Automotive

ADAS & Autonomous

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DEVELOPMENTS IN ADAS AND AUTONOMOUS

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Introduction: Rapid acceleration

Assisted driving has come very far, very fast. Almost every current vehicle model sold by the world's top manufacturers has at least some ADAS functionality, with certain features even coming standard. Only a few short years ago, nearly all of these were either prohibitively expensive or unavailable, full stop.

It's not really a surprise that we've managed to get here so quickly. Everyone knows that autonomous driving is the bright, shining future and, on the way there, everyone's scrambling to get a piece of the ADAS market. From sprawling, incumbent carmakers down to scrappy young tech companies, thousands of enterprises are feverishly working to become the solutions of choice for assisted driving and, well down the road, complete autonomous operation.

The stakes are enormous. Auto sales are notching new records, particularly in the world's top market, the United States. In 2015, a record of nearly 17.5M light vehicles were sold in America, and analysts expect a new all-time high for this year. That trend should keep rolling – one estimate has it that just under 21.5M vehicles will be sold in 2020. In that year, some of the more optimistic projections anticipate we'll have fully autonomous vehicles on the road.

That's only a precious few years away, so let's see where we are just now in terms of business trends and technology and how realistic that forecast might be.

Carmakers and solutions providers won't go solo

Vehicle manufacturing is an industry well accustomed to collaboration. For decades now, one of the key ingredients in the success of any top carmaker has been its ability to work with a large, disparate number of suppliers. It has never been easy to juggle these many relationships at once, while ensuring that the end product is completed on time and within budget.

That ability is going to be strongly tested from now until full autonomy. Even at their comparably modest level of assisted driving, today's autos carry a raft of cutting-edge solutions and technologies. So in addition to traditional parts suppliers, carmakers now must collaborate

with the providers of such goods and services. And a Microsoft or a Cisco is a very different sort of company than a Delphi or a Continental.

So it's no coincidence that we're seeing a host of high-level, formal and international tie-ups between such companies involved in the ADAS/autonomous space. A very recent example is the alliance between BMW, US computer chip making giant Intel and the vision systems specialist Mobileye. The press release announcing the three-way partnership was very upfront about the great many challenges on the way to full autonomy and stressed the need to divide the work required to get there:

"The path to get to a fully autonomous world is complex and will require end-to-end solutions that integrate intelligence across the network, from door locks to the data centre," it stated. "Transportation providers of the future must harness rapidly evolving technologies, collaborate with totally new partners and prepare for disruptive opportunities."

Like nearly every other major player in the ADAS-to-autonomous game, the trio is aiming not only for the winner's circle, it wants to take the ultimate prize. The three companies said they are to "strive for an industry standard and define an open platform for autonomous driving". This would then be made available – presumably for a handsome price – not only to peer carmakers but other industrial enterprises that might be able to use it for their products.

Another marriage of tech aristocracy to automobile royalty has recently been reaffirmed. Earlier this year Microsoft – very eager to move some of its efforts from the dormant PC market to the brave new world of autonomous driving – and Toyota announced the expansion of their existing collaboration. The two have established a new joint venture to concentrate on data analytics called Toyota Connected. In Toyota's words, Connected "will consolidate Toyota initiatives in data centre management, data analytics, and data driven services development".

The US tech giant and the Japanese manufacturing incumbent have an approach to the ADAS/autonomous car market that differs from that of BMW/Intel/Mobileye. Microsoft's ambition is to become a sort of conduit for the heavy amount of data streamed to and from ADAS/autonomous vehicles, via its Azure cloud computing platform. Meanwhile, Toyota says it "seeks to connect cars to people's daily lives". The idea is to build an ecosystem of user-friendly, practical lifestyle apps that would offer such help as blood pressure monitoring (through sensors in the car), and suggestions for restaurants along a chosen route, derived from data the system has gleaned about a user's driving habits.

These collaborations are but two of the numerous alliances being formed to handle the increasingly daunting task of getting vehicles to complete autonomy. Other recent examples abound – this past spring, onetime go-it-alone autonomous kingpin Google found a partner. This is Fiat Chrysler Automobiles, which is teaming up with the IT giant in a try at developing a self-driving minivan. Meanwhile, on the regulatory side Google is one of the main companies (along with Ford, Volvo, and rideshare services Uber and Lyft) behind the launch of the Self-Driving Coalition for Safer Streets, an industry group that advocates for governments to establish what its counsel and spokesman David Strickland said should be "clear rules of the road", for autonomous driving.

ADAS: easy on the gas

Such alliances are being developed in anticipation of mounting technological and regulatory challenges. While these collaborations are being formed, and the hard work of developing autonomous functionality parcelled out, just now the great need is to continue building up ADAS technologies.

Ford is one of the entities doing this work. The company says it has tripled its investment into such solutions; the idea is to strengthen and expand what's already on the market. Two features it is currently burning the midnight oil to bring to market are Traffic Jam Assist and Fully Active Park Assist. As Ford describes them, "Traffic Jam Assist helps the driver with steering, braking and acceleration in heavily congested traffic situations on motorways. Easily activated by pushing a button, the system helps keep the vehicle centred in the lane and brakes and accelerates to keep pace with the vehicle in front. Fully Active Park Assist will help drivers by steering and controlling the transmission, throttle and brake to seamlessly pull into a parking spot at the touch of a button".

One of busy Toyota's big current research efforts in the ADAS field is what it loftily terms its 'guardian angel' project. This is a set of protocols that would essentially correct the mistakes made by the driver, who for the most part will remain in almost complete control of the vehicle. The system should kick in if and when a mistake could potentially lead to an accident. The company is making guardian angel functionality a key focus of research at the facilities in Palo Alto run by its Toyota Research Institute. This is a broad ADAS/autonomous research shop, in contrast to the data science-focused Toyota Connected initiative.

Assisted driving is also continuing to move out of the realm of passenger cars. The commercial vehicles segment also has a vested interest in developing these technologies. After all, care must be taken to ensure that cargo loads are transferred as safely and efficiently as possible. Plus, we shouldn't forget that the frequent long haul driving typical of the segment puts a strain on even the most capable and seasoned human operator, making the segment ripe for eventual autonomy.

Lorry makers have as much ambition as their light vehicle peers in getting ADAS functionality into their vehicles and, like them, they also buy them on the market from time to time. This past June, Germany's lorry systems manufacturer Knorr-Bremse reached a deal to purchase Tedrive Steering Systems, a state-of-the-art components maker. In its press release heralding the deal, Knorr-Bremse wrote that with its asset-to-be, it "will be able to offer extended automated driving functionalities that were previously restricted to the passenger car sector, such as active lane-keeping on motorways/freeways, as well as functionalities specific to commercial vehicles".

Assisted driving capability, and its potential in the trucking segment, was one of the motivations behind auto parts specialist ZF Friedrichshafen's purchase of America's TRW Automotive Holdings, a large-scale deal that was completed last year. ZF Friedrichshafen executive Frank-Detlef Speck told *Transport Topics* magazine that "with the TRW acquisition and the strength in the commercial-vehicle segment, ZF is ready to develop solutions for all levels and use cases of automated driving and driver-assist systems".

For *any* kind of vehicle maker, the importance of favouring the development of ADAS technologies, as opposed to a hot, blind sprint towards full-on autonomy, has been heightened lately by several setbacks. Specifically, in several isolated incidents, recent-model Tesla equipped with the company's Autopilot feature were involved in crashes. The first occurred this past May in Florida; a Model S collided with a lorry's tractor trailer when the larger vehicle drove across a motorway perpendicularly. The Autopilot was engaged at the time but the system failed to apply the brakes. And according to Tesla's investigation of the incident "the high ride height of the trailer combined with its positioning across the road and the extremely rare circumstances of the impact caused the Model S to pass under the trailer, with the bottom of the trailer impacting the windshield of the Model S". The vehicle's driver was killed.

Shortly thereafter, a Model X hit a guardrail and then a concrete median on the Pennsylvania Turnpike motorway, rolling over and coming to a stop on the road. According to the vehicle's driver, Autopilot was activated at the time of the occurrence, although local police have cast some doubt on that assertion.

And, of course, there was the notorious fender-bender that saw one of Google's self-driving prototype cars side-swipe a bus at the beginning of the year. Thankfully, as both vehicles were travelling quite slowly (the Google car at 2 mph, the bus at 15 mph) there were no fatalities, yet the incident still shone a harsh light on the current state of self-driving technology.

The future is autonomous

Those accidents might be giving the driving world pause to think about whether we should be careering so quickly towards that golden, self-driving future. This introspection is proper and necessary… but at the end of the day, it won't put the brakes on the efforts being made by the increasing number of companies, incumbent and upstart alike, determined to get us there.

In parallel with the increased ADAS efforts discussed previously, Ford is also pouring more resources into developing autonomous capability. The company says it has "a robust and separate fully autonomous vehicle development programme that is focused on delivering SAE International Level 4 capability, which does not require the driver to be in the loop. We have fully autonomous test vehicles already on the road in Michigan, California and Arizona. Also, Ford plans to triple the company's autonomous vehicle development fleet this year – making it the largest of all automakers – to continue testing and research of autonomous vehicles".

Elsewhere in Detroit, mighty General Motors is expanding its autonomous reach. One of its more recent moves was to buy into it, when it reached a deal to purchase San Francisco start-up Cruise Automation. This is an interesting, rather sideways route to autonomy, because Cruise Automation is developing an aftermarket kit that promises to transform an existing car model into a self-driving machine; this is in contrast to most autonomous efforts that focus on packing the requisite equipment and technology into the vehicle during production. Cruise Automation will become part of the US auto giant's Autonomous Vehicle Development Team and is to operate as a standalone unit within that group. We can anticipate that at least some of its innovations will find their way into GM's wider self-driving effort. The company's tech is obviously highly prized by the carmaker because, by some reports, it paid over $1Bn (£760M) in cash and stock for the acquisition.

In terms of the specific autonomous technology being developed at the moment, one particularly hot area are the sensors that function as the ‘eyes’ of the vehicle. The Tesla Model S Florida crash illustrated the need for improvement in this, owing to the apparent failure of the car’s sensors to pick up a sudden, unexpected obstacle.

In the case of a veteran manufacturer honing its cutting edge, Jaguar Land Rover recently unveiled what it vividly describes as "next-generation sensing technologies that will be the eyes of the future autonomous car". These include Surface ID and 3D Path Sensing, which employs the feed from a vehicle’s cameras, plus ultrasonic, radar, and LiDAR sensors to provide a full, 360-degree of the car’s environment. Another very promising feature is the manufacturer’s Terrain-based Speed Adaptation, which Jaguar Land Rover says can "sense bumpy terrain including uneven and undulating surfaces and washboard roads, potholes and even standing water". But that’s only the beginning, adds the company, "it is then intelligent enough to predict the potential impact of these surfaces on the car’s ride and automatically adjust speed to keep passengers comfortable".

And, as with ADAS, the makers of larger vehicles and the technology to power them are rumbling towards autonomy. This past April in Europe, the Dutch Ministry of Infrastructure and Environment sponsored a demonstration of commercial vehicles utilising technology that is certain to become standard in autonomous lorries. Six different European lorry makers demonstrated their capabilities in the area of platooning, in which the vehicles synchronised and communicated with each other through Wi-Fi in order to ride close together in a single file, as a unit, towards their destination. Although drivers were present in each vehicle for the demonstration, the event demonstrated that automated platooning can work in the commercial sphere with current technology.

Conclusion: so where does this leave us?

In all the rush and excitement to get us to 100% autonomy, it’s sometimes easy to forget that we’re still well short of the goal. And it’s wrong to speed too quickly to the destination; those recent accidents, while anomalies, are troubling indications that there is danger in moving too recklessly. They prove that experiments and half-proven technology belong in the research lab or on the test track, not on the motorway. Our trip to that driverless future should be more measured, considered and gradual. So at the moment, those predictions of hands-off operation by 2020 (or even 2018, as Tesla’s colourful CEO Elon Musk predicted) look overly optimistic.

That said, these are heady, thrilling times for the car industry and the many parts and technology suppliers associated with it. All of them have a stake in the autonomy game and are, to varying degrees, devoting the resources, manpower and finances to cut the driver out of the process. We’re going to see more ADAS features coming down the pipeline in the immediate future and probably another high-level alliance, or several, before hands-off functionality starts to become standard. Once that happens, we’ll be within a few miles of true Level 5 autonomy. So although the end is still a longer distance away than some would like, it’s within a long drive; we just have to be a bit patient and continue to hang on.