

AUTONOMOUS TECHNOLOGIES IN THE TRANSPORTATION OF DANGEROUS GOODS

AUTONÓM TECHNOLÓGIÁK A VESZÉLYES ÁRU SZÁLLÍTÁS TERÜLETÉN

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Abstract

In this article, I attempt to present the self-driving technologies of nowadays as well as trying to analyse the opportunities of using them in the field of transportation of dangerous goods, especially in the case of military road transportation.

Keywords: dangerous goods, autonomous vehicle, autonomous loading, military dangerous goods transportation, military autonomous technologies

Absztrakt

A cikkben kísérletet teszek feldolgozni a jelenlegi önvezető technológiákat, valamint elemezni szeretném ezek alkalmazásának lehetőségét a veszélyes áru szállításban, különös tekintettel a katonai veszélyes áruszállításban alkalmazható eljárásokra nézve.

Kulcsszavak: veszélyes áruszállítás, autonóm járművek, autonóm rakodás, katonai veszélyes áruszállítás, katonai autonóm technológiák

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INTRODUCTION

Since the treaty on dangerous goods came into operation in Hungary several different professional articles got published. Some of those articles are about theoretical issues, some of them present the rules and regulations, and then there are some that portray the change in these regulations. And last but not least, there are some that deal with the execution of these rules. So did in my previous articles. As I was analyzing the professional articles/columns, presenting traffic/transportation and new inventions used in logistics, I found shortcomings in the use of autonomous technologies.

According to professional forecasts, within 7-8 years the handling, marking and placarding of dangerous goods will be done by robots. As a result, storekeepers and wrappers will be replaced by automats. Today there are no rules applying to the use of robots at any modes of the transportation (ADR, RID, ADN, IMDG, ICAO) of dangerous goods. Therefore, I argue, the time has come to start the preparation immediately, because within a couple of years what now seems futuristic will be a reality such as self-driving trucks or aircrafts without a pilot. It is already customary to use drones to carry packages or spray plants at the port of Hamburg and at the container terminal in Ludwigshafen where self-driving vehicles are now used to move dangerous goods. These developments generate great expectations on the part of EU and inland lawmakers as there emerged a need for a new basis of regulating and controlling the transportation of dangerous goods. This new basis is to follow and adapt to the recent developments in the transportation of dangerous goods in terms of its mechanical, safety and legal facets. [1]

THE CURRENT STATE OF TRANSPORTATION OF DANGEROUS GOODS

As I mentioned in the introduction, each transportation mode has its own provisions on the transportation of dangerous goods. Therefore, the commonly accepted practice today is that all rules are changing at different rates and the length of the “grace period” is also different from one another. Railway and road transportation rules and regulations are almost harmonized because both change in uneven years and their grace period is also six months. Even the companies in this field have to accommodate to the rules until the 30th June. In contrast to this, the rules governing aviation in the context of carrying dangerous goods are changing every year and there is no grace period either, therefore the companies in this field have to accommodate within one month to a new situation. The naval codes are also changing every even year and the grace period is merely one year long. Since the provisions on the transportation of dangerous good are changing at differing rates, this situation lays a great charge on dangerous goods transportation advisers to know about these and to put them into practice.

As a result of the above mentioned reasons, there is a period when the previous rule is still in operation while the new one can also be used simultaneously so that market entrepreneurs can make their decisions according to both regulations.

This compound attention can cause several problems even among experts. Within a multi-modal transportation it is an important issue to know which rule to use because of the different “grace periods”. Even within the EU, lawmakers had been trying for ten years to harmonize the rules of transportation of dangerous goods, with limited success: the railway and road transportation. According to the latest news from Brussels, there are efforts emphasizing that the provisions should be with a deadline of 2021. [1]

Also controversial is the railway transportation of dangerous goods because of the difference between the EU and so-called SZMGSZ-countries. The original idea was that RID enters into operation from 2018 in the last countries, independently. However, “SZMGSZ-countries” found a lot of standards in EU regulations so they postponed the complete

implementation of RID until 2019. The other problem is that the National Regulations in Poland asks for the featuring of the transportation of dangerous goods in the CMR despite having been pressured to suspend this rule in the name of harmonization. Even the minute books prove this from the WP15 meetings. [1]

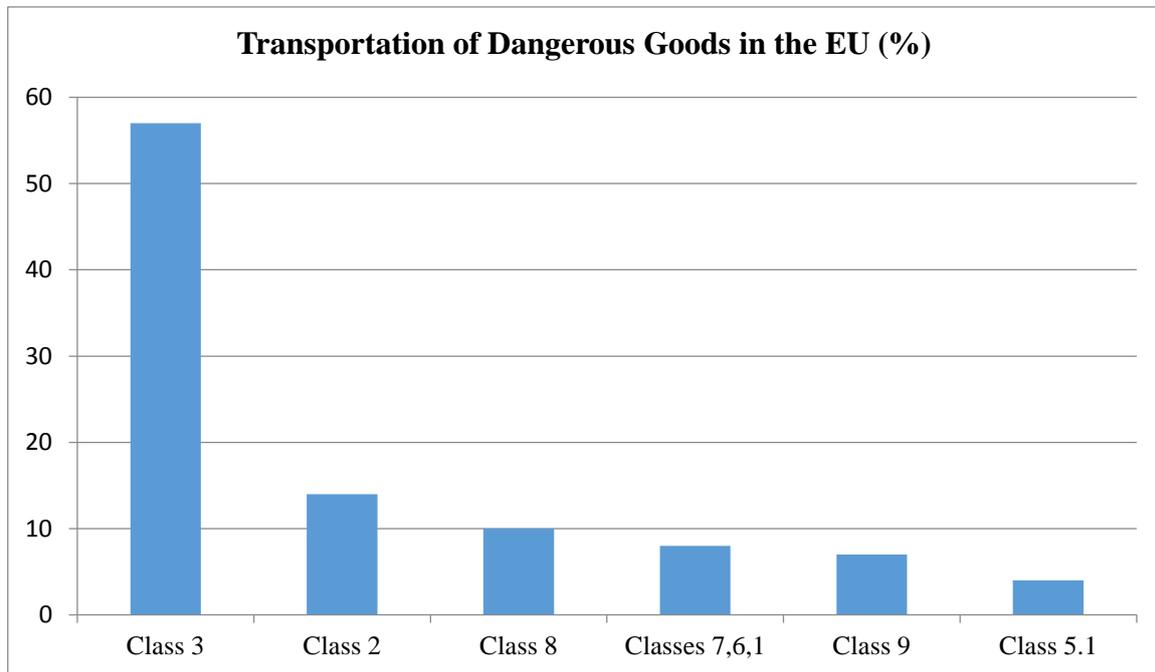


Figure 1. Self-made Diagram [1]

The figures proportion that can be seen on the diagram is very typical of the sector, and in comparison to the previous period, there is only a slight change. The capacity in the case of transportation of dangerous goods in the EU is above 80 billion ton per kilometer, but the Hungarian income/share is only 14,8%. An important additional data is that in comparison to 2010, the level of dangerous good transportation quantity/capacity of the EU increased by 2,8%, but in Hungary it is 14,9%.

It also is essential to mention that there is a change to use the fines so still there is (measure, circumstances to impose a fine, redeem). In the US, from this year there is a penalty from 463,-\$ (it is approx. HUF 120.000) til 180.000,-\$ (it is approx. HUF 48 million) to the transporters of dangerous goods. According to this measure, Hungarian fines seem reasonable, but the entrepreneurs probably think otherwise. [1]

A facility operating with dangerous goods or a venture operational system is a constantly renewable, extremely complex process. It is shown through the chemical industry that the development is constant and the previously mentioned rules exist only in the virtual world. [2] The product of factories that are producing dangerous goods as their final product can be used as fuel for vehicles – not only in the case where there is a driver but also, with vehicles without a driver. In some of those cases, the above mentioned rules also apply because in the case of self-driving vehicles, there is no need for “traditional papers”.

THE SITUATION OF SELF-DRIVING VEHICLES IN HUNGARY

The traditional division in traffic (road, vehicle, driver) is changing as time passes, because of the spread of autonomous technologies therefore, the role of the driver is less important. The scope of traffic on the one hand side is to ensure participation in economical and commerce

and on the other hand to create co-working on regional level. [3] Finally on local level to create harmony with the environment and keep the mobility. The development of autonomous technologies is more forward than the legislative field which is not a novelty in the modernization of vehicle development. Nowadays, it is also common that in many countries there is a standard or rule to establish the use and release to traffic, approval the technical provisions on self drive vehicles. [4]

The modification of the Vienna Treaty in 2016 was a big breakthrough because one of its chapter is handling the role of the driver and the connection between the driver and the vehicle. The ENSZ EGB working party did not pay any attention on the long ago safely working systems (ABS, ASP,ART) but those are taking over the role of the driver even if it is a short period of time. The Treaty included that the driver has to control the vehicle through the whole ride. As a result of vehicle development and authorization from the road transport authorities millions of vehicles are on the road legally. The modernization of the Treaty could not wait any longer because the invented systems and their connections created the basis of the autonomous driving functions, that are already diverted from the original provisions of the Treaty.

The working groups modified the treaty on the support of the driver in connection of self-driving vehicles. The point of this amendment is that the driver can switch off the system and this system is in compliance with the ENSZ EGB provisions. Basically, this was the first step to regulate the self-driving vehicles for the sake of safety. [4] [6] [7]

In the past years, there were significant changes in Hungary in the field of autonomous traffic management. There is already a governmental order and a governmental decision on the establishment on the test track in Zalaegerszeg just as on the related authority cases. Recently, the change on test vehicles on developmental issues and testing enter into force in the 5/1990 KÖHÉM order on examination of vehicles and in 6/1990 KÖHÉM order on circumstances of release to traffic. The lack of legislation on the field of vehicle industry made them to change the gear especially in the highlight of autonomous vehicles. As a result of fast reaction the definition of the test vehicle has changed in the above mentioned orders and two subcategories emerged such as autonomous vehicle for non-developmental issues (the driver led the car manually) and the autonomous vehicle for developmental issues (the test driver can hand over the control to the system). [8] [9] [10]

According to internationally accepted and detailed classification/ranking of the test on self-driving vehicles, it is already in the order and the categories as well.

- Non autonomous (level-0): the driver constantly pays attention to all matters around the vehicle, for example: holding the lane system (LDWA), frontal crash watch system (FCW)
- Aid system to the driver (level-1): the built in system supports the gearing the dynamic progress by helping and/ or intervene in the behaviour of the driver
- Partly automated system (level-2): in one or more driving mode one or more system is activating itself to help gearing, speeding and the analyzing of information from the environment to the driver with the expectations that the driver can handle all the other tasks to the dynamic drive.
- Conditional automatization (level-3): in driving mode the automated driving system is handling all the excercises for dynamic driving with the expectation that in every minute the system can react on the driver's willingness
- High automatization (level-4): In driving mode the automatised driving system is in all aspects handling the excercises of dynamic driving even if the driver is not reacting proper on intervention. For example on parking in and out automatically, parking in a garage, speeding on highway by 180km/h automatically (including

holding the lane, passing, the last ones should be activated by the driver but it is not necessary to overlook them, only when the system is alerting).

- Total automatization (level-5): during the operational time the automated driving system is handling all like forward information from the environment to the system just as the driver would do. So in every aspect it embodies a total automated driving. [4] [5] [6] [7]

It is clear that the rules should be worked out for the driver until level 2 because it is the part of the system. But from the level 3 it is not necessary rather optional until level 5 because the system fulfills all the expectations on the road/ under operation. From level 3 the system does not just intervene while speeding/ slowing down but it takes over sometimes at gearing. The level 2 is already in reach but level 5 is only reachable from 2026-2030 approximately according to the experts. [4]

There has been a significant change in last year when they changed the definition on vehicles gearing in the UN provision just as well the mechanical demands. The change covers all the manoeuvres until level 3 (Automatically Commanded Steering Function : ACSF, Corrective Steering Function CSF, remote control parking RCP).

It is important to mention the test driver who is in the vehicle through the whole test and able to intervene to control the vehicle instead the system and from he is responsible to the safe drive independently from which level the vehicle is. The education of the test driver is filled with special demands almost as difficult as to get a Formula1 driver license.

The present regulation gives a detailed provision for the vehicle manufacturers on test drive, on the circumstances of a test drive, and according to that the test must be done on a ground away from the traffic or in the traffic. Important rules that the companies have to prepare the vehicles mechanically, need to have insurance also, they have to pay attention to cybersafety.

The above mentioned regulation states that the vehicles should be installed with a machine that saves the name of the test pilot, speed, GPS data, the actual mode (manual or automatic) and it should save the vehicles installation data. The test pilot should be warned with a tone and just right after he has to take over the drive.

The previously showed regulation Hungary ensured its position on autonomous vehicles and traffic. In the forthcoming period the regulation should be constantly supervised to keep the pace with the speed of the development. Day by day new questions emerge and new situations seeking for solutions therefore more detailed regulations should be done as well. The Hungarian test experiences can help to find the best solution on regulation. [11]

AUTONOMOUS TECHNOLOGIES AT MILITARY FORCES

Lately a convoy of self-driving vehicles went through Europe until the port of Rotterdam. Maybe these types of vehicles are not part of the everyday traffic but it is not deniable that they are in presence in Europe.

The experiences so far that technical development can be done by only financially strong entrepreneurs because their investment in expensive research is in return in the future income. In my opinion the autonomous vehicle development is the highlight of vehicle manufacturers and for the next 10-15 years it gives aim/ approach to them to live up to.

In the cases of traffic performance road network and their connection points play a crucial role. [12] Self-drive trucks, loading machines can cause savings at companies. Therefore to introduce these machines at military forces are also important which is basically already started by using drones. In this field it is also undeniable that what can be used in military can be used in civil life as well. No too long ago a company that was delivering small packages used drones to deliver the packages and saved a lot on delivery time and on costs.

In the following chapters I will try to present by using autonomous technologies what type of and advantages can be reached on socially, economically or on military basis.

Significant saves can be performed by using self-driving vehicles as the cost of a driver salary which is the three-quarter of the total costs that will fall out from the cost bond. A vehicle fleet without a driver and a cargo attendant and their salary can mean that the rest can go for salary development to the rest or innovation. In many ways it is not negligible that these cars can drive 24 hours a day and as a result of that a whole new view can be reached at the sector.

Significant change is also expected in the area because today the other basis of the payment is depending on the use of fuel / mileage and savings can be performed there too. This special fare is not encouraging the drivers to choose the shortest way.

The autonomous forklifts will be able to choose the optimal use of fuel and speed, and to keep them at the optimal level. The vehicle fleets will be driving in convoy by using the vacuum effects thus reducing the moving energy.

The above presented technologies will mean economic advantages and as a side effect it will have a positive effect on road safety as well. Thanks to good programming it is possible that less human mistakes, errors will happen, because the automated vehicles are installed with sensors that can react in dangerous situations instantly and are able to avoid dangerous situations safely. Road safety is only happening when human mistakes are not replaced by the machine.

Last but not least at the transportation of dangerous goods a higher standard is acceptable in the perspective of road safety. This special field demands a lot from the driver therefore there is a lot of general rule to their job, because these drivers risks their lives by driving a ticking bomb. Hopefully the above enlisted criteria will help the development of road safety.

SUMMARY

In the article I tried to present the situation of the autonomous technologies and their use. It is stated that Hungary made the basis of the rules and therefore it starts from a good position in the competition in the autonomous technologies. It is also stated that the ADR has not made any rule on the use of autonomous technologies only created the chance to use hybrid and electric vehicles. Written document has not been released to transport dangerous goods with an autonomous vehicle.

It is also important to mention that autonomous vehicles can play a crucial role in road safety and in the environmental development, plus it can further the EU's intentions toward its goals. There is a huge social debate on the role of the driver especially in Germany where virtual intelligence programming is in the center of argument. It is hard to decide that what would happen if the system drives the vehicle in a dangerous situation toward a kid or an old person. In an average situation when humankind would drive the vehicle in a minute a human has to make the decision and it depends on the reflex, it is minimized that we can speak of conscious decision making. But at an autonomous system we have to define previously what is less important in a social perspective.

The chance of a 24-hour drive with an autonomous vehicle is raising some questions in the light of a human driver especially to reconsider the regulation of resting and driving times of the driver because soon both will be on the road at the same time. The appearance of these vehicles raises some serious questions and gives tasks for the state to solve on taxation, competition rights and on the market as well.

The above presented technologies soon should be in use at the Hungarian military forces. In the forthcoming period of time the future military force of vehicles should be planned and in that one there must be a place for autonomous vehicles not just in vehicles but on the support field too.

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