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THE DISPATCHER

Telematics Industry Insights by Michael L. Sena
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The 5th Generation of Mobile Wireless is Arriving

MOBILE TELEPHONY is the provision of telephone services to phones which may move around freely rather than stay fixed in one location. Mobile phones connect to a terrestrial cellular network of base stations (cell sites), whereas satellite phones connect to orbiting satellites. Both networks are interconnected to the public switched telephone network (PSTN) to allow any phone in the world to be dialed.

The use of the G's was started by the International Telecommunication Union (ITU) in the early 1990s. The pattern is actually a wireless initiative called the International Mobile Communications 2000. 3G, therefore, comes just after 2G and 2.5G, the second-generation technologies.

Information in this table has been compiled by the Editor from various sources. Here are a few clarifications of items in the table.

FDMA - Frequency Division Multiple Access

OFDM – Orthogonal Frequency-Division Multiplexing

Handoff, Horizontal – Intra-system handoff occurs between a Point of Access supporting the same network technology (e.g., two geographically neighboring Base Stations of a cellular network).

Handoff, Vertical – Inter-system handoff occurs between Points of Access supporting different network technologies (e.g., an IEEE 802.11 and a 3G Base Station).

ON OCTOBER 1ST, VERIZON, the largest mobile network operator in the U.S., began offering installation of its **5G** home broadband in Sacramento, CA with Houston, Indianapolis and Los Angeles to follow. Customers will be able to begin receiving service once the installation of small cells on utility poles and street lights is complete, with pricing set at \$50 for VERIZON WIRELESS customers and \$70 for non-customers. Those prices include all taxes and fees and do not require an annual contract. Customers who sign up for 5G home broadband service in the selected areas can expect bandwidth speeds of around 300Mbps, with peak speeds of nearly 1Gbps depending on location.

A new generation of cellular standards has appeared approximately every tenth year since **1G** systems were introduced beginning in 1970. Each generation is characterized by new frequency bands, higher data rates and non-backward-compatible transmission technology. **5G** is up next. Full introduction on all types of devices in all major markets is not expected for another one-to-two years. What can we expect from it that we have been missing in all of the earlier generations, and what will it mean for automotive applications? The table below provides an overview of the technologies and capabilities of the different generations and I will try to fill in the details.

Generation	1G	2G/2.5G	3G	4G	5G
Deployment	1970/1984	1980/1999	1990/2002	2000/2010	2017/2020
Bandwidth	2 Kbps	14-64 Kbps	384 Kbps - 2 Mbps	200 Mbps	>1 Gbps
Reference Term	AMPS, NMT		UMTS	LTE	
Technology	Analog Cellular	Digital Cellular	Broad bandwidth/CDMA/IP technology	Unified IP and seamless combination of LAN/WAN/WLAN/PAN	4G+WWWW
Operating Frequency	800 MHz	GSM: 900MHz, 1800MHz CDMA: 800MHz	2100 MHz	850 MHz 1800 MHz	FR1: 400 MHz-6GHz FR2: 24.25GHz-52.6GHz
Service	Mobile Telephony/Voice	Digital Voice, Short Messaging	Integrated high quality audio/video and data	Dynamic information access, variable devices/Voice requires VoLTE	Dynamic information access, variable devices with AI capabilities
Encoding	FDMA	TDMA/GSM/cdma One/GPRS	CDMA2000/WCDMA	OFDM	OFDM/MC CDMA
Switching	Circuit	Circuit/Circuit for access network and air interface	Packet except for air interface	All Packet	All Packet
Core Network	PSTN	PSTN	Packet Network	Internet	Internet
Handoff	Horizontal	Horizontal	Horizontal	Horizontal and Vertical	Horizontal and Vertical
Fallback	None	None	2G	2G or 3G	4G

What's different about 5G?

I have been trying to sift through the kernels of information on 5G to separate the wheat from the chaff. An example of chaff is the fact that Verizon's home service introduced on the 1st of October is a non-standard form of 5G. Verizon plans to switch to the global standard in 2019 and replace the equipment with new, standard equipment at no cost to its existing customers. Another example is AT&T calling its 4G network *5G Evolution*. They are taking this liberty because all 5G devices will initially need 4G/LTE to make connections to most networks where 5G is spotty or nonexistent, and at the same time 4G is improving its data speeds.

Just to be clear: According to everything I have found, 5G will let you send text messages, make phone calls, browse the Internet and stream videos. Everything you can currently do on a 4G mobile phone with respect to the Internet will still be possible with 5G, but the experience will be better with 5G.

5G will deliver three major improvements over the current generation of mobile connectivity: 1) greater speed (20 times faster than 4G) will move more data; 2) lower latency to enable faster response; and, 3) the ability to connect many more devices simultaneously, including sensors and smart devices, not just phone modems. The reason it is being developed is to support the increasing number of Internet-enabled devices, not just mobile handsets, and because many of the applications require much more bandwidth than 4G can offer.

The biggest difference between 5G and 4G is the use of unique radio frequencies. 4G networks use frequencies below 6 GHz. 5G uses extremely high frequencies in the 30 GHz to 300 GHz range. These frequencies provide a very high capacity for speedy data. They are not cluttered with other cellular data and because they are highly directional, they can be used in direct adjacency with other wireless signals without causing or being disturbed by interference. 4G shoots off data in all directions, often beaming radio waves at locations that are not requesting access to the Internet.

Another difference is that 5G uses shorter wavelengths, allowing antennas to be much smaller than those in use with earlier generations. Due to their smallness, a base station can hold many more directional antennas. The result is that 5G can support over 1,000 more devices per meter than what 4G supports. 5G also has the ability to adapt to different types of data and to different data rate



5G Logo

Massive MIMO

Today's 4G base stations have a dozen ports for antennas that handle all cellular traffic: eight for transmitters and four for receivers. But 5G base stations can support about a hundred ports, which means many more antennas can fit on a single array. That capability means a base station could send and receive signals from many more users at once, increasing the capacity of mobile networks by a factor of 22 or greater.

*This technology is called **massive MIMO**. It all starts with MIMO, which stands for multiple-input multiple-output. MIMO describes wireless systems that use two or more transmitters and receivers to send and receive more data at once. Massive MIMO takes this concept to a new level by featuring dozens of antennas on a single array.*

MIMO is already found on some 4G base stations. Massive MIMO has only been tested in labs and a few field trials. In early tests, it has set new records for spectrum efficiency, which is a measure of how many bits of data can be transmitted to a certain number of users. Installing so many more antennas to handle cellular traffic also causes more interference if those signals cross. That's why 5G stations must incorporate beamforming.

<https://spec-trum.ieee.org/video/telecom/wireless/everything-you-need-to-know-about-5g>

requirements, switching to higher or lower powered modes when required.

There's always a 'but'. The downside with these ultra-high frequencies is that they work only if there is a clear, direct line-of-sight between the antenna and the device receiving the signal. Some of these high frequencies are absorbed by humidity, rain and objects, limiting the distance they can travel. As a result, we are going to have a lot of small antennas in every room in a building and larger ones on buildings, power poles and who knows what else. Then there will be repeater stations to give the wave a boost when needed.

Whose standard is it anyway?

In an opening to an article produced by Ericsson on the subject of 5G standardization, the author writes: "The 5G standardization process is complex and highly innovative." I'm not sure whether it's the innovation applied to the process that makes it complex, but it is anything but easy to understand.

The **ITU** (International Telecommunication Union of United Nations—the organization holding the Future Network Car Symposium shown on the first page) through ITU-R has established a timeline for the standardization of the 5G protocol, called IMT-2020.¹ The standard is expected to be met by 2020. ITU has divided 5G network services into three categories:

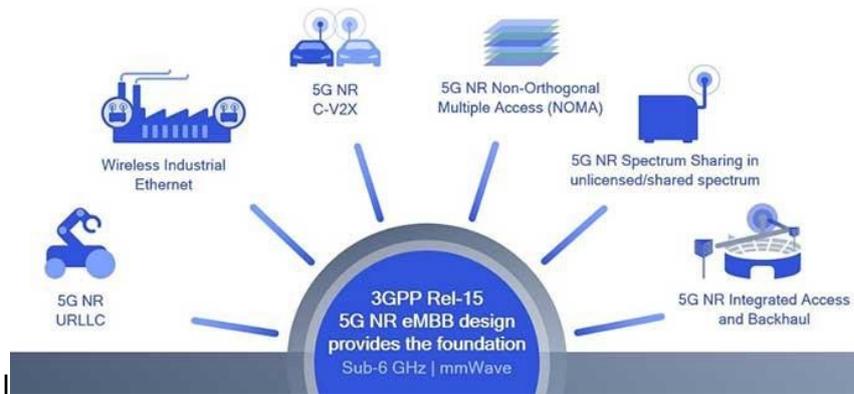
- Enhanced Mobile Broadband or handsets (eMBB);
- Ultra-Reliable Low-Latency Communications (URLLC) – this includes industrial applications and 'autonomous' vehicles; and,
- Massive Machine Type Communications (MMTC) or sensors.

Initial 5G deployments will focus on eMBB and fixed wireless, which makes use of many of the same capabilities as eMBB.

3GPP (The 3rd Generation Partnership Project) is the body that governs the creation of cellular standards. It completed the first implementable specification for 5G NR (New Radio) in December 2017. This is referred to as 3GPP Release 15, and it is for Non-Standalone (NSA) 5G NR operation. It would be built on top of existing LTE networks. In June 2018, 3GPP announced the finalization of the Standalone (SA) operation, which allows for deployments of 5G in places that do not necessarily have existing LTE infrastructure.

Release 16 is the next step in the standardization process. It begins with URLLC and extends to utilizing unlicensed and new spectrum sharing paradigms (5G NR-U and 5G NR-SS).

1. **ITU** is the United Nations specialized agency for information and communication technologies (ICTs). ITU allocates global radio spectrum and satellite orbits, develops the technical standards that ensure networks and technologies seamlessly interconnect, and strives to improve access to ICTs to underserved communities worldwide. **ITU-R** (ITU-Radiocommunication) has the mission within ITU to ensure rational, equitable, efficient and economical use of the radio-frequency spectrum by all radiocommunication services, including those using satellite orbits, and to carry out studies and adopt recommendations on radiocommunication matters. Working Party 5D is responsible for the overall radio system aspects of International Mobile Telecommunications (IMT), comprising IMT-2000, IMT-Advanced and IMT-2020.



5G for the auto industry

The auto industry has been using the ‘Gs’ ever since GM OnStar chose to put a Motorola telematics unit in its first system back in 1995. We have moved—painfully at times—from one G to the next, all the while hoping that we could make the move up to the new G before the network operators threw the old G out. The telecom industry leads; the automotive industry follows. That was the way it was. Now, it feels like there is some degree of equivalence between the two parties. 5G needs applications that hunger for large amounts of data delivered with zero latency, and land transport vehicles are poised to oblige. Emergency calls with position, fleet management, floating vehicle data and traffic information have managed with 2-4G, but to move up both safety and infotainment up to where they will be truly effective, vehicles will need to communicate with each other (V2V) and the infrastructure (V2X) instantaneously. 5G’s sub-one-millisecond latency for moving a packet of data between two vehicles or to a roadside unit will be essential. 5G’s ability to connect to multiple devices simultaneously is also crucial.²

5G NR-C-V2X is on the roadmap beyond eMBB, as seen in the diagram above, and this is scheduled for December 2019 in Release 16. Before we are there, we have 4G-based Cellular-V2X (LTE-V2X) for digital short range communication (DSRC).³ C-V2X is a relatively recent development based on Release 14 in March 2017, and is positioned in direct competition to standards ITS-G5, developed in Europe by ETSI (European Telecommunications Standards Institute), and WAVE (Wireless Access in Vehicle Environments), developed in the U.S. by IEEE, both based on IEEE 802.11p (WiFi). C-V2X has two complementary communication modes, the *Direct Mode* that uses the ITS 5.9 GHz band and a *Network Mode* that uses the

2. 5G can only work on 5G-compatible devices, and these devices are not yet available. But they are coming with the help of Qualcomm, Samsung, Ericson, AT&T and many others involved in the standardization efforts.

3. DSRC is a concept for a low latency medium adapted for a highly mobile vehicle environment. It is based on a distributed broadcast mode (300 meter range, line of sight), peer-to-peer exchanges, and engineered to work well in a moving environment. In 1999 the U.S. Federal Communications Commission allocated 75 MHz of spectrum in the 5.9 GHz band. ETSI allocated 30 MHz of spectrum in the 5.9 GHz band for ITS in 2008. Bearer protocols proposed for use in this band include those based on WiFi and those based on cellular (C-V2X Direct Mode).

broadband licensed spectrum. Since 5G will have backward compatibility with LTE, 5G NR-C-V2X will be compatible with C-V2X, but not with ITS-G5/WAVE, as shown in the diagram on the next page.

GM and Toyota have started to implement the 802.11p-based technologies in the U.S., and VW is planning to start in 2019. Ford has announced it would work with C-V2X, but has not provided any timings. Most others are choosing to wait for more definitive results of tests to show which is superior.

Continuous V2X technology evolution required

And careful spectrum planning to support this evolution

Evolution to 5G, while maintaining backward compatibility



The evolution of V2X short range communication according to 5GAA

Results of a field test of ITS-G5 versus C-V2X

As is the case with most standards clashes, there can't be two winners. If companies start implementing one of the bearer standards and it turns out that the other is a much better solution, there will be vehicles on the roads that cannot talk to each other. One proposal has been to use ITS-G5/WAVE for the simple safety messaging, but that will mean eliminating safety from C-V2X and eventually 5G NR-C-V2X. 5GAA with the help of Ford and Qualcomm has tried to insert some real objectivity in the discussions by conducting a series of field trials pitting the two against each other.

Cars in the tests were equipped with both technologies so they could be used interchangeably. Tests were made on a track at the Fowlerville Proving Ground in Michigan. In line-of-sight (two vehicles meeting), obstructed view intersection, blocker (obstruction between vehicles), UNII-3 interference and congestion, reliability and interference tests, C-V2X consistently outperformed ITS-G5/WAVE.⁴ If there was doubt before about which one was the better option, there should be no doubt now.

WAVE and LTE/C-V2X technologies installed in the test vehicles in order to ensure controlled testing.



4. The Unlicensed National Information Infrastructure (U-NII) radio band is part of the radio frequency spectrum used by IEEE-802.11a devices and by many wireless ISPs.

U.S. DOT Issues Its Report on Automated Vehicles



5. <https://www.transportation.gov/sites/dot.gov/files/docs/policy-initiatives/automated-vehicles/320711/preparing-future-transportation-automated-vehicle-30.pdf>

6. *Nomenclature Disclaimer:*
"Clear and consistent definition and use of terminology is critical to advancing the discussion around automation. To date, a variety of terms (e.g., self-driving, autonomous, driverless, highly automated) have been used by industry, government, and observers to describe various forms of automation in surface transportation. While no terminology is correct or incorrect, this document uses "automation" and "automated vehicles" as general terms to broadly describe the topic, with more specific language, such as "Automated Driving System" or "ADS" used when appropriate."

ON THE 3RD OF OCTOBER, 2018, the U.S. Department of Transportation issued *Preparing for the Future of Transportation: Automated Vehicles 3.0 (AV 3.0)*.⁵ A news release included the statement that "this document builds upon *Automated Driving Systems: A Vision for Safety 2.0 (ADS 2.0)* (released on 12 September 2017 and reported on in the November 2017 issue of **THE DISPATCHER**) and expands the scope to provide a framework and multimodal approach to the safe integration of AVs into the Nation's broader surface transportation system." In the introduction to the **AV 3.0** report, Secretary of Transportation Elaine L. Chao describes the report as "another milestone in the Department's development of a flexible, responsible approach to a framework for multimodal automation...and describes the Department's strategy to address existing barriers to safety innovation and progress."

The document is 65 pages long. Almost one-third of it is devoted to an appendix containing voluntary technical standards for automation. This appendix on its own would be reason enough for downloading the report. **AV 3.0** opens with a list of DOT's six automation principles and a disclaimer on nomenclature.⁶ Whatever anyone else calls it, DOT calls it all 'automation' and 'automated' without acknowledging that there are major differences among the various types of systems. Separating and clarifying the differences is not even addressed in the section on Key Terms and Acronyms. I believe this is a significant flaw in the document, but let's push on.

DOT has adopted six principles which it states has shaped its policy on 'automated vehicles'. These are:

1. Prioritize safety – acknowledges the risks of automation as well as the potential safety benefits, and will lead efforts to address those risks.
2. Remain technology neutral – leaves the choice of technologies to the public, not the Federal Government.
3. Modernize regulations – will promote and support voluntary, consensus-based technical standards, starting with "adapting the terms 'driver' and 'operator' to recognize that they do not refer exclusively to a human.

4. Encourage a consistent regulatory and operational environment – attempts to get the States to agree on a single approach, rather than promoting its own standards.

5. Prepare proactively for automation – provides guidance and best practices on vehicle-to-vehicle and vehicle-to-infrastructure communication, but does not promote any particular approach or technology.

6. Protect and enhance the freedoms enjoyed by Americans – this means Americans manually driving their own vehicles and DOT ensuring that automated vehicles focus on enhancing individual freedom by expanding access to safe and independent motoring to people with disabilities and older Americans.

Everyone should mind their own business

Besides the travelling public, there are four parties that need to be engaged in a cooperative effort on every transportation issue, and DOT reminds us that automation is no exception. DOT’s role, as the “steward of the Nation’s roadway transportation system”, is to “ensure the safety and mobility of the traveling public while fostering economic growth and supporting job creation and workforce development.” State and local governments take the lead in licensing drivers, establishing rules of the road and formulating policy in tort liability and insurance. Private industry does the research and develops the technology.

In previous DOT documents on automation, NHTSA was given the key Federal role in guiding the other parties. In **AV 3.0**, all eight of DOT’s Operating Administrations are invited to contribute while the road-focused ones, NHTSA, FMCSA, FHWA and FTA, are the key Administrations for working with AV. (See sidebar)

The premise upon which DOT’s **AV 3.0** policy is built is the following: “Automated vehicles that accurately detect, recognize, anticipate, and respond to the movements of all transportation system users could lead to breakthrough gains in transportation safety. Unlike human drivers, automation technologies are not prone to distraction, fatigue, or impaired driving, which contribute to a significant portion of surface transportation fatalities. Automated vehicle technologies that are carefully integrated into motor vehicles could help vehicle operators detect and avoid bicyclists, motorcyclists, pedestrians, and other vulnerable users on our roadways, and increase safety across the surface transportation system. Their potential to reduce deaths and injuries on the Nation’s roadways cannot be overstated.” I have added the underlines. The entire document is written in the conditional mood, in which the validity of propositions is dependent on some condition that must be fulfilled.



DOT’s Operating Administrations

FHWA – Federal Highway Administration is responsible for providing stewardship over construction, maintenance and preservation of the Nation’s highways, bridges and tunnels.

FMCSA – Federal Motor Carrier Safety Administration aims to reduce crashes, injuries, and fatalities involving large trucks and buses.

FAA – Federal Aviation Administration is responsible for the Nation’s aviation system.

FRA –Federal Railroad Administration enables the safe, reliable, and efficient movement of people and goods by rail.

FTA – Federal Transit Administration provides financial and technical assistance to local public transit systems.

MARAD –Maritime Administration is promotes the sue of waterborne transportation and its integration with other transportation systems.

NHTSA – National Highway Traffic Safety Administration mission is to save lives, prevent injuries and reduce the economic costs of road traffic crashes.

PHMSA –Pipeline and Hazardous Materials Safety Administration protects people and the environment by advancing the safe transportation of energy and other hazardous materials.

Private industry should do the heavy lifting

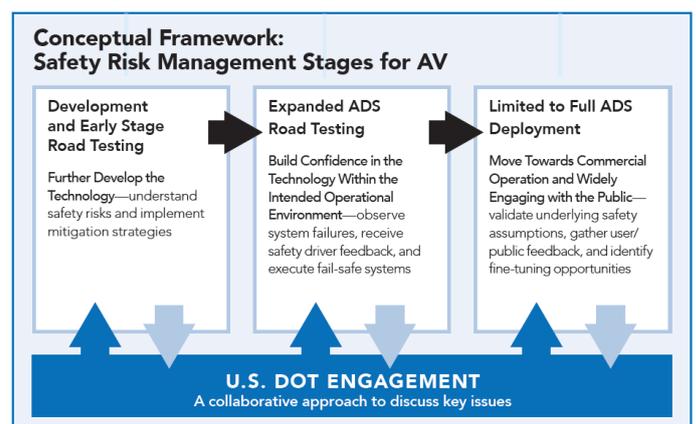
In the section on Roles in Automation, it states that private industry should “continue to be the primary source of transportation research investment and commercial technology development,” and “governments at all levels should not unnecessarily impede such innovation.” DOT has identified five activities that it intends to pursue in partnership with the private sector and the other levels of government. These are:

1. Establish performance-oriented, consensus-based, and voluntary standards and guidance for vehicle and infrastructure safety, mobility, and operations.
2. Conduct targeted research to support the safe integration of automation.
3. Identify and remove regulatory barriers to the safe integration of automated vehicles.
4. Ensure national consistency for travel in interstate commerce.
5. Educate the public on the capabilities and limitations of automated vehicles.

DOT has charged NHTSA with gathering comments on proposed changes to safety standards to “accommodate vehicle technologies and the possibility of setting exceptions to certain standards—that are relevant only when human drivers are present—for ADS-equipped vehicles.” It has also decided that the development of software used in ADS-equipped vehicles “requires a new approach to the formulation of the Federal Motor Vehicle Safety Standards (FMVSS).” FMCSA will take responsibility for investigations for commercial vehicles.

The road to deployment

DOT has provided a Conceptual Framework for managing the risks along the path to full commercial integration. As in the rest of the document, instead of stating “This is what we want you to do,” it writes: “U.S. DOT envisions that entities testing and eventually deploying ADS technologies will employ a mixture of industry best practices, consensus standards, and voluntary guidance to manage safety risks along the different stages of technology development.” In other words, we are not going to tell you what to do or how to do it, but we expect that you will do it in a way to safeguard lives. There is no mention of proposing Federal legislation that will supersede State and local laws and regulations, and there is no mention of a Federal testing and certification process.



Covering the complementary technology bases

There were two sections in the report which for me were unexpected. One addressed the role of DOT in *Cooperative Automation and Connectivity*. The report states that “...communication both between vehicles (V2V) and with the surrounding environment (V2X) is an important complementary technology that is expected to enhance the benefits of automation at all levels.” It then adds an important qualification: “Communication should not be and realistically cannot be a precondition to the deployment of automated vehicles.

DOT, under the former Democratic administration had heavily promoted 802.11p WAVE DSRC utilizing the 5.9 GHz band for V2V communications. Legislation was prepared to make this technology mandatory in all new vehicles. When the Republican administration took office in January 2017, these plans were put on hold. It is now clear that under the current administration, DOT will not support or promote WAVE over Cellular-V2V/V2X. The report states: “The Department encourages the automotive industry, wireless technology companies, infrastructure owner operators and other stakeholders to continue developing technologies that leverage the 5.9 GHz spectrum for transportation safety benefits...but the Department does not promote any particular technology over the other.”⁷

The other section that was a surprise, but a welcome one, was *Learning from the History of Automation in the Aviation Workforce*. “Regarding the integration of automation into professional driving tasks, lessons learned through the aviation industry’s experience with the introduction of automated systems may be instructive and inform the development of thoughtful, balanced approaches.” I could not agree more. Early aviation automation systems were similar to our ADAS systems. They performed simple functions and pilots accepted them because they were easy to understand and reduced the workload. As the systems became more automated and complex, they became more difficult to understand, but the pilots were expected to take over when they malfunctioned. Manual flight skills were being lost as pilots were encouraged to depend more and more on the automated systems. Eventually, the problems were identified and improvements were made, including better algorithms, better sensors and improved pilot-system interfaces. As a result, automation has made flying safer.

The report ends with a number of questions.⁸ It does not say who will answer them. I guess that will be us.

7. Here is a quote from the report: “Over the past 20 years, the U.S. DOT has invested over \$700 million in research and development of V2X through partnerships with industry and state/local governments. As a result of these investments and partnerships, V2X technology is on the verge of wide-scale deployment across the nation.

8. DOT’s closing questions:

- As driving becomes more automated, how can safety be improved?
- How will people interact with these technologies?
- What happens when a human vehicle operator switches to or from an automated driving mode?
- As automated driving technologies develop, how will the Nation’s 3.8 million professional drivers be affected?
- Which regulatory obstacles need to be removed?
- What opportunities and challenges does automation present for long-range regional planning?
- Will automation lead to increased urban congestion?

Dispatch Central

Platform-based taxi services currently account for 30% of the global taxi market, according to Goldman Sachs. A Bain study concludes that most platform-based taxi users “tend to care most about the cost, waiting time and driver ratings, and much less about the brand of car in which they travel.”

9. AAA has an affiliated organization called *AA Foundation for Traffic Safety*, which was founded in 1947 as a not-for-profit, publicly supported charitable research and education organization. It does not appear that this report was produced by the Foundation, but by other AAA National staff.

10. For this study, AAA evaluated three top-selling models including a small sport utility vehicle, a medium sedan and a full-size pickup truck. To establish repair part types and costs, all replacement parts discussed are OEM components charged at their suggested list prices. To establish mechanical labor costs, a national average customer-pay rate was determined based on data from National Auto Body Research as well as AAA Approved Auto Repair facilities and rounded to the nearest whole dollar amount. Labor rates used do not include state or local taxes, shop supplies fees or hazardous materials disposal charges. To establish repair times, data was obtained from CCC Estimating (Certified Collateral Corporation), Mitchell1 ProDemand, Safelite, Inc. and Nissan, Ford and Toyota dealer repair facilities. Full methodology is available at newsroom.aaa.com.

Daimler and Geely set up JV taxi service

IN A FIRST sign of GEELY’s 9.69% investment in DAIMLER, the two companies established a 50:50 joint venture in China for operating a platform-based taxi service that will go head-to-head with DIDI CHUXING. Didi won the battle for China two years ago with Uber when Uber withdrew from the market after two years and \$2 billion in losses. DIDI invested \$1 billion in Uber and Uber, along with investors in UBER CHINA, received 20% of the combined DIDI and UBER company. The market for platform-based taxis is worth \$23 billion, and DIDI accounts for 90% of all bookings, according to Bain & Co. The JV company will be headquartered in Hangzhou, China (GEELY’s home) and will use Mercedes S-Class, E-Class and V-Class vehicles—“among others”.



AAA says ADAS adds both safety and cost

THE AMERICAN AUTOMOBILE ASSOCIATION is North America’s largest motoring and leisure travel organization. It offers its 59 million members travel, insurance, financial and automotive-related services through its 42 individual regional clubs. It is best known for its roadside assistance services and its maps and TripTik travel planners. A report prepared by AAA and released in October, 2018, has the title: *New Vehicle Technologies Double Repair Bills for Minor Collisions*.⁹ The research showed that ADAS, such as automatic braking, blind spot monitoring and lane departure warning can cost twice as much to repair following a collision compared to vehicles without ADAS. The reason is the expensive sensors and their calibration requirements. The study found that even minor accidents to windshields, bumpers and mirrors can add up to \$3000 to repair costs because of the sensors that are behind these components. AAA urges consumers to review their insurance policies to make sure that they cover potential repair costs before buying cars with ADAS.¹⁰



Who makes the most reliable cars?

ACCORDING TO CONSUMER REPORTS, it’s TOYOTA (with its luxury brand LEXUS as number one and TOYOTA number two),

MAZDA and SUBARU. For the magazine's Annual Auto Survey, CR collected data from 500,000 vehicles from its members using a questionnaire that it sends to members of CR.org and Consumer Reports Magazine. Survey respondents are asked to note any problems that occurred in the past twelve months, and to identify problems that they consider to be serious because of cost, failure, safety or downtime. The survey has a list of trouble areas which the respondent checks off, from engine to electrical system, climate controls to infotainment. The rankings for a company are based on the average reliability for vehicles in a company's lineup.

At the bottom of the list of 29 are TESLA at 27, CADILLAC at 28 and VOLVO at 29. TESLA owners complained about the Model S suspension and its door handle, the falcon wing doors on the Model X (pictured) and general lack of reliability with the first-year Model 3. CADILLAC has a number of problems, especially in-car electronics. VOLVO got nailed because of display screen freezes and problems with the climate system and interior cabin rattles.



Digital license plates in California

WHERE ELSE but California? Digital license plates will begin to be introduced into the *Golden State* during 2018. REVIVER AUTO claims they have developed the world's first digital license plate. Why? you might ask. What could be the benefits of paying \$600 (suggested manufacturers retail price) as a substitute for a zero cost piece of metal with a number that does not change? Well, you could change the colors of figure and ground. It used to be that you received a new piece of metal every year on which the numbers and background in the state's official colors were reversed, but that seems like ancient history. You could update the year instead of sending out stickers. Since you get the sticker when you pay a tax, that cost is already covered. You can add messages, like the ones on the sample plate above. Who is supposed to read these messages? I could get the same result on a mobile app on my smart phone. Who covers the cost when the plate is stolen—and it will be stolen, just like metal plates are stolen today, but these plates are valuable as digital displays. Rather than adding more cost, take away the license plate and display the registration number on the surface of the vehicle or the glass.



Are Tesla's October sales a one-off event?

AUTOMOTIVE NEWS each month sends out its U.S. Sales Report, a compilation of each OEM's monthly and year-to-date sales with a comparison to the same period one year earlier. The table is preceded by a brief summary of the state of the market, and then snapshots of the carmakers that had the biggest gains or losses compared to a year earlier. October's report opened with the following: "U.S. light-vehicle sales, behind strong light-truck demand and elevated incentives, edged up 0.4 percent in October, signaling the second-half slowdown that began in July is moderating. The SAAR (Seasonally Adjusted Annual Rate) came in at 17.59 million, the highest of the year. FCA, Toyota, the VW Group and the Hyundai Group posted gains while GM, Ford, Honda and Nissan slipped."

I skipped past the notes on FCA, Toyota, etc. and moved down to the table. The OEMs are listed by year-to-date sales, with the highest sales company at the top usually 'Other' (e.g., Aston Martin, Ferrari, and Lotus) at the bottom. Tesla has usually been just above McLaren which is just above Other. Not this time. It had moved up three places, above Volvo, JLR and Mitsubishi Motors. October sales were 21,700 compared to 4,200 in October 2017. That's a 416.7% increase. Year-to-date sales were up 225.8% over a year ago to 129,000. The new Model 3 accounted for 17,500 of those sales. I checked the September table and saw that it was actually in that month Tesla made the jump. There was also no mention of its increase in the Automotive News report.

Does the fact that AUTOMOTIVE NEWS did not even give Tesla a "by the by" in its September or October reports mean that it is discounting the increases as one-off events, or is the column being written by a computer that doesn't recognize triple-digit increases or decreases? I guess we'll have to wait and see until the November numbers are in.

U.S. Sales Report from Automotive News for October 2018 versus October 2017

Tesla Motors*	21,700	4,200	416.70%
Mitsubishi Motors N.A.	8,002	7,381	8.40%
Jaguar	2,648	2,891	-8.40%
Land Rover	7,846	5,477	43.30%
Jaguar Land Rover N.A.	10,494	8,368	25.40%
Volvo Cars N.A.	7,327	7,008	4.60%
McLaren*	142	115	23.50%
Other**	291	296	-1.70%
U.S. LIGHT VEHICLE	1,361,355	1,356,111	0.40%



Percentage change in stock prices for selected car OEMs from the beginning of 2018 until November 8, 2018. The High is the highest price for the stock during the period.

OEM	High	Change %
VW	€180+	-5
Toyota	¥7750	-10
BMW	€95	-13
Daimler	€75	-25
Ford	\$14	-25
Tesla	\$375	+6.4

Is It Time to Throw the Bus Under the Bus?*



This is a city bus in Paris. It could be any city. Is the oversized city bus an endangered species? If not yet, will it be soon?

**To “throw under the bus” is an English language expression that means to betray, discard or disown. It is clichéd and hyperbolic, but in the case of what is happening with city buses in many cities, it is fitting.

How would I feel if I were the head of a public transport agency in many of today’s major cities? In a word: abandoned. After gaining support for bus lanes, seeing congestion charging passed or being seriously discussed and parking rates raised to the roof, after finally getting the money to install digital signage with real-time bus, trolley and rail rapid transit arrival times, obtaining modern, air-conditioned transit vehicles, installing automatic payment systems, after all this, what happens? City governments start to promote personal transit options that both reduce ridership on the collective transport systems and further reduce the available right-of-way by inserting bike lanes and allowing bicycles and scooters—both with and without power sources—onto the roadways.

Let’s look at London. In March, 2017, London’s Mayor, Sadiq Khan, along with Transport for London (TfL) announced a plan to encourage more people to use London’s buses. Ridership was falling and was forecast to decline in 2017/2018 by 2.3%. With falling ridership has come falling revenue, forcing efforts to reduce costs. The Mayor and TfL attributed the reduction in ridership to the fact that bus speeds have fallen by an average of 3%. The fall in bus speeds, according to TfL, is the consequence of three factors: a high level of construction work, which reduces rights-of-way in the construction areas; the “sharp rise in numbers of private hire vehicles (i.e., Uber); and a rise in the number of ‘small’ delivery vehicles (e.g., bikes, scooters, miniature cars)”. What is TfL proposing to do about it? One of its measures is to match bus capacity with demand by reducing the ‘underused services’ in Central London and reallocating them to where they are needed, that is, in the outer London areas.

Maybe TfL is on to something

That’s an interesting approach. People aren’t taking the buses because they are slower than alternative options (e.g., private cars, taxis, bicycles), so instead of reducing the availability of those options to speed up the buses, TfL will reduce the number of buses in Central London and re-deploy them in the suburbs where there is apparently less construction, fewer private hire vehicles and a paucity of small delivery vehicles. That, of course, will increase the available road space for the alternatives. Is the eventual result of demand matching the elimination of all buses

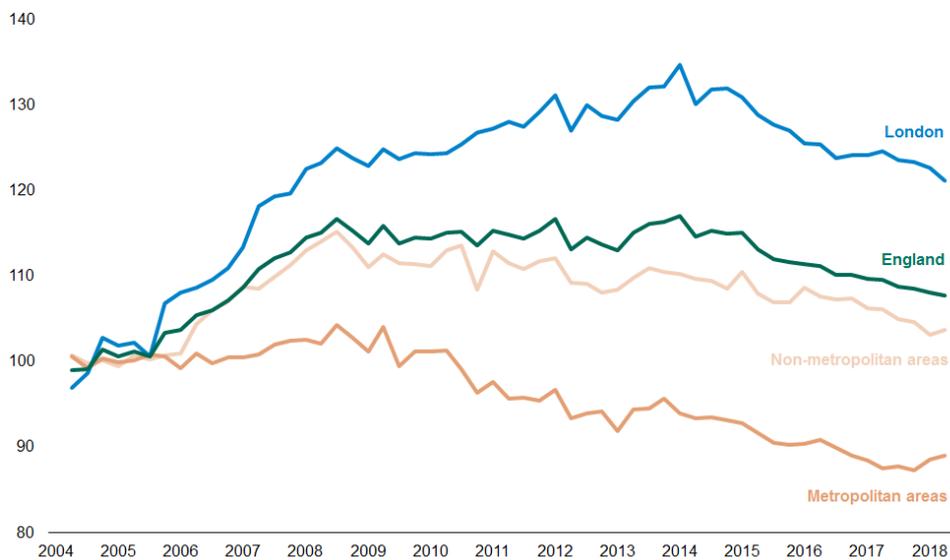
from the center of London, replaced by personal mobility options? Let's hold that thought.

How about the rest of the Great Britain compared to London? Gov.UK has excellent statistics and data about the local bus sector.¹¹ The graph below shows that there was a steep increase in passenger journeys in London between 2005 and 2014 and then they started to decline. Uber announced its London services in 2012, but it took them a few years to get up to speed. By the middle of 2015, Uber had 15,000 drivers in London, would have around 30,000 a year later and 40,000 by June 2017. The total number of all private drivers (i.e., including Uber and all of its competitors) in London doubled from 2012 when Uber started to 116,000 by 2017.

Passenger journeys in non-metro areas in Great Britain and non-London metro areas started to decline in 2009. This cannot be due to Uber and its compatriots since services started in only a few other locations, such as Birmingham, Manchester and Liverpool, well after London. It can neither be explained by construction and deliveries. Either fewer people are travelling or fewer people are taking the bus. It's the latter, according to the U.K. Department for Transport (DfT) in its 5 July 2018 report: Road Traffic Estimates: Great Britain 2017.

Passenger journeys on local bus service by metropolitan area status in Great Britain (England, Scotland and Wales)

Index: 2004/05 = 100, seasonally adjusted



Meanwhile, on the other side of the pond

Transit ridership decreased in almost every major city in the United States between 2015 and 2017. The exceptions are Houston and Seattle. Ridership fell by over 10% in Washington, DC, a city well served by bus and rail services. Bus ridership has fallen by 20% in



11. <https://www.gov.uk/government/collections/bus-statistics>



Personal transport. Not a bus in sight. Image by Tomi Um in NEW YORK TIMES article *Electric Scooters in New York City? They Just Might Work* (August 18, 2018). (Note the chicken waiting for a reason and opportunity to cross the road.)

Los Angeles since 2013, the year ridership peaked. LA's Metro surveyed citizens and found that the main reasons people stopped taking the bus was because their travel patterns changed, it was too hard to get to and from transit stops, buses were too slow and service was unreliable. What did LA Metro do? It matched bus capacity to demand and cut service.

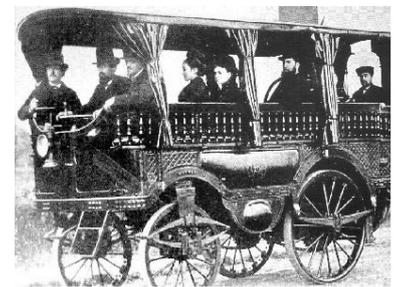
All the while car usage increases. The Federal Highway Administration reported that all drivers racked up a record 3.22 trillion miles in 2016 compared to 3.1 trillion in 2015. It was the fifth year in a row of increases for private driving. Lower fuel prices and a strong economy has kept people in their cars and apparently coaxed them out of buses or kept them from making the switch.

If buses disappeared from cities, would we miss them?

If we are talking about ones that look like the Paris bus on the first page of this article, or the big articulated ones, my answer would be no, we would not. City buses have gotten too big for most of the routes on which they travel. The first buses a century ago were the size of a minivan. Even the London double-deckers that I rode regularly in the early 70s were tiny compared to the behemoths filling up the streets that were never designed to accommodate them. With a conductor taking fares, they could load and unload very quickly. Their main competition was the black taxis, but there was no congestion on the streets.

The fewer the routes and the longer the distances between where people need to start and end, the less use people have for buses in urban locations. Manhattan is perfectly designed for buses if there was one running on every street and avenue, and if they ran often. But if you load up the roads with private and commercial vehicles, and allow on-street parking on one or both sides, buses lose their utility even where they could be most effective. If people are going to sit in traffic, they might just as well get a ride from door-to-door—if they can afford it. That's where Uber is trying to go with their current business, and where all the platform companies want to be with driverless vehicles: approaching the cost of a bus ride.¹²

We need to start thinking outside the bus. If a city is serious about providing a useful bus service, it needs to run them everywhere and often, including at night. It must, therefore, get rid of cars driving and parking on its streets. That includes both private and commercial cars (i.e., taxis). It needs to eliminate all trucks and delivery vans parking in its bus lanes. If it cannot do these things, it should do what London and Los Angeles are doing, which is gradually taking buses out of service while their citizens find and use other options. What cities are doing today all over the world is neither providing an adequate service to their citizens nor using the money allocated for transport in a cost-effective way.



Here is Amédée Bollée's L'Obéissante (The Obedient) steam-powered bus in 1875.



This Daimler CC bus of 1912 (above) like the London General Omnibus Company S742 (below) of around the same period took up a minimal amount of road space.

12. Uber's business model postulates that drivers earn more money if they are carrying a rider 100% of the time their car is in operation, and the way to capture 100% of riders is by having the lowest fares and the largest number of vehicles in service. Uber has tried to explain this logic to its drivers with limited success.

A Dispatcher's Musings: The End of History - Part II

"The only thing that matters is the future. I don't even know why we study history. It's entertaining, I guess—the dinosaurs and the Neanderthals and the Industrial Revolution, and stuff like that. But what already happened doesn't really matter. You don't need to know that history to build on what they made. In technology, all that matters is tomorrow."

Anthony Levandowski
in an Oct. 22, 2018 article in *THE NEW YORKER*, "Did Uber Steal Google's Intellectual Property?"

13. *Risorgimento* (Italian for 'Rising Again'), is the 19th century movement for Italian unification that culminated in the establishment of the Kingdom of Italy in 1861 and the unification of all of Italy with Rome as its capital in 1870.

I DON'T KNOW Anthony Levandowski, the person who made the statement to the left. I have read a bit about him. He does have a history. He's well-known in driverless vehicle circles. He apparently cares enough about his own past not to have changed his name to Seven Eleven. I'm not interested in Anthony Levandowski per se. What I am interested in is the fact that there are people like him, holding his views about the irrelevance of history, who are doing things that will have significant effects on humans and the societies in which we live, and that one day the future they help to create will be the legacy for those who may come after.

Anti-historians should not be confused with anti-intellectuals. The latter group disdain all forms of learning, including history, and dismiss all art, literature and science as impractical and unnecessary. Anti-historians should also not be confused with futurologists, those who believe they can predict the future, whether as an eschatological endeavor, a literary fantasy (i.e. science fiction) or a business exercise. Anti-historians are intellectuals who suppose that everything in existence has been put at their disposal in order for them to create the future which they believe should be created. It does not matter where the tools or knowledge or resources came from nor why they exist. What matters is only what can be done with them.

We've been here before

Anti-historianism is not a new phenomenon. Slightly more than a century ago, in 1909, a group of young Italians started the *Futurism Movement* by issuing the Manifesto of Futurism. *Futurism* was principally an artistic movement, but its tenets were derived from the political, social, economic and technological events of the previous fifty years in Italy following unification and the *Risorgimento*.¹³ This was a time of major technological change almost everywhere in the world, but especially in Europe, the United States and Japan. It was even more dramatic in Northern Italy. During the previous fifty years, machines had been invented that could propel man on land and on water at heretofore unimaginable speeds. The Wright brothers had demonstrated that Homo sapiens could indeed fly. Herr

Daimler and others showed that the power of locomotives and steamships could be scaled down to the size of a vehicle controlled by a single person. Now, during the first decade of the 20th century, their effects were being felt in Italy.

Filippo Tommaso Marinetti was the founder of the *Futurism Movement*. He authored its Manifesto, which provides a program of actions and beliefs preceded by a Prologue that describes the social setting at the time. There are eleven propositions. The first and second praise danger, energy, audacity. (Does this sound like “Move fast and break things”?) The third contrasts the *Futurist* passion for movement and activity against ‘Literature’ which exalts repose, ecstasy and dreams. The fourth is the best known: “*We declare that the splendor of the world has been enriched by a new beauty—the beauty of speed. A racing car with its bonnet draped with exhaust pipes like fire-breathing serpents—a roaring racing car, rattling along like a machine gun, is more beautiful than the winged victory of Samothrace.*”¹⁴ The fifth follows with: “*We will hymn the man at the steering wheel, whose ideal axis passes through the centre of the earth, whirling round on its orbit.*”

In the Prologue of the Manifesto, Marinetti wrote: “*We drew near to the snorting beasts and laid our hands on their burning breasts. Then I flung myself like a corpse on a bier across the seat of my machine, but sat up at once under the steering-wheel, poised like a guillotine blade against my stomach.*” He is describing an event that took place at 5 a.m. in 1908, when he and his compatriots were about to race around the streets of Milan’s outer suburbs at 60 miles per hour. Boccioni wrote about the experience: “*The era of the great mechanized individuals has begun, and all the rest is Palaeontology...therefore we claim to be the primitives of sensibility that has been completely overhauled.*”¹⁵

The Futurists were not only exalting motorized vehicles—especially the car—they were raising driving by humans to the highest level of achievement. The creation of the automobile industry (FIAT was founded in 1899) “capable of producing machines that could hold their own in international competition gave industry a glow of psychological prestige that mere increase in quantity of established products could not have done.”¹⁶ **Man+Machine=Future.**



The Founders of Futurism - Filippo Tommaso Marinetti (centre), the founder of the Futurist movement, with the artists (left to right) Luigi Russolo, Carlo Carrà, Umberto Boccioni, and Gino Severini. (Hulton Archive/Getty Image)

14. The *Winged Victory of Samothrace*, also called the *Nike of Samothrace*. “Just do it.”

15. In 1909, Marinetti wrote a science fiction play, *La donna è mobile* (*Poupées électriques*), first presented in Turin. Today, the play is remembered through a later version, named *Elettricità sessuale* (*Sexual Electricity*), and mainly for the appearance onstage of humanoid automatons (mechanized individuals), ten years before the Czech writer Karel Čapek would invent the term ‘robot’.

16. Banham, Reyner. Theories and Design in the First Machine Age. The Architectural Press (1960).

One day your future will be someone else's past

It was the Italian middle class, the *bourgeoisie*, to which Marinetti and his compatriots belonged, who were the *Futurist's* main audience. This group wanted Italy to join the major countries on the world stage. It did not want to conserve the existing world order; it wanted to destroy it and create a new one. World War I showed that the machines the *Futurists* were idolizing were capable of wreaking havoc, and the *Futurists* urged the *Fascists* to use them to bring about the future which they believed was Italy's destiny. They did not succeed.

There are similarities between today's times and those at the turn of the 19th century to the 20th. Technological change is rapid, and there seem to be no accepted norms for how these technologies can or should be used. Robotization and the development of collective intelligence (aka artificial intelligence) appear to be in the hands of individuals who feel no particular accountability to any authority. We are building vehicles that drive themselves, even race each other with no driver at the wheel, like the Roborace car to the right. We are building machines that will think for themselves and do so better than we humans can. **Machine+AI=Future.**

It may seem natural to people like Anthony Levandowski to believe there is nothing to learn from why *Futurism* didn't lead to the future the *Futurists* expected. There are others, including your editor, who have another opinion, who believe that anyone who is dependent on a functioning political framework to undertake and execute an idea should have a good understanding of why *Futurism* and *Fascism* failed. There are significant lessons to be learned. The lessons are similar to those learned by studying the extinction of the dinosaurs,¹⁷ the gradual disappearance of *Homo Neanderthalensis*, the reasons why the Industrial Revolution took place, and "other stuff like that". We learn what worked and what didn't, and we try not to make the same dumb mistakes all over again so that everyone's lives can be better sooner than later.



A car built to race against other cars with no driver on board.

17. It really does matter whether the extinction of the dinosaurs was caused by a huge asteroid smashing into Mexico, a one-off event, or by hundreds of thousands of years of massive volcanic eruptions. See [THE ATLANTIC](#) (Sept. 2018): *What Really Killed the Dinosaurs?*

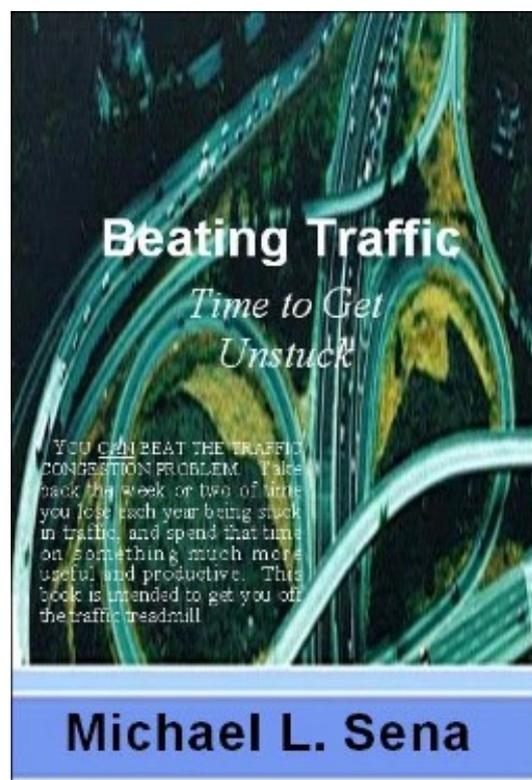
Past and Future Juxtaposed *Unique Forms of Continuity in Space* (1913)

Artist: Umberto Boccioni
Frustrated by the constraints of the canvas, Boccioni found it more effective to explain Futurist principles of movement in a three-dimensional form. His sculpture captures the essence of a figure in motion, rendered in geometric forms that convey an effortless grace and speed. Draped clothing seems to blow in the wind as the robotic figure strides forward, creating an aerodynamic effect. As an homage to Auguste Rodin, Boccioni's sculpture is armless, referencing the "incomplete" Walking Man and the classical Greek statue, Nike of Samothrace. THEARTSTORY.ORG.

About Michael L. Sena

Michael Sena, through his writing, speaking and client work, attempts to bring clarity to an often opaque world of vehicle telematics. He has not just studied the technologies and analyzed the services, he has developed and implemented them. He has shaped visions and followed through to delivering them. What drives him—why he does what he does—is his desire to move the industry forward: to see accident statistics fall because of safety improvements related to advanced driver assistance systems; to see congestion on all roads reduced because of better traffic information and improved route selection; to see global emissions from transport eliminated because of designing the most fuel efficient vehicles.

This newsletter touches on the principal themes of the industry, highlighting what, how and why developments are occurring so that you can develop your own strategies for the future.



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