The History of Automotive Safety Technology

Over the last 70 years vehicle safety has improved significantly largely due to a handful of critical in-vehicle technologies. These technologies started with the introduction of seat belts in the 1950s (Ford 1955 and Saab 1958), interestingly it took a further 30 years for the first seat belt law to be introduced in New York in 1984. The 1970s saw three major in-vehicle safety contributors with the introduction of seat belt reminders (1970), Anti Lock Braking Systems (ABS) (1971) and Airbags (1973).

Source: The Boston Consulting Group
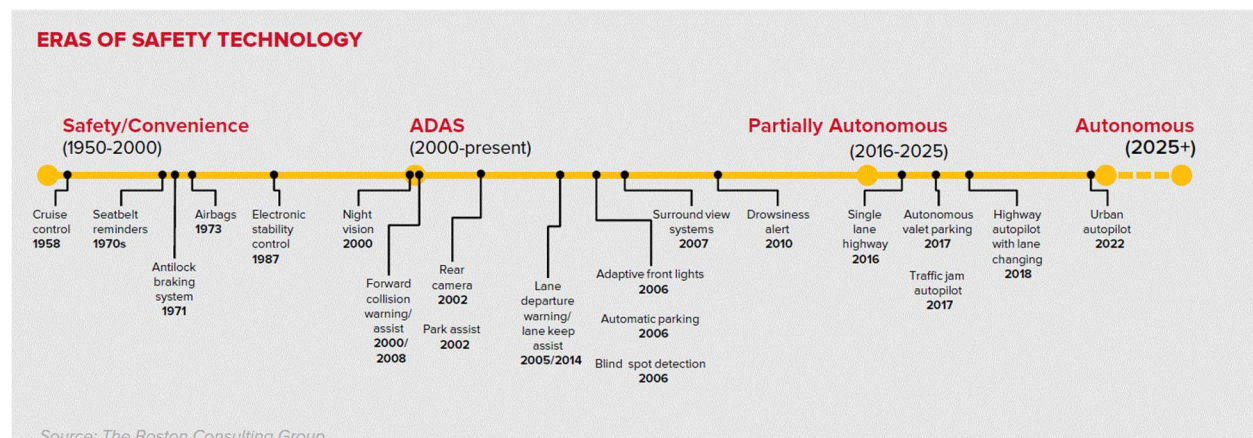
A decade later and the first Electronic Stability Control (ESC) was introduced in 1987. From 2000 to the present day most in-vehicle safety improvements have focused on Advanced Driver Assistance Systems (ADAS). These include Night Vision (2000), Rear view cameras (2002), Forward Collision Warning/Assist (2000/2008), Lane Departure Warning/Assist (2005/2014) and many others.

However, despite substantial improvements in driver safety which have been achieved by the successful introduction of these technologies, many of which are standard today, driver safety remains a serious problem. In the US alone NHTSA recently reported there were more that 6.1 million road crashes, the World Health Organisation are reporting over 1.2 million road fatalities each year, with over 50 million are injured. Due to these stubbornly high statistics it's

no surprise that deaths due to road traffic accidents are predicted to be the third leading cause of death by 2020.

The Big Safety Questions

Statistics indicate that over 90% of all observed accidents are due to human error, which raises three important questions:

1. Despite the new protective technologies, why are road fatalities still so high?
2. If over 90% of all observed accidents are caused by human error, why is there so little focus on the state of the driver?
3. Why have none of these protective in-vehicle safety technologies over the past 70 years addressed the critical issue of driver error?

This issue of driver safety and the need to reduce human error is not only relevant to SAE Level 0 to 2 vehicles but it is possibly even more relevant to the pending introduction of partial and highly automated vehicles (SAE Levels 3 and 4 respectively). This is because for many years to come, vehicles will need to transfer driving responsibility from the human driver (SAE Level 0-2) to sophisticated, automated, self driving systems (SAE Levels 3 and 4) and back. The critical issue concerning most vehicle OEMs is transition demand, that is the transfer of control back from the automated driving system to the driver. If the driver (whom we know is prone to error) is not attentive then transfer of control may occur when the driver is not in a suitable state to safely resume control, this situation could be potentially fatal for the driver and vehicle occupants. The topic of transition demand, or transfer of control, also raises a number of liability and insurance issues.

Statistics show that commercial vehicle fleet drivers are at even higher risk of accidents and for this reason we are starting to see the emergence of basic driver monitoring systems introduced into the commercial fleet market. However, these systems only address the basic driver behavior parameters such as driver out of position, head tracking and driver drowsiness, critically, they fail to adequately address the need to measure driver cognitive workload and actively manage the drivers attention and situational awareness.

Due to the above reasons there is still a need for new innovative technologies to reduce human error and actively support the drivers cognitive capabilities in order to improve driver attention and situational awareness.

There is also a need for new technology to help keep the drivers cognitive workload at the optimal point of human performance as illustrated by the Yerkes-Dodson Model in Figure 1 below.
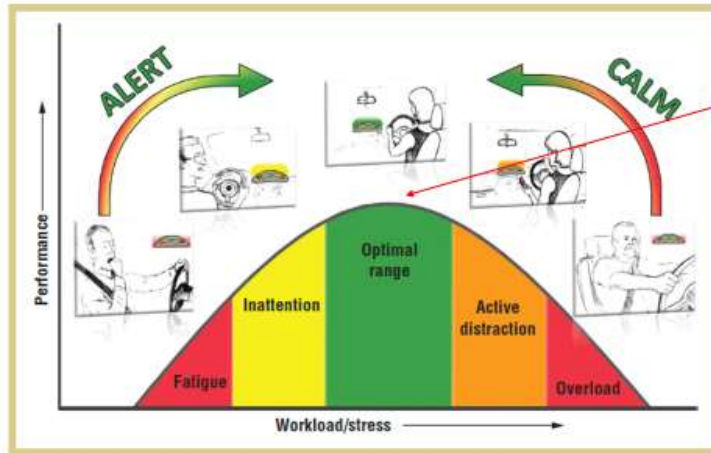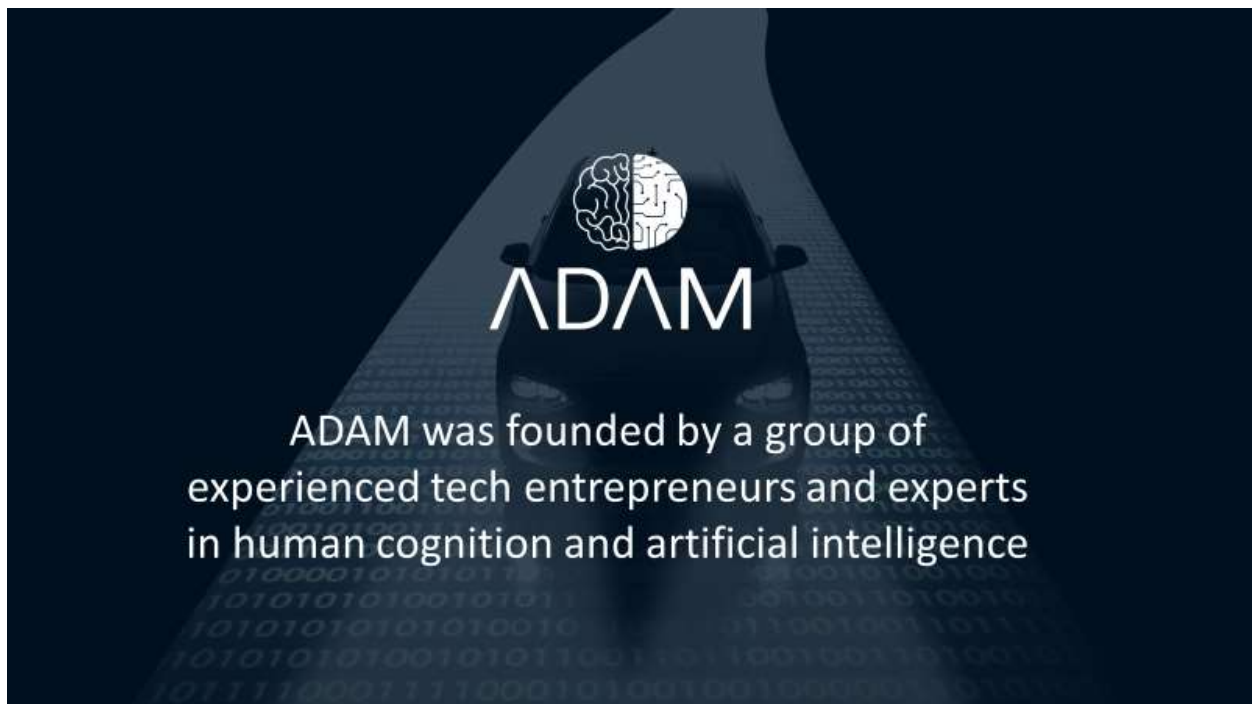
Challenge for automotive OEMs is to keep "Driver Workload" in "Optimal range"

The **Yerkes–Dodson law** is an empirical relationship between Stress/Workload and human performance, originally developed by psychologists Robert M. Yerkes and John Dillingham Dodson in 1908. The law dictates that performance increases with physiological or mental arousal, but only up to a point.

Yerkes-Dodson states there is a direct relationship between Human Performance and Workload

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It is with these specific objectives in mind that a group of experienced technology entrepreneurs with backgrounds in human cognitive science and artificial intelligence founded a start-up company called ADAM Cogtec. These entrepreneurs have now successfully developed a proof of concept for several layers of the ADAM Cogtec comprehensive Driver Attention and Awareness software Platform. The team has also successfully filed a portfolio of Patents to secure intellectual property protection.

ADAM was founded by a group of experienced tech entrepreneurs and experts in human cognition and artificial intelligence

Early laboratory based experimental results using a recently developed prototype are showing exciting and significant improvements in driver situational awareness, recognition of hazards and driver response times. More specifically, initial user assessment results are indicating an improvement in driver response times by an average of x% and improvements in situational awareness, where hazard detection rates have increased by an average of y%. These results were obtained by measuring driver performance using a driving simulator in ADAMs Lab. In addition, the latest prototype has been able to successfully detect impaired drivers, through alcohol abuse, and the system is now capable of providing a system output which determines whether a driver is cognitively capable or incapable of driving compared with baseline performance. The very latest algorithms are also showing promising results in predicting (several minutes ahead) whether the cognitive capability of the driver will improve or deteriorate over time. (Need data here). ADAM also indicate that plans are in place to test the impact on driver cognition due to substance abuse.
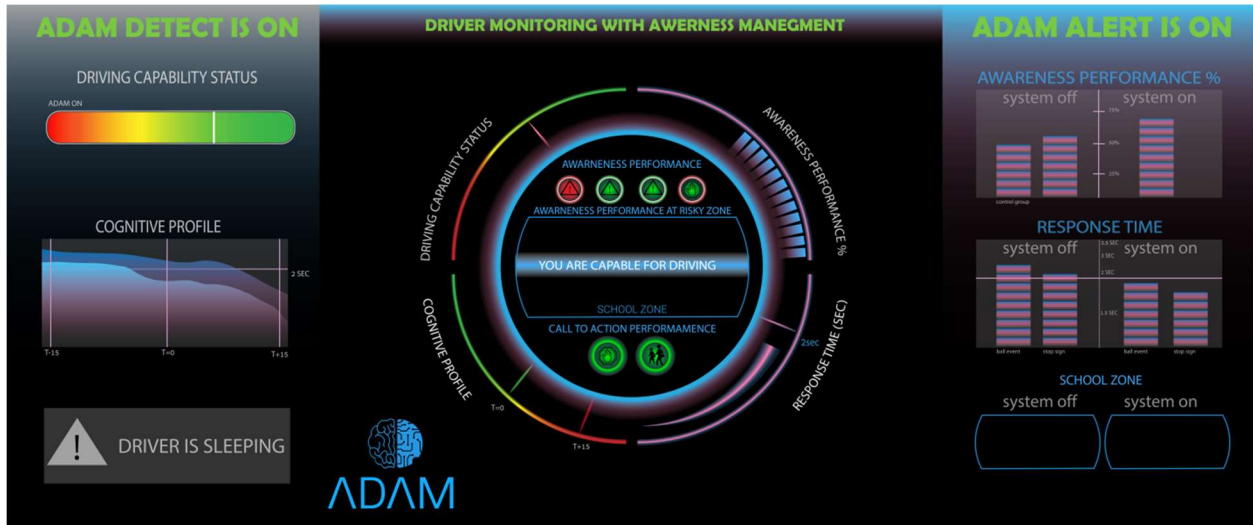
The following shows a video of a recent user experiment using the latest proof of concept in the ADAM laboratory.

<Insert video clip here>

ADAM Cogtec have now recruited an experienced senior automotive executive with a proven track record of taking human machine interface (HMI) concepts successfully through to production and into the market. Dr. Carl Pickering has worked for Jaguar Land Rover for almost 20 years and joined ADAM Cogtec on Monday 18th December 2018, he has a technical background and is a Chartered Electrical/Electronic Engineer and a Fellow of the Institute of Engineering and Technology (IET), he also has an MBA and a PhD in Automotive Human Machine Interface.

Dr. Pickering brings a wealth of HMI knowledge and automotive experience to ADAM and has joined as Co-founder and CEO. In addition to providing strategic direction on business development activities including leading efforts to drive initial collaborative engagements into the automotive sector, he will also provide hands-on technical direction on all product development and R&D activities to ensure the ADAM Platform fully meets the needs of the automotive vehicle manufacturers and Fleet markets.

Dr. Pickering said "ADAM's driver attention and awareness software platform offers a unique and much needed innovative approach to driver safety and well being, in addition, the platform will serve as a key enabler for the successful introduction of automated vehicles SAE Levels 3 and 4 including the extensive commercial vehicle fleet market".

With over 70 million passenger vehicles manufactured each year the potential OEM market is substantial, in addition there are currently over 300 million commercial vehicles on the world's roads. Combined the OEM and aftermarket offer a potentially lucrative multi-billion dollar market.

Dr. Pickering stated: "Based on promising experimental results from the early proof of concept, ADAM are now actively seeking Investors and collaborative Development Partners to strengthen the software development team, accelerate completion of the ADAM Attention and Awareness Platform and to establish meaningful business development engagement with the automotive sector."

For further information please visit www.adam-cogtec.com or email enquiries@adam-cogtec.com.

ADAM is now aiming to collaborate with leading partners to accelerate the execution of this highly promising platform, and provide significant contribution towards Driver Safety, wellbeing and Human Machine Cooperation

ENABLING THE AUTOMOTIVE EVOLUTION