Conference Summary

Car Training Institute

Automotive Transmission technology is a future factor

Summary of 7th International CTI Symposium and Exhibition

"Innovative Automotive Transmissions, Hybrid & Electric Drives North America 2013"

May 13 to 16, 2013, Rochester, MI http://bit.ly/CTI_USA

Rochester/Düsseldorf, June 2013. When any important conference or event is held, it is supported by key expectations. In all the proper dimensions, the 2013 North American Transmission Symposium & Exhibition exceeded the expectations of conference organizer CTI. In terms of attendance, quality of informational sessions and value to participants, this was a remarkable industry event.

380 representatives of industry, the supply base, government and academia gathered at the Royal Park Hotel in Rochester, Michigan between May 13–16. Not only did those numbers exceed the early projection (250), they established a record for the conference in North America!

The numbers didn't tell the whole story, however, for the conference drew from well beyond North America. This year's event attracted again many engineers and sales representatives from Europe and Asia, too. Such robust diversity - 15 countries, in fact! - attested to the reputation of CTI conferences, the value of individual symposium offerings, and the unmistakable globalization of the auto industry.

Symposium topics demonstrated that transmission and driveline represents a very complex and challenging technology sector. Not only that, with its increasing use of innovative automatic transmissions, hybrid drives and electric drives, this sector is advancing by means of widely differing technologies. It is not consolidating around a single mindset or hardware mechanism. Attendees returned to their homes from this symposium understanding they had generous exposure to 'state of the art' thinking from an industry undergoing rapid change.

Pre-Symposium Class: The perfect preparation

The conference was preceded on May 13 & 14 by an transmission function overview - "Basics & Practice of Automatic Transmissions" - for those who wanted a comprehensive refresher. Compared to last year the extension of the seminar from one to two days was very welcomed by the participants to receive a broad overview of different types of transmissions, their mechanical function, advantages and disadvantages. They particularly enjoyed the deeper insight into the

details like powertrain management and TM controls. Overall the two days built a valuable fundamental for the next days ahead.

Two days ahead – fully packed with latest information on trends & technology

This CTI conference, like the six which have preceded it in North America, was divided into plenary sessions showcasing high level industry directional topics and parallel sessions sharing specific technology applications (this year they were extended to in total 6) As participants gathered credentials in the gallery of the Royal Park Ballroom on the morning of May 15, anticipation was in the air. That anticipation was fueled by supplier banners in the gallery suggesting themes easily associated with this complex industry:

- *The mission is Passion!*
- *Innovation Worldwide*
- *Discover the Global Power!*
- *Small Components; Big Contributions*
- *Efficiency Through Innovation*

On behalf of CTI, Conference Chair Ernie DeVincent of Getrag welcomed participants to the Symposium. He noted that this year's conference attendees had traveled to Rochester from the US (73%), Europe (19%), and Asia (5%). Ernie DeVincent pointed out that 2013 participants came from the supplier community (66%), OEMs (11%) and transmission manufacturers (11%). Finally, he described this group as 56% engineering/R&D, 26% marketing/sales and 18% general management.

DeVincent explained the conference structure (plenary + parallel sessions), the extensive technical ground which would be covered, and the remarkable access each and every participant could have to the industry's most talented technology experts and management.

Most of all, he encouraged attendees about the value they would surely derive in their time together at this truly global Symposium opportunity.

The governement´s view and the industry´s technological answers

In the lead plenary session, participants were addressed by **Matthew Brusstar**, Deputy Director of America's Environmental Protection Agency (EPA). Brusstar described a shifting American transportation paradigm, moving from large cars dependent on large oil to smaller cars depending on fewer oil imports and more renewable resources.

He also described the EPA's looming greenhouse gas regulations which take effect in 2017 as well as the industry's response to those rules. He offered his enthusiastic view that advanced gas engines and transmission technologies were leading the way. He lauded 'start-stop' and mild hybrid technologies in particular. He observed that the EPA was less confident about the role that strong hybrids would play in meeting 2017 greenhouse gas requirements.

As he concluded, Brusstar suggested that the industry was on course to meet the unprecedented fuel economy challenges ahead. He took pleasure in reporting that the relationship between EPA and automakers has never been more collaborative.

Next, **Oliver Schmidt,** General Manager, Engineering & Environmental, Volkswagen NA provided an overview of Volkswagen's work with hybrid powertrains. That work is based on the belief that conventional drive technologies alone will not be enough to limit global warming, and that electric drive technologies are best positioned to help close the gap.

Schmidt shared a history of VW's pioneering work with electric vehicles and HEVs dating all the way back to the 1970s. He noted with real pride that VW is electrifying all of its vehicle classes and engineering the same for its Porsche and Audi carlines.

He introduced conference participants to the technical details of VW's Jetta Hybrid. Schmidt noted that 1) Jetta is intended as a mass market vehicle and 2) its capabilities are driven by intelligent and replicable technology. He lauded its unique drivetrain, composed of a turbocharged 4-cylinder engine, a dual dry clutch gearbox and an advanced, lightweight lithium ion battery system. Finally, he described VW's move towards modularization. Its modular transverse kit (MQB) is a design direction which imposes common dimensions across carlines between bulkhead and front wheels. Such standardization, along with a common engine orientation for all vehicles, affords great efficiencies through design standardization. Oliver Schmidt proudly noted that VW's flexible design is able to accommodate alternative drivetrains and fuels.

The next plenary session, entitled "Hybrid Air: Breakthrough Innovation", was presented by **Patrick Signargout**, Vice President of Peugeot-Citroën (PSA). Signargout noted proudly that PSA was Europe's #1 OEM in electric vehicle sales, and had been for nearly two decades.

He described Hybrid Air as "a disruptive technology in the world of hybridization." This mild hybrid is based on a gasoline engine with start-stop technology. It features an innovative marriage of proven technologies: a 3-cylinder gasoline engine, an automatic transmission, a hydraulic engine pump and an energy storage unit. The 'new' aspect of this new hybrid technology is its combination of gasoline power and air power derived from regenerative kinetic energy. At low speeds, air power is used. At cruising speeds, gasoline power is used. Under high torque circumstances (rapid

acceleration or hill climbing), a combination of the two is used. Overall, this system provides a dramatic reduction in fuel consumption for urban usage.

Signargout was pleased to advise that the European press has reported Hybrid Air to be the best "start-stop" vehicle example on the market. PSA plans for this innovation to go to market in 2016.

The final day one plenary featured **Alexander Edwards**, President of Strategic Vision, Inc., a leading expert in consumer and market research. Edwards helped his audience take a close look at "The Emerging Alternative Fuel Customers." Using information gleaned from Strategic Vision's 2012 New Vehicle Experience Study (NVES) of 415,000 new car buyers, he took his audience through the values and priorities of hybrid customers.

NVES showed that alternative fuel vehicles continue to make up a small part of the sales picture in the US (hybrids @ 3%; diesels @ 2%), that buyers tend to be male, married, older, well educated and employed, and that Toyota and Lexus continue to "own" this niche market.

Although acceptance and openness to considering alternative fueled vehicles is growing, incremental sales will only be possible if the total value equation - the combination of price, functionality, performance and fun - is correct.

Alexander Edwards' closing exhortation was for the world's OEMS: "Don't simply build great technology. Make sure customers *understand* your innovations."

Never, ever bet against Engineering

An intended highlight of the first day was a panel discussion moderated by **David Cole**, Chairman Emeritus of the Center for Automotive Research. Entitled "Which Technologies Will Drive Best Fuel Economy?", it featured a distinguished panel (Matthew Brusstar, Oliver Schmidt, Ernie DeVincent, Dimitri Kazarinoff of AVL, Mirceau Gradu of Chrysler & Klaus Ludwig of Continental) offering answers to questions targeting future fuel economy.

Coming as they did from different strategic enterprises, there was only modest agreement among the panelists. *Future power plant preferences?* "We just don't know." *Future fuels?* "Customers can choose from among so many: petroleum; biofuels; hydrogen; NH3; etc. "*Future price of gasoline?*" Most saw it escalating upwards to $5; some cited alternative fuel technology progress as a compelling reason for the price of petroleum to come down - and radically - in the years ahead. Broad agreement was found in only two areas: 1) that, for customers, "It's all a matter of economics" and 2) that OEM progress in meeting fuel economy standards could come with such a high cost that customers might refuse to buy…..and the "American fleet would become 'Cubanized' (increasingly aged and tired)."

Other trains of thought which emerged from this panel were: 1) the increasing importance of systems thinking in drivetrain design; 2) the increasing availability of competing powertrain technologies; and 3) the fact that different regions of the world have entirely different vehicle usages and expectations. All panelists agreed that it had never been harder to meet the requirements of governments and consumers at the same time.

Moderator David Cole brought the panel discussion to a close by wryly pointing out that today's increasing regulatory demands and the growing number of different technologies being employed to meet them were "great for engineers but a house of horrors for those who must work in finance!" He offered this metaphor for today's technical challenges: that, in these demanding and rapidly-changing industry times, it was "much easier to be a spectator in the stands than a gladiator in the arena."

Nearly 40 technical lectures to choose from

There were 20 individual concept, component or development improvement papers presented as part of day one´s parallel sessions. Each represented distinct thinking by a subject matter expert from industry or academia, and participants were free to choose from an incredibly broad range of topics. The first day's parallel sessions addressed the themes of 1) Cooperation in Transmission Development - on the example of Ford´s and GM´s collaboration - & new DCT, AT and CVT concepts or optimizations – with presentations by e.g. Getrag, IAV, Chrysler, Schaeffler and Bosch; 2) Development Tools & Standardization – looking into endurance cycles, transmission calibration and the impact of ISO 26262 and SAE J2980 - and Transmission Components – especially looking at friction, bearing, clutching devices and traction; & 3) Optimization of Transmissions & Driveline NVH – for the first time covered in a separate session

The second day contained 19 individual component or process improvement papers presented.. These parallel sessions addressed the themes of 1) Reconsideration and Comparison of Transmission Concepts, a new DCT platforms, Tremec´s latest 7-speed MT (which debuts in the 2014 Chevrolet Corvette Stingray), Consideration of Gear Ratio, The role of TM in EV And HEV Drives ; 2) again: Transmission Components like dog clutches and synchronizers and transmission lubrication; TM & Hybrid Electric Drives for Commercial Vehicles with presentations by Eaton, ZF and AVL ; & 3) Transmission Simulation and Transmission Controls with lectures e.g. by Ricardo, Vicura, AVL and GM

Ride & Drive Event: let theory become practice

Throughout the conference, test drives were available to participants. Ten cars/trucks had been prepared by OEMs and/or suppliers showcasing cutting edge technologies, and registered attendees could reserve them for 10 minute drives on area roadways. Included in this collection were Renault Clio (Getrag 6DCT250), Ford C-MAX Energi Plug-in Hybrid and Fusion start-stop, Volkswagen Jetta Hybrid and e-Golf (2 models), Chrysler 2013 Ram and 2014 Jeep Cherokee, Magna modified Focus Electric and AVL modified C-MAX with AVL Drive.

Such test drives were real time demonstrations of "state of the art" transmission and drive technologies. In addition, they presented valuable opportunities for development engineers to see how other manufacturers were addressing *their* areas of expertise!

These test drives made the parking lot at the Royal Park a veritable "field of choices": a microcosm of the most innovative driveline technologies available to customers today. This conference resource was greatly appreciated by participants; nearly all of the available 160 drive slots were used.

Supplier Exhibition

Twenty-six suppliers were on hand to display their latest products and services, amongst them also the sponsor companies DANA, Getrag and Schaeffler (sponsor IAV supported the evening event on Ovation Yacht). Their technology displays were useful to Symposium participants and to exhibitors alike, for the audience provided a cross section of truly elite OEM and supplier engineers. At the same time, exhibitors enjoyed networking opportunities with their competitors. A common sentiment among exhibitors was that this forum presented a focused opportunity to reach the right people. "It is a great way to gain connections and it is a great thing that the show is growing every year." commented Tyler Morsehead of Metaldyne.

More or less gears? And: Where does all the energy go?

In the lead plenary session of the second day, **Prof Dr. Ferit Küçükay** of Braunschweig Technical University addressed participants on the topic of Energy Savings.

"Where does all the energy go?", Prof. Küçükay asked his audience as he began. His opening premise was simple: that in all vehicles there is a huge difference between the *theoretical* amount of available energy and *actual* energy delivery. A complex review of energy losses within the vehicle followed, with attention being given to such major loss sources as rolling resistance, drivetrain transfer and conversion losses, vehicle weight and aerodynamics.

Audience members saw clearly that the value of Küçükay's technical analysis was in the need to identify areas for improvement. His in-depth examination of energy losses between the tank and

the wheel made an excellent case for system optimization of the kind which combines traditional transmission design concerns with engine concerns.

Next, **Shinji Morihiro**, Corporate Vice President of Jatco Ltd. from Japan, provided a future look at how changing transportation modes are likely to impact future transportation products.

Morihiro cited data from Global Agenda Councils predicting that forces at work today will greatly change transportation modes of the future. Among those forces are: 1) an aging population which drives less; 2) increasing urbanization, bringing with it the need of residents to drive less; and 3) increasing urban congestion, causing changes in the traditional appeal of automobile ownership. In emerging economies in particular, he foresees very different transportation requirements for people than for goods. He predicts that people will need to move mainly within cities and that goods will make up the bulk of transportation requirements between cities. Increasingly, people in megacities will not own vehicles: only rent them.

As such, he foresees three very different transmission requirements: for people within megacities (small vehicles); for goods within megacities (delivery vehicles); and for goods between ports/production facilities and megacities (large trucks). Shinji Morihiro foresees all urban driving taking place under stop-and-go conditions at speeds mainly from 10-50 KMH. He predicted that vehicle *owners* will want different attributes than vehicle *drivers.* Owners will require high reliability and easy serviceability; users (renters) will want vehicles which are easy for them to drive, despite their unfamiliarity with the vehicles they rent. In the vehicles they design to meet future transportation needs, OEMs will need to design to meet both owner and user requirements for each vehicle type.

The next plenary session, entitled “7/8/9/X speeds – Or Is 4 Enough?”, was presented by Dr **Gunther Fraidl**, Senior Vice President, AVL Powertrain Systems.

In it, Dr Fraidl examined the current direction of automatic transmissions having more and more gears, sharing conventional wisdom that *fewer* speeds result in larger power losses and *more* speeds result in added smoothness and greater economy. Assuming only current engine technology, he predicted, the number of gears can be expected to grow.

Dr Fraidl shared two current technical trends which run contrary, however. The first is that there are distinct possibilities for further combustion engine optimization. (He was particularly interested in how advanced turbocharged direct-injection engines will benefit less from more transmission speeds.) Another is that today’s electrification and hybridization direction introduces additional design freedom, creating opportunities to reduce energy losses or simplify transmission design. And such design freedom can be used to counteract the known disadvantages of high ratio steps described above.

He concluded by observing that future engines and transmissions need to be developed within a comprehensive systems approach. In that way, the advantages of new engine concepts can be also utilized to simplify transmissions, promoting cost efficiencies for the whole system. Thus, Dr Fraidl expects that, after increasing the numbers of gears in the medium term, the average number of transmission speeds will decrease in the long run.

The final plenary session of day two featured **David Petrovski**, Principal Analyst of IHS Automotive, exploring this theme: "Have We Finally Reached the End of the Speed Wars?"

To prepare his audience to answer that paramount, high interest question, Petrovski described the world's highly regional transmission preferences: step ratio automatics in North America; DCTs in Europe & CVTs in Asia. He presented high level drivetrain product plans for 8 global manufacturers for 2014-2017. He described the average life cycle of a typical transmission from concept to investment to introduction to maturity as a 6-10 year period, but pointed out that manufacturers will often build in 3 or 4 distinct product enhancements during that cycle. The picture David Petrovski's painted was that of a complex and highly competitive industry in which all manufacturers are working on something new at all times.

In the context of 'what's next?', Petrovski suggested that the ideal transmission of the future would need to address these deliverables: 1) creating satisfactions beyond mere cutting edge technology that customers can fully recognize (i.e., aspects reflecting drivability, shift quality & fuel economy); 2) using technology to further minimize internal driveline losses; & 3) finding new ways to use the transmission to control the engine to operate to its greatest efficiency.

Employing 'American Idol' style voting methods, David urged his audience to use cell phones to provide answers to these 5 discussion questions:

1. *Will we see more than 10 forward speeds for light duty vehicles?*
2. *Will DCTs be accepted by US consumers?*
3. *How much fuel economy will be needed to justify all new future transmissions?*
4. *What trend will have the greatest impact on the next transmission design cycle?*
5. *What transmission technology is best suited for the P2 hybrid?*

This ingenious form of Q&A was very welcomed by the audience, more than 100 texted their electronic responses and led to representative results!

As he closed, David Petrovski wryly confessed that - in an industry evolving as rapidly as this one - any specific prediction he might make would surely change in the months ahead. He urged his audience to *"Never, ever bet against engineering!",* understanding fully that new designs and

concepts for making transmissions even more formidable and efficient are probably right around the corner - even in a mature field like transmission design.

Animated by the competition

As a final and unannounced Symposium feature, the panel convened once more to address the question about technologies most likely to capably address fuel economy while being profitable.

Much discussion was given to the maturity of current automatic transmission design, the effects of looming CO2 regulation, the need for continuing - even radical - innovation, and changing battery systems for hybrids. It was most enjoyable to see the eight panelists - experts, all - engaging each other so enthusiastically! Bert Martin, Chrysler's Senior Manager of Advanced Transmission, summed up the discussion very well in saying: *"I am animated by the competition that is so evident in the transmission industry. In my view, we're getting back to the golden age of transmission development."*

When the panel discussion came to an end, audience members realized how helpful it had been to listen to such accomplished industry professionals candidly discuss the future….and the value of incremental speeds beyond six.

Close

The 7th International CTI Symposium and Exhibition demonstrated what one participant referred to as "an excellent mixture of proper business interest mixed with eager participant enjoyment." How fruitful and appropriate that the elite engineers on hand from around the globe could strike a healthy balance between sharing their existing expertise and hungering to learn even more.

At it drew to a close, Conference Chairman Ernie DeVincent praised the CTI event, lauding such Symposium characteristics as: "global attendance, global discussions, the right blend of technical, strategic, regulatory and forecasting presentations, and the best networking opportunity for our industry *anywhere*."

Later, conference coordinator Sylvia Zenziger described the 2013 North American Symposium as a *'Runde Sache.'* The translation from German means 'a round thing.' Zenzinger´s reference is to the fact that the 2013 conference was a completed circle, with teaching generously available during Symposium sessions and practical application available in the many concurrent test drives. A completed circle, indeed!

Attendance at this year's Symposium provided *another* participant value, as well - this one, very subtle. In addition to the energetic networking which took place on the conference floor and in various presentation salons, each participant left the event knowing that he or she now had a passing but personal familiarity with some of the industry's most accomplished thinkers. In most

cases, such familiarity did not exist before the CTI Symposium. It suggested that participants with a future need to contact such industry experts for opinion or advice could do so with a brand new confidence…..shaped by a shared and valued experience.

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