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Toyota Prius: AEI's Best Engineered Vehicle for 2004

The name Prius comes from the Latin "to go before," and the all-new 2004 model definitely is blazing new trails in hybrid passenger car technology and engineering. So much so that the readers and editors of *Automotive Engineering International* have voted the car Best Engineered Vehicle for 2004. The second-generation gasoline/electric hybrid provides a larger and more versatile mid-size



2004 Toyota Prius

interior and significantly improves upon its pioneering predecessor in terms of performance, efficiency, emissions, and consumer appeal.

Best-in-class fuel economy and emissions are made possible by Toyota's second-generation gasoline/electric hybrid technology. Today at 11:30 a.m. in Room D3-17/18, Toyota engineers will discuss the development of the hybrid system in the "Advanced Hybrid Vehicle Powertrains Session." The full hybrid system is capable of operating in gasoline or electric modes, or a combination of both, and produces more power from both the gasoline engine and electric motor, giving the new model acceleration from 0-60 mph (0-97 km/h) in about 10 s (vs. 12.7 s for the previous model) and significantly improved passing performance. In addition, it yields even better fuel efficiency, with combined U.S. EPA (Environmental Protection Agency) highway/city mileage of 55 mpg, compared to 48 mpg for the previous generation. The car's body aids the powertrain in the search for ultimate efficiency with a drag coefficient, at 0.26, that is one of the lowest for a production vehicle sold in the U.S.

Emissions are improved by 30% over the previous model's, with nearly 90% fewer smog-forming emissions than a conventional internal combustion engine (ICE) vehicle. In California and those states

See *Best Engineered*, Page 17

Mann+Hummel oil module has high plastic content

The use of plastics in oil modules is not new, but Mann+Hummel GmbH (Booth 2035) is taking it to the next level. Congress attendees can go along for the ride at 10:30 a.m. today (March 8) in Room D2-08, where Kai Knickmann, Vice President of Engineering for Liquid Filter Systems in the company's automotive OE division, will present a paper on the module.

More than 85% of the module's mass is made of plastic, the resin for which is supplied by Bayer. Mann + Hummel designed the module with Audi, its

customer, for the OEM's 2.0-L four-cylinder FSI gasoline direct-injection engine. At ±1500 g (53 oz), the module offers a mass savings of about 20% over a comparable module with an aluminum housing, according to Knickmann. That percentage is even more impressive considering that the plastic module offers functionality not possible with an aluminum type, he added.

An aluminum oil cooler attaches to the module. Metal parts in the module itself include inserts and valves.

See *Mann+Hummel*, Page 17

SAE 2003 President reflects on the past year

This being my last chance to communicate with you as SAE President, I wanted to say to each member that I appreciate so much the opportunity you gave me to serve our Society and profession this year. A special thanks also to my company, DaimlerChrysler, for all of the special arrangements they made to allow me to devote my full time to SAE, and for allowing my wife to accompany me on all of the trips, all while paying for all of the expenses. My administrative assistant at DaimlerChrysler, Diane Marcoux, was invaluable in coordinating with SAE staff on all of the flight arrangements, hotel accommodations, expense reports, etc. No one could do this job without such wonderful support.

Throughout the world (we traveled to 15 different countries as well as many sites in the USA), we found SAE is held in high esteem, and we were treated royally. The SAE staff did a tremendous job of planning all of the trips so that we accomplished something meaningful for the



Jack E. Thompson

society while boosting the local societies. We continued the practice of promoting collaboration with other societies serving the mobility community and signed six new MOUs outlining our joint agreements. We were very impressed by our SAE Brasil and SAE India affiliates, where major Congress-type meetings were organized and executed with high quality. We also strengthened our ties with the U.S. Military Transportation and Logistics activities and, at their

See *President*, Page 17

High performance says it all for SAE 2004 World Congress

The next best thing to driving a fast car is talking about one...or two, or more. This year's SAE World Congress provides plenty of high-performance listening time.

Wednesday's 10 a.m. keynote session, High Performance Cars – A Passion for Performance, spotlights a few legends from the race and production side of the business: John Coletti, Chief Engineer of Ford Motor Co.'s Special Vehicle Team; Dan Knott, Director of DaimlerChrysler's Performance Vehicle Operations; Dave Hill, General Motors Corp.'s Vehicle Line Executive and Corvette Chief Engineer; and Peter Spence, Toyota Racing Development's Vice President and Technical Director.

The action continues on March 11. Carroll Shelby, Chairman of Carroll Shelby International, Inc;



Says SAE '04 General Chair Philip Martens, "The SAE World Congress is a great place to re-energize, network with your colleagues, and get an improved perspective on what it takes to be successful personally and professionally."

Steve Saleen, President of Saleen, Inc.; and Jack Roush, Chairman of Roush Industries are scheduled as panelists for a 10:30 a.m. Thursday

See *High performance*, Page 16

Today's Congress Highlights

- **OESA Panel - Global Manufacturing Footprint 2010**
7:30 a.m.–8:30 a.m. Registration
8:30 a.m.–12:00 p.m. Program
Riverview Ballroom
- **Grand Opening Session**
8:30 a.m.
AVL Technology Theater
- **Intelligent Vehicle Initiative (IVI) Technology - Advanced Controls**
9:00 a.m.
Dana Technical Innovation Forum
- **Keynote Presentation: Volkswagen Fuel Strategy - A Way to Sustainable Mobility**
Matthias Rabe, Executive Director of Group Research, Volkswagen AG
9:00 a.m.
AVL Technology Theater
- **Why buy Diesel - Customer Pull or Corporate Push?**
10:00 a.m.
AVL Technology Theater
- **Keynote Presentation: The Road Towards Sustainable Transportation**
Margo Oge, Director, Office of Transportation and Air Quality, Office of Air & Radiation, U.S. Environmental Protection Agency
11:45 a.m.
AVL Technology Theater
- **Keynote Presentation: Sustainment of the U.S. Army Ground Vehicle Fleet**
Major General N. Ross Thompson III, Commanding General, U.S. Army Tank-automotive & Armaments Command
12:45 p.m.
AVL Technology Theater
- **Diversity Challenges in the Global Supply Chain**
1:30 p.m.
Dana Technical Innovation
- **The Future for Hybrid Vehicles- Can Hybrids compete with gasoline and diesel and what will future hybrids look like?**
1:30 p.m.
AVL Technology Theater
- **Powering the Future - What propulsion systems and fuels will power the automobile of the future? How will the mix of hybrids, gasoline, diesel, and fuel cells evolve over the next 15 years and how will it impact the automotive industry?**
3:30 p.m.
AVL Technology Theater
- **The China Experience: Value Chain Costing**
3:30 p.m.-5:00 p.m.
Dana Technical Innovation Forum

Cylinder deactivation for the Hemi

DaimlerChrysler's booth, located adjacent to the SAE Technology Theater, carries the theme Engineering the Future, which is apropos considering the variety of alternative powertrain technologies on display. One of these technologies is the

The system deactivates eight of the valve lifters—supplied by INA—stopping combustion and loss of energy due to pumping air through these cylinders. The transition from eight to four cylinders is said to take just 40 ms. Some of the significant



The 5.7-L Hemi V8 powering the 2005 Chrysler 300C and Dodge Magnum RT will include the Multi-Displacement System, which transitions the engine from eight to four cylinders in just 40 ms.

Multi-Displacement System (MDS), which is standard equipment on the new Hemi-powered 2005 Chrysler 300C and Dodge Magnum RT. According to the Chrysler Group, these are the first "modern, high-volume" production vehicles in North America to feature fully functioning cylinder deactivation.

"The MDS seamlessly alternates between high fuel economy four-cylinder mode when less power is needed, and V8 mode when more power from the 5.7-L Hemi engine is in demand," said Eric Ridenour, Executive Vice President of Product Development, Chrysler Group. "This [transition] optimizes fuel economy... without sacrificing vehicle performance."

technologies enabling the MDS, according to Chrysler, are the sophistication of the algorithms controlling the system and the use of Electronic Throttle Control.

Fuel economy gains are estimated at up to 20% under certain driving conditions, with a projected 10% aggregate improvement. "The MDS has a very simple design that allows an engine with 390 lb•ft (528 N•m) of torque and 340 hp (254 kW), [but] with the fuel economy of a large V6 or smaller V8 engine," said Burke Brown, Chief Engineer of the 300 and Magnum vehicles.

"We planned it all along," said Brown, in noting that the Hemi was originally designed to accommodate MDS. This approach resulted in a

See *Cylinder*, Page 16

Brainy idea for engine assembly

Braintech Inc. (Booth 1221) is displaying "seeing" robotics technology that recently merited it a Henry Ford Technology Award.

The Vancouver-based company designs 3-D vision-guided robotics (3D-VGR), which are in use at Ford's Windsor and Essex plants in Canada. Ford was the first major auto manufacturer in the world to deploy the technology.

In association with world-leading robotics company ABB and Ford's engineering team, Braintech developed and implemented a 3D-VGR system for assembly of Ford's F-150 pickup truck engine. Comprising an ABB robot and Braintech 3D-VGR software, the system is used to mate the integrated air-fuel manifolds and engine heads on engine blocks. The system features Braintech's patent-pending SC3DT (single camera 3-D technology), which uses one camera image to guide a robot for the pickup and assembly of heavy engine parts.

Braintech's VFR systems are also used by General Motors Corp., Hino Trucks, Delphi, and TI Automotive Group.

Patrick Ponticel



At Ford, Braintech's vision-guided robot system is used in the placement of engine heads on engine blocks.

Industry leaders to discuss business and technical issues at AVL Technology Theater

The business perspective on many of the automotive industry's most pressing issues will be discussed by industry leaders at the AVL Technology Theater on the show floor throughout the SAE 2004 World Congress.

More than 15 business sessions will be presented throughout the four-day event. Topics will include diesel passenger cars, hybrid vehicles, business synergies, and the challenge of optimizing onboard embedded control systems. Speakers will include representatives from

Ford, DaimlerChrysler, General Motors, Toyota, National Highway Traffic Safety Administration, J.D. Power and Associates, U.S. EPA, and Delphi.

Introduced at the 2003 World Congress, the Technology Theater proved to be a popular forum for discussion and debate of business and strategic issues by prominent industry executives. Sponsored by AVL, this year's Technology Theater will feature speakers such as Jim Queen, Vice President, General Motors Corp., North America Engineering; Phil Martens, Group Vice President, Product Creation, North America, Ford Motor Co.; J. T. Battenberg III, Chairman of the Board, Chief Executive Officer & President, Delphi Corp.; and James Truchard, CEO, National Instruments.

The new "High-Performance Vehicles – A Passion for Performance" program will include "The Team Approach to Designing High-Performance Vehicles;" "High-Performance Engineering from the European Experts" (featuring representatives from leading European design and engineering firms such as Cosworth, Prodrive, Lotus, Ricardo, and AVL); and "Niche Vehicles and Flexible Manufacturing: Building Consumer Excitement, Showroom Traffic, and Profits." Speakers include Jack Roush, Carroll Shelby, Dan Knott, John Coletti, and others well known for developing high-performance vehicles. Drag Racer John Force will speak on Thursday at 12:30 p.m.

For details, see the SAE 2004 World Congress Final Program.

Ford builds bridge to hydrogen future

While widespread sales of fuel-cell vehicles may be many years off, Ford Motor Co. is not waiting to test the hydrogen waters. The company has developed a Focus-based technology concept car employing an internal combustion engine (ICE) fueled by hydrogen that it says could be built today. The H²RV (Hydrogen Hybrid Research Vehicle) combines a 2.3-L ICE, in supercharged form, with a Ford-patented Modular Hybrid Transmission System (MHTS). The latter can be used interchangeably in various vehicle structures and uses a single 300-V electric motor, up-graded automatic transmission, and modified hydraulics. The powertrain



FordH2RV1 Ford Hydrogen Hybrid Research Vehicle (H²RV)

is at the Ford display (Booth 1871) and will be discussed at today's "Advanced Hybrid Vehicle Powertrains" technical session in Room D3-17/18 beginning at 9:00 a.m. The architecture and development of the car's hydrogen-sensing and -mitigation system will also be discussed in the "Systems Engineering" session today at 9:30 a.m. in Room W2-67.

Two H²RV vehicles have been built for demonstration on the streets of southeastern Michigan, but says Gerhard Schmidt, Vice President, Ford Research and Advanced Engineering, "What we are lacking are the other two legs of this three-legged stool: a fueling infrastructure for hydrogen, and uniform laws and regulations that will allow its use across the nation."

Emissions from the car of all pollutants, including carbon dioxide, are nearly zero. An electric motor in the automatic transmission and advanced embedded controls allow a stop/start function and offer extra power for acceleration. First unveiled in the Model U concept vehicle at

See *Ford builds*, Page 16

SAE Member Lounge available

The SAE Member Lounge, located in Congress Central, room W2-60, is open to all members of SAE and offers a place to relax and revamp for the next Congress activity. Beverages, continental breakfast, small sandwiches, and light snacks will be offered daily through the support of SAE's affinity program providers: Hartland Insurance, Liberty Mutual Insurance, United Parcel Service, Selman & Co., Chorus Call, and MBNA America.

Credit card phones will be available and can be connected to a PC when not in use. Stop by to relax and learn about SAE's benefit programs that can save you money.

The Member Lounge will be open Monday, Tuesday, and Wednesday 8:00 a.m. to 5:00 p.m., and Thursday 8:00 a.m. to 4:00 p.m. You must have a member badge or valid SAE membership card to enter.

Editorial staff

AEI editorial staff for the Show Daily can be reached during show hours at Booth 1859.

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InterRegs honors engineer for work in regulations

InterRegs, the UK provider of updates to governmental regulations from around the world, will honor Bart P. Terburg as winner of the SAE/InterRegs Standards & Regulations Award for Young Engineers during Tuesday's Honors

Convocation, 11:30 a.m. - 1:30 p.m. in room W1-52.

This is the fourth year of the award, which with a \$1000 cash prize rewards participation in standards and regulations by young engineers, and encourages increased

participation in the field. The award is given to a practicing engineer under the age of 40 who is involved in standards, regulations, or conformity assessment systems that improved safety or reduced emissions in a mobility product. The

nominee is required to author a 2000-word essay detailing how this was achieved.

Terberg, Global Regulations Manager & Senior Development Engineer at GE Consumer Products - Lighting in Cleveland, OH, leads the



Bart P. Terburg is winner of the SAE/InterRegs Standards & Regulations Award for Young Engineers

company's automotive lighting regulatory program. This involves managing the company's representation in global automotive lighting regulatory and standards committees.

Along with activities related to regulations, Terburg also is development engineer and safety leader of the automotive product line. His main expertise lies in the field of halogen and discharge light sources for road-illumination devices. He has authored and collaborated on several scientific papers and technical presentations, and has been a main force in studies and research concerning the relationship between the performance of blue-coated automotive light sources and the impact on traffic safety through the reduction of headlamp glare and color separation. He has made key contributions to the development and validation of a bulb-color separation test, which distinguishes acceptable and unacceptable coated bulbs in terms of their light scatter, or glare.

Information about the products and services offered by InterRegs will be available in leaflet form at the Sponsor Showcase on the show floor near Detroit Hall entrance, as will a demo CD-ROM.

Patrick Ponticel

2004 SAE Annual Business Meeting scheduled

The Annual Business Meeting of the members of SAE has been scheduled for Wednesday, March 10, during the SAE World Congress. The meeting will begin at 1:00 p.m. in the Dana Technical Innovation Forum. During the meeting, SAE 2003 President Jack E. Thompson will deliver the Presidential address, the election of 2004 Board of Directors will be announced, and the SAE Annual Report will be presented.

Information regarding the meeting will be available in the SAE 2004 World Congress Final Program.

Safety software

Safepass 201 and Safedesign Insight from **MTS Systems Corp.** improve product development productivity by automating test setup processes and synchronizing computer-aided engineering (CAE) models with test data. Safepass 201 eliminates days from the FMVSS 201 certification process and helps automotive manufacturers ensure new car designs meet interior head-impact safety requirements. The software automates target calculation, head-positioning, and correlation practices. Safedesign Insight video analysis and validation software overlays the results of



safety tests with CAE simulations, improving the side-by-side comparison process currently used. Engineers can calibrate video and CAE data while tracking motion in both physical and virtual tests. Booth 601

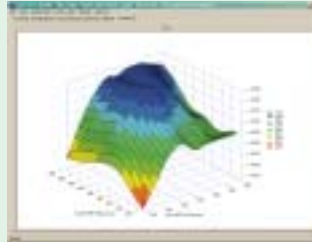
Variable valve timing

Taylor Engineering's model TE-401 lift/duration control subassembly provides variable valve timing for present-day automobiles and adjusts the operating parameter of engines. It accepts control and status outputs from a vehicle's onboard computer and applies control signals sequentially to each valve, positioning them to within ± 0.005 in (0.13 mm). The key to this accuracy is the timing oscillator within the module. It is applicable to engines with two, three, and four valves per cylinder. Booth 2835



Engine design tools

Virtual engines 6.0 from **Optimum Power Technology** accelerates the engine design process by solving engine performance design problems, providing design space



analysis, and selecting the best of alternative engine designs. It includes a simulation monitor option that allows results data on the database to be plotted directly to the screen. Measured performance and sensor data can be imported into the virtual engines 6.0 database for archiving and correlation purposes. Other improvements are included for valve design, turbocharging, and unconventional engine design features. The firm's network supercomputer enables engineers to apply parallel-processing technology to engine design problems. Booth 1539

Illumination design

Release 1.2 of LucidShape software from **Lambda Research Corp.** and **Brandenburg GmbH** assists with automotive illumination design and analysis. Based on a ray-tracing engine, the program enables design of reflectors, refractors, windscreens, and sources for headlamps, fog lamps, signal lamps, and taillamps. Light-mapping and Monte Carlo ray-tracing modes are available. The program also has smart tools to map the light filament to a light screen to determine cutoff points and facet orientation. The accompanying Lucid Functional Geometry (LucidFunGeo) module has smart tools and dialogs to speed the automotive user through the reflector- and lens-design tasks. The programs address what-if scenarios including dialog animation, control of filament motion in real time, and flexing a reflector to bend inward and outward to converge and diverge a faceted reflector. Booth 214



Imaging system

NAC's Memrecam fx RX5 offers high-speed imaging flexibility and performance in onboard automotive testing and provides a solution for image capture in confined spaces such as foot wells or engine compartments. The RX5 system provides a mega-pixel camera system that can be modified to accept multiple cameras, offering an alternative system to reduce the added weight of onboard test instrumentation systems. The camera head records images at 1000 frames/s with 1280 x 1024 pixel resolution. It can be configured with up to four fx RX camera heads, or up to four Memrecam Micro camera heads, and can be mounted up to 18 m (59 ft) from the digital recording processor. Booth 414



Volvo goes with the flow

The rapid development of the XC90 on the S80 platform used existing computational fluid dynamics techniques to deliver 50% more cooling airflow, and drove the development of more advanced methods for future

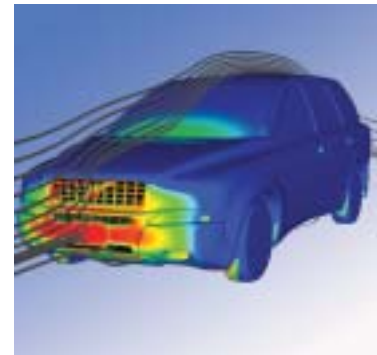
Volvo programs. Details of the methods developed will be presented at one of the first technical sessions today, Thermal Management, in Room D2-15.

In the early stages of design evaluation on the XC90 project,

radiator top water temperature was evaluated using a method that relied on testing to validate the connection between computed parameters and temperature. More desirable would be a method that could couple the

cooling airflow to the radiator water temperature.

Several possible methods for coupling the airflow and distribution obtained from the Fluent (from **Fluent, Inc.**) simulation to the radiator water were identified.



The final CFD model of the Volvo XC90 was built using production-level data, and included detailed modeling of the grille, other openings in the fascia, and a U.S. license plate. The calculated streamlines are from a Fluent analysis.

One route was to use separate heat exchanger modeling software, translating the results from a Fluent simulation. This turned out to have several drawbacks, such as the inconvenience of translating data, and additional software license costs.

Instead, it was decided to stay within a single software environment, using Fluent's concept of user-defined functions (UDFs) to model the coupling between the cooling air and heat exchangers. In the UDF routines, each heat exchanger was numerically discretized and the hot side flow through the core modeled. The resulting radiator water temperature was then obtained directly from the Fluent simulation. This was one of a series of techniques developed.

An extensive program was run to establish how the CFD methods compared to measurements, using a Volvo S80 and a V70. For both vehicles at 15 different run conditions, computed data were compared to experiments, mostly with good correlation. The CFD methods created to support the XC90 development are now currently used in all Volvo projects for which cooling performance is addressed.

David Alexander

SAE Foundation Lounge

All **SAE** Foundation contributors wearing a Foundation VIP ribbon are invited to visit the SAE Foundation Lounge located in Congress Central, adjacent to the SAE Member Lounge. A relaxing environment with comfortable seating, refreshments, and telephones will be available to you Monday through Thursday from 8:00 a.m. to 5:00 p.m. In addition, a special demonstration of *A World In Motion* challenges will take place on Wednesday, March 10, from 10:00 to 11:00 a.m. in the lounge.

Visteon's systems integration on display

Visteon Corp.'s handiwork is available on at least four of the vehicles being displayed during the SAE 2004 World Congress.

The Focus C-Max, part of Ford's exhibit, incorporates the supplier's climate, audio, and interior systems. The dual climate-control system allows the temperature to be varied independently and at different levels for the driver and front passenger. "The system has the capability to maintain a set temperature on both sides of the car without the need for constant manual changes," according to Robin Pannecouk from Visteon communications.

Climate-control components are sourced through various European Visteon plants, including the Alba facility in Hungary, which supports the supply of compressors for various Ford models. System development work was done at Visteon's climate-control facility in Kerpen, Germany.

The vehicle's instrument panel and center console are produced at the Visteon plant in Berlin, Germany with instrument cluster engineering work done at Dunton, Essex, and production at the Enfield, Middlesex facility in the UK.

Visteon served as the climate-control systems integrator, as well as the full cockpit systems integrator, for the Nissan Titan displayed at the State of Mississippi booth. Cockpit modules include those for the instrument cluster, instrument panel, steering column, multimedia head unit, wiring harness, console, and HVAC control.

As the climate-control integrator, Visteon's work included the upfront CAE (computer-aided engineering) modeling of heater, air conditioner, defroster performance, and validation.

The cockpits are assembled at the Lextron-Visteon facility in Canton, MS, via inline vehicle sequencing (ILVS). "ILVS allows for just-in-time production with the ability to build the cockpit modules on demand in about 90 minutes," according to Pannecouk.

Other vehicles on the show floor that include Visteon technology are the 2005 Chevrolet Corvette and the Chrysler 300. The Corvette uses Visteon's high-intensity discharge projector headlamps that provide "a very high-intensity light produced from an electric arc inside a capsule filled with xenon gas," said Pannecouk. A Visteon-branded Boston Acoustics audio system is available on the 300.

Kami Buchholz

Career development opportunities

If you're looking to hire or be hired, the SAE 2004 World Congress offers several ways to help you network to find the right company or professional to meet your needs.

Learn about succeeding in the automotive industry at the SAE

Career Development Session on Tuesday, March 9, from 1:30 p.m. to 3:30 p.m., in Room W2-65, Cobo Center. Hear valuable tips from speakers including Steve Dulieu, Director, Human Resources, Product Development, Ford Motor Co.; John

Baylis, General Manager – Administration, Toyota Technical Center; and John Tenerowicz, Vice President, Human Resources, Aerotek.

Stop by the Career Center now located in Congress Central, Room W2-60, and check out the many job

postings available and post your resume for free. Those wishing to display their resumes should bring 50 copies directly to the Career Center, open Monday-Wednesday, 8:00 a.m. to 5:00 p.m. and Thursday, 8:00 a.m. to 4:00 p.m.

Dana adds heavy-duty tandem axle

The Commercial Vehicle Systems Division of **Dana Corp.**, sponsor of the Dana Technical Innovation Forum (and exhibiting in Booth 2979), has rolled out its new lineup of heavy-duty Spicer D190 series of single-reduction tandem

ratio coverage of 3.42:1 through 7.17:1 were scheduled to begin in December.

The family of axles include six patented or patent-pending features, reducing the total component count by more than 50% vs.



According to Dana, its new Spicer D190 heavy-duty tandem axle introduced by its Commercial Vehicle Systems Division features the strongest axle housing box section in its class.

drive axles. With gross axle mass ratings from 52,000 lb (23,600 kg) for the D52-190 model to 60,000 lb (27,200 kg) for the D60-190, the family of axles will be targeted to more demanding vocational on-road applications, such as heavy haul and refuse.

According to Dana, extra wide face-width gearing adds greater strength over earlier designs for additional durability. The gearing and bearing system has been redesigned to address the increased durability and reliability requirements of contemporary and future generation power/torque engines and transmissions. Production and customer shipments of the axles, which offer a

conventional heavy-duty tandem drive axles.

One of the new patents is for a standard-equipped lubrication pump for lower operating temperatures and added spinout protection. Forged, heat-treated steel differential cases boost strength for increased gear and bearing life. Sixteen 20-mm (0.8-in) diameter ring gear fasteners ensure high clamp load for better reliability. An integrated ring gear and wheel differential mounting system eliminates bolted joints, and an integral pinion cage and carrier adds stiffness and strength while eliminating a potential leak path.

Jean L. Broge

CAE in plastics design

With years of experience in applying CAE (computer-aided engineering) tools in different automotive plastics component design analyses, the authors, from **Visteon**, try to define the accuracy of CAE simulations through three carefully selected case studies: natural frequency prediction, vibration stress calculation, and fatigue analysis. Results will be presented today in a paper titled

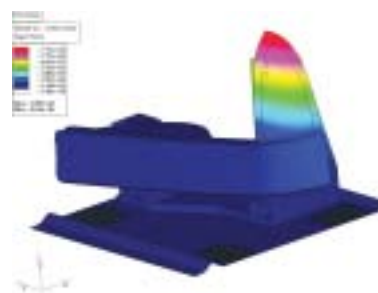
"On the Accuracy of CAE Structural Simulations in Automotive Plastics Component Design" in the Advances in Plastic Components, Processes, and Technologies session in Room D2-08.

In study 1, a park and turn lamp mounted to a sheet metal test fixture was clamped on a shaker to measure its natural frequencies. A modal analysis performed using MSC.NASTRAN, from **MSC.Software**, predicted the lamp assembly's first natural frequency close to the tested value. Other similar CAE-test correlations also confirmed that CAE predictions on structural global properties such as natural frequency, displacement, and structural stiffness are in general quite accurate.

In study 2, a headlamp was subjected to a vibration test. The NASTRAN modal transient method was employed to simulate the headlamp stress response at the exact location where the strain measurement was taken. CAE predicted much higher peak stress than the measurements, although the predicted RMS value was close to that from the test. This case showed that CAE results do not correlate so well for the predictions of local properties such as vibration-induced stress or strain response.

In study 3, a side marker failed early in a vibration test, due to cracks at the corner of the T-shaped attachment. To improve the fatigue life, the shape was thickened. CAE (A-to-B) calculation with Abaqus, from **Abaqus, Inc.**, was employed to estimate the stress level and predict the fatigue life. Success was validated by a test of the modified component. This third study indicated that CAE predictions on an A-to-B comparison are accurate even for a difficult task such as fatigue life prediction.

David Alexander



Modal analysis of a lamp assembly accurately predicted the first natural frequency.

New forum on show floor to feature popular technical sessions

Some of the best technical presentations at the SAE World Congress will have a new home in 2004. The new **Dana** Technical Innovation Forum has been added to the exhibit floor to showcase high-interest sessions (traditionally only available in Cobo Center's meeting rooms), as well as this year's new special programs on high-performance vehicles, diversity suppliers, and panels on doing business in China, Poland, and Austria.

This new Forum was initiated to bring cutting-edge technical sessions to the show floor and enable a larger, broader audience to experience this aspect of the technical program. Two sessions of the "High-Performance Vehicles – A Passion for Performance" program will take place in the Forum. On March 9, "Impact of Race Development on Production Vehicles," moderated by Peter Schoegg of **AVL**, will feature Peter Spence, **Toyota Racing Development**; Doug Duchardt, **GM Racing**; Andy Randolph, **Hendrick Motorsports**; and Gil de Ferran, former racing champion. "New Vehicle Engineering – The Ford GT" (held on March 10), organized by **Car and Driver** editor Csaba Csere, will feature technical presentations detailing various aspects of the development of the landmark **Ford GT**.

Intelligent vehicles and Six Sigma are among the cutting-edge topics that will be spotlighted in technical sessions at the Dana Technical Innovation Forum. The two-part session "Intelligent Vehicle Initiative (IVI) Technology – Advanced Controls," organized by W. Riley Garrott and Frank S. Barickman of the **National Highway Traffic Safety Administration**, will be held March 8. The "Six Sigma" session will be held March 11, organized by Bryan L. Dodson and Don P. Lynch of **Visteon Corp.**, with support from the **American Society of Quality's** Automotive Division.

For complete details on the schedule of presentations, see the SAE 2004 World Congress Final Program.

Integrated simulation from GTI

Gamma Technologies Inc. (GTI) has unveiled Version 6.1 of GT-SUITE, an integrated simulation toolkit for engine and powertrain design and analysis, and is demonstrating its enhanced capabilities in Booth 921.

"The trend toward the adoption of integrated simulation tools in the automotive industry is gaining in popularity with design engineers," said Thomas Morel, President of Gamma Technologies Inc. With GT-SUITE, it is possible to simulate engine performance, vehicle dynamics, valvetrain dynamics, cooling systems, fuel-injection systems, and cranktrain dynamics within one tool, Morel added.



GT-SUITE 6.1 features in-cylinder 3-D CFD by built-in KIVA, enabling the assessment of the effects of injection-system modifications on combustion and emissions.

GTI incorporated wide-ranging inputs from a number of engine manufacturers in enhancing the CAE toolkit. One new feature is in-cylinder 3-D computational fluid dynamics (CFD), which was enabled with the addition of **Wisconsin Engine Research Consultants'** combustion modeling in the 3-D KIVA code. This capability is said to speed up design of diesel combustion systems through more accurate predictions of combustion and emissions.

Other new technical capabilities include a 3-D CAD discretization tool that reduces labor required to build models of engines, built-in design of experiments with optimization to automate design iterations, coupled injection and combustion simulation via GT-POWER + GT-FUEL, a fuel-cell model for vehicle applications, a 3-D CAD/STL manifold discretization tool, and a thermal library for temperature analysis of general structures.

Ryan Gehm

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Technology, business meet in landmark SAE 2004 World Congress program

Showcasing the event's emphasis on bringing together technology and business, the **SAE 2004 World Congress**, March 8-11 at Cobo Center in Detroit, features the largest technical program in its history, with more than 1500 papers

scheduled to be presented. A record number of these presentations—approximately 50%—will be from representatives of the industry's OEMs and major suppliers including 25 of the top 30 suppliers. Global in scope (42 countries are

represented), the technical sessions are again organized within five technology areas to allow attendees to easily access the technical information they seek: Advanced Propulsion/Powertrain; Lightweight Materials; Advanced Electronics;

Environment/Emissions; and Safety/Testing. This year's World Congress will also feature a special program, "High-Performance Vehicles – A Passion for Performance" on the exhibit floor.

See Program, Page 16

What's New
from the exhibitors

The SAE 2004 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.

Software infrastructure

The rtX from **Applied Dynamics International** is a PC-based extension of the SIMsystem product line. Designed to meet the



requirements for real-time hardware-in-the-loop simulation applications, the rtX features a comprehensive software infrastructure to simplify the complexities of integrating real-time computer models with actual hardware. Standard components include an integral data-acquisition system, and a fault-insertion capability with the ability to script an entire test scenario. The platform spans applications ranging from small open-loop testers to high-fidelity powertrain and chassis test systems. Booth 2403

Pressure gauges

WIKA Instrument Corp.'s Type 700.04 and 700.05 differential pressure gauges are suitable for industrial-grade applications. The 700.04 is a piston-type gauge for



use with clean liquid or gaseous material. Features include a NEMA 4X weather-protection dial and a panel mounting kit. The gauge is field-liquid fillable and measures differential pressure ranges to 100 psi (690 kPa) with a maximum working pressure of 6000 psi (41,370 kPa). Type 700.05 offers a diaphragm-style assembly suited for no blow-by low/medium differential and medium/high process pressure material. The convoluted diaphragm separation eliminates the need for close tolerances, making it suitable for material with particulate matter. Features include a NEMA 4X weather protection dial, a panel mounting kit, and a calibration test report supplied with each gauge. The gauge is also field-liquid fillable and measures differential pressure ranges to 100 psi (690 kPa) with a maximum working pressure of 3000 psi (20,700 kPa). Booth 1552

Fastening material

The FAS-NER system from **AKH Inc.** eliminates the need for spot welding and riveting. A punch and die operation automatically feeds, punches, inserts, and locks the self-piercing fastener to produce a solid joint in one high-cycle operation. The system joins similar or dissimilar metals and thicknesses and is available as a single-hit machine or a completely automated turnkey system that includes insertion into main production lines through machine integrators. Booth 2349



High-speed camera

Weinberger Vision Technology Corp.'s SpeedCam Visario 1500 is a high-speed camera with a resolution of 1536 x 1024 pixels. The camera records up to 10,000 frames/s and features a rugged mechanical design and small size and mass. The Visario 1500 is suited for high levels of acceleration and vibration. A CMOS sensor with electronic shutter was developed for demanding tasks and offers high resolution, dynamics, and noise reduction. Features include intuitive configuration and application software, exchangeable standard lenses, and extensive seamless system integration possibilities. Booth 523



Statistical software package

MINITAB Release 14 statistical software for **Microsoft Windows**, by **Minitab, Inc.**, provides powerful data import, export, and manipulation. The product has made such advances as expanded and simplified graph creation and editing, and quality tools including multivariate control charts and process capability analysis. New statistical features include partial least squares, customizable menus, toolbars, and settings that can be used to create shareable profiles. Booth 1348



Control system

Electronic Concepts & Engineering offers the EUNP electronic control unit, a flexible control system suited for prototype vehicle applications that can be used as a central single-node system or a distributed multi-node system. The EUNP offers digital, analog, power, and serial I/O as well as fiber-optic and wired CAN communication interfaces. The watertight unit measures 3.3 x 3.2 x 7.9 in (84 x 81 x 200 mm) and is designed for harsh environmental conditions. Embedded software is available for each specific application, creating a customized solution. Booth 2501



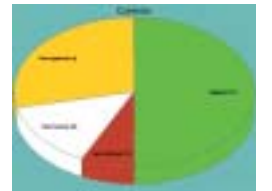
Compact multi-analyzer

The OR34 created by **OROS** is a noise and vibration analyzer that addresses application domains including rotating machinery, industrial acoustics, and structural analysis. The product features two or four inputs, one high-speed generator, and three integrated and dedicated digital signal processors. It comes with NVGate noise and vibration software that allows simultaneous recording of time domain signal, and complete reporting tools to **Microsoft Word**. Booth 1533



Risk management software

The Web-based process engine from **egip Software AG** offers three-level architecture and allows companies to maintain complete control of their business-critical processes through one collaborative platform. Features include consistent online controlling of facts; immediate information in real time to solve problems; active enterprise-wide integration of all entities concerned into defined procedures; and current risk management on a Web-based platform across the company. Risk management standards are applied on the same platform, and all relevant processes are subject to consistent visualization and optimization in terms of auditable information, flows, responsibilities, and performance. Booth 2047



2005 Ford GT centennial car

The 2005 Ford GT supercar is a combination of Ford's past and future. The 5.4-L V8 engine is composed of four-valve cylinder heads, is boosted by an **Eaton** screw-type supercharger, and offers 500 hp (393 kW) and 500 lb•ft (678 N•m). The GT also features forged



components, including the crankshaft, H-beam connecting rods, and aluminum pistons. Braking is handled by four-piston aluminum **Brembo** monolock calipers with cross-drilled and vented rotors at each corner. The hybrid-aluminum spaceframe chassis employs 35 extrusions, seven complex castings, two semi-solid formed castings, and various stamped aluminum panels. The 2005 GT is more than 18 in (457 mm) longer and stands 4 in (102 mm) taller than the 1960's Le Mans racecar, after which it was designed. According to Ford, other new technologies include super-plastic-formed aluminum body panels, roll-bonded floor panels, a friction-stir welded center tunnel, a capless fuel filler system, one-piece door panels, and an aluminum engine cover with a one-piece carbon-fiber inner panel. Booth 1871

Simulation technology

Ansoft's Maxwell v10 offers improved productivity and performance, and additional coupled analysis capabilities. Features include a 3-D thermal solver capable of solving stand-alone transient thermal applications and coupling to existing electromagnetic solvers, and a 3-D stress-analysis solver to determine mechanical stress that can be coupled to the electromagnetic and thermal solvers for detailed analysis. It also includes Maxwell 2D Simplorer transient coupling that offers simulation accuracy with complex electromechanical devices and drive systems. A 3-D motion capability handles rotational and translational motion, and IGES and STEP file translation have been upgraded in the new release. Booth 2214



Stand-alone camera

The VITcam product series from **AOS Technologies** Inc. is a high-speed camera designed for stand-alone operation in harsh motion-analysis environments. The VITcam features high-resolution images, fast record rates, ease of use, and a rugged high-*g*-impact design. Its small size, weight, and internal battery operation enable the camera to be mounted in places such as under seats, hoods, or in vehicle foot wells, enabling engineers to capture and see high-speed events. A 1394 FireWire interface offers easy connection and operation with a PC or laptop. Booth 321



Silicon components

Ceradyne, Inc.'s cam rollers and fuel pump rollers are made of silicon nitride, a lightweight, wear-resistant ceramic material. The components replace steel rollers to eliminate the wear and galling of metal, thus improving engine reliability, according to the company. Silicon nitride features low mass combined with high strength and contact-fatigue resistance to permit use under high contact stresses. Cam rollers are used for unit injector fuel pumps and for



intake and exhaust valves for Class 8 diesel engines. They are also used for common-rail, high-pressure fuel pumps for light-duty, as well as large, diesel engines. Booth 2853

Calibration tool

ECM's compact engine development and calibration tool, the AFM1500, measures the air-to-fuel ratio to determine engine driveability, fuel economy, and emissions. Its modules are designed to support in-vehicle powertrain calibration. Features include a wide air-fuel-ratio (AFR) measurement range, fast response, linear analog output, SMB bus ports, and easy air calibration. All modules use wide-range AFR exhaust sensors. Booth 811



Prototyping platform

DECOMSYS::NODE<ARM> is an automotive prototyping platform from **Decomsys** for the FlexRay communication standard. Building



on the ARM9 processor, the platform provides a set of typical I/O for x-by-wire applications together with **Altera's** Excalibur EPXA4 device, a system-on-a-programmable-chip solution that is suited for applications requiring high deterministic performance and fault tolerance. Two operating systems are available: the TimeCore standard automotive core and the RTAI Linux, a low-cost development environment. The system's application range can be expanded to include prototyping cars as well as controlling various motors. Booth 1327

Dispensing system

The Ultra TT Automation Series from **EFD** is an automated, tabletop assembly process that combines accurate programming



with closed-loop dc servo control and powerful drive motors for fast, precise positioning of the dispensing tip. Benefits include improved productivity, process consistency, and less scrap and rework. Benchtop bonding, gasketing, and filling operations can all be programmed using a **Palm** handheld. Graphic user interface software provides improved control of positioning and dispensing parameters. The systems are offered with either 325 x 325 mm (13 x 13 in) or 525 x 525 mm (21 x 21 in) work envelopes and are fully compatible with a wide range of dispensing valves and syringe reservoirs. Booth 1245

What's New
from the exhibitors**Collision simulation**

The DyMESH (Dynamic MEchanical SHell) 3-D collision simulation software from **Engineering Dynamics Corp.** employs methods from finite-element technology for collision detection to stress-strain relationships for force calculations. The 3-D mesh used to visualize both the vehicle and assigned mechanical properties is an input, while vehicle-fixed collision forces and moments are produced as output. HVE displays the resulting vehicle damage with high resolution in minutes instead of days. DyMESH is particularly suited for severe underride or any crash where 3-D collision dynamics are present. Any type of vehicle involved in any number of collisions, including secondary and multiple impacts, may be simulated. Booth 435

**Fineblanking technology**

Feintool System Parts has added coil-to-component technology to its fineblanking process to produce complex 3-D metal parts to net shape at a part-per-stroke rate. The forming, fineblanking, and stamping (FFS) technology uses multiple tooling modules fed by a CNC-controlled part-transfer system to consolidate all operations into one pass through a 500-ton (454-t) hydraulic press. FFS is suited for intricate automotive components such as racks, clutch plates, and seat recliner hardware and is effective for ferrous and non-ferrous parts up to 5.0 mm (0.2 in) thick. Booth 839

**Data acquisition**

The TDAS G5 from **Diversified Technical Systems** (DTS), Inc. offers 32 channels of data acquisition in less than 3 cm³ (0.2 in³) per channel. The system includes a microprocessor, sampling rate of 100 kHz/ch, a



non-volatile memory, and 100 baseT Ethernet communications to simplify crash testing preparation and data downloads. Compatible with all existing DTS sensors, the complete system includes a TDAS G5 module, in-dummy docking station, dummy wiring system, and control box. Specifications for the in-dummy docking station include an integrated battery, direct connections with existing in-dummy sensors, and connections to link multiple units together, maximizing total channel capability to 224 or more channels. Booth 438

Exhaust flowmeter

Horiba Instruments, Inc.'s EXFM-1000 is an ultrasonic-based exhaust flowmeter designed to directly measure the displaced volume of exhaust from vehicle engines. The instrument consists of a flowmeter packaged with supporting pressure and temperature transducers in a compact configuration. It can be used in conjunction with a mini-diluter system for low-level **EPA** Tier II and **CARB** SULEV measurements and was proven reliable and repeatable across a wide range of flow rates and temperatures, according to the company. The EXFM-1000 accommodates high exhaust temperatures without the need for cooling equipment and is capable of measuring 3 to 300 standard ft³/min. Booth 1801

**Calibration system**

A plug, play, and calibrate system for sensor and signal conditioning from **Honeywell Sensotec** is compliant to the IEEE 1451.4 standard for connectivity of sensors and associated signal conditioning. A transducer electronic data sheet (TEDS) containing sensor specifications, calibration data, and user-defined location information is stored in the sensor. When connected to the SC2000 or any IEEE 1454.4 compliant signal conditioning, the sensor is interrogated for the TEDS information and automatically sets up and calibrates the signal conditioning with the sensor. Booth 746



Emissions analyzer

The Model 600 HCLD Analyzer by **California Analytical Instruments**

uses flame-ionization detectors, chemiluminescent, and non-dispersive infrared to analyze the nitrous oxide in concentration within a gaseous sample. The 16-bit microprocessor control board consists of 16 digital inputs and outputs, 16 analog inputs, and 4 analog outputs. The analyzer display includes screen presentation of alarms, and for precision measurements, the analyzer's accuracy is increased by entering calibration curve-fit polynomials.

Booth 2362



Fuel-tank leak tester

An automotive fuel-tank leak tester from **Vacuum Technology Inc.** features a large-volume plastic part that renders other methods unreliable, according to the



company. The mass-spectrometer system's tanks are filled with helium at low pressure inside a vacuum chamber to test a leak rate of 5×10^{-4} atm-cc/s. Production requirements are met with three automated systems featuring 65-s cycles, including load and unload. Booth 1575

CAN card

The PXI 3051 is a CAN card from **Göpel electronic** that offers additional functions over its predecessor, the PXI 3050. The PXI 3051 does not require special



plugs because a 25-pole connector sends and receives all signals. Two ports on the basis board and two on the PXI card realize the higher hardware performance. Each channel is a 32-bit CAN controller so the card can be used with improved efficiency. An input and output line is available for each port, allowing trigger functions to be called on the unit under test or enabling further measurement instrumentation. The trigger line also can be used via the PXI bus. The PXI 3051 features onboard tools such as network management, while its software offers extended ramp functions for the output of messages. Booth 2401

Noise control technologies

The hemi anechoic chamber designed, engineered, and installed by **Eckel Noise Control Technologies** at the **Arctic Cat** noise and vibration facility achieves low frequency cut-off of 80 Hz and NC15 with an operating 500 ft³/min (14,158 L/min) ventilation system. The Eckel metallic wedge units made of factory-finished enamel for the chamber feature an overall depth of 27.25 in (692 mm) with a low-frequency cut-off of 120 Hz. The entire chamber is constructed on a vibration-isolated floor system, and the silenced ventilation system provides room for airflow via roof-mounted silencers and vertical corner inlet and exhaust passages. Booth 1632



Communication controller

TTTech Computertechnik AG's subsidiary **TTChip** has designed the AS8202NF third-generation TTP controller for commercial



production. The automotive-qualified device provides support for fault-tolerant, high-speed bus systems. The AS8202NF offers improved reliability and is qualified for the full temperature range required for automotive applications. Data transfer rates of 25 Mbit/s with MII and up to 5 Mbit/s with MFM/Manchester are supported, making the AS8202NF the first TTP controller to support both MFM and Manchester coding. Booth 1327

Design analysis

SolidWorks Corp. has upgraded its COSMOS finite element analysis (FEA) applications, COSMOSWorks, COSMOSFloWorks, and COSMOSMotion, making the suite 10 to 15 times faster than comparable applications and enabling solvers to use processor cycles more efficiently. Users can test assembly behavior without fully modeling component connectors, such as pins and springs, up front. Analysis is simplified with the addition of usability features that simulate processes such as heat regulation using a thermostat with simple menu-driven commands that replace manual computations. Additional visual and reporting features enable users to extract more precise results from their analyses. Improved integration with SolidWorks 3D mechanical design software enables COSMOS users to analyze designs without re-entering data and switching between applications. Booth 2306



Transmission components

Tsang Yow Industrial Co., Ltd. offers a wide range of manufacturing processes, including precision



machining, gear cutting, heat treating, laser welding, spline forming, and assembling. The company focuses on both OEM and aftermarket automatic transmission parts, torque converter parts, oil pumps and parts, heavy-duty clutch parts, and parts for agricultural and construction machines. Booth 1755

What's New from the exhibitors

Vibration control

The 8500 shaker vibration-control system from **Vibration Research Corp.** features Ethernet interface, thus eliminating 50/60 Hz noise problems and removing accelerometer cable runs between the shaker



amplifier and control room. The 8500 uses 24-bit A/D and D/A, allowing separation of input signals 120 dB apart and eliminating the need for pre-scale circuits on the inputs and outputs. Other features include the transducer electronic data sheet, high frequency of up to 20,000 Hz (suitable for piezo shakers), and 13,000 lines of random control to provide improved fine frequency control.

Booth 1528

Oxidation modeling

Akron Rubber Development Lab., Inc. has expanded work in diffusion limited oxidation modeling to study the aging and related material property changes of



automotive elastomer components. The methodology improves service life prediction at operating temperatures and guides developments in stabilization through compounding and design changes. The studies require combining models for oxygen diffusion and oxidation kinetics and using experimental and numerical approaches to study and analyze the problem. Applications of diffusion-limited oxidation have been used in lifetime prediction techniques of elastomer components including hoses, belts, O-rings, seals and tires, bushings, door seals, and wiper blades.

Booth 1700

Crash analysis

Microsys' crash analysis toolkit for its PowerPlay analysis software puts sophisticated injury calculations onto engineers' desktops. Product engineers can view sensor data, perform injury calculations, and analyze the results using the toolkit. A menu-driven and intuitive-operator interface guides users through a crash analysis. A sensor mapping function automatically locates the sensor files required for each algorithm. The system may be used alone or in conjunction with the Microsys SureFire system for control of crash facility instrumentation.

Booth 339



CFD code upgrade

CD adapco Group has released the latest version of its computational fluid dynamics code STAR-CD. It



offers enhanced capability for simulating a wider range of flow processes in and around vehicles including external dynamics, underhood thermal management, engine and aftertreatment processes, and climate control. There is also a STAR-Design default plug-in available that provides a built-in solid modeler for STAR-CD users without a CAD seat.

Booth 921

Trivalent chrome plating

Tsukiboshi Manufacturing, a distribution partner of **AdvanTech International,** has



converted from hexavalent chromium plating to trivalent or Tri-Chrome plating for its cold-formed fasteners. Tri-Chrome plating provides the quality of the hexavalent chromium finish, while maintaining the corrosion resistance. Tri-Chrome is used in automotive, motorcycle, and industrial marketplaces.

Booth 1737

Water deflector

ADCO Products, Inc. offers ADCOSEAL 300 for use in the door water deflector assembly area. The high-strength, hot-applied synthetic elastomer-based adhesive provides faster throughput when pumping because of lower viscosities. ADCOSEAL 300 also provides density reduction improvements and forms thermal bonds to both polyethylene and thermoplastic polyolefin at low temperatures while providing improved tack and peel strength. It is offered in either black or neutral and can be used in a foamed or unfoamed state.

Booth 1535



Dynamometer testing

SAKOR Technologies Inc., has upgraded its DynoLAB PT dynamometer test cell supervisory system to DynoLAB test executive software 4.1. The software package, upgraded from 4.0, provides support for high-speed wireless communications between the test cell sensors and control console. Applications include performance evaluation, drivetrain and component durability testing, in-use simulation, quality control, and catalyst performance and aging studies. It seamlessly integrates external devices, including all types of dynamometers, throttle actuators, spark and fuel controllers, emissions analyzers, and other "smart" I/O devices.

Booth 749



Strategic planning

Germany's **bonné GmbH** assists carmakers and component manufacturers with the organization and coordination of complex development processes. Its services include the overall strategic project planning of processes for the automobile sector. Specialists create databases; coordinate and manage deadlines, quantities, and costs; prepare presentations; chair meetings; and act as intermediaries between internal and external partners. By delegating time-consuming, non-technical administrative work to a neutral, independent service provider, engineers and developers have more time to focus on their core competencies.

Booth 2330

Cylinder...Continued from Page 3

cylinder-deactivation system that is completely integrated into the engine design with fewer parts, he added.

Cylinder deactivation is being introduced on the passenger cars first, said Brown, because that is where the biggest opportunity is in terms of fuel-economy gains while maintaining performance. "If you put it in a bigger vehicle, it's still going to work well," he said, when asked of the possibility of adding the MDS-equipped Hemi to the Dodge Ram pickup and Durango sport utility vehicle.

Also on display are a pre-production version of the **Jeep** Liberty CRD, the Chrysler Group's first diesel-powered passenger vehicle; an F-Cell A-Class fuel cell vehicle; and a **Dodge** Ram HEV (hybrid-electric vehicle).
Ryan Gehm

High performance...Continued from Page 1

session, Niche Vehicles and Flexible Manufacturing. Both sessions—taking place on the show floor in the **AVL** Technology Theater—underscore the various gatherings aimed at those with a passion for high-performance.

The passion for performance mini-conference is "going to attract somewhat of a different audience to the show," said Phillip Martens, the Ford Group Vice President of Product Creation who is serving as General Chair of the SAE 2004 World Congress (Ford is host company of the event). The performance-orientated sessions are expected to draw a crowd of current and future technical professionals.

GM's Coletti knows that high-performance technology "will have a nice trickle-down effect to other products."

But another outgrowth of high-performance discussions is the topic's inherent ability to spur young minds into pursuing an automotive engineering career. "Our ability to draw and create interest in this event," said Martens, "is extremely important. We have to re-energize the attractiveness to the industry. And collectively, we can do that."

Other AVL Technology Theater sessions on Wednesday and Thursday also address high-performance-vehicle themes. Jim Queen, Vice President of North American Engineering at GM and General Chair for the SAE 2005 World Congress—coinciding with the 100th anniversary of SAE—said it takes engineers to make technology meaningful and relevant to vehicle buyers. And one conduit to accomplishing that feat is the SAE World Congress. "We just need to continue to take World Congress to a new level," said Queen.

Kami Buchholz

Ford builds...Continued from Page 3

the 2003 North American International Auto Show in Detroit, the hydrogen hybrid powertrain is a runner in H²RV. "The hydrogen internal combustion engine in the H²RV has reliability proven to be similar to a gasoline-fueled engine," said Bob Natkin, group leader for hydrogen ICE development, Ford Research and Advanced Engineering. "Maintenance is much the same, as is long-term durability."

The 3420-lb (1550-kg) H²RV stores 2.8 kg (6.2 lb) of compressed gaseous hydrogen at 5000-psi (34.5-MPa) for a range of 125 mi (200 km). The car's advanced 288-V 3.6-A•h advanced Li-ion battery supplies 25 kW (peak) and 10 kW (continuous) power to the electric traction drive, supplementing the ICE's 110 hp (82 kW) @ 4500 rpm for total power of 143 hp (107 kW). Acceleration from 0 to 60 mph (97 km/h) is achieved in 11 s, and fuel economy is 45 mi/kg of H₂ (MH cycle).

"Fuel cells promise improved efficiencies, but hydrogen-powered hybrids offer a near-term cost-effective bridge to fuel-cell technology," said Arun Jaura, project leader for hybrid electric vehicle development, Ford Research and Advanced Engineering. In June, Ford announced that it would place a fleet of hydrogen fuel cell Focus vehicles on the streets of Vancouver, British



Gerhard Schmidt, Vice President, Ford Research and Advanced Engineering

Columbia for evaluation early in 2004. The H²RV's hydrogen-powered ICE is meant as a transition strategy to stimulate the hydrogen infrastructure and related hydrogen technologies including onboard hydrogen fuel storage, hydrogen fuel dispensing, and hydrogen safety sensors.

Compared to fuel cells, Ford says that hydrogen ICEs are all-weather capable, require zero warmup, and have no cold-start issues. They are highly efficient (52% peak efficiency) and can easily achieve SULEV emissions, or better, and more than 99% reduced CO₂ vehicle emissions. Performance is comparable to that of gasoline engines, while fuel efficiency is increased by 25% with the engine only and up to 50% with an aggressive hybrid electric strategy.

Kevin Jost

Program...Continued from Page 9

Focusing on emerging and advanced technologies, new products, and new applications, SAE 2004 World Congress sessions will cover topics that have proven to be popular in past years, as well as 18 new topics.

New sessions in the "Advanced Propulsion/Powertrain" track cover thermal and fluid sciences, the progress of hydrogen, and research and development supporting the Army transformation. Popular returning sessions include: Advanced Hybrid Vehicle Powertrains; Homogeneous Charge Compression Ignition (HCCI) Combustion; Fuel Cell Power for Transportation; and Transmission and Driveline Systems.

The "Lightweight Materials" track brings back sessions on reliability and robust design in automotive engineering, and stainless steels. Six new topics will be introduced this year, including sessions on: modeling of materials for crash applications; welding and joining; and failure analysis and creative problem solving.

In-vehicle networks, CAD/CAM/CAE technology, and simulation are among the highlighted subjects in the "Advanced Electronics" track, which adds new sessions on in-vehicle software at this year's event.

The "Environment/Emissions" track features sessions on climate control, diesel exhaust emissions control, and emissions measurement and testing. New sessions introduced this year will cover topics such as global climate change and its potential impact on the mobility industry, environmental challenges of alternative vehicle technology design, and product environmental design.

Accident reconstruction and vehicle aerodynamics are among the popular sessions returning in the "Safety/Testing" track. New topics will include pedestrian safety, structural crashworthiness, and foam applications for crashworthiness.

The "High-Performance Vehicles – A Passion For Performance" program, occurring in the **Dana** Technical Innovation Forum and **AVL** Technology Theater on the show floor, will feature technical sessions, panel discussions, and keynote addresses from the field's leaders. Highlights include a session covering the development of the new **Ford** GT, and a panel discussion featuring representatives from leading European design and engineering firms. For more details, see this issue's articles on the AVL Technology Theater (p. 3) and the Dana Technical Innovation Forum (p. 8).

For a complete, up-to-date technical session program, see the SAE 2004 World Congress Final Program.

Best Engineered...Continued from Page 1

adopting California standards, Prius has been certified as a Super Ultra Low Emissions Vehicle (SULEV) and as an Advanced Technology Partial Zero Emissions Vehicle (AT-PZEV) category vehicle. AT-PZEV certification requires the SULEV exhaust standard linked with the ability to meet a zero-fuel-evaporative standard, a 150,000-mi (240,000-km) durability demonstration, offering an extended emissions system warranty, and technology deemed by the **California Air Resources Board** (CARB) to advance future fuel-cell vehicles. In the rest of the country, Prius is certified as Tier 2, Bin 3.

New to the Prius navigation system is Bluetooth technology for hands-free communication using any cellular phone with built-in compatibility. A first-ever in a Toyota Division vehicle is a new smart entry and start option, which allows hands-free keyless entry and startup.

Remarkably, all of the technologies and features are made available to consumers with nearly no compromises compared to conventional mid-sized vehicles. The suggested retail price is still around the \$20,000 level. The car's powertrain seamlessly blends the power delivery from the engine, electric drive motor, and the generator so that the driver does not feel the vehicle changing operational modes. And to give owners additional peace of mind, hybrid-related components are covered under warranty for 8 yr/100,000 mi (160,000 km).
Kevin Jost

Mann+Hummel...Continued from Page 1

Along with a 20% mass savings comes a 20% costs savings, Knickmann said.

In his paper, "Development and Market Launch of the World's First Oil Module with a Fully Plastic Housing," Knickmann states, "Oil modules have been in use since the early 1990s, especially in the passenger car sector. During this time, the standard material for the housing has become die-cast aluminum. Based on the positive long-term experience with polyamides in the oil system—for example screw caps for oil filter brackets—the realization of the fully plastic oil module was the consequential step."

Knickmann continued, "This was only possible through the combination of various boundary conditions: the development of high-temperature plastics, modern production processes, and simulation possibilities."

With high use of plastics, oil modules are faster and cheaper to produce. No machining (e.g., turning, drilling, milling) is necessary; and the geometry is achieved in the injection-molding process. "One major advantage for the overall production



The Mann + Hummel oil module is 85% plastic.

process is that the plastic processing, from granulate to the finished product, is carried out in one step," Knickmann said.

Not every engine design is amenable to plastic oil modules, he noted, especially one calling for the module to be located on the exhaust side. "You need to take into account how much effort is needed to make some heat shields, and decide whether it is worth the effort," he said. "This is what we typically do with every new program, without a lot of prejudices affecting our decision. It all comes down to whether we can make a business case with plastic."

Although the oil module for Audi is 85% plastic, the percentage can go as high as 90%, Knickmann said. The oil module has a paper filter media, the company has developed a plastic filter media for use in **DaimlerChrysler** V6 and V8 engines in Europe and the U.S., Knickmann said.

Patrick Ponticel

President...Continued from Page 1

request, converted all of their mil specs into SAE Standards.

The Board of Directors this year approved an agreement between SAE and the **Convergence Transportation Electronics Association**. This agreement accomplished two key goals: created the Convergence Transportation Electronics Program Office and established joint operation of the Convergence Conference & Exhibition. We also converted the **Service Technicians Society** (STS) into a Program Office to continue this effort at a lower cost. We elected Richard Schaum to be the first Automotive Vice President, complementing the work of our Aerospace Vice President, Bob Spitzer.

A major effort was launched to reinvigorate our ground vehicle standards activity and create a consultant "Institute" at the Automotive Headquarters, both benefiting from the leadership of former SAE President Neil Schilke and others.

For the first time since adopting "Policy Governance" about 12 years ago, the Board has begun a major re-write of the Ends Policies, which describe the results (what benefit, for whom, at what cost) we are trying to achieve as a society. And, we have an active committee planning our 100th Anniversary in 2005, with a lot of commemorative products already available. The Board also agreed to finally get our fiscal year and terms of office to be consistent with the calendar year, which will eliminate a lot of confusion and clarify goals for the staff.

We have also decided to move the World Congress into April for more favorable weather in Detroit and away from overlaps with the European auto shows. The staff has developed new TechKnowledge products and TeleWebcasts to help members get technical knowledge with minimum time commitment, and we have moved to much more electronic delivery and communication with an enhanced Web site.

All of this rapid change and we think, progress, owes a great deal to the SAE Staff led by Ray Morris, Executive Vice President and Chief Operating Officer. He has been a great colleague and mentor this year.

Jack E. Thompson

19th Cliff Garrett Turbomachinery Engineering Lecture on Wednesday

Plan to attend the 19th Cliff Garrett Turbomachinery Engineering Lecture on Wednesday, March 10, from 4:00-5:00 p.m. at Cobo Center in Room M2-30. The lecture, titled "Turbocharging Technologies to Meet Critical Performance Demands of Ultra-Low Emissions Diesel Engines," will be presented by author Steven D. Arnold, the 2003 SAE Cliff Garrett Turbomachinery Engineering Award Recipient.

Exhibit Directory Addendum

The following is a Directory update as of February 26, 2004

Alpump Private Ltd.

170-172 Industrial Estate
Perungudi Chennai, Tamil Nadu 600096 India
www.alpump.org

Booth 255

Alpump is a leading manufacturer of water pumps, oil pumps and various kinds of machined components and assemblies as Original Equipment for several vehicle and engine manufacturers in India like Tata Motors, Ashok Leyland, Mahindra & Mahindra, Hyundai, Simpson, Hero Honda, Bajaj Auto, SAME India, Hindustan Motors, etc.. It exports 20% of the production, mostly to Netherlands and USA. Alpump also makes wheel cylinders and air brake components.

Analog Devices Inc.

Three Technology Way
Norwood, MA 02062-9106 United States
www.analog.com
nitsa.olivadoti@analog.com

Booth 2419.1

Anand Motor Products Ltd.

NH 8 Khandsa
38 Km Stone
Gurgaon, Haryana 122001 India
www.amp-india.com
amp@amp-india.com

Booth 258

AMP is India's leading "QS-9000" and "ISO-9002" certified manufacturer of Rubber

Moulded and Rubber to Metal Bonded Automotive Components since 1978. AMP is a Government of India recognized "Export House" and enjoys O.E.M. Quality reputation National and International Markets. AMP has recently commissioned a modern plant spread over 150,000 sq.ft. at an investment of Rs.150 million with in-house facilities of rubber mixing, metal preparation, press shops, moulding, etc. The unit is also proud to have state-of-the-art Research and Development and Tool Room facilities. AMP has received various awards from National, State Governments and also from Independent Trade Organisations over the last ten years. The company is committed to increase its market share within India and abroad. It is working on TS-16949 and hopes to achieve the same by February 2004.

Apple

1 Infinite Loop
Cupertino, CA 95014-2084 United States

Booth 2821

BIR Inc.

425 Barclay Blvd.
Lincolnshire, IL 60069-3609 United States

Booth 2839

BIR manufactures x-ray computed tomography (CT) systems for inspecting light metal castings. CT data are used for 1st article inspection, nondestructive internal/external geometry capture, flaw detection, and dimensioning. CT-based point cloud and STL files export to solid modeling, surface modeling, rapid prototyping, variance mapping, porosity and wall thickness reporting software.

CANMET Materials Technology Lab.

568 Booth St.
Ottawa, Ontario K1A 0G1 Canada

Booth 1223

Engineering & Mfg Services (EMS)

9445 Arbor Ln.
Goodrich, MI 48438-9285 United States
www.ems-north.com

Booth 764

EMS is a company focused on rapid technology solutions that are affordable and easy to use. It is now more important than ever to be able to deliver products to market quicker, better and without mistakes. Using rapid technologies earlier and more often in the design, engineering and manufacturing process allows companies to get to the market sooner and with better products than their competitors.

Freedom Technologies Corp.

5505 S. Old US 23
Brighton, MI 48116 United States

Booth 3032

Gajra Gears Pvt. Ltd.

Station Rd.
Dewas, Madhya Pradesh 455001 India
www.gajra.com
export@gajra.com

Booth 253

Gajra Gears incorporated in the year 1962. We are one of the largest manufacturer of Automotive Gears in India. We are manufacturing wide range of Transmission Gears, Shafts, Sleeves & Planetary Aassy. For replacement, O.E.M. & Export market. Besides these we also manufacture Gear Cutting Tools, Flexible material handling pallets & Laser Marking Machines.

Hi-Tech Gears Ltd.

Tower B South City-I
Millenium Plaza
Gurgaon, Haryana 122002 India
www.hitechgears.com

Booth 358

A Public Limited company with integrated management systems including ISO, TS 16949, ISO 14001, OHSAS 18001, was incorporated in 1986. Manufacturing transmission gears & shafts, Warm & cold forgings with Technical Collaboration of Kyushi Musashi, Japan (A Honda Subsidiary). Hi-Tech has a wide customer base in India & abroad.

Hungarian Trade Commission

500 N Michigan Ave. 810
Chicago, IL 60611-3752 United States

Booth 249

Invest In Honduras (FIDE/AHM)

Hospital Mario Catarino Rivas PO Bx 1858
Colonia El Pedregal 500 mts al norte
San Pedro Sula Honduras

Booth 1056

LDRA Technology Inc.

2625 Judah St., Suite 3
San Francisco, CA 94122-1431 United States
www.ldra.com
mtadlaoui@ldra-usa.com

Booth 2515

LDRA Technology Inc. provides a unique environment that helps teams accelerate testing of embedded and real-time systems and deliver a safety critical and business critical software on time. Coding Rules Checking, Data flow Anomalies Detection, Static Code Analysis, Complexity Metrics Analysis, Code Coverage, Automatic Generation of Test cases, Test Harness and

Test Report, Automatic regression Testing, Host/Target Test Execution are the key solutions that help developers overcome the challenges of testing software in circumstances where computer software is required to be reliable.

Lifelong India Ltd.

D-1 Saomi Nagar South
New Delhi, Delhi 110017 India
www.lifelongindia.com

Booth 354

We are a QS 9000 company and a system supplier to Honda in India. We are manufacturing Air Cleaner Assemblies, Handle Steering Sub Assemblies and various other plastic parts.

Longkou Haimeng Machinery Co., Ltd.

Huangshan Haimeng Industry Zone
Longkou City Shandong 265715 China

Booth 2941.1

Management Science Associates Inc.

6565 Penn Ave.
Pittsburgh, PA 15206-4407 United States
www.msa.com

Booth 2312

MSA possesses over thirty-five years of experience in the consumer packaged goods industry and has applied its expertise in this field to other industries. MSA offers many products and services to help automotive companies understand the industry dynamics that affect their business, and map out successful strategies to overcome the obstacles that confront them.

MAU Inc.

501 Greene St., Ste 100
Augusta, GA 30901-1495 United States

Booth 117

Metal Powder Report

Elsevier Ltd.
Langford Lane
The Boulevard
Kidlington Oxford OX5 1GB United Kingdom

Booth 2562

Metal Powder Report is the leading international magazine serving the powder metallurgy industry. With a unique blend of technical and management information, the magazine is an essential information and buying source for components manufacturers serving the automotive and aerospace industries.

Mueller - BBM Vibroakustik Systeme

455 E Eisenhower Pkwy. 190
Ann Arbor, MI 48108-3323 United States

Booth 810

National X-Ray Corp.

595 Old Norcross Rd., Ste. G
Lawrenceville, GA 30045-7667 United States

Booth 705

NTF (India) Private Ltd.

49 sector 3 IMT Manesar
Gurgaon, Haryana 122050 India
www.ntfindia.com
info@ntfindia.net

Booth 259

NTF is engaged in the manufacture and supply of interior and exterior components based on Woodstock and GRP by thermo compression and RTM process respectively. Interior components viz. : Door trims, trim inserts, roof liners, rear parcel trays Exterior components viz. : Complete car body panels, spoilers, complete tractor body panels, canopies etc Locomotive components viz. vestibule doors, console tops etc. and coach components viz. side wall panels, modular toilets and X-ray machine covers.

Perseus Development Corp.

222 Forbes Rd.
Braintree, MA 02184-2706 United States

Booth 2300

An Inc. 500 company, Perseus Development Corp. (www.perseus.com) develops and implements web-based market research surveys for automotive companies to conduct market research studies for product development, to collect and analyze data throughout their supply chain, to survey employees worldwide in different languages, and to conduct customer satisfaction surveys.

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Booth 2923

Quality Team 1

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Highland Park, MI 48203-3783 United States

Booth 2962

Red Devil Brakes Inc.

RR 6 Box 2391
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www.redevilbrakes.com
reddevilbrakes@aol.com

Booth 2960

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www.ringplusaqua.com

Booth 260

We manufacture Starter Ring Gears (from 150 mm O.D. to 1200 mm O.D.) for Automotive, Stationery and all other Engines which use Electric start. In addition we produce flexplate assembly mainly used on American cars fitted with automatic transmission.

Smith Metal Products

PO Box 20361
Bowling Green, KY 42102-6361 United States

Booth 115

Society of Manufacturing Engineers (SME)

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One SME Dr.
Dearborn, MI 48121-0930 United States

www.sme.org

Booth 348

Since it was formed in 1932, SME has worked to make engineers, companies, educators and others successful in their quest to advance the manufacturing industries.

Sterling Tools Limited

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Faridabad, Haryana 121003 India

www.stlfasteners.com

Booth 352

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www.usafcu.org

Booth 128

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E4, MIDC Industrial Area

Walu
Aruangabad, Maharashtra 431136 India

www.varrocengg.com
chandak.ashok@varrocgroup.com

Booth 257

Varroc has 4 companies having 10 plants at Pune, Aurangabad and Greater Noida (Delhi). Varroc has 3 product divisions viz: Polymer, Electrical, Engineering, and Quality Systems and Business Practices.

Vir Rubber Products Private Ltd.

Subhash Rd.
207 Planet Industrial Estate

Vile Parle East, Haryana 400057 India
www.virrubber.com

marketing@virrubber.com

Booth 356

Manufacturers and OE Suppliers of Rubber to Metal Bonded Products such as: Silent Block Bushes & Spring Bushes; Engine Mountings & insulators; Rubberised sprockets; Tension / Guide Cam Chain; Critical Rubber Moulded Items

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Booth 2928

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Automotive Component Mfg.
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Booth 262

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