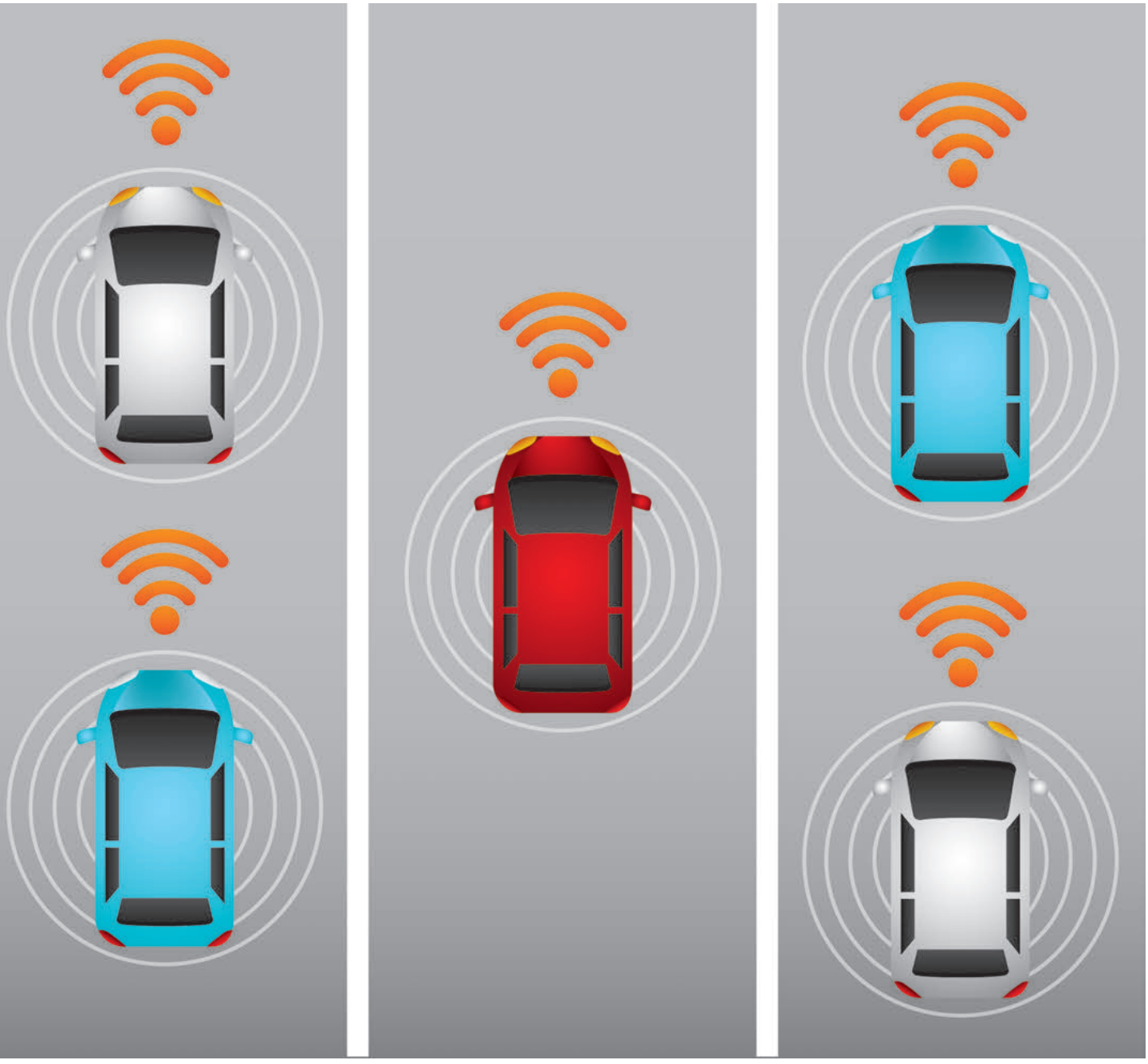
UNECE

All you need to know about Automated Vehicles

Technical progress and regulatory activities



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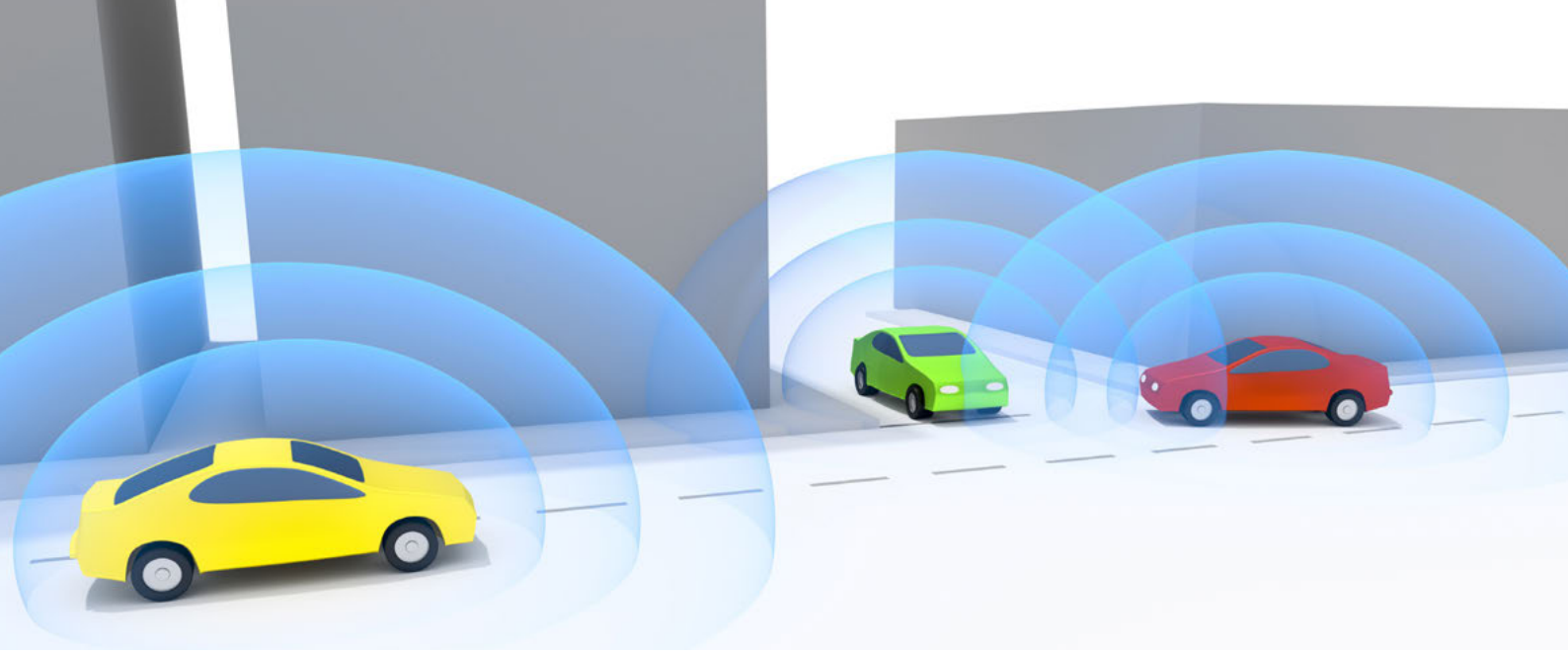

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1. Overview

The motor industry's 125-year history is an impressive succession of innovation. Today, the industry faces the challenging task to massively electrify vehicles over the next 5 to 10 years, at least in developed markets.

At the same time, with the rise and promises associated to automated driving, we are standing before what will be the biggest quantum leap forward in automotive technology in history.

Automated vehicles have the potential to change the life of billions of people and fundamentally change how road transportation works. This will be made possible by the global automotive industry, which employs some 50 million people and represents a turnover of almost $2 trillion per year.

Since it is widely acknowledged that up to 90 per cent of road crashes are at least partially due to human error, assisted and automated driving systems could reduce the human factor from the road safety equation, leading to a significant decrease in road crashes, and therefore could significantly reduce deaths and injuries on roads.

Automated driving could also support existing policies that otherwise would have no clear path to implementation, such as intelligent transport systems and mobility as a service.

Yet, all these benefits will not come at once and will not come by themselves. Conditions in some developing countries will be such that it will be difficult to accommodate autonomous driving for decades. In addition, automated vehicles raise as many questions as they offer potential benefits. These include: responsibility, safety standards, software reliability, environmental performance and cybersecurity, to name just a few.

Providing an appropriate and balanced regulatory answer to these questions is a prerequisite to the mass introduction of these vehicles on the road.

UNECE, through the World Forum for Harmonization of Vehicle Regulations (WP.29) and the UN Road Safety Instruments, is the platform where countries from all around the world gather to develop jointly the regulatory frameworks governing these vehicles. It has therefore embarked since 2014 in adapting existing legal instruments and developing new ones to facilitate the gradual introduction of automated driving functionalities.

In an effort to focus its activities on automation, UNECE established the Working Party on Automated/Autonomous and Connected Vehicles (GRVA) in 2018.

Since the establishment of GRVA, the Working Party has created a global scheme to develop requirements and guidelines for automated and connected vehicles, namely the Framework on Automated/Autonomous and Connected Vehicles (FDAV), which largely guides GRVA's work. This Framework was drafted by China, the European Union, Japan, and the United States of America and endorsed by the World Forum for Harmonization of Vehicle Regulations and the UNECE Inland Transport Committee. The document defines a safety vision, key safety elements, guidance to the Working Parties of WP.29 as well as a programme of activities. These activities, at the intergovernmental level, form a novel initiative aimed at harmonizing globally automated driving regulations and creating a more productive environment for innovation.

GRVA achieved some initial results under the 1958 Agreement, with the adoption of amendments to UN Regulation No. 79 (Steering) as well as of new UN Regulations Nos. 157 (Automated Lane Keeping System), 155 (Cyber Security and Cyber Security Management System) and 156 (Software Update and Software Update Management System).

This brochure focuses on the automotive sector developments and governmental responses, as well as provides insights on the activities' development performed by intergovernmental bodies of UNECE to enable assisted and automated driving as of September 2021. It further includes a short section aimed at providing clarity about various myths.

2. Technical developments in the field of assisted and automated driving systems

The technical progress in the field of assisted and automated driving, for the last seven years, is impressive. A Japanese vehicle manufacturer launched a model in March 2021, which is the first series vehicle equipped with a Level 3 technology. At the time of drafting this brochure, a German vehicle manufacturer was also equipping its flagship vehicle with an automated driving system.

A ride hailing system using vehicles equipped with automated driving systems is currently providing hundreds of trips per week to the public in East Valley of Phoenix, Arizona. These vehicles are not operated by human drivers, but are supervised by a remote operator monitoring the rides. In addition, Automated Shuttle manufacturers are experimenting with automated shuttles in many locations around the globe.

These industrial achievements find their technical origin in the early developments related to warning and assistance systems, which were closely linked to safety systems. Anti-lock Braking Systems (ABS), in the seventies, and Electronic Stability Systems (ESC) in 1995, were the first systems that interfered with driving tasks and were sold across the series vehicle model ranges. At a later stage, Adaptive Cruise Control (ACC), Lane Departure Warnings Systems (LDWS) and Advanced Emergency Braking Systems (AEBS) for trucks and coaches were implemented. These were the first systems using sensors to monitor both, the road and other vehicles ahead of the subject vehicle.

Since 2014, further developments in the field of assisted driving have occurred thanks to technical progress and industrial competition. For instance, an announcement by a search engine company as well as market pressure created by an electric vehicles manufacturer, offered a Level 2 assistance system for sale.

In Europe alone, a considerable number of vehicles were equipped with assisted driving features of Level 2 already in 2018. A year later, this amount increased significantly, reaching about 10 per cent of the cars sold.

Technological progress in the field of Artificial Intelligence, especially with the growing use of Machine Learning and Deep Learning, increased possibilities in the field of Object and Event Detection and Response (OEDR). Light Detection and Ranging systems (LIDARs), radars and cameras as well as Deep Learning related technologies provide opportunities for developing the highest levels of automation. These sensing and automation technologies can also be utilized for “simpler” use cases, such as safety features that provide assistance to drivers when a potential crash is detected. These “simpler” technologies include AEBS and steering assistance at low speed, Emergency Steering Function (ESF) and Risk Mitigation Functions (RMF).

3. The role of the World Forum for Harmonization of Vehicle Regulations (WP.29) on assisted and automated driving

Early responses

The emergence of safety features in the automotive sector led WP.29 to establish, in 2002, the Informal Working Group on Intelligent Transport Systems (IWG on ITS).

From 2002-2013, the ITS group focused on driver-assistance technologies entering the market and human-machine interaction issues resulting in guidelines for high-priority/safety-critical warning and on Advanced Driver Assistance Systems (ADAS). These developments coincided with ESC's and AEBS' market entry for trucks and coaches. As these technologies and systems advanced, the ITS group shifted its attention toward automated driving systems.

From 2014-2018, the group, renamed IWG on Intelligent Transport Systems/ Automated Driving, considered the intersection between automated driving and traffic rules. It developed definitions, terms and concepts, as well as proposed

UN Regulation No. 79 (Steering), established under the 1958 Agreement, contained the provisions for the approval of Automatically Commanded Steering Functions (ACSF) limited to 10 km/h and Corrective Steering Functions (CSF) for two decades. This speed limit prevented the type approval of driver assistance systems to achieve higher velocity. Some manufacturers developed lane keeping functions that were using the Electronic Stability Control (ESC) in order to cope with this limitation.

In 2014, activity began to develop the regulatory provisions under which the 10 km/h limitation could be exceeded. This produced the regulatory basis under which vehicle manufacturers could enter the market with ADAS, namely Levels 1 and 2 technologies.

Automated Driving Systems

The Word Forum felt that regulatory activities on assisted and