for manufacturers of automated cars.

4 CONCLUSIONS

The introduction of unmanned control systems in vehicles in the near future will entail changes in the regulation of civil law and criminal liability arising from damage caused by a highly automated vehicle. That is why it is now necessary to review the mechanisms for compensation for harm caused by unmanned vehicles. In addition, it is important to conduct theoretical research in the field of the use of unmanned systems controlled by artificial intelligence, as well as add new provisions to the legislation governing a fundamentally new circle of public relations.

The technology of unmanned movement is still far from perfect, which means that accidents are inevitable. But the purely human trait to learn from our mistakes will allow in the future to minimize such incidents on the roads. But accidents with unmanned vehicles in any case will occur, simply because when cars go, then accidents occur, this is inevitable.

To date, to address the issue of liability for damage caused by a highly automated vehicle, the following issues should be addressed:

- it is necessary to introduce a single term - a highly automated vehicle;
- to fix the procedure for issuing a special permit of the competent authority for the experimental use of unmanned vehicles;
- introduce mandatory liability insurance for the production and use of highly automated vehicles;
- develop and approve a minimum standard for a highly automated vehicle;
- consolidate the mechanism and procedure for compensation for damage in case of an accident involving an unmanned vehicle, determine the subjective composition of liability, as well as the conditions for liability in such situations;
- to fix the mechanism and procedure for compensation for damage in an accident involving an unmanned vehicle, determine the subjective composition of liability, as well as the conditions for liability in the event of vehicle theft;
- oblige manufacturers of highly automated vehicles to establish a "black box" fixing the course of the trip.

As for the distribution of responsibility, then most likely it will look like this:

- insurance companies will be liable for the insured unmanned vehicles, but only if, at the time of conclusion of the policy, the company was notified of the fact of unmanned use of the vehicle;
- if the unmanned vehicle has not been insured, the owner will be liable;
- if the accident was caused by a malfunction in the program or equipment of the vehicle, the responsibility is transferred to the manufacturer (the owner or the insurance company has the right to set a regression);
- if the accident was caused by the owner of the car interfering in the software or equipment of the insured vehicle or the owner did not follow the manufacturer's instructions (for example, the software was not updated), the insurance company may recover the amount of insurance compensation paid from the owner.
- if an accident occurred when the vehicle was stolen, then the culprit of the accident will be responsible.

Thus, Compulsory Motor Third Party Liability (CMTPL) insurance for the owner of an unmanned vehicle will not differ much from the insurance of a standard vehicle, but the owner will have to follow the software update and prevent interference with it and the vehicle equipment. It is likely that with the development of technology, the cost of insurance for unmanned vehicles will significantly decrease, compared with the standard, due to a decrease in the probability of getting into an accident.

When unmanned vehicles go off the assembly lines and appear on the roads, the autopilot will have to "side by side" with manual control. Accidents and conflicts cannot be avoided - this is a fact. In the case of manual control, the driver is more likely to make a mistake. However, this does not mean that with an accident, a priori the fault falls on the shoulders of a person, because artificial intelligence also suffers from software failures.

But there are other concerns here - with the increasing number of unmanned vehicles on the roads, drivers who drive manually will have an insignificant chance of justification. At the same time, these changes will decrease with the increasing number of drones.

Unmanned technology will save millions of lives, but no matter what the quality of the software, crashes cannot be avoided. The problem is that although the driver of a highly automated vehicle does not need to closely monitor the situation on the road, today he still bears full responsibility for the vehicle.

Perhaps in the future, everything can change when private car ownership goes into oblivion, and drones become available in the system of ride sharing services. Then, in the event of accidents, corporations such as Google, Baidu and Uber will be responsible, to which smart robo-cars will belong.

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