

Automotive Engineering International Presents

SHOW DAILY



A bright future for diesel in U.S.?

The message from the U.S. Environmental Protection Agency about the future of diesels was made crystal clear at Monday afternoon's Blue Ribbon Panel: it will be as clean as gasoline by the end of the decade.



"We have a couple programs coming in the next 5-6 years that will ensure, in the light-duty market, that diesels will be as clean as gasoline-powered engines," said Jeffrey Holmstead, Assistant Administrator for Air and Radiation at the EPA. "I think it's important for the companies represented here to hear the government say, to the extent there were any health effects with diesels, we think they are addressed in the regulations coming on line—and in a way to avoid dislocations in the oil and auto industries."

Holmstead and other panelists agreed that U.S. consumers need an education about diesel-fueled vehicles. The mention of diesels "conjures up images of smoke plumes from tailpipes," said panel moderator Susan Cischke, Vice President of Environmental & Safety Engineering at Ford.

Continued on page 22

Denso looks to CO₂ future

Concerns over global warming in recent years has prompted a switch in many countries to car air conditioning (A/C) systems using HFC-134a refrigerants instead of CFC-12.



Denso's latest advanced climate-control developments involve carbon dioxide (CO₂) refrigerant, which is considered to be one of the most promising alternatives.

However, Denso Corp. and other industry companies believe there is more room for environmental improvement and are searching for an even more environmentally benign refrigerant to reduce global warming. Denso, the global leader in A/C systems with 24% of the global market, yesterday revealed details on its latest advanced climate-control developments using carbon dioxide (CO₂) refrigerant, which is considered to be one of the most promising HFC-134a alternatives.

According to Denso, the global-warming potential of CO₂ is about 1/1300 that of HFC-134a, so leakage from an A/C system using

the refrigerant is much less of a concern. CO₂ has a lower critical temperature and higher critical pressure than does HFC-134a. Therefore, in systems adopting CO₂ refrigerant, the high-pressure-side temperature exceeds the critical point and results in an operating pressure 7 to 10 times greater than that of HFC-134a.

Denso's CO₂ A/C system differs from a conventional HFC-134a configuration in a number of ways. Instead of a conventional condenser, a gas cooler reduces CO₂ temperature upon discharge from the

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Vicon models motion

The **U.S. Army Tank-automotive and Armaments Command (TACOM)** has recently implemented **Vicon's** motion-capture technology in its virtual prototyping initiatives. TACOM's Automotive Research Center has installed a 16-camera Vicon 8i system, which will be used to perform digital-human simulation and analysis in support of human interface development for wheeled and tracked vehicles. Other companies that have employed the technology include **BMW, Peugeot, Nissan, Toyota,** and **Renault.** The technology is currently on display at Booth 1701.

TACOM's efforts into virtual prototyping began about five years ago when its Research Development & Engineering Center (TARDEC) ceased construction on full-scale mockups of vehicles during the conceptual phase of vehicle development. TACOM then began to employ new digital-human modeling tools such as Vicon's motion capture system to assess human-factors and ergonomic issues, producing more accurate data than obtained from



Vicon demonstrates its motion-capture technology, which employs high-definition cameras and multiple sensors attached to a person's body.

previous electromagnetic motion-capture systems.

The Vicon 8i can perform motion capture at 1-million pixel resolution using the company's Mcam high-definition cameras. According to

John Francis, Senior Sales Engineer with Vicon, a human-factors or ergonomics specialist using Vicon's motion capture technology can conduct multiple variable permutations such as tracking head movements/coordination, motor reaction, ingress/egress, and seated-operator studies with immediate feedback.

Vicon is taking its motion-capture technology further through its collaboration with **EDS** to develop virtual-reality-based product design, manufacturing, and maintenance evaluation. The joint-effort will provide an optimized interface between Vicon's motion-capturing technology and EDS PLM solutions Jack digital-human modeling software.

EDS's Jack software is used for the creation of physiologically realistic digital humans that can be manipulated in the virtual space. Vicon's technology adds the ability to capture highly accurate real-time human motion data that can be used to drive these digital figures. Frank Bokulich

OESA's e-business report

The **Original Equipment Suppliers Association (OESA)** presented on Monday "An Industry Progress Report on e-Business," a program that focused on several topics including the need for standardization within the automotive industry, the progress made in different e-business areas, and OEM and supplier perspectives on Internet initiatives and implementation.

Jane Warner, President, Manufacturing Global Industry Group, **EDS**—which sponsored the program—cited a **KPMG** study that found several other industries to be ahead of the automotive industry in e-business. She also noted that only one out of three Tier 1 suppliers has an IT infrastructure in place to support its e-business initiatives. Companies that do not have an e-business strategy, said Warner, will

2001 E-business Report Card

	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Procurement	D	D	D	D+
Supply chain	B-	B-	B-	B-
Product development	B-	B-	B	D

Note: D = developing, B = beginning

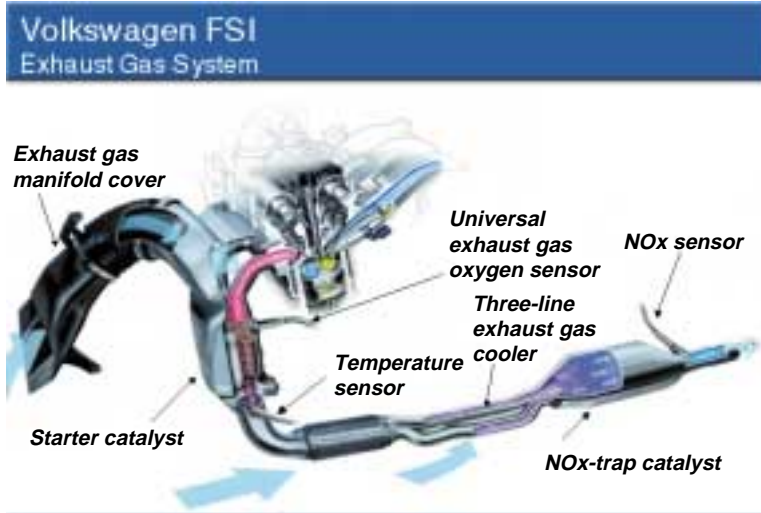
Continued on page 21

Today's Congress highlights

- Digital Car Conference Interactive Technology Sessions—Michigan Hall—8:00 a.m.-4:30 p.m.
- Life Cycle Panel—Room D0-03AB, 9:00 a.m.-12:00 p.m.
- CAE panel—Room D0-03AB, 2:00-5:00 p.m.
- Lighting Technology—Room D0-05AB, 9:00 a.m.-5:00 p.m.
- 42-Volt Technology—Room D2-15, 9:30 a.m.-5:00 p.m.
- Cultural Diversity Workshop—Room D2-08, 2:00-5:30 p.m.
- Professional Currency—Room O2-43, 2:00-5 p.m.
- Driver Distraction—Room D3-16/17/18, 2:00-5:00 p.m.
- Buckendale Lecture: Design of Electronics for Commercial Vehicles—Room W2-66, 4:30-5:30 p.m.

Exhaust gas aftertreatment

To reduce the fuel consumption of their vehicle fleet, Volkswagen AG developed spark-ignition engines with direct fuel injection. Those who attend yesterday's Advanced Catalysts and Substrates Technical Session learned how engineers first had to develop a suitable exhaust gas aftertreatment system to launch this new engine concept with stratified lean operation mode while meeting the stringent EU IV emissions standards. This feat was achieved as part of an intensive cooperation between Volkswagen AG and **OMG**, formerly dmc² Degussa Metals Catalysts Cerdec AG.



Engineers from Volkswagen and OMG created an exhaust gas aftertreatment system during development of FSI engines to meet EU IV emissions standards.

Due to intensive cooperation of the development partners involved, it was possible to implement for the first time an exhaust gas aftertreatment system based on NOx-storage-catalyst technology for the emissions standards in the Volkswagen Lupo FSI (fuel stratified injection). The fuel consumption of the Volkswagen Lupo FSI is 4.9 L/100 km. The emissions and fuel consumption targets were successfully achieved by:

- A general exhaust gas aftertreatment concept with a NOx-storage catalyst and on-demand purging functions based on NOx-sensor control.
- Improvement of the aging stability of the catalyst system by developing a stable NOx-storage catalyst and light-off catalyst formulation, engine-out emissions reduction, and exhaust gas cooling devices.
- Improvement in the desulfation characteristics of the NOx storage catalyst and development of an active desulfation process.

European fuel-quality standards required the development of a new active and lambda-controlled desulfation process. Although the Volkswagen FSI exhaust gas aftertreatment concept can withstand high fuel sulfur contents, sulfur-free fuel is required for best fuel economy. With widespread available sulfur-free fuel, advanced NOx storing components with a wider NOx activity window can be used, which leads to more frequent use of fuel-saving lean operation mode.

Since spring 2000, several mineral oil companies have introduced sulfur-free fuel with less than 10 ppm in Germany. Volkswagen supports this trend, hoping that within a short time period the availability of sulfur-free fuel will be extended to other countries.

As soon as fuels with less than 10 ppm are available within the European Union on a widespread scale, new NOx storing components with wider NOx activity windows and higher desulfation temperatures can be employed. When catalyst deactivation occurs very slowly due to low sulfur concentrations, the chance for a "natural" desulfation to be performed before active sulfur regeneration must be initiated is increasing. Fuel economy will thus increase not only by rare desulfation. The main advantage will be more frequent use of lean-burn and stratified engine operation mode especially at higher catalyst temperatures.

The researchers believe that worldwide improvements in fuel quality standards are needed for market penetration of FSI engines. As direct gasoline injection is the technology with the highest potential in reduction of CO₂ and fuel consumption, any initiative will be supported that promotes the FSI strategy.

Linda Trego

NEC senses passengers

NEC Technologies Inc., an affiliate of NEC Corp., demonstrated Monday at Booth 1229 a technology it has developed to accurately predict the size and position of a seat occupant. The SeatSentry occupant-sensing system can detect whether it is an adult, a child in a safety seat, a seated child, or an out-of-position child (by NHTSA guidelines) in the front seat. According to Phillip Rittmueller, Vice President, NEC Technologies, Automotive Electronics Division, the technology now makes it unnecessary to disable the airbag on the passenger side.

"The National Safe Kids Campaign reported (last month) that nearly half of the children riding on the road today don't wear safety belts or use the wrong child seat," said Rittmueller. "That means more kids are riding in the front seat and now more kids are at risk. The safest place for children is still in the back seat of the car. However, we need smart technologies to protect everyone, (especially) when they can't protect themselves."

Using electric-field sensing, the system detects the relative mass and relative position of an occupant through the use of a series of flexible sensor mats embedded in the seat. The sensor mats are connected to an electronic control unit (ECU) at the base of the seat. If the mass is mostly at the front of

the seat, as with an infant in a rear-facing infant seat, it will not deploy. The system detects adults as small as 51 kg (112 lb) to allow the passenger airbag to safely deploy. The Massachusetts Institute of Technology (MIT) Media Lab originally developed electric-field sensing through the application of mathematics and physics to music. The goal of the researchers was to investigate the interaction between people and inanimate objects.

NEC developed its technology from the MIT research and got 3M to incorporate it into the seat. "We've worked with all the major seat manufacturers and all the foam manufacturers in North America and have successfully integrated this technology into (many) different seats," said Donn Schumaker, Business Unit Manager, 3M Electrical Products Division. "Because the sensor mat is made from the same foam material as the seat, the SeatSentry is virtually undetectable by the occupant."

NEC co-developed with JAE the case that houses the electronics in the ECU as well as the connection interface that goes to the sensor mat assembly in the seat and the vehicle harness.



The SeatSentry occupant-sensing system from NEC uses sensor mats installed in the seat cushion to detect an infant's mass in a rear-facing seat and to suppress the passenger airbag.

The NHTSA FMVSS-208 mandates that by MY 2004, 35% of new cars must be equipped with occupant-sensing systems that meet injury criteria or suppress the airbag. By MY 2006, all new cars must have this capability. According to NEC, the SeatSentry system meets all of the NHTSA proposed tests for static suppression, including testing with the available child seats specified in the regulations. The major OEMs in Detroit are scheduled to introduce the system in their vehicles "in the coming years," claims NEC. A version of the system for side airbags can currently be found in all Honda vehicles with side airbags.

Jean L. Broge

AVL measures up to emissions

AVL North America (Booth 1001) made several major announcements on Monday, including the introduction of a new tunnel design for its SPC-472 sampler. According to William Silvis, Director of Research and Development at AVL, the design achieves full-flow constant volume sampler (CVS) correlation for particulate testing, producing partial flow system results comparable to those from more expensive full-flow equipment. "This is of particular significance when we consider the standardization efforts under way to develop a worldwide method for testing and sampling heavy-duty diesel engines," he said.

Transient partial-flow systems have historically experienced two types of deposition losses—diffusion and thermophoretic—inside the sampling system. According to AVL emissions specialist Norbert Kreft, AVL modified the probe, transfer tube, and tunnel to minimize those losses. A shorter probe length and thinner probe wall combined with additional insulation to the mixing point contributes to reductions in thermophoretic losses. The thinner tube material allows for a quicker assimilation of the exhaust temperature, reducing particulate loss. An adjustment of the angle within the re-circulation zone diffuses the sample throughout the mixing zone and reduces deposits. To compensate for system time delays, the SPC-472 implements "look-ahead" controlling, which "uses a pre-recorded exhaust flow signal to control the partial flow sampling system," said Kreft.

AVL also introduced a partial-flow, bag-sampling system, or bag mini-diluter (BMD), for measuring the emissions from super ultra-low emitting vehicles (SULEVs). AVL claims the BMD-150 exceeds the basic requirements outlined by the AIGER consortium, including a flexible dilution circuit to provide the proper performance on a wide range of fuel types, from methanol and compressed natural gas to clean, reformulated gasoline.

Jean L. Broge

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Denso looks to CO₂ future...continued from page 1

compressor. The CO₂ is not condensed by the gas cooler because the refrigerant exceeds its critical point on the high-pressure side. Instead, an expansion valve condenses part of the refrigerant as a result of adiabatic expansion. An inner heat exchanger between the gas cooler and main heat exchanger further cools the refrigerant by exchanging heat with refrigerant flowing on the low-pressure side of the system. The inner heat exchanger also increases cooling

performance. The accumulator is eliminated on the low-pressure side since pressure on the high side is 10 MPa (1450 psi) or greater—much higher than that of the conventional system. Since the accumulator is integrated with the internal heat exchanger and expansion valve, the system is simplified and easier to install in the vehicle.

Taking the concept a little further, Denso has also developed with Toyota Motor Corp. a CO₂ A/C system with heat-pumping

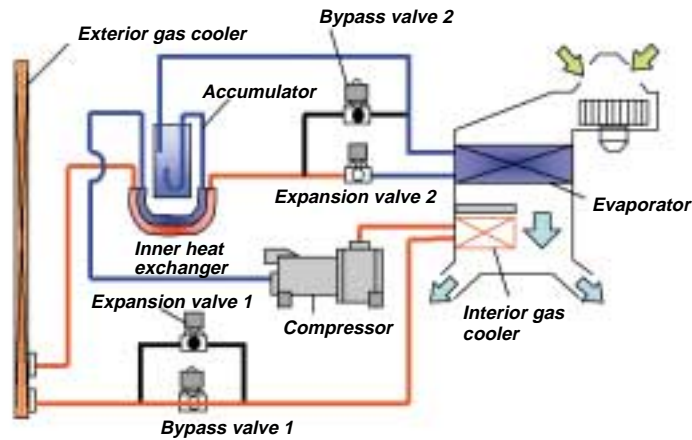


Denso and Toyota developed a CO₂ A/C and heat-pump system to provide cabin cooling and heating for Toyota's FCHV-4 fuel-cell vehicle.

perform dehumidification by closing bypass valve 2 and controlling the opening degree of expansion valve 2. The compressor for the system is driven by an electric motor, and the compressor and motor are hermetically integrated.

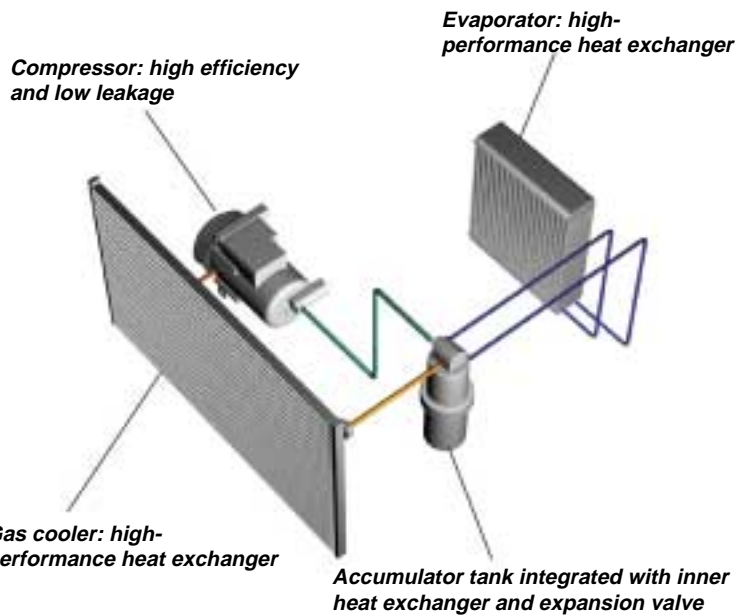
Given their success, Denso engineers are quick to point out that before CO₂ A/C systems can enter the mass market, cost and weight must be reduced and reliability improved. The infrastructure for service and maintenance equipment as well as standardized procedures for handling CO₂ systems for service and maintenance need to be developed. Because these issues are very difficult for one company to tackle, Denso intends to work with automakers, other A/C system suppliers, and governmental agencies worldwide.

Kevin Jost



capabilities to provide cabin heat in Toyota's FCHV-4 fuel-cell hybrid vehicle (see figure), which cannot rely on waste heat from an IC engine for this capability. The system switches from heating to cooling mode via two bypass valves. Refrigerant circulates in the system much in the same way it does in the

A/C-only CO₂ system. For heating, bypass valve 1 closes and bypass valve 2 opens, then the air-mix dampers of the interior gas cooler open. The high-pressure and -temperature refrigerant discharged from the compressor exchanges heat with the air while flowing into the interior gas cooler. The system can



The basic configuration of Denso's CO₂ A/C system.

Luncheon cancelled

Please note, the Women Engineers Committee's planned luncheon and "Achieving Work/Life Integration" panel scheduled for tomorrow, March 6, from 11:30 a.m. - 1:45 p.m. in Room O2-44, has been cancelled.

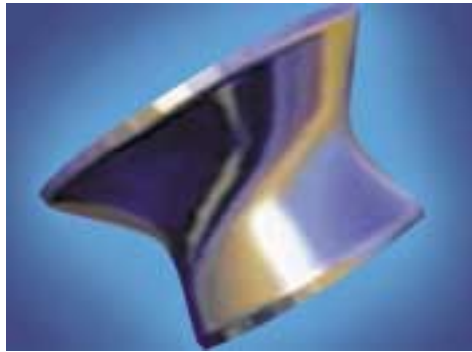
AEI Tech 2002 Awards

Each day, AEI Show Daily editors highlight some of the top products and technologies on display at the SAE 2002 World Congress.

Test and device automation

A modular, PC-based system from **PEUS-Systems Inc.** considers the complete testing, archiving, management, evaluation, and quality control needs of modern testing laboratories in the automotive industry. It focuses on the automation and integration of all measuring devices on test cells as well as portability, open interfaces, and compliance with international standards. The system can be extended for integration of additional tests, test cells, and devices, including central parameter and data management, networking, and global data access. It provides interface drivers to all existing devices.
Booth 1151

Fastening system



The **AKH Fas-ner** solves problems inherent with other joining methods. Benefits of the system include the ability to join precoated metals as well as dissimilar metals, electrical continuity at the joint, visual joint quality confirmation, elimination of plating bleed-out, a vibration-

resistant solid joint, quality consistency from joint to joint, and high corrosion resistance throughout the joint. The system is a simple punch and die operation that automatically feeds, punches, inserts, and locks the self-piercing, flush-mounted Fas-ner to produce a solid joint in one high-cycle operation.

Booth 2501

3-D interactivity



Vicon Motion Systems' CAD with 3-D visualization software allows designers and engineers to interact in digital environments. The subject wears highly retroreflective markers, 3-D head-mounted display, and data gloves. The system captures the

subject's 3-D data points and tracks movement. Ergonomics, visualization, and human factors software programs are used to verify human interaction with product design. Virtual training and maintenance can be accomplished concurrently at the design stage.

Booth 1701

CFD package

FLUENT 6, which is built on **Fluent Inc.**'s core unstructured technology platform, expands the automotive applications for CFD simulation, including deicing and water runoff, fuel tank studies, HVAC systems and components, painting, and flow-induced noise. Major enhancements in turbomachinery modeling and underhood thermal analysis provide economical design testing options for automotive engineers. A moving/deforming mesh capability, released in beta form with this version, is one of many building blocks in the release intended to tackle challenging IC engine modeling.

Booth 2450



Oil-pan filtration

The all-plastic oil-pan-filtration system from **SPX Filtran** integrates different processes and components into one product. It is designed to provide a "fill for life" concept for transmission filtration. The



modularized system provides almost 50% system weight reduction over replaced components, cost reduction due to reduced number of components and assembly steps, synchronization of components (six into one system), and improved quality control due to one supplier rather than six. The suction inlet position allows the customer to reduce ATF consumption substantially while reducing cavitation. Booth 2765

Communication controller

The TTP/C protocol is finding more applications in safety-critical systems such as those used in the automotive industry. **TTTech Computertechnik AG's** new TTP/C controller models are designed to meet the TTP/C specification and can be transferred to silicon as a stand-alone device or as part of an SOC solution. The C2 and C2S models allow communication at speeds up to 5 Mbit/s in asynchronous mode and 25 Mbit/s in synchronous mode. The configurable bus interface module affords 8-, 16-, or 32-bit width and either Intel or Motorola type accesses. The first TTP/C-C2 silicon implementation, a stand-alone controller, is available from **Austriamicrosystems AG** and has AS8202 as its device number. The firm will bring the C2S version, called AS8202S, on the market shortly after the AS8202. **NEC** is also implementing a stand-alone controller based on the TTP/C-C2S and supporting the full 32-bit host CPU bus interface.



Magneto-rheological fluid

Lord Corp. and **Delphi Automotive Systems** co-developed the magneto-rheological (MR) fluid used in Delphi's MagneRide semi-active suspension system, which features a monotube design with no electromechanical valves or small moving parts. The peak power is 20 W at each of the system's four dampers. The specially formulated MR fluid has a low viscosity that is forced through a magnetized opening in the MagneRide damper. The material changes from a fluid state to a semi-solid state that is directly proportional to the magnetic field applied to it.

Magnetic particles in the fluid form a dense network of chains when a magnetic force is applied to them. When it is removed, particles revert to their free, unchained form and allow movement of the dampers. MagneRide provides a 5-ms response time, which is three to five times faster than the hydraulic system in the CVRSS damper. Booth 1711



Magnesium opportunities and challenges discussed

The war of the metals is raging all over the world. Automakers, challenged by the need to produce lighter vehicles with improved fuel economy and environmental performance, are in hot pursuit of the most technically feasible and cost-efficient alloys. Aluminum, plastics, and steel have long been in fierce competition to become the material of choice for construction of lighter weight vehicles, but recently, a new player has entered the playing field—magnesium.

World-renowned experts addressed advances in magnesium technologies for automotive applications during an all-day session, "Magnesium Technologies for the Automotive Industry," yesterday. The session consisted of numerous technical papers focusing on the technical advances and challenges faced by magnesium suppliers.

"Rapid technical advances in magnesium alloys and processing is driving automakers and suppliers to magnesium—the lightest of all commonly used metals," said Stephen Erickson, Technical Specialist, **Noranda Magnesium** and Co-Chair of the SAE session. "In 1990, a typical vehicle consisted of 1.4 kg (3 lb) of magnesium. Today, this has increased to 3.6 kg (8 lb). With recent advances in high-temperature strength and creep resistance, the metal makes even more sense for automakers who are looking to reduce weight in high temperature areas under the hood, such as automatic transmission cases and engine components."

Because magnesium has excellent flow characteristics, thin-walled die castings for a variety of automotive parts can be manufactured. Thin-walled parts reduce the weight and cost of castings because less material is needed.

The magnesium alloys industry has witnessed double-digit growth since the late 1990s and continues to grow at that rate today. Over the next few years, a forecasted over-supplied marketplace will further challenge magnesium producers to add more value to their product at a reduced price to customers.

At present, magnesium is primarily used for production of interior automotive components such as steering column brackets, instrument panels, seat frames, steering wheels, ashtray doors, sunroof track assemblies, and mounting structures for audio equipment. New developments give promise to expand these applications to powertrain and chassis components.

Jenny R. Hessler

Cultural Diversity Workshop planned

A Cultural Diversity Workshop discussing "Global Enigmas - Coping with Alternative Perspectives" will convene today beginning at 2:00 p.m. in Room D2-O8. Panel members, representing countries such as Brazil, Germany, India, and Japan, will represent an integral part of the program, offering their native country's perspective to the illustrated cross-cultural situation. Content will include defining stereotyping; introduction of the cross-cultural situation; cultural sensitive behaviors for successful problem solutions; five-step method for problem solving across cultures; panel members' specific views to the problem solving solution; and an interactive discussion with panel members and the audience. Organizers include Maria F. Baker, **Culturespan Relocation & Language Services**, and Bruce D. Peters, **Fiat Auto Powertrain Italia**.

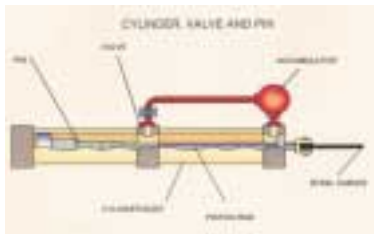
What's New from the exhibitors



The SAE 2002 World Congress provides industry suppliers the opportunity to showcase their products, services, and technologies to the global automotive community. Show Daily editors review what some exhibiting companies are displaying this year.

Hydraulic deceleration

A new concept in programmable deceleration systems from **Aries Ingeniería Y Sistemas**, S.A. is used for upgrading the deceleration pulse-control capabilities of existing or new crash simulation systems. The technology allows test engineers to program complex deceleration curves for regulation compliance, R&D, or for conformity of



production testing. The test sled runs into an array of steel cables symmetrically connected to two hydraulic rams. The cables pull the piston rods of the hydraulic cylinders, forcing the oil through the exit orifice of the regulation valve. The system consists of a valve that controls oil flow through a variable area orifice, regulating pressure and force in the cylinders connected to the arresting system. The system is suitable for new facilities and for upgrading existing tracks, as it can be easily installed. Booth 844

Release coatings

DuPont TraSys water-based release coatings are environmentally safe, enabling molders to meet even the most stringent existing and anticipated environmental regulations. TraSys is free of volatile organic compounds and ozone-depleting chemicals. DuPont also has eliminated chlorinated solvents from its release products rather than replace them with carcinogenic solvents or flammable alcohols. The releases are manufactured using highly effective, stable raw materials and are mixed in a unique blending process to yield the desired durability. Product consistency and reliability keep production running smoothly, while competitive pricing, combined with the high levels of performance and longevity, provides the most cost-effective release available for elastomer molders. Booth 2632

Engine development



IAV Automotive Engineering's FI^{2RE} is a tool for engine research and development. It increases the flexibility of injecting and igniting fuels for diesel, gasoline, or natural gas. The unit is capable of up to five injections per cylinder, per 720° crank angle. The injections are also capable of being simultaneous on several different cylinders. The FI^{2RE} can be used for up to eight cylinders on gasoline engines (injection and ignition) and

up to 12 cylinders when used on diesel engines. It can be controlled by any CAN communication controller. The field of application for the FI^{2RE} ranges from emissions research and testing to the evaluation of new unconventional injection and ignition sequencing, such as rate shaping or microinjections. The tool's structure and software are fully flexible and may be customized. The product is based on a Motorola MPC555 controller.

Booth 2905

Anti-pinch protection

Mayser's anti-pinch protection systems for side windows are equipped with pressure-sensitive sensors. Two conductive surfaces are either integrated directly in the rubber seal of the window or are inserted in an additionally mounted rubber profile. If something gets caught between the rubber and the



window, the contact is closed and the window movement is stopped or reversed. An advantage of the pressure-sensitive protection is its extremely short response time. In addition, the switching behavior of the sensors is consistent; the weather and strong vibration do not affect it. The sensors switch only if a small amount of pressure is applied to them. The company is currently working on a presence sensing anti-pinch protection system that uses ultrasonic technology. Ultrasonic sensors can be used in power roofs for convertibles that require other solutions because of a lack of a solid frame.

Booth 3148

Decoupling element

Witzenmann's KSE stainless steel decoupling component will be used by DaimlerChrysler for all 2002 Mercedes S-Class V8 turbo diesels. The decoupler eliminates noise in



the engine and exhaust systems. The component is approximately 76 mm (3 in) wide by 51 mm (2 in) long. Designers started with the internal tube for exhaust gases, then covered it in multi-layer bellows with 3-5 corrugations. The unit is sleeved in a wire mesh ring, which further muffles noise.

Booth 1846

Limited slip differential

The Super LSD (limited slip differential) from **Tochigi Fuji Sangyo KK** includes a core clutch developed to work well with the strut suspension found in front-wheel-drive vehicles. The unit also works well in the front axle of four-wheel-drive off-road vehicles. Compared to other torque-sensing LSDs, the super LSD



has a lower torque bias ratio (1.5-2.0), which fits well with front suspension systems. Production costs are lower because of similarities to open differentials, and the device can be lubricated with standard differential fluid or ATF. The system can easily replace open differentials because it uses many of the same components and features identical installation points. The device provides good handling and control as well as a cost reduction. Booth 1757

Diagnostic tools

Diag3G and VCI PartX are new diagnostic tools from the **ACTIA Group**. Diag3G is a rugged, 400-MHz PC-based service tool with standard interfaces including USB, Ethernet, RS232, and PCMCIA. Compact and lightweight, it incorporates a hard disk, a CD or DVD drive, a VCI, a 10.4-in TFT display with touch screen, and a NiMH battery with its charger. VCI



PartX is also a rugged, PC-based wireless communication interface designed for end-of-line diagnostic. It supports TCP/IP protocols and a high-speed CAN bus to download software to the relevant ECU quickly and efficiently during vehicle manufacture. Booth 2067

CFD package

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provide economical design testing options for automotive engineers. A moving/deforming mesh capability, released in beta form with this version, is one of many building blocks in the release intended to tackle challenging IC engine modeling. Booth 2450



Combustion diagnostics

AVL Visiolution sensor and data-processing technology monitors flame events in standard, multicylinder engines and demonstrates potential improvement areas of the combustion system. The sensor technology is based on the use of optical fibers and micro-optic front elements. Standard applications include flame propagation stability



diagnostics at low- and part-load conditions, and the location of knock centers at high- and full-load and of combustion events caused by rich mixture regimes, hot spot ignition, or homogenous compression ignition.
Booth 1001

Crash wall

BIA offers a turnkey measurement system that helps quantify the structural integrity of vehicles in full-frontal, frontal-offset, and side-impact crash test conditions. The system consists of a load cell matrix of 64 independent tri-axial cells that is installed to a frontal barrier face (FMVSS 208) or movable barrier (FMVSS 214). The load cells are capable of impact forces of up to 400 kN (89,900 lb) in the x-axis and 150 kN (33,720 lb) each in the y- and z-axis, with a total accuracy of 0.5% across the measurement range. Test parameters such as load-cell range and auto or manual calibration are easily configured using a Windows-based PC. The data-acquisition system is installed on top or inside of the load-cell structure to minimize complex cabling and associated losses in accuracy. Communication with the control system is made via fiber-optic cable using IEEE or Ethernet communications protocol.
Booth 751



Sound and vibration testing

Brüel & Kjær's PULSE Production Test System is a turnkey QC system for measuring the sound and/or vibration of a product on a test stand. At the heart of the system is the PULSE Multi-Analyzer that performs a variety of analysis techniques simultaneously and in real time, thus keeping cycle time to a minimum. The production test advisor software provides pass or reject ID, stores the data in a database, and provides Pareto charts of the reject statistics. The system is designed to be configurable with a standard Windows interface for a range of applications, thus avoiding the need for custom software.
Booth 838



Isolated analog input

The CR9058E 50-V isolated analog input module from **Campbell Scientific** further extends the capability of the CR9000 measurement and control system. The module includes 10 differential or 20 single-ended channels (software selectable) with individual A/D converters on each channel for simultaneous sampling at up to 50 kHz. Input voltages can be as large as ± 50 V dc, but with a 24-bit A/D converter, even a millivolt output of unconditioned thermocouples can be read within $\pm 0.1^\circ\text{C}$. The module features easy-connect capability, which allows wiring to a separate connector that plugs into the module and frees the data-acquisition system to be moved to different test stations.
Booth 804



Optical sensor

The Correvit HS-CE optical sensor system from **Corrsys-Datron Sensorsystems**, Inc. simultaneously measures roll angle, pitch angle, longitudinal speed or vectoral velocity, transverse speed, and drift angle. The sensor is the first measurement device to incorporate the Correvit pupil-splitting technology that allows

measurement of movement in three axes with a single optical path. This capability provides increased accuracy, a measurement field diameter of 30 mm (1.2 in), and a local resolution of up to 0.5 mm (0.02 in).

Booth 942



Development tool

Dearborn Group's Hercules is a high-performance development tool that supports advanced CAN network analysis and interaction with in-vehicle network systems. Using the 32-bit Windows-based application in conjunction with



the company's *Gryphon* hardware interface, users can monitor, receive, filter, transmit, and edit CAN frames over a variety of communication links. Other features include support of up to six CAN channels, support of Intel/Motorola/GM-Monarch data forms, real-time playback of captured buffer information, and the ability to transmit a frame table using 34 available hot keys. Booth 959

Dynamometer control

Dyne Systems Co.'s Inter-Loc V dynamometer control system is a software-based multi-loop controller for up to three dynamometers or throttle control devices. Each control loop is updated 1000 times per second, providing fast, precise, repeatable control, even at rapid transient rates. The Inter-Loc V is modular in design, so only the components required for the specific testing application are integrated into the control system. The basic unit has three slots into which any combination of dynamometer or throttle control modules is inserted. External instrumentation is connected to the MS and Sub-D connections on each module. All popular dynamometers are supported, including ac and dc motoring, eddy current, water brake, chassis, dual-ended, and hydraulic. Control and monitoring of the system is easily accomplished with a rack-mountable unit. It contains a full VGA active-matrix-color LCD with a touch-screen interface, which displays dynamometer and engine speed, torque, power, and vacuum (if implemented). Booth 114

Support software

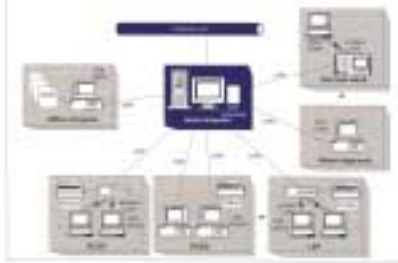
e-GIP Software AG has developed an intranet- and Internet-supported innovation process called the electronic-Generic Innovation Process (e-GIP). The software is a knowledge and process platform for the support of innovation and workflow management. It is an assistant for project management, a platform



for idea management, and an information center for all project activities. The specific connection to mailing systems enables automatic control of all project-relevant activities, which enables e-GIP to increase the performance of processes and the efficiency of employees by a noticeable margin.
Booth 3229

Universal test system

Froude Hofmann's Universal Test System (UTS) features state-of-the-art software that covers all possible checks regarding end-of-line tests. As a unified automation and measuring system, the UTS can control roll test stands, wheel-alignment machines, and headlight-aiming stations. It provides programming and diagnosis of vehicle control units and testing of electronic components.
Booth 2551



Vibration indicator

The Model 683A from the IMI Sensors division of **PCB Piezotronics, Inc.** is a panel-mount, digital vibration indicator with alarm. The device operates from ac or dc power and provides excitation for ICP accelerometers or 4-20 mA, loop-powered vibration sensors. An LED display provides scaling and menu-driven setup of up to four set points, each with individual status indicators and relay outputs. An adjustable time delay eliminates false alarm trips due to momentary vibration upsets.
Booth 1115



Remote visual inspection

Everest VIT is offering an upgrade program to enhance the video, language, and storage functionality of its VideoProbe XL PRO and Industrial XL PRO inspection



devices. The XL PRO is a portable, multi-purpose video borescope incorporated with the firm's iView platform, which allows images to be manipulated, stored, or copied for in-the-field or off-site assessment using a joystick controller. When upgraded to version 2.2 software, the XL PRO allows a user to choose from a menu of up to five operating languages (English, French, Spanish, German, or Italian). The v2.2 software upgrade also provides improved split-screen display, enhanced image zooming with both pan and steer views, and a character generator overlay for both still and live video.
Booth 1659

Liquid-crystal pigment

Wacker Silicones' Helicone HC special-effect pigments create innovative, optically variable color effects based upon liquid-crystal-modified organic molecules. Interference effects cause reflection of a certain spectral component of the incident light, with transmission of the remainder; there is no absorption of light in the visible spectrum. A base color undergoes a strong shift toward short wavelengths as the viewing angle changes or narrows. The pigments and the optical enhancer HELIPLUS additives have created a formulation space in which the synergy of these materials allow opportunity for reduced cost while developing spectacular and unique appearance and performance characteristics. Rather than relying on color development strictly from the pigment itself, the appropriate use of the technology allows for greater color impact due to reflectivity and particle spacing.
Booth 2509

Contour welding

Leister Lasersystems' Novolas C is a flexible system that performs welding as the workpiece is guided beneath the laser spot on a precise x-y table. The Windows-based software allows for easy



programming of various weld patterns and features two levels of password protection for safe and secure operation. The versatile clamping device enables quick changeover and economical job lot production.

Booth 3350

Helium leak detector

MKS Instruments' PICO Series is a portable mass spectrometer-based leak detector that weighs only 7.3 kg (16 lb). Using an ion-trap mass spectrometer, the unit can detect leak rates as low as 1×10^{-7} atm-cc/s from pressurized lines or enclo-



sures and from vacuum chambers. The device is suitable for air-conditioning, automotive, petrochemical, and semiconductor applications. The PICO also has an integral vacuum system, which incorporates a turbomolecular pump as well as a backing scroll pump. It measures approximately 100 mm (4 in) wide, 380 mm (15 in) long, and 250 mm (10 in) high. A touch-screen interface displays the current helium leak-rate and historical leak-rate data. An adjustable audio signal is provided.

Booth 2862

Airbag deployment testing

Microsys Technologies Inc. has completed the installation of a fully automated, static airbag deployment room within its new facilities. The 3.7- x 3.4-m (12- x 11-ft) room has an operator area complete with viewing window and allows for the installation of up to three



SureFire control systems for product development, demonstrations to potential buyers, and training of new hires, customers, and sales agents. Customers may rent the facility for test deployments if their own facilities are not available or capable of meeting peak test demands. The facility includes SureFire control system and software, PowerPlay analysis software, dual Redlake HG2000 imagers, dual 2A squib supplies, squib resistance, squib current readback, automatic light control of seven 1000-W halogen lights and a 35-W HID light, combination of mobile light poles and ceiling-mounted light track, safety interlocks, ambient temperature and humidity monitoring, and flexible test fixture to accommodate different types of airbags.

Booth 819

Terminal material

C18080/K88, a new precipitation strengthened alloy designed to meet the needs of the automotive connector market, was developed jointly between **Olin Brass** and **Wieland Werke**. C18080 addresses the demand for high conductivity copper alloys with improved strength, formability, and stress relaxation. The alloy has strength up to 550 MPa (80 ksi) combined with 80% IACS electrical conductivity. These properties, combined with the ability to operate at temperatures up to 200°C (392°F), make the alloy suitable for demanding applications.

Booth 2950

Test chambers

Tenney Environmental's new series of rapid-cycling test chambers can simulate temperature or temperature and humidity conditions and are well suited for use in electronic, automotive, and military quality assurance and reliability testing, as well as research testing and production processes. The chambers are offered with workspace sizes of 0.14, 0.31, 0.59, 0.91, and 1.13 m³ (5, 11, 21, 32, and 40 ft³) with a temperature range of -70 to +200°C (-94 to +392°F). They include removable access panels to the refrigeration system, control system, and optional accessories. The design allocates space within the interior of the cabinet for all standard options, which improves the mobility of the unit as well as the overall appearance. The chambers also include a touch-screen controller that provides precise control over chamber operations and monitoring and is mounted at eye level. Airflow uniformity was improved by adding a ceiling plenum that circulates the conditioned air vertically down through the chamber.

Booth 511

Coaxial connector

Rosenberger's 360°-turnable, right-angle coaxial connector is custom-made for automotive applications with small spaces or limited accessibility. The connector is resistant to temperatures from -40 to +100°C (-40 to +212°F) and features small dimensions for easy installation in tight spaces. The connector is available in all FAKRA codings from A to Z. The unique rotation ability eliminates the need for different angle configurations of the same keyed part.

Booth 2671



Driver attention

Pi Technology's Phantom system allows the driver to manually activate controls without removing concentration from the road ahead. The system tracks the location of the driver's hand through a combination of proximity sensors on the instrument panel, and the display shows a graphical map indicating the closest control to the hand. When a control is touched, there is an immediate visual indication of that control. The system also features SWorD, a display unit built into the upper rim of the steering wheel. It uses a combination of LEDs and an eight-character matrix display to provide text and graphics information. Because the top of the wheel is visually located at the bottom of a driver's peripheral vision, it can be glanced at while looking in the direction of travel. The display is only activated when necessary.



Booth 1716

Level sensor

The LS-60 level sensor from **Power Components of Midwest, Inc.** features enhanced plastic components, internal contacts, and concentricity, resulting in improved trip accuracy and reliability. The height is reduced and o-ring seals are added to the top and bottom to ensure the hermeticity necessary to survive harsh conditions. The standard top-mounted bubble level makes calibration easy, and the new mounting bracket offers additional mounting options. Custom x and y trip angles can be created quickly and with minimal expense.

Booth 2456



Software development

TTP-Tools from **TTTech Computertechnik AG** support embedded software engineers with a powerful production development environment for building a fault-tolerant, real-time, time-triggered communication architecture. The TTP-Tools software addresses the needs of the systems engineer in the automotive, aerospace, and industrial control application domain. TTP-Tools provide rapid, harmonized, and systematic development while smoothly integrating into the existing development process. The 5th generation of TTP-Tools includes enhanced functionality and algorithms for fault-tolerance, new user interfaces, as well as support for the TTP/C chip generation. With TTP-Matlink and TTP-Tools, the user can design a model, generate application code and fault-tolerant communication drivers with specialized code generators, download the resulting application right down into the target, then calibrate and test the distributed application.

Booth 2413



Decorative plastics

Serigraph's Chrono-style decorating solutions provide the look of metal with low-cost, lightweight plastics. With a proprietary combination of screen printing, Select Metalization, and textures, the decorating process is suitable for instrument clusters and dials. Designers can create metallic effects in virtually any color, as well as incorporate rainbow or holographic effects, shine, glitter, brushed metal, and backlit graphics, which help achieve durable, high-end, cockpit styling and luxury looks without the cost of using metal.

Booth 517

Stepper motor chips

Trinamic's TMC235 family of stepper motor driver chips is a fully protected two-phase, 650 mA / 850 mA CMOS chip with serial interface and integrated DACs for low vibration ministepping. Open loop, short circuit, and over-temperature conditions are signaled via a number of status bits. The chip is available in a standard SO28 as well as in a thermally optimized chip-size package. Its wide operating temperature range makes it suitable for use in automotive applications. Together with the TMC428, the chips allow the setup of very compact, low-cost, one- or multi-axis positioning systems, which do not require any processing power for the control of movements.

Booth 3338

Constant-speed motors



Thomson Airpax Mechatronics' TAM58 Series of brushless dc motors combine nine-slot stator and 12-pole rotor design to deliver constant speed in a compact package. The modular motors can be ordered with an internal Hall-sensor wire-harness assembly, full onboard drive electronics, and optional heavy-duty, permanently lubricated, maintenance-free gear trains. The family consists of three standard motor lengths for maximum power output. Model 58MD080 is 80 mm (3.2 in) long with output power of 47 W, Model 58MD088 is 88 mm (3.5 in) long with output power of 60 W, and Model 58MD093 is 93 mm (3.7 in) long with output power of 90 W. Applications include automated conveyor systems, bar code labeling, printing, pumps, valves, machine tools, and agricultural equipment.

Booth 547

3-D interactivity

Vicon Motion Systems' CAD with 3-D visualization software allows designers and engineers to interact in digital environments. The subject wears highly retroreflective markers, 3-D head-mounted display, and data gloves. The system captures the subject's 3-D data points and tracks movement. Ergonomics, visualization, and human factors software programs are used to verify human interaction with product design. Virtual training and maintenance can be accomplished concurrently at the design stage.

Booth 1701



Environmental test chambers

Thermotron's SL-Series environmental test chambers provide increased capacity for applications involving high-volume throughput or large test articles. With increased internal dimensions, the chambers can handle product loads with dimensions in excess of 1200 mm (48 in). SL chambers range in size from 1475 to 2500 L (52 to 88 ft³). Selectable compressor sizes from 4.5 to 18.6 kW (6 to 25 hp) are available to tailor operating performance to individual client or industry-specific needs. In



addition to extreme temperature testing from -70 to +180°C (-94 to +356°F), the line of chambers is available with a full-range humidity system. The instrument incorporates a disk drive for data logging and convenient program storage. ThermoTrak II software simplifies lab management and improves performance by saving time, increasing productivity, and cutting costs. It links multiple chamber controllers to a central PC and lets tests run on several chambers simultaneously.

Booth 1725

Embedded control code

Real-Time Workshop Embedded Coder 2.0 from **The MathWorks, Inc.** is a model-based design solution that meets the need for production-quality C-code generation for embedded target deployment. It is efficient, readable, clean, and accurate in implementing the Simulink model and is customizable for specific customer needs. The code has improved in terms of embedded RAM size, ROM size, and execution speed over the first version released in November 2000. Code generated from Simulink models with pre-production versions of Real-Time Workshop Embedded Coder has already been used in automotive powertrain-control designs and received FAA certification in aerospace applications.

Booth 1629

Calibration system

Messring's DASCAL calibration system reduces the cost and time of calibration. Script-controlled software enables calibration in various adjustable modes. The software controls and monitors the entire calibration sequence automatically. The results for each



channel are compared automatically with standard values, then stored in a database and printed in the form of a calibration report. The stand-alone system also can be installed in existing NA33 data-acquisition systems as a plug-in card. Standard calibrations including static and dynamic calibrations, freely programmable calibration routines, and the production of any type of graph with 0 to 10 kHz and 0 to ± 5 V or 0 to ± 0.05 V can be performed simultaneously with a 16-bit resolution for eight analog or 16 digital channels.

Booth 731

Wheel force sensor

Sensor Developments, Inc.'s six-axis wheel force sensor automatically corrects and references a ± 5 V output signal to vehicle ground for each force and moment axis. The system includes the multi-axis sensor, rotating electronics, stationary hub, and receiver console. Features include noncontact signal transmission, crosstalk compensation $< 2\%$ FS, nonlinearity and hysteresis $< 0.5\%$ FS, high sample rate, 14-bit A/D resolution, 0-5 V dc rpm output, onboard shunt calibration, encoder resolution of 1500 ppr, and capacity ranges available from passenger vehicle to light truck.

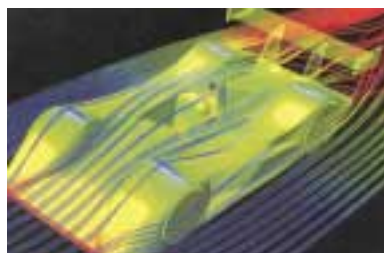
Booth 413



CFD software

CFX-5 computational fluid dynamics (CFD) software from **AEA Technology's** CFX division assists customers in improving profits by optimizing every aspect of fluid flow analysis. The product's latest release, CFX-5.5, provides a range of new modeling capabilities, meshing tools, and a new post-processor. It ensures robustness, ease of use, and accuracy via an advanced coupled multi-grid linear solver technology, enhanced meshing flexibility, high parallel efficiency, good pre- and post-processing capabilities, and a range of physical models including multiple frame of reference, turbulence, combustion, radiation, Eulerian two phase, and free surface flow. An open architecture encourages customization on all levels.

Booth 2250



Torque transmission

Wacker Ceramics' EKagrip nickel-diamond coating significantly increases the coefficient of friction between engine component surfaces. EKagrip frictional foils permit the transmission of up to three times the load possible with conventional systems, without the need to modify the joint design. Typical applications are joints between timing, balancing, and auxiliary drive attachments to crank- and camshafts, as well as drivetrain components such as clutches and manual or automatic transmissions.

Booth 2509



Fuel-tank test stand

Analytical Process Systems' fuel-tank-durability test stand, or Pressure Vacuum System (PVS), simulates pressure and vacuum variations that develop within fuel-tank systems during normal vehicle operations. The variations are typically due to fuel motion, tank wall motion, engine vacuum, and fuel vapor pressure changes. The PVS determines the fatigue life of the fuel tank by alternately applying internal pressure and vacuum to the tank at a given rate. Each cycle, consisting of one pressure and one vacuum run, executes four times per minute. Additionally, the PVS performs a leak test between cycles that consists of pulling a vacuum and holding it while measuring vacuum decay. The system offers both automatic and manual modes with easy customization of most test procedures to meet specific test requirements.

Booth 501



Die-face design

AutoForm Engineering's AutoForm-DieDesigner software for rapid die-face design and optimization improves quality, cost, and lead times in the design of sheet-metal parts and stamping dies. Tooling engineers can create fully parametric die-face designs rapidly from CAD surface data and can immediately try out and optimize their designs with integrated stamping simulation modules. Key features include fully automatic and semi-automatic design of binder and outer/inner addendum using profiles, easy part and tool modifications (morphing), automatic fill of holes and double-attached parts, and export of tool surfaces to CAD. For typical automotive parts, the complete die face can be created in only 60 min.

Booth 2464



Variable valve timing from Jacobs

As controller area networks (CANs) for vehicles become more commonplace, engine designers are pursuing advanced, next-generation variable-valve-actuation (VVA) technologies to achieve the elusive goal of direct, cycle-to-cycle, digitally controlled air management.

Jacobs Vehicle Systems (Booth 1844) believes that precision control of the last part of the ICE "trinity" (spark, fuel, and air) will bring even more astounding performance and gave two presentations on the subject yesterday.

A partial list of engine benefits resulting from cycle-to-cycle ICE air management includes:

- Reduced fuel consumption
- Lower emissions
- Improved starting and idle
- Faster warm-up
- Increased low-speed torque
- Reduced transient response time (or, in "blown" engines, reduced turbo lag)
- Engine braking (compression release)
- Exhaust-gas-temperature control for aftertreatment systems
- Advanced combustion processes using multiple types of fuel.

The race toward throttleless petrol engines and "variable displacement" involves a whirlwind of technologies. Tremendous promise is held in the application of increasingly flexible air and fuel systems, according to Jacobs. Most systems released and under study are for petrol engines, where big benefits are easiest to reap. Some state that even diesel engines could benefit with the right system, especially in terms of emissions control/reduction and driveability. Which valvetrain architecture will be the basis of future engines remains a question.

Technologies can be divided into two groups: systems using camshafts and camless systems. Technologies may also be classified as primarily mechanical, electrical, or hydraulic (or various combinations of these).

The commercialization of high volume, digitally-controlled, lost motion, electrohydraulic VVA systems for diesel engines of all sizes is part of Jacobs' near-term corporate objective. Why diesel VVA? Because, Jacob says, the company has more than 40 years of expertise in precision valve actuation for compression-release engine braking in heavy-duty diesel engines. The low-lift secondary exhaust valve opening shortly before TDC compression (Jake Brake technology) turns power-producing diesels into power-dissipating vehicle retarders. Indeed, hydromechanically created compression-release valve events can be seen as an early form of VVA technology.

Characteristics of Jacobs VVA Systems

- Non-catastrophic failure mode (cam profile can protect against valve-piston contact)
- Reliability (valve seating velocity and valve-piston clearance requirements met without sophisticated controls)
- Repeatability (less subject to trigger valve variability)
- Controllability (can provide secondary events without separate triggering)
- Limp home (limited lost motion) capability
- Low parasitic loss

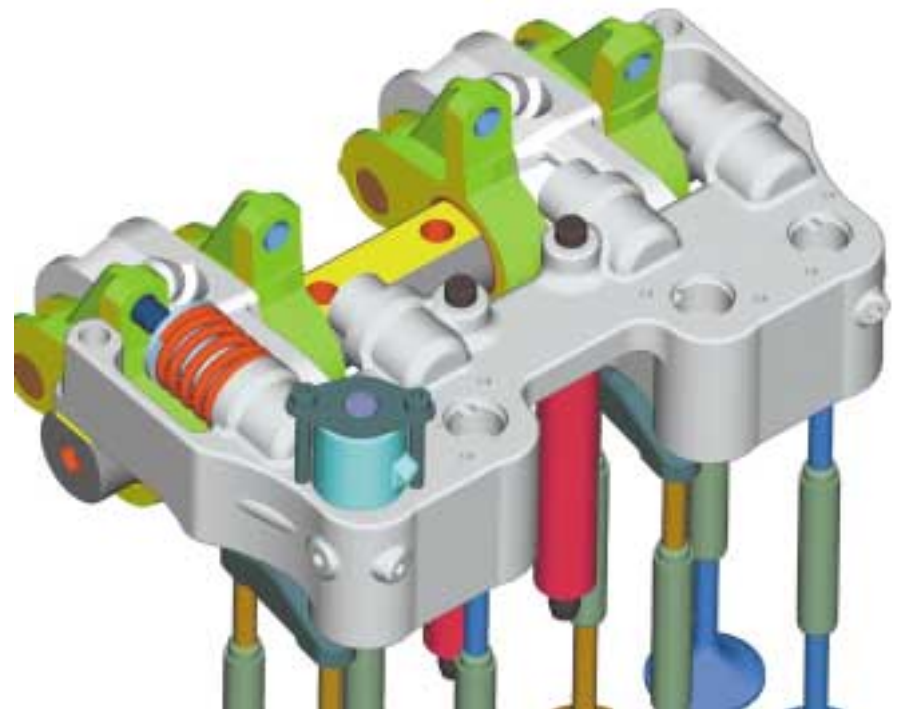
predicted benefits for a high-speed diesel engine that include:

- Reduced fuel consumption (4-5% average in various missions)
- Increased low-speed torque 400 kPa (8333 psi)
- Improved startability
- Improved transient response (20% quicker vs. standard engine at low RPM)
- Braking power (80% of positive power).

Concepts have been initiated at Jacobs for petrol engines to take advantage of known benefits in fuel economy and emissions reduction. Working within reliability paradigms of heavy-duty engines, the concepts add little in the way of incremental engine parts or expense and can even eliminate some existing engine hardware.

Relying on a conventional camshaft with special profiles enables engine benefits to be achieved reliably without concern for dreaded valve-to-piston contact. Cam-based lost motion systems are capable of the types of valve event flexibility that diesel or petrol engine designers would like to have.

In pursuit of increased engine retarding power, engineers at Jacobs realized that variable timing of the compression-release event was needed for ultimate performance across the engine-speed range. It also led to the realization that application of the same hydraulic principles used for engine braking could significantly



Jacobs concept to be used for engine testing and production viability analysis for heavy-duty VVA system.

improve positive power engine performance and emissions control as well as enable further increases in retarding power at all engine speeds.

Jacobs is continuing to produce engine-retarding systems while concurrently developing VVA systems. With such inherent efficiencies of the diesel, worthwhile benefits remain a challenge. However, Jacobs has

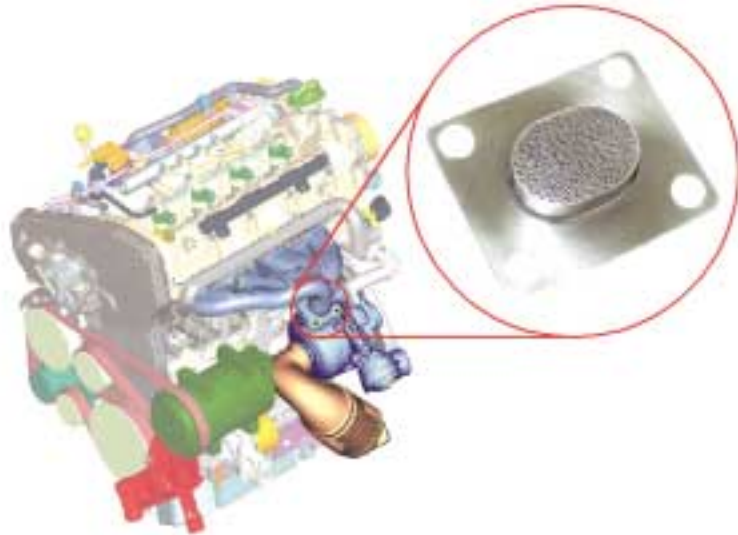
Capabilities of Jacobs VVA systems include control of valve lift within cam profile limits to enable early valve closing (Miller-cycle benefits); secondary valve events (e.g., compression-release braking, internal EGR); valve-lift cancellation (cylinder cut-out/variable displacement); and lift variation for reduced valvetrain power consumption, fuel economy, and breathing.

Patrick Ponticel

Aftertreatment strategies for small diesels

According to researchers from **Fiat** and **Emitec** who presented a paper during the Diesel Exhaust Emission Control Technical Session yesterday, the number of diesel-powered vehicles has increased significantly in recent years, mainly because of their low fuel consumption. In contrast to vehicles using gasoline engines, diesel cars had no need of exhaust emissions controls in Europe. With more

Engine-related reductions in NOx or particulate emissions from diesel engines can only be achieved, based on today's combustion processes, to the detriment of one or both components. As a result, it is likely that particulate reduction will require filters. Flow-through particulate traps are a new development that prevent plugging when regeneration fails to work.



In a study by researchers from Fiat and Emitec, a small catalyst was mounted before the turbocharger to take advantage of the thermal energy of the gases.

restrictive regulations and further reductions of emissions limits expected in the future, aftertreatment strategies have become crucial for small passenger cars.

Catalytic converters are more difficult to apply to diesels. The exhaust temperature is low and the engine runs lean, preventing NOx control with a three-way catalyst. Catalytic converters on diesel engines often fall below light-off temperature during deceleration and idling modes of the European driving cycle. Soot particles in the exhaust must also be contained.

In a turbocharged engine, the turbocharger acts as a heat sink, reducing exhaust gas temperature downstream by 50-150°C (90-270°F). During research, a very small catalyst was mounted before the turbocharger to take advantage of the thermal energy of the gases. Despite a small catalyst volume of 0.025-0.045 L (1.5-2.7 in³), high efficiencies were observed.

Another possibility for a catalyst optimization of a diesel exhaust system is a hybrid catalyst that uses different thermal masses within one substrate mantle. The object obtains fast light-off with improved heat storage.

The research done on a 1.9-L common-rail engine showed that installing a small catalyst in front of the turbocharger eliminated the need for the under-floor catalyst.

The small volume reduces the cost of the catalyst in noble metals and canning materials. The substitution of a hybrid catalyst for a metal substrate catalyst with the same cell density reduces HC and carbon monoxide emissions. The flow-through particulate trap shows a reduction of 22% compared to the production system. No significant power loss is measured from the production system combined with a pre-turbocharger catalyst.

John Fobian

Olefinic instrument panels

In the early 1990s, engineers had concluded that no single material would dominate the construction of instrument panels. Though technical discussions continued about the all-polyolefin or the all-polyurethane common-chemistry instrument panel (skin, padding, and substrate—all of the same chemistry), only a moderate amount of work was being done to advance these materials for the long-term aging and cost performance required in a vehicle. At that time styrene-maleic anhydride, combined with vinyl for a cover skin and polyurethane foam for padding, was the instrument panel substrate material most popular in **Ford Motor Co.** vehicles.

During the Instrument Panels (Part A) Technical Session yesterday, researchers from **Visteon** discussed how in 1993 a plastics recycling-reclaiming system was built to separate styrene-maleic anhydride for the carrier and polyvinyl chloride and semi-flexible polyurethane foam for aesthetics and safety features. Although such three-component foam construction dominated instrument-panel

construction, advances were being made to switch to other materials for vehicle weight reduction, product performance, and cost improvements. Different instrument panel constructions have included the Lincoln Navigator with an expanded polyolefin-backed

be blended to produce new compounds. These new regrind blends have different physical properties and performance characteristics that may have to be balanced to meet existing product requirements or tailored for new product introduction.



The Mazda Tribute instrument panel is constructed using Visteon's laminate injection-molding process.

vinyl cover, the Lincoln LS with a cast thermoplastic urethane skin, and the Mazda Tribute using the Visteon laminate injection-molding process. This latter process uses a single-injection-molding step, a vacuum-formed polyolefin skin backed with a polyolefin foam, and a polyolefin substrate. New panel designs coupled with new material systems have created diverse, in-plant recycle streams.

Various olefin chemical family recycle streams, including thermoplastic olefins, polypropylene, and polypropylene foam, can

The olefin products and percentage range used were selected for availability and elimination of sorting at 100% recycled content. The resulting compound proved to be a perfect replacement match for shrinkage, physical properties, and product performance requirements for an existing virgin resin. Availability of in-house recycling made it possible to provide a lower cost resin for a current product, improve plant efficiencies, and avoid expensive landfill costs.

John Fobian

Ford hydrogen engine

A production-viable vehicle powered exclusively by a hydrogen-fueled internal-combustion engine (H₂ICE) has been developed and tested. This low-cost, low-emissions vehicle is viewed as a short-term driver for the hydrogen-fueling infrastructure ultimately required for fuel-cell vehicles. The vehicle features a

highly optimized hydrogen ICE, a triple redundant hydrogen safety system, and a dedicated gaseous hydrogen fuel system. Engineers from the **Ford** Scientific Research Laboratory presented a paper on the vehicle during yesterday's SI Combustion Technical Session.

The engineers used an engine dynamometer facility to map a

Zetec-based 2.0-L H₂ICE at both a constant fuel-air equivalence ratio of 0.55 when throttled and over a range from 0.12-0.70 when unthrottled to provide a starting point for vehicle-calibration development. The engine was tested with a 14.5:1 compression ratio and fixed cam timing, but without EGR or an aftertreatment system. Following completion of the engine dynamometer development, the hydrogen engine team developed a plan to build and test the engine in a

for the fuel rail solenoid and the fuel injectors. The fuel line feeding hydrogen gas from the trunk to the engine was located under the floor pan.

Safety was a fundamental vehicle design consideration for this first prototype. The team built upon the experience of Ford's hydrogen fuel cell and compressed natural gas programs to produce a unique system. This triple-redundant system combines active and passive ventilation with

disabling the fuel supply and engine starter, opening the moon roof, and activating all ventilation fans if not already on.

Since hydrogen is significantly less dense than air, it will rise and disperse if it is not trapped. The passive elements of the safety system were designed to take advantage of this behavior. Hood louvers and the trunk seal vents (depressions in the trunk seal) allow hydrogen to escape to the atmosphere from the engine compartment and trunk, respectively. Thus, these elements further improve the vehicle's safety, providing redundancy without intervention from the other system elements.

Results of vehicle testing indicate the following:

- Carbon-based engine-out emissions testing indicated that HC and CO are less than SULEV standards, and CO₂ emissions are reduced to about 0.4% of the tailpipe levels produced by a gasoline fueled engine of the same displacement.



Ford's aluminum-intensive P2000 is powered by a hydrogen-fueled internal-combustion engine.



vehicle. This port fuel-injected four-valve-per-cylinder engine was integrated, together with a five-speed manual transaxle, into a P2000, an aluminum intensive five-passenger family sedan developed by Ford to support PNGV work.

The vehicle control system consisted of an electronic throttle operated in a pedal follower configuration, an air meter based open-loop fuel control, and an electronically controlled coil on plug ignition. In addition, a PCV coalescing oil separator was added to prevent recirculation of oil into the combustion chamber, thus reducing the potential for preignition or backflash.

The fuel system was designed for safety as well as functionality. All of the major components of the hydrogen fueling system were located in the vehicle trunk except

hydrogen detectors to enhance safety through redundancy. The heart of this system, the combustible gas detectors, consists of four sensors located in the engine compartment, passenger compartment, and trunk. Alarm conditions are triggered at hydrogen concentrations of 0.6, 1.0, and 1.6% (15, 25, and 40% of lower flammability limit for hydrogen). In addition to the detector, the safety system relied on several ventilation fans to circulate air within the trunk and engine compartments to prevent the formation of high concentration pockets of hydrogen within these areas and create more uniform mixtures at the sensors. Should hydrogen of sufficient concentration be detected, several measures are taken to minimize ignition potential. These measures include

- The engine-out NO_x emissions ranged from 0.23 to 0.46 g/km (0.37 to 0.74 g/mi).
- A metro cycle fuel economy improvement of up to 17.9% relative to gasoline.
- Smooth, acceptable drive feel in a city setting.
- Acceleration performance would require improvement for full customer acceptability. At equal performance, the metro cycle fuel economy advantage, relative to gasoline, is expected to decrease to about 11%.

Future testing should investigate technologies such as boosting, EGR, and various configurations of exhaust aftertreatment. Combinations of these are expected to substantially improve NO_x emissions, specific power, and fuel economy.

Linda Trego

OESEA's e-business report...continued from page 1

eventually become obsolete and will not be able to compete with those that do.

"E-business is business," said J Ferron, Automotive Partner, **PwC Consulting**. "E-business is not just about toolsets; it's about the processes of business, and about the survival of business." Ferron also presented an e-business report card that supports findings that the automotive industry is not steadily progressing in its e-business efforts. The report card covers three significant areas: procurement, supply chain, and product development (see table). Procurement remained consistent throughout the year, improving slightly in the fourth quarter. Likewise, product development improved in the third and more significantly in the fourth quarter. However, there was deterioration in the supply-chain area compared to last year's grades. None of the three categories received an S grade for "secure."

"Industry is more distracted than ever," said Ferron. "Industry is slow to accelerate beyond procurement. Some would say we are stuck in procurement." Ferron also said that the automotive industry is no longer the "poster child" for an old-economy industry benefiting from the new, adding that current practices inhibit general adoption of new processes and technologies. These practices include what Ferron referred to as the "Covisint effect"—companies waiting to see what will happen with Covisint before acting themselves.

There are large cost-saving opportunities through synchronization and collaboration, which require standards, said Bill Macfarlane, CIO, N.A., **Siemens VDO Automotive**. He also noted that there will be multiple exchanges in the automotive industry, and that presently, the pace of application development is ahead of developments in standards, which are necessary on a global basis to achieve application benefits. "OEMs are not telling us (suppliers) to wait for them to develop standards; but if we wait, they will tell us what to do," Macfarlane said. "We need to work together [with OEMs] to create standards for the automotive industry."

In a session on OEM Perspective, **Ford Motor Co.**'s Jim Buczkowski, Director, Manufacturing and Supply Chain Systems, IT and Business Infrastructure, presented the automaker's internal and external IT/e-business plans as well as recent

initiatives undertaken, including the launch of its portal on **Covisint** in February. Similar to comments made by Siemens VDO's Macfarlane, Buczkowski noted that the automotive industry is an "ecosystem that requires synchronization to find

and sustain the big payoffs of IT/e-business investments and to find new ways to collaborate." A supplier panel, moderated by Rick Radecki, Corporate Director e-Business, **Delphi Automotive Systems**, covered various topics such as the challenges and opportu-

nities for Tier 2 and lower suppliers and the emergence of a new business model as a result of e-business efforts. Panelists included Carol Dickson, VP, Business Development & Systems Integration, **The Woodbridge Group**; Tom Chubb, VP, OE Business

Development, **Michelin N.A.**; William Ryckbost, VP, Purchasing and Logistics, **Gentex Corp.**; Doug Grimm, VP, Supply Chain Management, **Metaldyne**; and Robert Breitman, CIO and VP, **The Gates Group** of Companies. Ryan Gehm

Exhibitor Directory Addendum

The following is a listing of new exhibitors, cancellations, and booth changes as of March 4, 2002. Watch for additions and changes here in future issues of the Show Daily.

New Exhibitors

AMPIP

Booth 3416

AT&T Wireless

26877 Northwestern Hwy., Ste. 208
Southfield, MI 48034 UNITED STATES

Booth 2350

An industry leader in voice and data communications, envisioning a world where people are liberated, surprised and enriched. The company's products offer an untethered access to all the world's people and all the world's information no matter where they stand on the face of the earth.

Felton Automotive

4797 Stoneleigh Rd.
Bloomfield Hills, MI 48302 UNITED STATES

Feltonauto@psenka.com

Booth 665

GMAC Mortgage

2600 Troy Center Dr., Ste. 100
Troy, MI 48084 UNITED STATES

Booth 3400

Mortgage loans, refinances and home equity line of credit; flexible loans with competitive interest rates for all home financing needs; eligible GM Supplier employees-cash off closing costs or reduced interest rates are one of the many exclusive values available to eligible employees of GM Supplier companies. GF Family First- Cash off closing costs or reduced interest rates, plus zero down home financing are a few of the many exclusive values available to GM Family members.

Hazama

Booth 3507

Information Builders Inc.

101 W. Big Beaver, Ste. 505
Troy, MI 48084 UNITED STATES

http://

www.informationbuilders.com

askinfo@ibi.com

Booth 2355

Provides customers with robust business intelligence, specializing in real-time information delivery over the Web. Headquartered in New York, helping companies and government organizations improve mission-critical operations by transforming data into usable information and delivering it to employees, managers, partners, and customers through the Internet.

With the award-winning WebFOCUS solution, the company delivers information for more than 11,000 global customer sites, including most of the Fortune 100 and all U.S. federal government agencies; employs 1900 people worldwide and generated revenues exceeding \$300 million in 200.

Peasa

Booth 3509

Secretariat of Economic Development

Blvd. Belisario Domínguez No 950
Tuxtla Gutiérrez
Chiapas MEXICO

3513

State of Durango

Mexican Pavilion

3317

State of Sinaloa

Mexican Pavilion

3316

State of Coahuila

Mexican Pavilion

3411

Wagner Engineering

58B Capitol Dr.
Wallingford, CT 06492

3362

Booth Changes

Mexican Pavilion

Celay

Booth 3412, 3414

Clevite

Booth 3505

Prodensa

Booth 3420

State of Aquascalientes

Booth 3318

State of Baja California

Booth 3418

State of Guanajuato

Booth 3319

State of Hidalgo

Booth 3312

State of Jalisco

Booth 3317

State of Mexico

Booth 3314

State of Nuevo Leon

Booth 3409

State of Puebla

Booth 3315

State of Queretaro

Booth 3316

State of San Luis Potasi

Booth 3320

State of Tamaulipas

Booth 3413

Zytek co-develops Smart hybrid

Zytek Electric Vehicles (Booth 2135) is exhibiting a diesel hybrid powertrain it developed in partnership with **MCC smart GmbH** and **DaimlerChrysler AG** for a special version of the Smart City Coupe called Hyper (hybrid and performance). The powertrain employs a custom-designed electric motor to accelerate the vehicle to about 60 km/h (37 mph), above which the diesel engine cuts in to take the car to 100 km/h (62 mph) in just 17.8 s—2 s faster than the standard diesel configuration. Comparative tests of both power systems revealed a 13% improvement in fuel consumption, with the hybrid consuming less than 3 L/100 km (78 mpg).



The Zytek electric motor fits into the space between engine, exhaust, and driveshaft. It has a mass of only 19 kg (42 lb), yet produces 25 kW and 55 N•m (40 lb•ft) from 0 to 4000 rpm. The permanent-magnet, brushless dc unit helps reduce CO₂ emissions to less than 80 g/km.

Power source usage decisions are made by a central electronic control unit designed by Zytek, which uses an **Infineon C167CR** processor and interfaces with a dual-CAN communications protocol. The ECU allows the electric motor to provide "fill-in torque" to smooth gear changes by providing propulsion for a few tenths of a second between gearshifts. It also improves efficiency by recovering energy on braking and deceleration if the battery requires more charge, saving an additional 5-6% in fuel consumption.

The powertrain has undergone successful initial testing, though a production decision has not yet been made.

Kevin Jost

A bright future...continued from page 1

they've come a long way over past few years."

Despite some challenges with NO_x and particulate matter, diesel-powered vehicles make sense right now because they are "power-effective, fuel-effective, emissions-effective," Nick Scheele, Chief Operating Officer, President-Ford Automotive Operations, said. Moreover, he added, their operating costs over 100,000 miles is less than for gasoline-powered types. And, though not as important in the U.S. as in Europe, CO₂ emissions are lower.

Currently set at 500 ppm, the sulfur content standard for diesel fuel will drop to 15 ppm as part of a phase-in program beginning in 2007. In the meantime, a diesel retrofit program already is under way to reduce emissions from trucks.

In Germany, about 34% of new cars sold are powered by diesel engines. "I drive one myself," said Rainer Baake of the Ministry of Environment, Secretary of State (Germany). "It's not stinky and does not make any noise, and I am very satisfied with it."

Patrick Ponticel