SAE 2014 On-Board Diagnostics Symposium

Technical Session Schedule

As of 09/15/2014 07:41 pm

Tuesday, September 9

Draft Schedule for On-Board Diagnostics Symposium - Day One

Session Code: ***OBD100***

Room TBD ***Session Time:*** ***ALL DAY***

Time	*Paper No.*	*Title*
8:15 a.m.	***ORAL ONLY***	***Welcome & Symposium Opening***
		Bernard Challen, Shoreham Services
8:30 a.m.	***ORAL ONLY***	***Keynote Speaker***
		Floyd Vergara, California Air Resource Board
9:15 a.m.	***ORAL ONLY***	***OBD US Update***
		Mike Regenfuss, California Air Resources Board
10:00 a.m.		***BREAK***
11:15 a.m.	***ORAL ONLY***	***Are Hidden Diagnostics Inside a Smart Device Allowed?***
		Smart Devices contain microprocessors but do not have enough diagnostic content to categorize them as diagnostic emissions critical controllers. The next round of proposed OBD regulations will further define the diagnostic requirements of such devices. This presentation will provide a working definition of a hidden diagnostic. Furthermore, it will illustrate examples of several types of hidden diagnostics and their characteristics in an attempt to determine if they are allowed by the OBD regulations. The intent of the presentation is to teach and inform both vehicle and smart device manufacturers how to identify and characterize hidden diagnostics in order to avoid OBD non-compliant smart device behaviors.
		Daniel Grenn, General Motors Vehicle Engineering Cntr.
12:00 p.m.	***ORAL ONLY***	***Ford OBD Experiences***
		Paul A. Baltusis, Ford Motor Co.
12:45 p.m.	***ORAL ONLY***	***OBD Exhibitor Introductions***
		Bernard Challen, Shoreham Services
1:00 p.m.	***ORAL ONLY***	***Networking Lunch with Exhibits***
2:00 p.m.	***ORAL ONLY***	***VW OBD Experiences***
		Robert Gruszczynski, Volkswagen of America
2:45 p.m.	***ORAL ONLY***	***Toyota OBD Experiences***
		Morton M. Smith, Toyota

3:30 p.m. ***ORAL ONLY*** ***JLR MAF Sensor Rationality Monitoring***

Introduction:
In common with a number of manufacturers, for higher output engines JLR has found it necessary to have two separate air intakes, each with its own mass air flow (MAF) sensor.
</p>
Problem:
On JLR¿s eight cylinder engines, the two separate intakes converge to a single throttle. CARB¿s OBD II regulation requires that input components be monitored for values that are, ¿neither inappropriately high nor inappropriately low¿ and the diagnostic for this compared each MAF sensor reading with half of the modelled engine airflow.
This worked well on the initial passenger car applications, but on our SUVs, it must be possible to fit raised air intakes to improve the vehicle¿s wading performance, which means that there is some distance between each intake¿s entry point. At low engine airflow conditions a crosswind could then create a flow imbalance across the two intakes, which caused a false failure of the MAF sensor monitor.
</p>
Development of a Solution:
Characterisation of the problem showed that a simple adjustment of the monitor entry conditions would mean blocking out a significant low speed and load area of engine operation, with no guarantee that there wasn¿t a customer driving condition somewhere that would still lead to a false failure. Discussing this approach with CARB did not go well, as the MAF is viewed as a key input component.
A number of solutions were then proposed and discussed internally, flow splitters, shut off flaps for one side of the system, deleting the MAFs and relying on MAP sensors or even fitting extra, redundant MAFs to provide a crosscheck. The goal was no hardware changes, no changes to the existing sensors and acceptance from CARB. This was achieved by developing a software algorithm that could identify a flow imbalance, but still allow the detection of a biased MAF.
For part of the test programme, a proving ground was used with a side wind generator, as this had a good level of repeatability, compared to public roads.

Martin Haggett, Jaguar Land Rover

4:15 p.m. ***BREAK***

4:45 p.m. ***ORAL ONLY*** ***Six Sigma Process and Design Methodologies in OBD***

Many corporations encourage Six Sigma process and design methodologies to be used in their product development. Some even require certain suppliers to adhere to expectations set forth by Six Sigma. This presentation will provide an overview of Six Sigma usage in On-Board Diagnostics (OBD) development. Specific examples from the various phases of OBD design, implementation, and validation will be described. Lessons Learned will also be discussed, as well as the advantages and disadvantages of various approaches for incorporating Six Sigma into OBD.

Justin Owen, Cummins Inc.

5:15 p.m.	***ORAL ONLY***	***Bringing the AUTOSAR Standard into a Gasoline Engine Controller Project ¿ a Comprehensive Analysis for the Diagnostic Event Manager*** *For more than 10 years the AUTOSAR (AUTomotive Open System ARchitecture) community has been working to standardize Basis Software (BSW) functionality and interfaces in electronic control units in automotive applications. With the latest standard version 4.1 OBD functionality is now covered with many extensions.* *</p>* *However, up to now the Diagnostic Event Manager (Dem) processing results from the monitoring functions (¿events¿), fault entry handling and several other specific OBD functionality has not been introduced into an engine controller yet. This is mostly due to the many specific requirements of an engine control unit, e.g. for the handling of misfire detection.* *</p>* *The presentation shows the ongoing activities at Bosch to bring the AUTOSAR Dem into an engine controller of a gasoline project together with a customer. It gives insight into the practical work of the analysis of the remaining gaps within the functionality as well as the interfaces to other packages and other features. That is, the current challenge is to identify the necessary features that are needed in the project and to fill these gaps with detailed functionality, e.g. on the synchronized computation of different operation cycles, indicator control, and similar conditions handling.* *</p>* *Most of the functionality is being known from proprietary diagnostic manager solutions. Therein, as a combination with a function inhibition management (AUTOSAR: FiM), extended functionality is already provided ¿ spanning from additional inhibit options up to multiple further attributes of the diagnostic results being reported to the diagnostic manager.* *</p>* *Furthermore, first solutions are introduced and an outline is given on the maturity of these approaches, remaining open topics and the next steps to bring these standardized packages with well defined extensions and modifications into series.* *Alexander Hinz, Robert Bosch GmbH*

Wednesday, September 10

Draft Schedule for On-Board Diagnostics Symposium - Day Two

Session Code: ***OBD200***

Room TBD ***Session Time:*** ***ALL DAY***

Time	***Paper No.***	***Title***
8:00 a.m.	***ORAL ONLY***	***OBD Standards Review*** *Paul A. Baltusis, Ford Motor Co.; Robert Gruszczynski, Volkswagen of America*
8:45 a.m.	***ORAL ONLY***	***OBD System Classification Process*** *A methodology is presented that seeks to create a common classification method for safety systems (from an emissions perspective), with the objective that they be permitted to interact with the emission related control system under certain constraints.* *Andrew Zettel, General Motors Co.*
9:30 a.m.	***ORAL ONLY***	***Working Group 1 & 17 and Worldwide Harmonization*** *Robert Gruszczynski, Volkswagen of America*

10:00 a.m. ***ORAL ONLY*** ***Diesel Misfire Challenges and Accomplishments***

David Mathews, General Motors Co.

10:30 a.m. ***BREAK***

11:00 a.m. ***ORAL ONLY*** ***Breakout Sessions***

Four dynamic and informative Breakout Sessions will be offered:
</p>
Electrification, moderated by Andrew Zettel
</p>
Communication Standards, moderated by Paul Baltusis
</p>
Diesel Misfire Monitoring, moderated by Dave Mathews
</p>
Diesel Aftertreatment, modereated by Hal Zatorski and John Van Gilder

12:45 p.m. ***ORAL ONLY*** ***Networking Lunch With Exhibits***

1:45 p.m. ***ORAL ONLY*** ***Breakout Session Summaries and Q&A***

This 90 minute session will cover a summary of the earlier breakout sessions as well as offer time for Q&A and open discussion amongst the moderators and attendees.

Moderators - *Paul A. Baltusis, Ford Motor Co.; David Mathews, John Van Gilder, General Motors Co.; Hal Zatorski, Chrysler Group LLC; Andrew Zettel, General Motors Co.*

3:15 p.m. ***BREAK***

3:45 p.m. ***ORAL ONLY*** ***OBD and Service Diagnosis for Powertrain Systems ¿ A Comprehensive Diagnostic Approach***

To accomplish the goal of an effective repair strategy, service diagnosis should combine guided trouble shooting with available OBD information, specific diagnosis and service routines. For this comprehensive diagnostic approach, a joined OBD and service diagnosis development process is the crucial success factor.
</p>
The presentation will show the joined on- and off board diagnostic strategy based on technical examples as a basis for an effective repair procedure. Different aspects of on- and off board solutions will be considered. Beside this an outlook regarding development trends for future on- and off board diagnostic will be given.

Holger Jessen, Robert Bosch GmbH

4:15 p.m. ***ORAL ONLY*** ***OBD Anomalies From A Service Perspective***

We define anomalies as failures that cannot be solved through conventional measures or teachings.
The problem with anomalies in the automotive teaching material and technician realm is that vehicles are not getting fixed in an efficient and timely manner.
</p>
However, these anomalies are not being addressed and dealt with, and have cost the industry in the way of consumers spending money on problems that are never fixed properly, and in a timely manner, thus creating a negative perception of the vehicle to the customer.
</p>
Anomalies have led, and continue to lead, to the instructors not knowing the proper answers, and the technicians not being able to repair the vehicle right the first time. This lack of information has delivered the industry a serious injustice when attempting to repair these problems that do not make sense.
Our presentation will show some of these issues of failures that were never addressed through the conventional teachings.
</p>
In our project, we will be looking at anomalies, so that the instructor will have a better understanding of what is not in the conventional teaching material and the technician will understand new operating strategies that are not published, in order to repair the vehicle in a timely and efficient manner. Steve will discuss the lack of codes of the rear oxygen sensor and its effect of final fuel trim, Jason will discuss a Chevy S10's variable cooling fan taking voltage from the electronic throttle body, which results in codes for the throttle body, but not for the fan, which can be very misleading in a fast paste environment.
</p>
Also, we will discuss the need to use labscopes to determine failures. Codes and conventional diagnostics do not explain problems. Noise from an outside source that is not big enough to view on a DVOM, yet a labscope will pick it up. For example, noise from an alternator causing air/fuel ratio imbalance codes, voltage spikes from a coil on plug causing a spike in cylinder head temperature sensor, which causes the cluster to see too high of a temperature, resulting in a vehicle shut down due to over temperature protection- not a real problem yet induced by outside factors.
</p>
We are presenting this material to bring to light the lack of information, and asking SAE to help us get this information available to Instructor/Developers and Technicians so that we can better service the vehicle which, in turn, will result in customers feeling happy and confident about their vehicles. This will also promote dialogue between engineers and technicians and possibly, through collaboration with one another, lead to better triangulation of onboard diagnostics.

Jason W. Smith, Consultants for Auto Repair Services; Steve Caruso, OBD2Training.com

4:45 p.m. ***ORAL ONLY*** ***Windows Based Diagnostic Platforms Present Special Challenges for Automotive Technicians***

The challenges and concerns of laptop based diagnostic platforms. How to avoid the common mistakes that limit functions and increase downtime.

Kurt Immekus, Volkswagen Group of America Inc.

5:15 p.m.	***ORAL ONLY***	***CARB Regulatory Process***
		Every department, division, office, officer, bureau, board or commission in the executive branch of California state government must follow the rulemaking procedures in the Administrative Procedure Act (Government Code § 11340 et seq.). Rulemakings must also comply with regulations and procedures adopted by the Office of Administrative Law (OAL), which reviews the regulations proposed by over 200 State agencies, including the Air Resources Board (ARB), for compliance with rulemaking procedures and standards. This presentation will outline the regulatory process followed by ARB, with specific reference to the current OBDII regulatory update. The focus of the presentation will be on the steps and procedures that are taken to propose and adopt a regulation, not on proposed requirements for the OBDII update.
		Leela Rao, California Air Resources Board

Thursday, September 11

Draft Schedule for On-Board Diagnostics Symposium - Day Three

Session Code: ***OBD300***

Room TBD ***Session Time:*** ***ALL DAY***

Time	***Paper No.***	***Title***
8:00 a.m.	***ORAL ONLY***	***Heavy Duty Keynote Presentation***
		Engines with Heavy Duty OBD were first introduced in 2010, and in 2013 the number of engines requiring HD OBD continued to expand. New and more challenging diagnostics continue to be added along with more stringent emission threshold limits. *</p>* *This presentation will focus on the key lessons learned during the 2010 and 2013 product launches as well as discussing the creation of an effective organization with tools and processes to deliver OBD compliant products. Challenges with Heavy Duty OBD will also be discussed; including aftertreatment diagnostics and issues related to the differences in regulations between US and Europe. Finally, and most importantly the future of OBD will be discussed. How can we make OBD a win-win for the end-user customer and the environment by leveraging advanced diagnostics to improve uptime, and decrease total cost of ownership? Can the certification burden be reduced and how do we integrate OBD with new and emerging technologies?*
		Stephen John Charlton, Cummins Inc.
8:45 a.m.	***ORAL ONLY***	***Heavy Duty Update***
		This presentation will focus on OBD challenges specific to the Heavy Duty Market. Potential Solutions and countermeasures will also be discussed. Challenges discussed will include issues related to being a horizontal industry and how application variation can impact diagnostic performance. In addition, Heavy Duty product cost and engineering resources are being impacted by regulation differences between the US and Europe; as well as, an increasing amount of system and threshold monitoring requirements. Finally, fault isolation and repair verification will be addressed for the Heavy Duty Market.
		Jeffrey Potts, Cummins Inc.

9:15 a.m. ***ORAL ONLY*** ***J1939 Standards Update***

This presentation will discuss the SAE J1939 serial communications interface with discussion on changes to the OBD tool compliance test and the resultant protocol changes and impact of the upcoming 500 kbps requirement. The material covered will include a high level review of J1939, the service tool interface requirements, and the recent changes to J1939. In addition the presentation will briefly review the standardized J1939 communications that can be used for accomplishing vehicle functions.

William Chittick, Cummins Inc.

9:45 a.m. ***BREAK***

10:15 a.m. ***ORAL ONLY*** ***Partial Volume Monitoring for Urea Based SCR Catalysts***

OBD emissions thresholds for diesel urea based SCR (selective catalytic reduction) catalyst have been driven down rapidly by regulatory authorities, and continue to be driven down
with the LEV III regulations proposed by ARB. The accuracy of state of the art NOx sensing technology is not keeping pace with the OBD requirements, motivating the need to look for more advanced SCR monitoring approaches.
</p>
One approach that has been employed with success for gasoline three way catalyst monitors is the so ¿called partial volume monitor where only a portion of the catalyst is monitored with the assumption that that portion will be damaged first.
</p>
In this presentation we investigate the potential benefit of partial volume SCR monitoring and the applicability of the assumptions.

Michiel Van Nieuwstadt, Ford Motor Co.

10:45 a.m. ***ORAL ONLY***

Journey of NO2 as a Feedgas from an Oxidation Catalyst to an SCR Catalyst - Is it Making it all the Way?

Selective Catalytic Reaction (SCR) of ammonia (NH3) and nitrogen-oxides (NOx) is a predominant technology used in modern diesel automotive applications as an exhaust aftertreatment technology to reduce NOx emissions below regulatory limits. One of the key solutions to improve the selective reaction of NOx with NH3 is the presence of optimal concentration of NO2 in the exhaust gas; many research papers have indicated ~ 30-50% NO2/NOx ratio would be required as feed gas to maximize SCR catalyst¿s NOx reduction efficiency. This led to numerous innovative exhaust oxidation catalyst formulations to produce sufficient NO2 as SCR feed gas. As a result, the OBD legislative requirements have followed the technology advancement demanding the monitoring of the NO2 production by oxidation catalysts.
</p>
This presentation will focus on unexplored territory, where the engineering community, especially OBD leaders, will be keen to review and discuss the impact of urea injection on potential transformation of NO2 in the exhaust aftertreatment system. Since most research papers and laboratory experiments use synthetic test bench applied gaseous NH3 as a reductant to study the SCR system sensitivity, they have proven NO2 exhibits strong influence on NOx conversion. Limited number of experiments we conducted using liquid urea solution dosing and measuring NO2 downstream of urea dosing to study how the urea spraying, evaporation, mixing, hydrolysis and localized exhaust gas quenching is altering the NO2/NOx ratio just upstream of the SCR catalyst or at the very first couple of inches of the SCR system. This presentation will summarize such case studies including measurements taken using various emissions analyzers, showing how the effect of the oxidation catalyst on generating NO2 may be impacted along the urea mixing and hydrolysis length. As a conclusion we will suggest new areas of research to better understand the feed gas quality impact on SCR efficiency in real world conditions including measurement equipment, OBD and base control algorithm theories.

Harsha K. Nanjundaswamy, FEV Inc.

11:15 a.m. ***ORAL ONLY***

Particulate Sensor Signal Processing and Interpretation for Particulate Filter Diagnostics

Lower emissions and OBD thresholds for particulates and a need for diagnostics that directly check for presence of particulates have motivated a shift in industry to particulate matter (PM) sensors for exhaust filter diagnostics. At present the most mature sensors are resistive types which accumulate particles between a pair of electrodes. To restore measurement capability the sensors are heated at regular intervals to remove accumulated particulates, leading to a periodic output. A somewhat unique challenge is posed by these devices in that they do not provide a measurement that directly correlates to a physical quantity indicating particulate levels. Most sensor manufactures provide parts which derive levels from the time required for the sensor to reach a threshold conductivity from a known clean state.
</p>
This talk considers the suitability of the accumulation time metric as an input to a particulate filter monitor and compares it to other possible approaches, including the rate of change of the sensor signal. Data and analysis are shown to compare these approaches for accuracy, repeatability, and the time required for a valid measurement both at a sensor and particulate filter monitor level. The potential for each method to provide robustness against noise factors to expected sensor response and drifts in part sensitivity over time is covered. The possibility of the various metrics to improve detection capability of leaking exhaust filters at lower thresholds is also considered.

Michael B. Hopka, Ford Motor Co.

11:45 a.m. ***ORAL ONLY*** ***Heavy Duty Hybrid OBD Progress***

Heavy Duty Hybrid OBD continues to be a topic of concern for heavy duty hybrid and engine manufacturers and their customers. This presentation will summarize the requirements derived from the OBD regulations that are applicable to heavy duty hybrids as well as the impacts of these requirements on existing and new designs, and the current progress towards understanding the test required and the OBD approval process. The presentation will provide an update on progress towards applying these requirements, overcoming the challenges that exist between hybrid and engine manufacturers to achieve OBD approval, and summarize the efforts in the SAE J1939 Hybrid Communication Task Force to standardize interfaces between hybrid power systems.

Christopher Charles Jones, BAE Systems Inc.

12:15 p.m. ***ORAL ONLY*** ***Networking Lunch With Exhibits***

1:30 p.m. ***ORAL ONLY*** ***Novel Approach to Diagnose SCR Feedgas Quality Deterioration in Diesel Aftertreatment Systems***

Selective Catalytic Reaction (SCR) of ammonia (NH3) and nitrogen-oxides (NOx) is a predominant technology used in modern diesel automotive applications as an exhaust aftertreatment technology to reduce NOx emissions below regulatory limits. One of the key solutions to improve the selective reaction of NOx with NH3 is the presence of optimal concentration of NO2 in the exhaust gas; many research papers have indicated ~ 30-50% NO2/NOx ratio would be required as feed gas to maximize the SCR catalyst¿s NOx reduction efficiency. This led to numerous innovative exhaust oxidation catalyst formulations to produce sufficient NO2 as SCR feed gas. As a result, the OBD legislative requirements have followed the technology advancement demanding the monitoring of the NO2 production by oxidation catalysts.
</p>
This presentation will introduce a new concept to utilize primarily an advanced SCR NOx efficiency monitor to diagnose the SCR system as a whole. This concept¿s key element is a so called SCR diagnostic coordinator which can schedule and execute various lower level diagnostics to pinpoint which component(s) may be responsible for the loss of SCR efficiency. For example the disadvantages of frequent DOC NMHC conversion monitoring execution are well known: fuel-oil dilution, excessive aging of DOC, DPF and SCR catalysts, surplus production of greenhouse gases, especially CO2 and N2O, potential NH3 slip, etc. While the OBD regulatory requirements force frequent execution of such diagnostics to fulfill in-use monitoring requirements, with the SCR coordinator the frequency of such a detrimental OBD function can be optimized.

Tamas Szailer, FEV Inc.

2:00 p.m. ***ORAL ONLY*** ***OBD Considerations for Dual- and Bi-Fuel Heavy-Duty Engines***

The U.S. heavy-duty commercial engine market is dominated by diesel-fueled engines. However, with a lower price and an abundant domestic supply, some fuels, such as compressed natural gas (CNG), are driving the market toward alternatives to the conventional diesel engine. With this price advantage, the market is growing quickly for both dedicated and dual-fuel natural gas engines. Dual- and bi-fuel heavy-duty engines benefit from the ability to retrofit on existing platforms and an ability to avoid dependence on an alternative fuel that may not yet have achieved a sufficient infrastructure. For these reasons, dual- and bi-fuel heavy-duty engine offerings are expected to see continued growth in the commercial engine market.
</p>
As more stringent OBD requirements for these engines are phased in over the next few years, with requirement for full OBD compliance in 2018, manufacturers must understand the impact these regulations will have on their base engine OBD strategies and calibration. This overview includes a summary of the current and upcoming OBD regulation requirements and focuses on the impact they may have on dual- and bi-fuel engines. These requirements will likely lead to an inability for retrofit companies to achieve OBD compliance without OE support.
</p>
The vast majority of dual- or bi-fuel systems on the market today are retrofit kits applied to Outside-Useful-Life (OUL) engines, which have the least certification requirements. With a significant amount of integrated strategy to support current HD OBD requirements for conventional HD engines, the retrofitter may not be able to apply a secondary controller for alternative fuel concepts without disrupting the OBD functionality.
</p>
If implementing a dual- or bi-fuel approach to an existing platform, OE manufacturers will also need to address impact of this new fueling and combustion system on their OBD monitors. Potential impacts may include the functionality and accuracy of monitors applied to the air, fuel, EGR and aftertreatment systems. For example, a diesel engine converted to dual- or bi-fuel operation can no longer use lambda as feedback for EGR control without modification, leading to a need for base engine and OBD strategy adjustment. In many cases, a parallel or switching approach with separate OBD strategy/calibration may be required.
</p>
An additional concern for alternative fueled engines utilizing natural gas is the emission of methane (CH4). While there are currently no OBD requirements in place for Green House Gas (GHG) emissions, it is likely that additional monitors will be required to ensure compliance with future regulations. As CH4 is considered to be a GHG with greater impact than carbon dioxide, any future regulations could greatly influence the OBD systems for those engines whose fuels have potential for excessive CH4 emissions. The known challenges of short circuiting air/fuel mixture with the currently common intake fumigation approach and poor conversion of CH4 with conventional catalyst formulations are potential impediments for success of some alternative fueled engines if OBD monitoring is required for GHG constituents in the future. Based on these concerns, it is critical that industry understands the impact new OBD regulations may have on current and future alternative fuel approaches and its ability to provide the market with powertrain alternatives that make use of currently abundant and lower cost fuels.

Claude Pilger, FEV Inc.

2:30 p.m. ***BREAK***

3:00 p.m. ***ORAL ONLY*** ***Historical OBD Collaborative Presentation***

This is a 90 minute talk surrounding historical OBD and will feature several industry experts.

Paul A. Baltusis, Ford Motor Co.