

What did you miss at AESIN 2017?

On Tuesday 3rd October I attended the AESIN 2017 conference and dinner at the National Motorcycle Museum in Solihull. After attending last year's event I was expecting a great day and a very strong turnout. I'm pleased to say, I wasn't disappointed! The conference had grown slightly since last year – around 200 attended the conference this year (compared to about 175 last year), and about 90 for dinner. If you weren't there, you missed a great event, but I hope this summary will give you a bit of a flavour of what you missed.

The Conference and Venue – The conference was held again at the ever popular National Motorcycle Museum, which is an excellent venue with great facilities for the conference sessions and exhibition space. The AESIN Annual Conference provides insight into the latest thinking from industry leaders and champions and provides companies in the sector with an opportunity to engage in UK programmes driving the automotive revolution enabled by electronic systems

As usual, the quality of the speakers and their content was quite exceptional and the event attracted a strong selection of influential and interesting delegates from the industry,, which meant that the networking opportunities were also very good. Of course, the dinner was pretty good too. All round I'd say the conference was excellent value and I'd like to express my congratulations and thanks to the organisers!

The Content – Much like last year's event, the organisers had managed to squeeze in a huge number of speakers onto the agenda. Again this year, I studied the agenda and made the judgement that Track 2 was more “full-on, low-level techy” and was focused on the vehicle electronics side of things, whereas Track 1 fitted my own interests better as it was more focused on the higher-level concepts such as the connected car, automotive security and ADAS/AV technology. So I opted for Track 1 again.

Introduction

This year's proceedings were, once again, kicked off with the customary introduction from Alan Banks, chairman of AESIN since 2012. Alan set the scene for what's going on in the industry and why the AESIN conference was so important in helping to bring the community together and drive it forward. He talked about the major achievements of the AESIN team over the last year, including lots of work with the Automotive Council, with 2 major roadmaps published over the last year:

1. A Roadmap for intelligent connected vehicle development
2. A Roadmap for electric vehicle architecture

He mentioned lots of interaction with the government and the great support they are giving to this sector and collaborations on Enabling Environments.

One of the important developments was the first AESIN plenary that was hosted by KPMG in Birmingham and was opened up to allow smaller companies to get access to the bigger guys

Alan concluded with a roundup of some of the areas of focus for the AESIN organisation and what's been going on in the various workgroups, including:

- ADAS and autonomous vehicles and working with Transport Systems Catapult – lots of work going on there

- Successful workshops on ISO 26262 safety critical systems, automotive security, BSI setting standards for ADAS
- Software workstream has gone through some remodelling – looking at methods and approaches of delivering software
- Working with Coventry University to put together education programmes in this area, with the discussion of a graduate apprentice scheme around ADAS, and also Cyber Security

The Executive Session



[“UK Roadmap for Intelligent & Connected Vehicles”](#) – David Skipp, Ford Motor Company

David, who was talking from the perspective of the Automotive Council, introduced his talk with a question – “Why does an autonomous vehicle need a roadmap?” to which the answer was “it doesn’t but we do”. Essentially he meant that we need to consider a whole bunch of things and create a roadmap for the development of AVs so that we know where we want it to go. The Automotive Council is doing just that.

He discussed the need to start the dialog on where we want them to play a part of our lives in terms of Industry Strategy, Traveller Needs and City Development.

Industry Strategy – the roadmap should create insight, drive implementation and establish strategy in three areas: Business Environment and Skills, Supply Chain and, Technology. It should be used to strengthen and promote sustainable growth of automotive sector in the UK and encourage investment in driverless vehicles

Travellers’ needs – should be relevant to travellers. We need to give them what they want at a price they can afford. The UK Traveller needs study (published by the Transport Systems Catapult) is a fine piece of research with extensive input from industry (including AESIN), which identified 12 challenges to improve mobility in the UK, with potential to unlock revenue opportunities. It looked at travel diaries and pain points and their willingness to pay for solutions. We also need to consider the role of technology in traveller behaviour change, which in turn will lead to town planning impacts in the future of cities

City Development – Cities and transport authorities are customers too and we need to respect their needs and social impacts. There are many considerations in city development and the roadmap needs to consider them all: Air quality, parking challenges vs economics and GDP development, walking, cycling taxis, aging, affluence, public transport, local industry, lifestyle

In his slide about “**Coexistence of Autonomous Technology Levels**” David discussed the situation we have now and the likely progression towards full autonomous driving.

SAE Levels 2 and 3 already exist in some newer cars, where there is widespread adoption of “Driver Assist” features. By 2025 we are likely to see the use of SAE 3 in limited applications only (e.g. commercial vehicle platooning).

SAE 4 is likely in high utilisation commercial environments (moving people and goods) from as early as 2020 and increasing towards SAE 5 from 2025 and beyond. Personal use is likely to remain niche until costs significantly reduce.

The goal of fully autonomous driving will be very challenging but compelling. David suggested that Safety feels like the dominant reason for doing this. Autonomous vehicles will need to quickly demonstrate an order of magnitude improvement in safety. Other drivers include convenience, productivity and efficiency to aid travel choices and improve network efficiency.

Technology – there’s a great deal of work to be done on technology to enable the roadmap, especially in areas such as sensors and processing, Communications and Human Machine Interface (HMI)

Enablers – there’s also a great deal of work to be done around some of the enabling technologies such as modelling and simulation (especially around simulating and certifying AI and Machine Learning systems)

What should we focus on next? - The critical challenges

David wrapped up his presentation with a discussion of some of the key areas where we need to make breakthroughs in order for CAVs to be successful. He presented a slide on each of the following: Processing (machine learning and AI), Communications (significant investment in 4G network reliability and coverage and 5G rollout), Validation and certification (validating complex AI and ML systems not possible with traditional methods), Assurance (trust, privacy, security and safety)

He concluded by saying that there are “Many cross sector and business opportunities ahead and a focus on risk to humans is critical for success”



[“Unlocking the Value in an Interconnected CAV Ecosystem”](#) – Mukarram Bhaiji, KPMG

Mukarram introduced his talk by telling us that KPMG have been working on Mobility for some time now. They see **three main disruptive forces** – changing consumer and societal demands in the future - **Electric vehicles, autonomous vehicles and Mobility as a Service (MaaS)**

Mukarram then showed us a [video](#), that painted a compelling picture of how 2030 mobility will be dramatically different from today - cheaper cleaner safer and more productive and entertaining, with young and elderly set to benefit from wider access.

Integrated mobility contracts will make it easier and more joined up and will ultimately mean owning a vehicle will become redundant. Cars of the future will look and function differently and mobility will be different

The video also proposed a shift in the structure of the sector and traditional business models with the emergence of two new ‘archetypes’: Metal smiths – traditional electronics tech manufacturers and Gridmaster – vehicle manufacturer and platform services providers that can offer consumer-centric mobility products and services

New mobility sector worth over 1 trillion dollars

Mukarram proposed that new service aggregators will replace the customer’s self-aggregation activities of today. We currently buy cars, fuel, insurance, parts, services etc directly from a range of different providers. In the future we will buy ‘mobility contracts’ from aggregators or mobility services providers.

He said that the downstream value of an EV/AV MaaS car could be 10x that of today – through high utilisation and opportunities for new revenue streams and new services connected into the car because passengers are not having to drive and therefore have more time.

Modelling on how the markets for EV, AV and MaaS will evolve shows strong growth up to 2040. They are interrelated trends that will strengthen each other. MaaS is already gaining traction up in urban areas but take-up is low in rural areas. However, it is expected to pick up more when AV becomes mainstream.

Consumers are changing their view of mobility – concept of ownership is changing. KPMG predicts that the cost of MaaS provision will be lower than private ownership (on a cost per mile basis), encouraging take-up. They predict that 50% of current UK car owners will not own a car by 2030

Mukarram concluded his talk by summarising some of the **Critical success factors necessary** to make the most of the opportunity. They included: Understanding what customers really want, skill at integrating with other ecosystem elements, Understanding all three elements of the ecosystem – physical, data and finance, advanced data analytics, secure network and data infrastructure

Mukarram closed by saying that traditional automotive players are not going to be able to do all this on their own and that's why the AESIN network is valuable.

[“Smart Mobility and “3S” Strategy” – Chris Lake, Bosch](#)



Chris began his talk by giving us a brief overview of the Bosch Group worldwide.

In 2016 alone, Bosch invested roughly 7 billion euros in research and development. Just about half of their 2016 research and development budget focused on the environment and on products designed to conserve resources.

Moving on from the introduction, Chris went on to tell us about Bosch software, IoT and Cloud services. On his ‘Bosch “3S” connectivity’ slide, he talked about Sensors, Software and Services. Bosch provides a multi-faceted IoT Suite covering buildings, industry, mobility and energy and Chris discussed some of the ways in which it all works together to create opportunities.

He then showed us a video about Bosch Mobility Solutions and how they are actively shaping megatrends in a changing world. He then went on to discuss some of the points in the video in a little more detail.

He discussed **Megatrends** and how they all relate to the user – **connectivity** (50 billion ‘things’ connected by 2020), **urbanisation** (60% of people living in cities and increasing), **demographics** (population getting older and young people having more influence), **energy and climate change** (global warming and resource scarcity leading to increasingly stringent targets and more regulations)

Chris talked about how we have to make ‘Mobility’ more fun and usable, safe and comfortable, efficient and economical. He said cars of the future will be more connected and we will need to consider the HMI more carefully as they start to integrate more connected services and features and allow us to interact differently with the vehicle and infrastructure

Teaching the vehicles how to drive themselves at various levels of autonomy – driver assist, partially automated, fully autonomous – will require deep thinking and big education programmes. New services

and experiences will also emerge around Automated Parking – 30% of all traffic in cities are looking for parking spaces. We should also look at the car as a connected hub or 3rd living space and think about how it connects with the city and the services and connectivity that can be delivered to it.

Chris left us with the point that a human-centred approach is very important to the success of all of these changes.



[“When Will My Car Be Able to Pick Me Up?”](#) – Simon Clark, PA Consulting

Simon’s opening discussion was around the fact that connected cars have been with us for a long time already with companies like Jaguar Land Rover and GM having launched connected car services years ago. Today we have many incumbent auto giants, but there are plenty of new kids on the block too – new players like Google, Tesla, and now even Dyson planning to make CAVs

Cars already do a lot for us today – many executive cars include an array of driver-assist features already however, fully autonomous vehicles are at least 10 years away in Simon’s opinion. He showed us a video that supported that argument – for a number of reasons. Lots of organisations need to be involved – roads, communications providers, law enforcement, governments, insurers, auto manufacturers, regulators. They all have a great deal of work to do to address the roadblocks in their way. However, every week we hear new news of new CAV projects emerging in new countries and with new companies

PA has lots of projects going on and has been speaking with insurers, law, auto manufacturers, police and govt to get a view of how far down the road CAVs are in the UK

The big challenge, in Simon’s view, is that ‘Everybody needs to be ready at the same time’

The Highways Authority – there will be a need to adapt local city and national infrastructure. In order to do this there will have to be some degree of national and international standardisation. Vehicles will need to speak the same language, which will require huge collaboration between auto manufacturers. They will also have to cater for the “Limbo State” – some CAVs and some normal vehicles on the road. **Experts believe it will be 10 years before we’re ready in this area.**

Communication and system providers – Consumers will expect new choices and outcomes from mobility service providers. The comms infrastructure will need to cope with more data and much more ubiquitous. **Experts believe it will be 13 years before we’re ready in this area.**

Law – Road regulations are likely to change. Criminal use of CAVs must be taken into account – who will be liable for traffic offences and accidents. There will need to be very advanced forensics, to deal with things like hacking – proving who’s done what to whom. **Experts believe it will be 10 years before we’re ready in this area.**

Government and policy makers – We need a real coordinated and sustained strategy to develop standards and policies around safety, testing and certification, privacy and data protection. We have an opportunity here to position the UK in a leading role. **Experts believe it will be 10 years before we’re ready in this area.**

Insurers – Who do you go to for compensation for accident? How do insurers manage pricing for insurance, investigating claims and sharing and processing data? **Experts believe it will be 8 years before we're ready in this area.**

Auto Manufacturers – there needs to be much more work on industry-wide standards and auto manufacturers will need to work out how they reinvent themselves properly as Mobility Service Providers (and what impact this will have on their business models). There needs to be great collaboration and industry-wide sharing of standards and views on what CAVs are for and how they're used. **Experts believe it will be 13 years before we're ready in this area.**

Regulators – Regulators can make or break the CAV world. There must be a careful balance between the scope to innovate in elements that hold competitive advantage, but rigid standards for elements that don't. A culture of competition but attract the right kind of companies to the UK. **Experts believe it will be 11 years before we're ready in this area**

Simon told us that **PA Knowledge Ltd has developed an Automation Maturity Scale – 'how we measure maturity'** – to understand how far the UK is along the road to fully adopting driverless cars

1. Nothing has happened
2. Exploratory thinking and testing
3. Key building blocks in place
4. Implementation progressing
5. Full maturity

They have explored some of the areas above and come up with the following assessments

Highways Authorities (2) – tight budgets mean they are typically not taking CAVs into account in upgrades for local roads. They need to be looking at road network support of CAVs and developing the appropriate infrastructure.

Insurance (2) – Knowing where will liability lies will be key and the capability to handle claims will be challenging. They will need to understand how to get access to data from across the ecosystem in order to help them assess risk and develop new pricing and liability models.

Automotive Manufacturers – will need to develop new skills and adopt new MaaS business models. They will have to solve issues around cybersecurity, software upgrade, certification

Simon's Conclusion – was that we won't see the UK having CAVs for another 10-13 years. We have made a good start down this road but there's a long way to go and we'll need lots of players to work together to make this happen.

["Funding Innovation across Automotive Electronics"](#) – David Tozer, Innovate UK



David introduced his talk with a little bit of background about Innovate UK – The UK's Innovation agency. IUK aim to drive growth in the UK economy by working with companies to de-risk, enable and support innovation.

David told us that IUK had a very busy 2017 – in which they managed to position over £250Million worth of activity and investment into automotive on a variety of initiatives, including; LEFT, CAV2&3, Vehicles to Grid, Faraday, Niche Vehicle Network, IDP14 and the Advanced Propulsion Centre UK

He told us a little more about the **CAV funding programme**, in which the first 2 competitions have already been hugely successful. The aim of this programme is to ‘Make the UK one of the world’s premier development locations for connected and autonomous vehicles and to help them realise their potential. They want to create a vibrant, world-leading industry and testing ecosystem where CAVs can be deployed now. This will be coupled with research that delivers real world solutions to result in the development of CAVs which are safe and secure by design

David then went on to discuss IUK’s initiatives around **Low Carbon Vehicles** and reminded us of the recent Government announcement that, in 2040, the sale of petrol-only vehicles will cease, and assured us that the policy drivers (inward investment, carbon targets, energy security and air quality) are very much aligned to make this happen.

David gave us some details of the **current live IUK competition – Low Carbon Vehicles and Zero Emissions – Integrated Delivery Programme 14 (IDP14)**. This is a £20 Million feasibility and Collaborative R&D competition that **closes on 13th December 2017**

Relating all of this back to AESIN, David pointed out that Electronics is a common thread throughout all of the initiatives (e.g. Components, telematics systems, fuel systems, engine control units etc). So the work that AESIN is doing will continue to be very relevant to their initiatives.

He rounded off his presentation with a discussion of future funding opportunities. He presented a slide that showed the roadmap for Power Electronics, jointly developed by the Automotive Council and the Advanced Propulsion Centre and indicated that there may be future funding opportunities around the roadmap. He told us that “we like consistency” and, although he couldn’t promise anything, he would be surprised if there’s not more investments around low carbon, battery technology, CAVs (CAV 4 likely) and infrastructure – integrating infrastructure and vehicles.

In closing the morning Executive session, Alan Banks highlighted that it is important to understand the value of consortium and working together through the AESIN network. AESIN can help its members to share ideas and facilitate open dialog and discussion.

TRACK 1 Presentations

Following on from the morning’s Executive Session, the rest of the day at the AESIN was split into two tracks. I sat through the track 1 sessions. The Track 1 programme was jam packed with great content and I took copious notes throughout the entire day. I’d be here until Christmas if I attempted to cover all of the presentations in detail (it was a lot of content!) so I will just give a few highlights from the rest of the day and leave it to you to read the presentations (which are [all available on the AESIN website](#)).

Track 1 was split into three main sessions; “**Connected Car**” – chaired by Martin Green of Visteon, “**Automotive Security**” – chaired by Peter Davies of Thales e-Security and “**ADAS and AV**” – chaired by Alan Walker of AVL.

Track 1: Connected Car – Introduction – Chaired by Martin Green, Visteon



Martin opened the first Track 1 technical session with a brief discussion of the US National Highway Traffic Safety Administration (NHTSA) mandate for V2V communications using DSRC on light vehicles. He then moved on to mention the work being done by the 5G Automotive Association (5GAA) Connected Car and also the new Euro NCAP roadmap that sets out strategic goals for 2020 to 2025 (including V2X communications)

Martin then went on to give us a brief update on the activities of the **Communications work-stream**. He told us that the **AESIN** Connected Car work-stream is the UK voice of industry and has been successful in getting CITE project funded.

The current Connected car work-stream as it stands will be soon be revamped and its scope widened

[“Security Issues in LTE-enabled V2X Communication Systems”](#) –
Mujahid Muhammad, Birmingham City University



Mujahid began his presentation by giving us an overview of **what is “V2X” communication** and what are its applications. Essentially, V2X is a generic term that is commonly used to refer to a number of different communication modes: Vehicle to Vehicle (V2V), Vehicle to Network (V2N), Vehicle to Infrastructure (V2I), Vehicle to Pedestrian (V2P) some sources suggest it also includes Vehicle to

Device (V2D) communications

Mujahid told us that the car is one of the fastest growing connected devices after the smartphone and V2X is one of the core areas of IoT. The applications of V2X communications currently include areas such as; Road Safety, Traffic Management, Infotainment, Autonomous Driving

Having set the scene with his first few slides, Mujahid then went on to describe a V2X architecture based on the use of LTE technology. Essentially, this could be used for 2 types of communications - V2N and V2V. Mujahid described some of the key advantages of LTE-V2X (over DSRC) as being – enhanced coverage, high mobility support, high density support, widely deployed infrastructure, V2V support through direct D2D, unicast/broadcast, strong evolution path to 5G.

He further described some of the characteristics of V2X Technology Evolution – High mobility, Dynamic network topology, unbounded network size, low latency, heterogeneous environment, high reliability

Moving closer towards the real subject of his talk, Mujahid then went on to discuss V2X Security and a number of potential attacks on V2X, categorised into 5 main areas: Availability, Authenticity and identification, Confidentiality, Integrity and Data Trust, Privacy (you can see the specific attack types listed in his presentation). He argued that V2X communications may convey sensitive and life critical real time info. So there is a strong need to ensure authenticity. The security of LTE-V is therefore critical in success of LTE-based V2X communications.

The rest of Mujahid’s presentation was focused on describing particular security features of LTE networks – the LTE Authentication and Key Agreement (LTE-AKA) protocol, highlighting some of the issues with that protocol and proposing some potential solutions. For the sake of simplicity I have skipped over these details but if you are interested in the details please look at the presentation and contact Mujahid.

The presentation served to highlight the very complex and challenging nature of such communications and the huge number of configurations and trade-offs necessary to develop workable standards and solutions. There's still a long way to go!

[“Let's Play Commute – Gamifying Connected Social Mobility”](#) – Paul Brookes, Siemens Mobility



Paul began his talk by presenting a challenge – Reducing congestion during rush hours

He told us that the traditional approaches to this challenge include such ideas as: modal shift (take bus or train), increasing road capacity at peaks (e.g. through tidal flow – lanes that change direction depending on time of day), car sharing, discouraging weekday use through taxation and congestion charging, load balancing. Most of these approaches require investment in infrastructure and political will!!

Paul then went on to tell us about an Innovation project, in which Siemens have been involved, in Coventry to investigate whether road user behaviour be influenced using incentives to reduce traffic congestion.

He described the key project activities of the project as:

- Fix the traffic management infrastructure in Coventry and enhancing information flows and decision making
- Understanding commuter patterns and motivations and modelling activity on selected routes
- Developing and deploying a mobile app that can be used to research and evaluate incentives and then report on the outcomes

Paul shared with us some of the feedback gathered at early phase **Focus groups** – including

“No interest in switching modes of transport and no interest in environment”

“There's limited capacity for carrying bikes on trains” and various other barriers

They have also found that 90% of people travel the same route every day, 1/2 of them accessed information en-route and nearly a 1/3 immediately before setting off. Parking was also found to be a challenge for commuters.

Paul described the various elements of the project:

- **Coventry City Council** – The road operator
- **Infohub** – traffic model
- **SGIL** – developed the app and gamification
- **Mira** – Simulation and traffic management
- **Coventry University** – driver behaviour – safe and not distracting – and evaluation
- **Siemens** – Cloud ITS integration

He also told us that Siemens is sponsoring a PhD at Southampton University, developing Roadcast forward prediction when there is an incident

Rewarding behaviour change – the app provides a gaming experience for users to try to achieve positive behavioural change, including the opportunity to win rewards through using the app and following its travel guidance.

Coventry City Council, has been working with industry to generate a range of rewards and benefits, such as; Flexitime supported by employers, sufficient parking, lower cost parking early, partner rewards

App launch – if you live in the Coventry area, get in touch!

Paul.brookes@siemens.com

[“Connected Automotive Satellite Serviced Integrated System \(CASSIS\): High-Speed Satellite-Terrestrial Hybrid Communication Enabling the Next Generation Connected Cars”](#) – Paul Febvre & Alessandro Modigliana, Satellite Applications Catapult



Paul kicked off his presentation with an overview picture of his **Vision for Future 5G Hybrid networks**, showing satellite constellations providing additional coverage and services to complement 5G, wireless, terrestrial and high altitude platforms. He discussed how the density of communications is increasing through satellites – mega constellations (1web – 680 satellites in LEO). He said this is a game-changer

enabled by cheaper access to space.

Paul then went on to discuss the **Connected Vehicle Market**. The good news for the satellite industry is that CAV revenues are up significantly (and are expected to show a CAGR of 24.3% between 2017 and 2022) and “by 2025, 27.2% of automotive use cases will use satellite connectivity”

Paul gave us his perspective on Connected Vehicle Applications in terms of their impact on the satellite industry. Safety and Security, Monitoring, Location Based Services, Communication, Infotainment and Autonomy will all create increased bandwidth requirements, and Paul argued that there is insufficient coverage and resilience in terrestrial networks to fully enable LBS and Monitoring services.

Ubiquitous high speed connectivity cannot be delivered by 4G/5G alone. This means increased bandwidth requirements for satellites. Paul showed us a slide that demonstrated the coverage gaps, network congestion, security issues and data-hungry OTA updates of 4G/5G. He proposed that satellites have unique and complementary features WRT to terrestrial and can offer a great opportunity to complement other technologies in providing comprehensive services to CAVs

Paul then handed over to Alessandro, to give us an overview of the CASSIS project

Cassis will connect mobile users worldwide to the internet at high speed and low cost. Satellite connectivity and 5G technology will offer hybrid comms solutions to connected cars, small vessels and small aircraft - Tapping in to global market of \$160 billion by 2022

The programme comprises:

Mobile user terminal – electronically steerable antenna, compact and light, scalable design, consumer affordable (<\$500)

Reconfigurable Communications Payload for Micro satellites – a high-throughput, multi-mission, multi-platform, multi-vendor, LEO payload with a scalable design, multi-beam antenna and some clever semiconductor innovation

A phased market approach will be adopted, starting with a low-volume high-cost solution aimed at the premium segment and early adopters, evolving towards a high-volume, low-cost solution targeting a mass market

Alessandro concluded his presentation with an overview of the CASSIS roadmap, working towards a product launch in 2022 and an “**Invitation for Collaboration**”. The programme would like to attract collaboration in shaping:

- Product Specifications
- Product Interface with Vehicle
- Applications which leverage Hybrid Comms Capabilities
- Commercial Partnerships for taking the Terminal to Market

Contacts:

Alessandro.Modigliana@sa.catapult.org.uk - Technology and Program

Christophe.Christiaen@sa.catapult.org.uk - Business Plan and Product Route to Market

[“An Update on the UK CITE Project”](#) – Claire Lewis, Visteon & Andrew Patterson, Mentor Graphics



Claire Lewis opened this presentation slot with a brief overview of the UK CITE project. UK CITE is a 2½ year project that will be trialling mixed road types and speeds up to 70mph, functionality, safety and convenience, road network efficiency and modelling multipath broadcasting and whole journey experience.

The Technology Mix – Claire showed us a mix of communications technologies used by the platform, depending on the installed technology and the type and urgency of the information to be transferred. Example messages might include Co-Operative Braking – SAE/NHTSA Class 2-3, “Accident – Lane closed ahead” or “Traffic jam – Take alternative route”, each of which has a different level of urgency and accuracy requirements and may be transferred by various different communications technologies. She described how the project is looking at how this data is displayed in vehicles in order to try to get the benefits of V2X to as many as possible

The project has **11 work-packages** and Claire discussed the split between the various partners. She then showed a table of Use-Cases (of particular V2X communications scenarios) and the project phases in which they were scheduled to be trialled.

She then showed us the **High-Level System Architecture** and told us that the project is using the same platform developed in a previous University of Essex IUK project. In terms of **vehicle installations**, Claire showed us pictures of 3 JLR cars and 1 Visteon test car (a Ford Focus – which was on display in the AESIN Conference exhibition area)

The **test route road and track** is around the Solihull, Coventry and Leamington Spa areas and consists of five different road types, ranging from Motorway down to Urban. Claire updated us on the building of the infrastructure, which seems to be well under way, with roadside units coming soon in various locations

Challenges the project had faced so far include: The size of the consortium and complexity of WP interactions – leading to lengthy decision-making. They are far enough into the project now to have built up an understanding of how all the partners operate and are learning how to work together. It also takes a constant effort to avoid “scope creep”.

On a more technical note, “power gaps” in the road network has been a challenge. Uncertainty around LTEV has also been a problem, but they have now made a decision to go with pre-standard LTEV. They also had various hardware issues with development kits.

Claire finished by saying that they intend to have Phase 1 public demo early next year

Following on from Claire, Andrew Patterson, gave a short overview of the work Mentor has done with Visteon on the CITE project to provide embedded software

Andrew described some of the technical challenges they were up against on the project, including; Comms link and coverage, Latency and delays, Bandwidth, Safety and reliability/heartbeat, Deployment adoption and acceptance, Privacy, security, data ownership

The Visteon unit can choose the best of the three communication methods – DSRC, Cellular LTE-V, WiFi in order to facilitate testing of multiple data paths

Andrew told us that they had used a Genivi architecture (an open-source in-vehicle infotainment platform architecture) and adapted and extended it for the project to enable display of V2X information and mirroring to mobile phone. He told us they have also developed a “Cloud emulator” to emulate V2X messages before the real system was available.

In conclusion, Andrew told us that Mentor hopes to promote the Genivi Linux-based infotainment architecture to a wide audience with Visteon. Including V2X display capability will provide significant safety and driver-information benefits and a continuing partnership with Visteon will help promote safety and reliability



Track 1: Automotive Security

The first of two Track 1 technical sessions in the afternoon was chaired by Peter Davies, Thales e-Security, who introduced the session and then handed over to the first presenter.

[“Usage of a Trusted Platform Module \(TPM\) to Secure the Central Gateway”](#) – Chris Shire & Garry Stansfield, Infineon



First up on stage was Garry Stansfield, who gave us a quick “Infineon at a glance” overview. He then moved on to discuss **Trust Anchors and Automotive Systems**.

He told us that IT security is built on three cornerstones – **Confidentiality, Integrity and Availability**. However, automotive security needs more than that. Secret keys are the basic prerequisite of any secured vehicle operation and he said “There are going to be a lot of security keys floating around on the internet and those security keys must be protected”.

Compromised keys = no security. Revocation is expensive and time consuming so key handling must be secured throughout the whole lifecycle. We therefore need to provide some ‘**Trust anchors**’ through protected execution environments and tamper resistance (there is no tamper proof) for higher security demands

Garry gave us an interesting description of how Standard ICs can be attacked in various ways – including Logical Attack (e.g. protocol fuzzing), Manipulative Attack (e.g. probing), Semi-invasive Attack (e.g. laser fault injection) and Observational Attack (e.g. power analysis). He then went on to describe some of the **Countermeasures** commonly used to mitigate these attacks.

Garry then handed over to Chris, who gave us an overview of Infineon’s **Trust Anchors** for various different automotive domains (Powertrain, Chassis, Body and Infotainment). He told us that Infineon proposes to categorise a range of use-cases into **three use-case classes**, using **AURIX™ HSM** alone, **Combined AURIX™ and OPTIGA™** and **OPTIGA™ TPM** alone.

Chris then went on to give us more in-depth description of the features of HSM and TPM and a comparison of the two, followed by some use-case examples and further use-case proposals. The details of all of these were a little heavy-going for this summary so I will refer the reader to their presentation (available on the website) or the product documentation available on the Infineon website.

In summing up their presentation, Chris told us that connected cars offer great cost saving potentials, convenience gains and new business opportunities throughout the automotive industry. However, trust anchors are indispensable in the context.

Infineon continues to explore solutions that provide security through a combination of AURIX™ and OPTIGA™ TPM. Infineon’s scalable portfolio of hardware trust anchors can offer Digital Resilience and Survivability in a cost efficient manner throughout the supply chain

[“Hack the Hardware: A Live Demonstration of Firmware Recovery from Vehicle ECUs and Other Devices” – Tony Gee, Pen Test Partners](#)

I’ll start by saying that I always find Pen Test Partners’ presentations entertaining, and this one was no exception. Tony introduced himself and the company, saying “you may know us from hacking kettles and stuff”! He did give use a bit of an overview of all the other things the company does though.

Tony started off by giving us a few examples of some of the more high-profile vehicle hacks that have hit the media in the last few years and went on to make the point that “**Physical access means game over**” – in other words, if a hacker can gain physical access to a car, it’s already in the hands of the attacker, it’s only a matter of time before they figure out how to hack into it.

Tony talked a little about “Attack surfaces” it’s easy to take a “Naïve view” of what a connected-car system might look like. However, a more “Realistic view” is much more complicated, with other things connected to the car, and in the path to the internet, with a much more complicated architecture. Attackers could be ‘Malicious insiders’, ‘man-in-the-middle’, ‘rogue nations’, etc., with more complicated attacker motivations.

He talked about how hackers find such a wealth of information in the firmware of a vehicle – hard-coded passwords and network configurations or unencrypted credentials and personal data. Developers assume code is hidden so they are often lazy about protecting it. Tony showed us a couple of examples of this.

Tony pointed out that hackers consider the internet as a great source of information about vehicle electronics, with surprising amounts of information available from the FCC and teardown reports published by companies such as HIS Markit. Armed with all of this information, it can be much easier to turn “black box testing” into “grey box testing”, and target your testing much more specifically!

He talked us through a number of common hacking techniques, like accessing the JTAG pins, probing the interfaces between CPU and RAM, “**Glitching**” (which involves stopping the software loading at the right point - by simply shorting a data pin to ground - so that it can’t load the kernel and bombs out back to a console prompt), **Code readout protection Bypass** (even locking the JTAG doesn’t actually lock the JTAG – it locks the FLASH but you can still load a simple programme into the CPU that reads the Flash one location at a time)

To wrap up his talk, Tony left us with some FINAL THOUGHTS:

- Do not assume your firmware is secret
- Do not rely on code readout protection
- Take precautions
- Accept that vulnerabilities exist and may be found
- OWASP and IoT Security Foundation guidance is excellent
- Make sure your outsourced development and manufacturing contracts specify security
- Test it, examine firmware & application layer, be sure

[“A Systematic Approach to Securing Automotive Systems”](#) – Pali Surdhar & Stuart Soltysiak, Thales e-Security



The talk began with the proposal that the “evolution of the car into a connected vehicle is presenting the automotive industry with similar challenges to IoT” – It’s presents a distributed ecosystem of things, with data collection and communication, much of this data considered sensitive. It also has a reliance on cloud

infrastructures to support scalability and performance and there are increasingly multiple and disparate sources of components in the hugely complex supply chain. It is therefore ever more important that security is considered from a complete systems perspective. The long lifespan, long lead times, and need for cost efficiency also affect security.

The talk then went on to introduce traditional security patterns and how the threat landscape looks different in more modern architectures with potential threats from the network, consumer applications,

H/W and S/W attacks, and weaknesses in the supply chain. This results in a need to consider a holistic approach looking at the full stack in the system.

They then went on to give us an overview of system security analysis, which takes a pragmatic approach, aligning security modelling with systems modelling, and looks at the full system context with functional behaviour and operational process views. They recommend an iterative approach, underpinned by use of a modelling tool for full top down functional decomposition.

In taking a Systematic approach to security, they stressed that it's important to merge in security concerns at every stage of development and ensure that Security becomes everybody's concern in the development process - they all have to think about "what if that goes wrong or gets attacked"

The talk concluded with a summary of the benefits of using such a systematic approach to security, including; Higher quality of system security, Effective demonstration of system security coverage, Knowledge transfer and education, Longer-term commercial benefit, and Compliance.



["Right-Sized Security for Automotive Systems"](#) – Erik Jacobson, ARM

Erik started off his presentation by telling us about an annual report from the Barr Group – The 2017 Embedded Systems Safety & Security Survey, which makes very interesting, if slightly alarming reading about the number of people working on what they thought were safety critical systems but thought that security was not their job. An infographic from the survey shows that 60% of embedded systems projects will be online and 25% of those could kill or injure. It also showed that 22% of designers do not have security as a design requirement.

He described a range of attack types that could pose a threat in automotive ecosystems – such as; Communication attacks, Life Cycle attacks, Physical attacks and Software attacks and then showed us a range of responses and a straight-line graph of increasing "cost/effort to attack" vs cost/effort to secure", with HW attacks being the most expensive to attack and the most expensive to secure, but also the most value to the attacker

Erik proposed that it is very important to conduct a good analysis of what you're protecting and from whom, in order to guide the security architecture and implementation. Attackers could range from a 12 year old kid in a bedroom to a nation state with a comprehensive and well-funded range of resources. Defending against strong attackers is expensive and may not be necessary all the time

He mentioned that we have heard a number of different approaches to threat analysis and overall security analysis and that ARM would be interested in talking to anyone that's doing standardised modelling or analysis that could benefit all the industry.

He then went on to describe some more robust platform security around **Hardware Enforced Isolation** such as TrustZone, which allows two operating systems to operate on the same chip simultaneously – "Normal World" and "Secure World". The most sensitive SW modules would need to be audited and re-factored into this architecture, but re-factoring can be time-consuming and expensive.

Finally he presented an overview of establishing trust and integrity based on hardware, including **Root of Trust (RoT) and trust anchors**, where RoT could sit in a security enclave called an HSM behind a TrustZone

Track 1: ADAS & AV



This session was chaired by Alan Walker, AVL, who gave us a very brief intro to AESIN's ADAS workstream and its subgroups (Systems, Sensing, Standards, V&V, Controls – upcoming and Infrastructure) before introducing the first speaker



[“Fast-Tracking Advanced Driver Assistance Systems \(ADAS\) and Autonomous Vehicles Development with Simulation”](#) – Xavier Fornari, ANSYS

Xavier kicked off his presentation with a short overview of Ansys and its System Business Unit before giving us an overview of the Ansys Simulation Platform

He then went on to discuss the **increasing complexity of car systems**. He told us that modern cars can have > 100 ECUs and that software size can run to 100M LoC. Cars are very complex systems, with complex interactions between multiple integrated networks, sensor fusion and surround sensing with ever increasing numbers of variants. Nearly every system is safety related.

For autonomous driving there are big validation and verification challenges and it's not clear how many billions of miles will have to be driven in order to demonstrate their reliability and safety in terms of fatalities and injuries. The cost of certified development is increasing quickly (ASIL D is 200% > than non-certified development)

Xavier then introduced the subject of Digital Simulation and showed us a “control-loop” for simulation of Autonomous driving technology – consisting of modules for Physical World, Actuators, Sensors and Controllers. Their simulation tools can simulate the full control loop, including full simulation of radar and other sensors drive scenarios, vehicle dynamics, and vehicle component models.

He followed this with an overview and discussion of their solutions for Model-Based Software Engineering (MBSE) and code generation, which can offer significant benefits in terms of better designs that are easier to review, certified code generation with SCADE, which is qualified under ISO 26262:2011 at ASIL D and C.



[“Challenges of Automotive RADAR Sensor Networks”](#) – Dr David Wheeler, EnSilica

David started off his talk with a slide showing some current market trends for RADAR modules and commented that roadmaps for current radar systems are actually quite modest. He believes that what's really needed is 10x the performance available today and then another 10x performance increase in the

next 3 years. So Ensilica is looking at 100 times performance increase.

Market trends

- Trend for more antennas on both receive and transmit
- Multiple radar sensors around a car for 360 degree coverage
- Slow chirp modulation → fast chirp mod → OFDM or CDMA
- Higher ADC sample rates → 40-100Msps becoming the norm
- Higher sweep bandwidths up to 4Ghz
- 2D → 3D → RADAR imaging
- Miso → MIMO
- Higher carrier frequencies 77Ghz to 120GHz
- Antennas integrated into package

David told us that current vehicles use discrete modules for different purposes around the car but these modules don't talk to each other. Future cars will see these radars being more integrated and collaborative. We're likely to see multimode radar parking without ultrasonic sensors and radar and camera sensor fusion.

All of this will lead to a range of challenges for the sensor network and the associated chipsets. For instance, what the market wants is RADAR imaging to challenge LIDAR, and DSP throughput is well below market needs, and the roadmap is not addressing L4/L5 autonomous driving.

David finished off with a discussion of the details of the EnSilica ADAS RADAR Imaging Solution and some conclusions about why it offers such a good solution for CAVs



[“Market Trends in Automotive Radar: Impact on System and Processing Architectures”](#) – Tom Wilson, NXP Semiconductors

Tom's presentation started off with an overview of the, now familiar, SAE Levels of Driving Automation and a look at the NCAP and automation roadmap trends over the next 10 years for ADAS, partial, conditional, high and full automation

Different levels of autonomous driving for different modes of driving and applications place very different requirements on the features of radar systems, and the introduction of these features imposes complicated ranges of requirements on radar development roadmaps at different times.

Tom gave us an overview of NXP's modular support for 5-Start NCAP solutions and showed us a diagram of their SAE L3/L4 Autonomous Architecture. He said they tend to segment L5 from L3/4 as L3/4 are rolling out now in production cars but L5 is more like fleet vehicles

The L3/4 autonomous architecture is designed to support redundancy and efficiency through the use of their “Big brain little brain” concept – if the main big brain fails, the little brain should be able to at least get the car over to the roadside. He also talked about “where to cut processing” and concluded that the closer you get to raw data the better quality the fusion process is.

Tom then went on to discuss the various different types of radar that are likely to be needed in an autonomous vehicle and how they will interact/integrate or compete with other sensor technologies such as vision, LiDAR and Ultrasonic. He showed a comparison of advanced RADAR Vs LiDAR – LiDAR gives better resolution

[“Update on the UK Autodrive Project” – Mark Cund, Jaguar Land Rover](#)



UK Autodrive is an ambitious three-year project, jointly funded by industry and government, that is trialling the use of connected and self-driving vehicles on the streets of Milton Keynes and Coventry. They are trying to achieve CAVs connected into real world, to show how these CAVs could deliver real benefits, putting pods into city environments, to provide insights into government and legislators on how these things work.

Mark told us that last October they demonstrated some Connected Car and Advanced Highway Assist features on a test track at the Horiba Mira high speed circuit – Demonstrations included; Highway driving, Overtaking, Driver intervention, Green Light Optimal Speed Advisory (GLOSA) and Electronic Emergency Brake Light (EEBL). They learned that following white lines is not a very reliable method! And in order to implement EEBL they need to work together in harmony between auto manufacturers

In June 2017 they demonstrated some more Connected Car features and some Autonomous City Drive features on the track – features demonstrated included; Navigation from the location to a selected destination, T-junctions, Cross-roads, Roundabouts, Traffic lights (all without other traffic on the road), Emergency Vehicle Warning (EVW), Intersection Collision Risk Warning (ICRW) and In-Vehicle Signage (IVS). Most of the features of the track layout were mapped so the car knew about them

In winter 2017 they will be trialling some new CAV features – Autonomous City Drive and Parking - with limited other traffic – Navigation from the location to a selected destination, T-junctions, Cross-roads, Roundabouts, Traffic lights, Collision avoidance (Vehicles + Pedestrians), Vehicle passing, Vehicle pacing, Vehicle merging, Vehicle lane keeping and Parking.

The Panel Session

At the end of a long day, packed with very interesting presentation material, it was surprising how many people were still in the room and how engaged the audience still were in the subject-matter. The panel session was introduced by Michael Pont from SafeTTy Systems Ltd, who gave us an interesting perspective on the evolution of driving from horse and cart to today’s connected cars and the autonomous vehicles of tomorrow.

This was followed by some very good questions from the floor, including; **What would a typical journey look like and to what extent would we need to communicate with the infrastructure? And Do we need autonomous only roads?**

Conclusion

Once again we saw an extremely rich variety of very high quality presentations, covering many of the critical issues in the landscape of automotive electronics and connected and autonomous vehicles. The quality of the delegates and speakers made for some great networking opportunities and the whole day was very well structured and delivered very professionally. So, all-in-all I have to say it was an excellent conference.

One of the biggest things I took away last year was a sense of the huge opportunity that goes hand in hand with the huge challenges that industry will face. This year, I felt that the conference gave me a real sense that things are happening in the sector and that we are moving beyond just the vision to actually start making some great progress in the last year. This was supported by updates from Innovate UK in terms of funding and government support for the sector and from some updates from successful projects.

The publication of some really well designed and useful roadmaps is also going to lead to increased direction and, hopefully, collaboration between vehicle manufacturers and government policy makers, which in turn will lead to faster development and deployment. It's clear that we still have a long way to go though!

About Actualise Consulting



The author of this conference summary, Daniel Dearing is managing director of Actualise Consulting Ltd – a Cambridge-based technology consulting company offering a range of technology commercialisation, technology assessment and innovation support services.

For more information contact: daniel@actualiseconsulting.co.uk. Follow [@danieldearing](https://twitter.com/danieldearing) on Twitter or [Daniel Dearing](#) on LinkedIn

Website: www.actualiseconsulting.co.uk

About AESIN

AESIN provides an excellent basis for collaboration across electronic and automotive domains with further workstreams on Electric Powertrain, Security and ADAS (Advanced Driver Assistance Systems).

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