automotion

EDITION 1 | 2008 | IAV – AUTOMOTIVE ENGINEERING

IAV Expands in North America

Cornerstone is laid in Northville Township

by Cheryl Boland

On February 26, a very wintery Tuesday morning, IAV representatives gathered along with several local dignitaries to lay the cornerstone on the future site of IAV's Technical Center North America. The symbolic ceremony reflected German tradition as a time capsule containing building plans, a rendering of the future facility, and copies of local newspapers was placed into what will become the new facility's sign. According to Utz-Jens Beister, IAV Automotive Engineering Inc.'s president, "It's more than a cornerstone. It's a symbol of our commitment to serving our automotive customers as together we embark on developing advanced powertrain technologies". Well wishers included the construction project team, IAV personnel from both North America and Europe, and representatives from state, county and local government, including Mr. Robert Ficano, Wayne County executive, and Mr. Chip Snider, Northville Township manager.

Robert Ficano, Wayne County Executive, thanks IAV for investing in Wayne County

Beister took the opportunity to personally thank everyone who was instrumental in getting the project underway, specifically, the State of Michigan, Wayne County and Northville Township for their tremendous efforts and ongoing support. "With the help of the State of Michigan through the Michigan Economic Development Corporation, Wayne County and Northville Township, we are now on the brink of laying the foundation for our new North American Technical Center", said Beister. Robert Ficano shared his sentiments, "IAV is a great example of how we in the public sector can come together with the business community under the right circumstances to create a win-win for both the company and Wayne County".

For IAV, the new Technical Center is the next logical and strategic step in supporting automakers as they develop and refine their powertrains and electronic systems for the future. The facility will house four state of the art engine dynamometers with full transient emissions capabilities and measurement equipment. Two test cells will cover diesel, gasoline and alternative fuel engines up to 450 hp. One dynamometer is configured to handle complete hybrid powertrains and the fourth is a heavy duty unit capable of testing engines up to 875 hp and 2,580 pounds of torque.

According to Beister, "It's customary when laying a cornerstone to include a chronicle as testimony of why we're gathered here today. Now, most of us won't be around 100 years from now to open the contents, but it's important to remember that the real cornerstones in the North American auto industry were also symbolically laid 100 years ago not far from here. They saw a dynamic future back then and so do we today".

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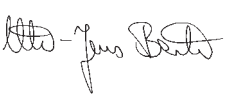
Editorial

Dear Readers,

"A climate for change" is the theme for this year's SAE World Congress. Often we perceive change just as an undesired challenge that needs to be overcome as quickly as possible. Yet when we look carefully we can often see new opportunities and perhaps the beginning of an exciting success story.

As an engineering consulting firm IAV understands its role is two fold. Primarily, IAV is offering engineering services and process expertise to support its customers in mastering increasingly complex development projects as efficiently as possible. However, by having an outside perspective, IAV can also act as an enabler to initiate and define these new opportunities. Therefore, IAV is approaching the SAE World Congress for the first time from two different angles. As an exhibitor, IAV will demonstrate its engineering competence by displaying advanced technologies and development tools, which you will find interesting when working on your future powertrain development projects. Secondly, as a co-organizer of SAE's new Executive Business Theater, IAV is addressing topics such as globalization, innovation and financing through our subsidiary Consulting4Drive to emphasize that these aspects are equally as important for success as technical attributes.

When you read through this new issue of Automotion, you will find articles regarding dual clutch transmissions, globalization and, of course, IAV. You will find out that IAV has celebrated an important milestone in its 10th year here in the US by laying the cornerstone for the new IAV Technical Center North America in Northville Township. With this investment, IAV underscores its commitment to the North American market as well as its confidence that Michigan will continue to be the heartland of the North American automotive industry.



Utz-Jens Beister
President of IAV Inc.

Dual Clutch Transmissions

Economy with performance

by Tom Reedy

Most volume production cars use either a manual transmission, requiring the driver to change gears by operating the clutch while shifting through gears, or an automatic transmission which does the shifting work for the driver via its clutches, torque converter and planetary gear sets. Both transmission types have distinct pros and cons concerning the key elements of efficiency, cost, weight, complexity and driveability. Manual transmissions are relatively light and simple with high mechanical efficiency. They allow the driver to execute whatever shift pattern is desired but many drivers prefer not to operate a manual clutch and shifter system. In addition, as the clutch is de-coupled, torque transfer to the driven axle is interrupted. Automatic transmissions are more complex and expensive with a relatively lower mechanical efficiency, but all shifting is automatic and can be calibrated for exceptional refinement while keeping the engine operating towards its optimal zone of brake specific fuel consumption.

The device lying somewhere between the two is the Dual-Clutch Transmission (DCT). Although invented in 1939 by Andolphe Kégresse, today's volume production DCTs use relatively new technology. Porsche has used DCTs in their race cars and one appeared in the Bugatti Veyron, but general commercialization of DCT technology has only recently taken off with Volkswagen being a pioneer in Europe (Beetle, Golf, Touran, Jetta, Audi TT and A3, Seat and Skoda cars) and Ford committing to DCT in Europe via a Joint Venture with Getrag. Chrysler has announced widespread use of DCTs in its vehicles and is building a DCT manufacturing plant in the US in partnership with Getrag. The DCT has several distinct advantages for volume production because it has the high mechanical efficiency of a manual and the excellent drivability of an automatic transmission. Shift times can be extremely rapid (measured in milliseconds) during which there is no loss of torque transfer to the driven axle. The DCT does not require a clutch pedal and it can be controlled and calibrated for "normal" and "sport" driving modes. The driver can also execute "manual" shifts as desired via an interface such as thumb paddles or a tiptronic type gearstick.

IAV's controls and calibration engineers have expertise regarding the precision control of the clutches to achieve precise coordination of shift kinematics. Calibration of the torque transfer relationship between the clutches has a direct and significant effect upon key factors such as shift quality, clutch temperatures, durability and driving pleasure.

Fundamentally, a DCT works around a two part transmission where the odd gears are on one input shaft and the even gears on another (Fig.1). The shafts are actually co-located on the same center line, with one shaft inside the other. The inner shaft feeds first, third and fifth gears while the outer feeds second, fourth and sixth gear (Fig. 2). Each shaft is controlled by its own clutch that is driven by the engine (Fig.3). Of course, the number of gears can be as high as desired depending upon package space and system requirements.

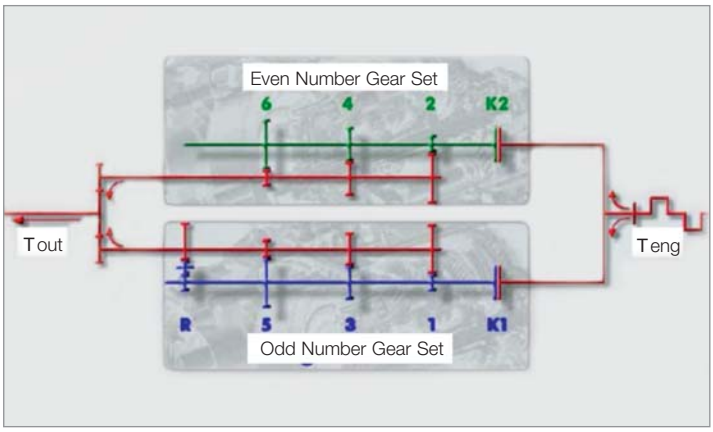


Figure 1 – Schematic layout of a six speed DCT

One of the greatest advantages of the DCT is improved vehicle fuel economy, compared to a conventional automatic transmission. Not only is the device itself mechanically efficient, but the elimination of the torque converter further aids system efficiency. A DCT is a relatively light, mechanically simple and compact gearbox lending itself very well to compact cars, the C and D segments and sporting variants. In addition, the vehicle manufacturer can offer the car buyer a very attractive range of tactile interfaces for operating the DCT.

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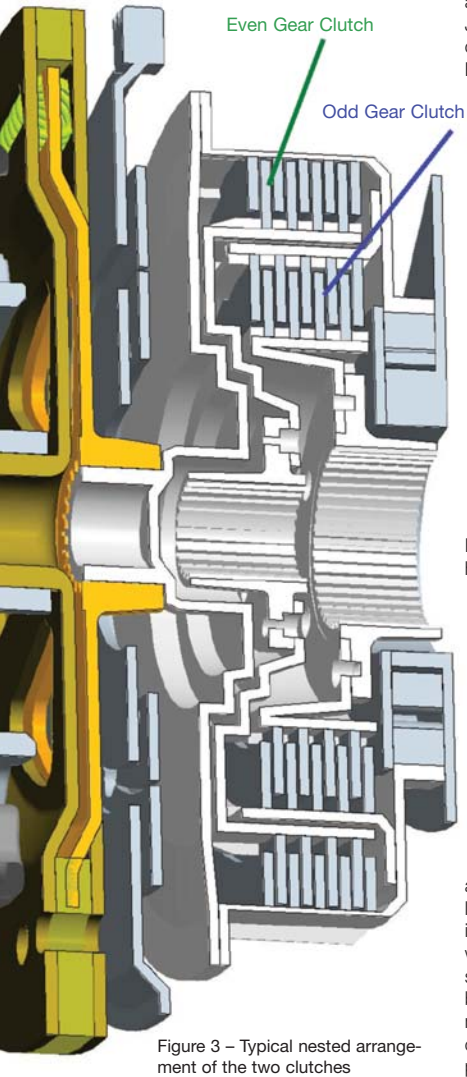

Figure 3 – Typical nested arrangement of the two clutches

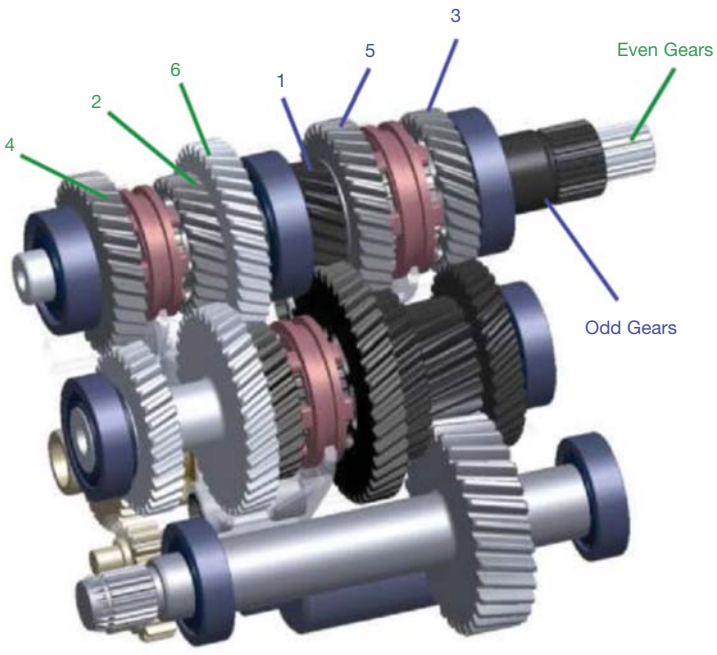

Figure 2 – Input shaft and gear layout example for a six speed DCT

NVH Integration of Diesel Engines into US Vehicle Platforms

Economy with comfort

by Tom Reedy

As the price of crude oil rises over the next five to ten years, the price of gasoline at the pump will rise accordingly and US OEMs will experience increasing demand for light duty vehicles with superb fuel economy. IAV believes there is a strong future for light duty diesel in the US, but not until the price premium of diesel emissions systems is mitigated by the overall reduction in cost of ownership through improved economy. Light duty diesel provides fuel economy benefits on the highway that can even outweigh that of parallel hybrids which are usually better suited to repetitive stop-start driving around town. The added cost burden of US diesel emissions after treatment should also reduce if production volumes rise.

IAV predicts that as US OEMs begin to offer platforms with diesel options, diesel engine energy physics will cause vehicle NVH issues which must be resolved to produce acceptable refinement. With respect to NVH, US vehicle platforms tend to be designed with gasoline engines in the product plan and so structures and bodies are designed only to mitigate gasoline engine levels of energy input. When a diesel engine is integrated into a US derived platform, IAV finds that significant effort and expenditure is needed to resolve the inevitable NVH issues caused by the transfer of the harsher engine vibration and acoustic energies into the vehicle.

IAV has three potential approaches to satisfy a customer's platform level NVH goals:

1) Isolate and treat the powertrain (the engine and transmission together).
2) Isolate and treat just the vehicle.
3) Treat both the powertrain and vehicle together as a total automotive system.

Typically vehicle platform teams accept that the engine contains design best practices resulting in best-in-class NVH and satisfaction of corporate NVH targets. Vehicle platform teams tend therefore, to treat the engine as an NVH "black box." Under such circumstances, IAV focuses its NVH attention onto refining the vehicle platform as it reacts to the engine. We also optimize the engine calibration to aid platform specific NVH performance.

IAV treats the engine as the energy source and the vehicle as the receiver-emitter. Both must be quantified to proceed. A number of proprietary and commercially available toolsets are used for "up-front" engine and vehicle analyses. These are correlated with real data taken from a semi-anechoic engine dynamometer and instrumented test vehicles. Assuming the engine meets its own NVH targets, energy transfer control measures are focused on the engine to vehicle interfaces, vehicle structures, body panels and the body cavities. NVH management is achieved through the sum effect of all the NVH treatments implemented into the vehicle, to control low (<250 Hz) and high (>250 Hz <16 kHz) frequency energy.

This approach requires four very important steps through the vehicle program. First, engine mechanical and acoustic energy must be objectively measured and translated into "forcing functions." These are applied to CAE models to investigate design requirements for the engine mounts, the vehicle structure and the body. Second, a vehicle level NVH Targets Document must be created through the measurement of a strategically agreed set of competitor and reference vehicles. Third, mule level test vehicles must be built for correlation of the CAE analyses and for the early try-out of NVH fixes. Once NVH solution concepts are agreed, they can be detailed and released to supplier tooling for subsequent vehicle build phases. The fourth and final essential step is the measurement of prototype vehicle samples through each plant build phase, to ensure that NVH performance is not being eroded while build variations converge to design intent as tooling matures.

Energy Transfer from the Engine into the Vehicle

Mechanical and acoustic energy emitted by an engine has many potential transfer paths into the vehicle (Fig. 1). These paths are both structural and airborne. As energy propagates along transfer paths, it can excite associated vehicle components which, due to their mass, stiffness and mounting may be very receptive to one frequency or several orders of excitation (Fig. 2). The intensity of excitation is proportional to the amplitudes and summation of the energy inputs. The driver and passengers will feel either continuous or phased vibrations in the seats, pedals, steering, shifter and other tactile components, and they often hear disturbing booms, growls, whines and buzzes from the body and trim, any of which, unless controlled, will significantly erode ownership pleasure and brand quality while increasing warranty claims.

A vehicle powered by a diesel engine nearly always requires a significantly larger focus on NVH refinement compared with the same vehicle powered by a gasoline engine. This boils down to the fact that diesel engines are heavier, have a relatively "noisy" fuel pump and injectors, higher cylinder pressures and "noisy" combustion events (especially when cold), and greater component inertias. However, today's light duty common rail diesels are designed and calibrated to meet increasingly aggressive system-level NVH targets and they exhibit an NVH "fingerprint" which is rapidly converging in quantity (sound power), towards that of a gasoline engine of equivalent power output.

IAV finds that US vehicle OEMs have naturally omitted the application of diesel engine forcing functions to their vehicle structural models when diesel power was not in the original product plan. As light duty diesel begins to enter the US marketplace, OEMs will have to focus attention to the resolution of vehicle NVH issues to create a saleable diesel variant.

European OEMs have faced this problem for over 25 years and specifically design vehicles from first principles with diesel engines in the plan. During the initial design stages, diesel engine forcing functions are applied to the vehicle CAE models and NVH countermeasures are tooled in from the start. This has helped European OEMs to progress one stage further in NVH refinement and instead of having to attack fundamental issues they surgically manipulate specific "segment related" noise quality attributes into a refined base platform, thus greatly enhancing the brand quality and image of their diesel vehicles.

In IAV's experience, US vehicle assembly plants have to cope with significant extra bills of diesel NVH parts and line-side treatments which can add more than $250 to the manufacturing cost of the vehicle. One

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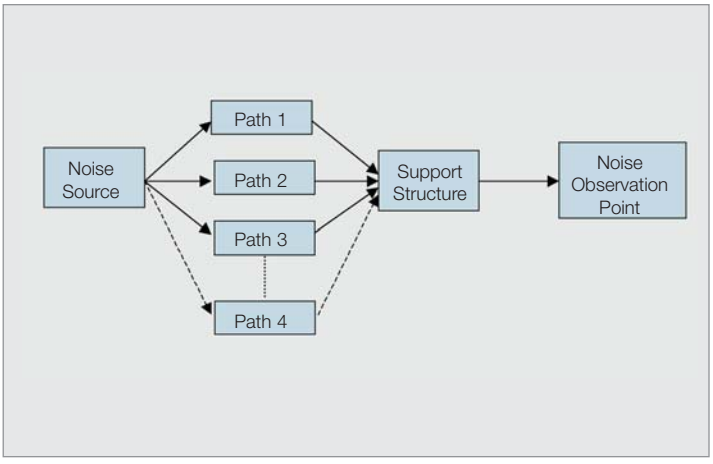


Figure 1 – Simplified noise transfer path model

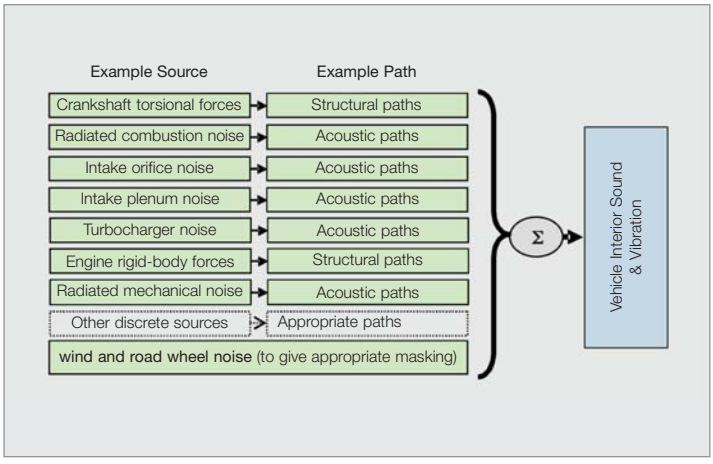


Figure 2 – Some typical source-path-vehicle NVH issues

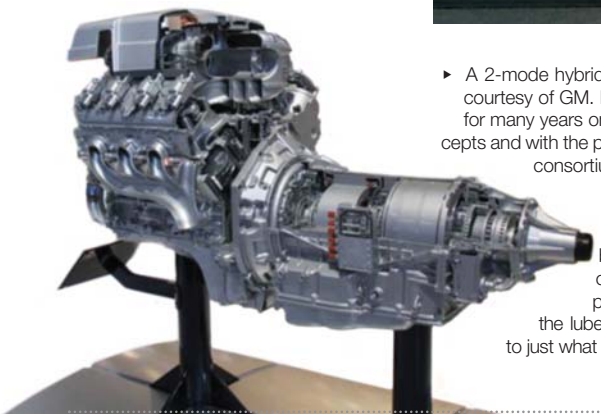
IAV at SAE 2008

Technology – Driving a climate for change

by Paul Moreton

IAV looks forward to seeing you again this year at SAE World Congress. The show starts on April 14th and runs through April 17th. Our booth is easy to find on the main aisle to the Technology Theater, next to Chrysler. As usual we have a range of exciting exhibits:

- A display of IAV techniques for automated engine mapping and our advanced testing and calibration techniques that ties in with the highly dynamic engine dynamometers featured at our new Technical Center North America, due to open later this year.
- A variable displacement engine concept. An idea that may be essential in the 35mpg fleet average world.
- A Heavy Duty OBD display. This is an important topic in the HD world with 2010 regulations coming all too soon.



- A 2-mode hybrid transmission exhibit, courtesy of GM. IAV has been working for many years on different hybrid concepts and with the partners in the 2-mode consortium.
- A vane type oil pump with variable displacement that offers reduced pumping loss by optimizing the lube oil pressure and flow to just what the engine requires.
- A display of IAV's techniques and capabilities in the area of safety critical system reviews. This is offered as an independent consultancy checkup of today's X by wire systems.
- Our partner Extessy will be demonstrating their Networked Simulation tools.

In addition to the exciting topics on display at our booth, our sister company C4D (Consulting4Drive) is sponsoring the Executive Business Theater where you can hear a range of business oriented presentations by top automotive executives.

Drop by the IAV booth #1556 to talk with our experts and enjoy a cup of coffee. Be sure to drop off your business card: a daily drawing will be held for an iPod Touch!

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Continued from page 3, "NVH Integration of Diesel Engines into US Vehicle Platforms"

US OEM recently had to contemplate the creation of a low production volume diesel-specific body that would have resulted in unacceptable costs and plant proliferation. In preference to the far larger implications of structurally addressing a transfer path issue post vehicle impact validation, IAV has even seen the last minute addition of an engine balance shaft system at over $200 per unit.

The NVH Integration Process at IAV

IAV uses its time proven engine NVH integration process to achieve diesel vehicle refinement to targets. This process contains building blocks that directly support the essential four steps of an NVH integration program. It first requires the optimization of the design of the powertrain mount system (isolators and brackets), the engine acoustic treatments (injector covers and top cover), and the induction and exhaust as far as possible to achieve the best possible "tuned" isolation of the powertrain from the vehicle. In essence, IAV "contains" the powertrain without affecting other criteria such as performance, economy and cooling. In this way the number of treatments needed to the vehicle body, interior trim and the tactile components are significantly reduced. This is almost always the best way to reduce plant proliferation while reducing tooling and piece costs. It is cheaper and "best practice" to isolate the powertrain by carefully optimizing the new interface components that will be required anyway. Since there are so many permutations and variations in vehicle structure, body design and robustness, IAV very rarely has the luxury of achieving acceptable vehicle refinement solely through the isolation of the powertrain to the vehicle. Inevitably, the vehicle will tend to react to powertrain inputs. To integrate a diesel engine into a vehicle platform we deploy the four step NVH process that is repeatable, robust, holistic and of specific added-value to customers.

Conclusion

IAV believes that the NVH process of integrating a diesel engine into a US vehicle platform can be executed to a value added and repeatable template. Assuming the engine already performs to corporate NVH targets, IAV focuses their NVH skills on containing the powertrain to reduce its structural and acoustic energy signatures, and then treating the vehicle and its energy transfer paths to fix its tendency to react to the engine. A process is deployed made up of the four key steps detailed at the end of the first section which are superimposed onto the platform engineering program and are verified in the vehicle assembly plant. Diligent application of this process will lead to customer satisfaction in both fuel economy and vehicle refinement.

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IAV Expands Globally in 2007

Right there with our customers

by Tammy Peth and Sandra Kaspar

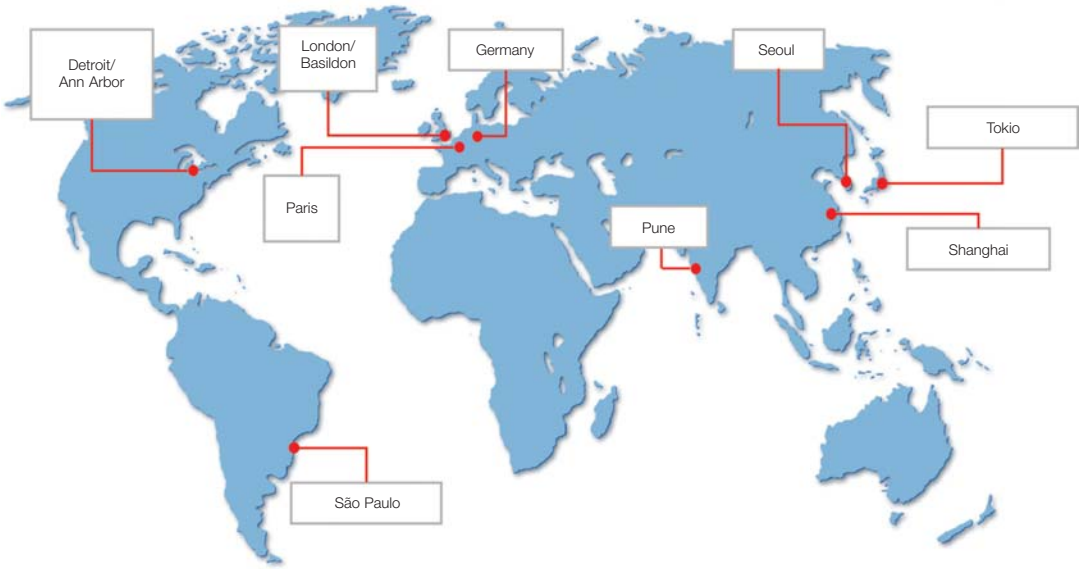
In an effort to better assist local customers and projects, IAV expanded its global presence in 2007, by establishing new subsidiaries in Japan, India and France. “The establishment of additional international office locations is a logical step for our business development” explains Kurt Blumenroeder, IAV Group President and CEO. “Our philosophy is: Be global! Globalization in the auto industry has become a reality. We are where our customers need us, nationally as well as internationally. With locations in England, USA, Brazil, China, and Korea along with the newly established locations, IAV is able to execute country-specific projects on-site, as well as, manage and deliver major international projects effectively and with the highest quality.”

Kon’nichiwa IAV Japan

Recently, Japan has been opening up to the idea of globalization. In early 2007, IAV established a local office in order to provide more personal and timely assistance to our Japanese customers. IAV Co. Ltd. will represent IAV in several areas of expertise and will act as a gateway for major international projects. For many years, IAV has worked closely with Japanese automakers and suppliers.

Namaste IAV India

As with China, India contributes a large portion of growth in the Asian market. The growing middle-class and approximately 1 million car buyers per year are a real challenge for automakers. IAV India Pvt. Ltd in Pune, established in May 2007, provides local support to customers in the Indian market: “With our experience in China and Brazil we are well-positioned in the area of localization. We assume responsibility in identifying potential suppliers, evaluating their competencies and pre-selection for OEM”, explains Kurt Blumenroeder.



Bonjour IAV France

In mid-October 2007, IAV customers and employees celebrated the official grand opening of IAV S.A.S.U., in Guyancourt, near Paris. Paris is the center of the French automotive industry and, therefore, the ideal location to serve our customers. The local IAV office in France will represent IAV in several areas of expertise and will also act as a hub for customers in the French market.

Even as IAV‘s international subsidiaries grow to meet expanding customer needs, the operational headquarters of IAV will remain in Germany. In addition to the three development centers which are located in Berlin, Gifhorn and Chemnitz, IAV has six additional offices strategically located throughout Germany. “The largest portion of our business remains in Germany where our customers demand and expect our broad range of competency. In our opinion, performance and customer proximity go hand-in-hand: Technological competence for the entire vehicle, excellent employees, state-of-the-art equipment, reliable project management, as well as program confidentiality are offered to our customers from all of our global locations”, explains Kurt Blumenroeder.

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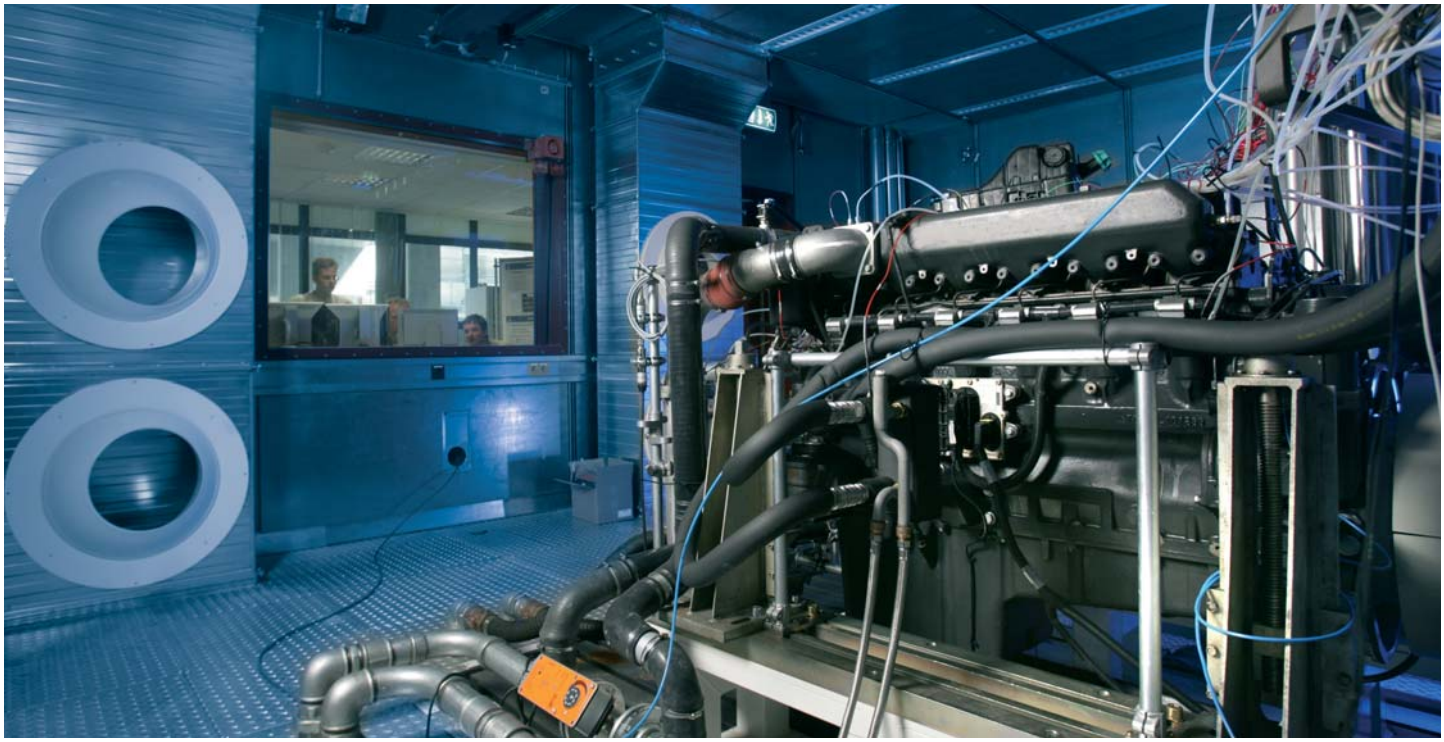
Intelligent Dynamometer Automation

Quality results from unmanned test cells

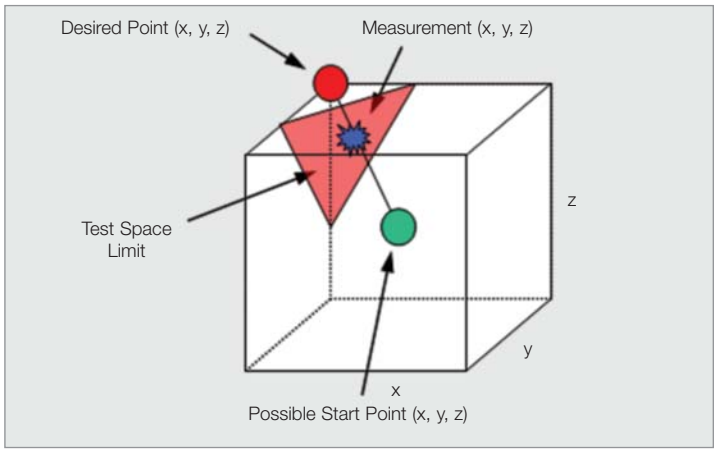
by Jens Breitinger



The engine dynamometers at IAV's new Technical Center North America in Northville Township, MI will be built to the same standards as the dynamometers at IAV in Germany. Therefore the new test facility will allow around the clock fully automated mapping.

A prerequisite for automated mapping is the combination of a detailed design planning process and a sophisticated engine dynamometer management system. In addition, real-time monitoring of the test components and instrumentation is required. Benefits of automation, beside improved equipment utilization, are the verification and increase of data quality through the integration of appropriate functionalities. In turn, high data quality is a fundamental prerequisite of high quality Design-of-Experiment (DoE) models. Consistently high-quality measurement data requires a flexible automation system. Depending on the engine concept several parameters have to be varied or optimized at the dynamometer. IAV's measurement automation software MPI² meets all criteria for successful design plan measurements:

- Realization of complex parameter setting strategies
- Continuous monitoring of critical engine operating limits
- "Intelligent" reactions to engine limit violations
- Online optimization of certain parameters
- Adaptive step size for rapid measurements



Vector Scan Method

The goal of efficient automation is the ability to measure all DoE design points while the engine operates safely even in critical ranges. If certain points cannot be measured, an alternative parameter combination is used. The combination is found by using an intelligent measurement strategy such that it corresponds to the original point in the best possible way. Additionally, the continuous comparison of several adjacent measurement points serves the purpose of ensuring the plausibility of data and guarantees constant high-quality results. Likewise, reference measurements are regularly carried out to ensure correct test equipment and engine operation.

Often the exact limits of engine operation are not known in advance; therefore a planned parameter combination could damage the engine. An accurate setting strategy of the automation software is important: non-critical parameters will be set directly, whereas critical parameters will be set following a vector scan method. The operating point follows a direct vector between a reference point and the set point. In case of limit violations the last valid step is chosen.

IAV's modularly structured "intelligent" automation software MPI² has been used for production calibration programs for many years. Since last year MPI² is available as a commercial software package under the name ORION, developed in collaboration with A&D, who market the product.

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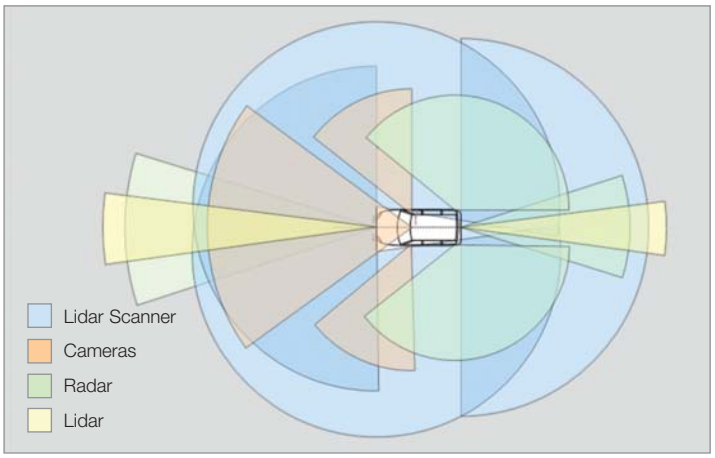
IAV supports University Team at DARPA Urban Challenge 2007

Technical University Brunswick is the best German team

by Michael Sachse and Jason McConnell

The team from Brunswick University of Technology in the DARPA Urban Challenge



Sensor cover

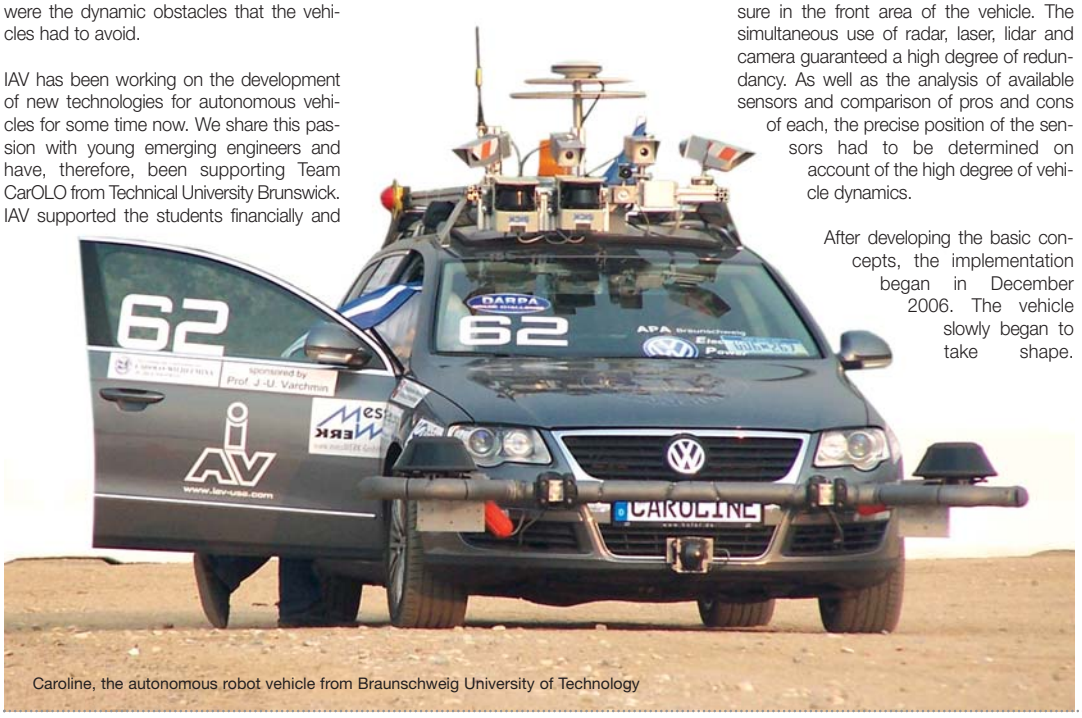
The DARPA Urban Challenge, a contest for autonomous vehicles, organized by the United States government, was held for the 4th time in 2007. After several teams successfully completed the course in the Mojave Desert in 2005, the 2007 contest clearly demanded a higher standard. The desert environment was changed to an urban neighborhood. The former air base at Victorville, California was selected for the contest since it is modeled after a small town. The vehicles had to independently apply traffic rules on a road course of approximately 60 miles. The biggest challenges were the dynamic obstacles that the vehicles had to avoid.

IAV has been working on the development of new technologies for autonomous vehicles for some time now. We share this passion with young emerging engineers and have, therefore, been supporting Team CarOLO from Technical University Brunswick. IAV supported the students financially and technically with their development vehicle named "Caroline". This project provided the opportunity for everyone involved to take a look into the future and work with the potential issues in the area of obstacle and surrounding area identification.

In addition to the high standards specified by the DARPA (Defense Advanced Research Projects Agency) for the vehicle, the tight schedule proved to be another challenge. At the beginning of the project, significant emphasis was placed on creating an efficient software architecture. Highest priority was placed on the definition of the functional partitioning by using independent modules and gateways. A linear concept in the data flow enabled the development and testing of the modules, avoiding interference. Due to the complexity, the modules were distributed onto six Pentium-1.8M processors.

In addition to the software architecture, another focus area was the sensor concept. It was essential to combine the strengths of each of the sensors and produce redundancies. IAV's main focus was the sensor enclosure in the front area of the vehicle. The simultaneous use of radar, laser, lidar and camera guaranteed a high degree of redundancy. As well as the analysis of available sensors and comparison of pros and cons of each, the precise position of the sensors had to be determined on account of the high degree of vehicle dynamics.

After developing the basic concepts, the implementation began in December 2006. The vehicle slowly began to take shape.



Caroline, the autonomous robot vehicle from Braunschweig University of Technology

Based on the use of integrated sensors and multiple processors, Caroline's functionality was incrementally increased to the level that was needed to participate in the DARPA Urban Challenge.

Caroline in a road traffic situation

The start of the contest was promising: Out of over 100 vehicles, the Technical University Brunswick vehicle supported by IAV qualified for the final round which was held at the end of October. During the final round, Caroline experienced a small collision and was the fifth vehicle taken out of the contest with damaged sensors, resulting in a 7th place finish overall. The Tartan Racing Team from Pittsburgh placed first with The University of Stanford, California, following in second.

"We congratulate the CarOLO Team for an excellent finish" remarked Udo Wehner who is responsible for the area of driver assistance and active safety at IAV. "From the start, the contest was fascinating and the standards were high. The incentive to win the next time is very high based on the outcome this time around", states Wehner.

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IAV Sponsors the University of Michigan International Engineering Summer School

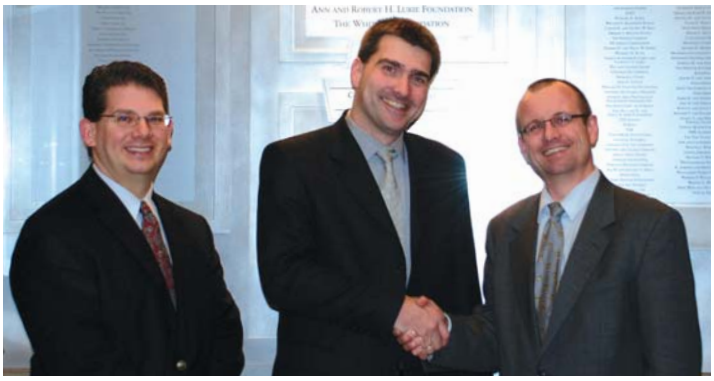
Training tomorrow's global engineers

by Cheryl Boland

IAV is the proud sponsor of the 2008 International Engineering Summer School, a partnership between the University of Michigan and the Berlin University of Technology in which engineering students travel to Germany to gain insight into German culture, engineering and industry. The program is geared toward first and second year students and combines intensive German language training with hands-on engineering experience. Lab work is combined with visits to relevant scientific and industrial sites in and around Berlin, including a visit to IAV GmbH.

According to Volker Sick, Chair of International Programs Committee and Professor of Mechanical Engineering, "The support that IAV provides for the International Engineering Summer School is fantastic. It helps the College of Engineering at The University of Michigan in a significant way with our mission to provide an international experience for our students."

During the program participants will earn academic credits by working in small project teams with students from the University of Technology to design and conduct experiments, analyze results, and present reports to faculty and industry representatives. This approach provides international perspectives on engineering, as well as the development of intercultural communication and problem solving skills. Possible project choices for 2008 include turbo-charging and exhaust gas recirculation to improve compression-ignition engines, understanding the energy demand of automotive components, and signal controllers and their applications, just to name a few.



Professor Volker Sick thanks IAV for their support

According to Utz-Jens Beister, president of IAV Inc., "We feel the Summer School program is a wonderful opportunity for students to acquire the skills necessary to be successful in today's global marketplace and are proud to be a part of it".

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Public Appearances & Publications

Congresses

Visit IAV's booth at the following trade shows:

Apr 14-17, 2008
SAE World Congress
Detroit, USA

Apr 24-25, 2008
27th International Vienna Engine Symposium
Vienna, Austria

May 6-8, 2008
Testing Expo
Stuttgart, Germany

May 6-8, 2008
2nd CTI Symposium + Exhibition Automotive Transmissions North America
Southfield, MI

May 28-29, 2008
The Diesel Engine
Rouen, France

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IAV Conferences

IAV will be organizing symposia on the following topics:

May 26-27, 2008
3rd Conference "Simulation and Testing in Algorithm and Software Development for Automotive Electronics"
Berlin, Germany

Jun 19-20, 2008
2nd International IAV Conference "MinNO$_x$ – Minimization of NO$_x$ Emissions through Exhaust Aftertreatment"
Berlin, Germany

Sept 17-18, 2008
3rd Conference "Gas-powered Vehicles - The Key Technology on the Road to the Emission free Propulsion of the Future?"
Berlin, Germany

Oct 23-24, 2008
1st Conference "Thermoelectrics – A Chance for the Automotive Industry?"
Berlin, Germany

Organization: lars.gamasin@iav.de

Papers

Our experts will be delivering papers on the following topics:

Apr 14-17, 2008
SAE World Congress, Detroit, USA
"Investigations on Supercharging Stratified Part Load in a Spray-Guided DI SI Engine"
julius.pape@iav.de, marc.sens@iav.de, A. Kneifel, S. Buri, A. Velji, U. Spicher (University Karlsruhe)

Apr 24-25, 2008
29th International Vienna Engine Symposium, Vienna, Austria
"A New Methodology for the Development of Hybrid Powertrains"
K. Cornelsen, Prof. Dr. T. Form (Technical University Brunswick), daniel.jaensch@iav.de, wilfried.nietschke@iav.de, thiess-magnus.wolter@iav.de

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