

Operator panels take all you've got

In the world of equipment control, tasks are becoming ever more complex, which has a lot to do with the growing popularity of CAN bus in mobile construction, agricultural, and industrial equipment. With transmission speeds from 100 kB/s to 1 MB/s with high data integrity, CAN bus allows easy control and monitor of machines, equipment racks, and attached ancillary equipment.

To enable vehicle operators to see a clear display of the data transmitted on the bus, **Wachendorff** has developed the OPUS A1 and A2 operator panels. Using a TFT (thin film transistor) display and function keys, all the relevant data for the machine compo-

Compact operator panels from Wachendorff work with CAN bus to allow for fast programming, production data acquisition, and visualization of data. (All images courtesy of Wachendorff.)



The user-programmable operator panel OPUS A2 permits the driver to select the user-interface best suited to the current operating situation. By replacing many individual instruments with just the one operator panel, the stock level of individual parts is reduced.

nents and ancillary equipment can be quickly visualized and changed if required. At the same time, these operator panels are tough enough to withstand mechanical, electrical, and chemical effects that they are subjected to in operation. The modular construction of the user interface enhances the ease of operation.

Wachendorff operator panels are equipped with a tactile-touch keyboard and backlit keys, and protected to IP65 against liquids and dirt. The compact devices feature a 5.6-in screen, measure 229 x 160 x 70 mm (9 x 6 x 3 in), and can be equipped with either a TFT color or an STN (supertwist nematic) grey scale display, each with a resolution of 320 x 240 pixels. Internal



Easy to operate with a multitude of possible applications, agricultural modern tractors and other off-highway equipment rely on rugged operator panels.

data processing is via a 16-bit **Siemens** processor with a clock speed of 20 MHz. Internal memory is available in the form of 1 MB flash for BIOS, 4 MB flash for project data, and 512 kB SRAM and 32 kB EEPROM.

The portable SD (secure digital) memory cards eliminate the need to write to the operator panel's ROM chip via software and a PC, as the update can be carried out in the field. The capacity of the memory card depends on the user profile, including GPS position data, operating time, and parameters specific to the unit such as sensor data, which all can be stored on the card at intervals defined by the user. The memory cards allow data to be available at any time for use in a PC, either on the shop floor or in the office, for maintenance purposes, or for optimizing the installation. The device can also send and receive in the traditional manner via two CAN bus' and one serial port.

Seven user-programmable function keys and a rotary actuator with 30 increments per turn and push-to-enter functionality simplify menu selection for the driver. Switching the screen display is quick, as is changing the data by means of a push button. **Microsoft** Windows-based programming software enables user interfaces and software to be created and adapted quickly and securely, without any specialized knowledge being necessary.

The supply voltage can lie anywhere in the range of 8 to 60 V dc. The maximum current consumption is 1 A, and the quiescent current remains below 100 μ A. If the supply is interrupted, such as when the vehicle's battery is being exchanged, then a capacitor backs up the real-time clock for up to two weeks. The operator panel is designed for rugged mobile use, tolerating temperatures from -25 to +65°C (-13 to +149°F). The IP65 protection level, the vibration and shock resistance, and levels of EMC (electromagnetic compatibility) and ESD (electrostatic discharge

control) compatibility (air discharge 15 kV) all contribute to allow the panel to meet the requirements for such rugged environments.

In addition to the standard version, the operator panel is also available as an optional ISO-11783-6 Virtual Terminal type, onto which a specific job computer on the vehicle or attached

device can copy its own project; other customized layouts can quickly be implemented if required. In addition to the standard models, Wachendorff can design and manufacture operator panels that are specific to any OEM's cabin design and instrumentation environment.

Jean L. Broge

Upgraded digs for new diesels

Detroit Diesel and **Freightliner** officials recently outlined how Detroit Diesel's 3.2 million-ft² (297,290-m²) complex in Redford, MI, will be reshaped as a comprehensive zone for testing and producing commercial vehicle powertrain components.

"We're getting rid of old and under-utilized equipment," Carsten Reinhardt, President and CEO of Detroit Diesel, said in summarizing the \$275-million project.

The new equipment to replace the old covers a wide plant swath. On the testing side, approximately \$22 million will be spent over the next three years to re-groom a 250,000-ft² (23,000-m²) engineering laboratory for testing of current pro-

duction engines—Series 60, MBE 900, and MBE 4000—as well as new engines. Lab enhancements include upgrading the test cells to meet 2007 and 2010 emissions measurement requirements as well as improving those performance test cells to increase overall operating efficiency.

Production revisions at the 65-year-old facility include a new 15,000-ft² (1400-m²) assembly line and testing zone for the MBE 900. Available in the marketplace since 1998, the MBE 900 is currently produced at **DaimlerChrysler's** Mannheim, Germany, engine facility. (Freightliner and Detroit Diesel are part of DaimlerChrysler's Commercial Vehicles Division.)

Redford facility workers will build the medium-duty engine for the North American market in 2007, with European and Asian engine versions remaining the supply domain of the German plant.

The six-cylinder, 7.2-L engine—with ratings of 170 hp (127 kW) and 420 lb-ft (569 N-m) to 300 hp (224 kW) and 860 lb-ft (1166 N-m)—eventually will take a Redford facility production spotlight.

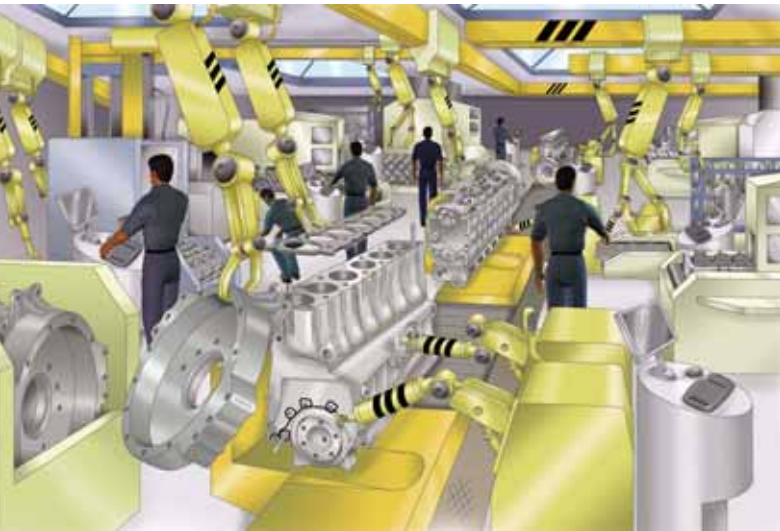
"We will move from four displacements—4.3, 4.8, 6.4, and 7.2 L—to one in 2007. The 2004 ratings range from 170 hp and 420 lb-ft to 330 hp and 1000 lb-ft. These ratings cover a range from the lowest MBE 904 [the four-cylinder version] to the highest MBE 926 [the six-cylinder version]," said Ed Crawford, Director of Design-Engineering for Detroit Diesel.

The approximate \$4-million MBE 900-related investment provides a framework for producing an engine that will utilize exhaust gas recirculation (EGR) and a particulate filter as the primary means of achieving emissions requirements. More details about the engine will be released in the coming months "as the engine continues through its development," noted Crawford, adding, "The engine was designed by our counterparts at DaimlerChrysler in Stuttgart, Germany, with input from us on the requirements of the NAFTA (North American Free Trade Agreement) market for such an engine."

A power choice for vehicles such as school buses, transit buses, and construction applications, the MBE 900 will accent fuel efficiency, electronics, durability, and emissions characteristics. "We are currently in the process of investigating several different filter technologies to ensure that whatever filter supplier we select for 2007 will provide us with the most technologically advanced product for our customers," Crawford said.

A next-generation heavy-duty engine joins the production lineup in 2007. The new production line for the heavy-duty engine program represents a \$150-million investment and will cover cylinder block machining, cylinder liner machining, cylinder head machining, engine assembly, and testing. Block casting is likely to be done overseas.

"The next-generation engine provides us with a common yet flexible platform that will enable us to meet not only today's global emission standards, but tomorrow's anticipated standards as well," said Jim Gray, Program Manager for NAFTA Heavy Duty Engine (HDE) Program.



Detroit Diesel production upgrades include a final assembly line for a new heavy-duty engine.



The Series 60 engine, a fully integrated electronic heavy-duty diesel engine, is a popular choice in the Class 8 market. A next-generation heavy-duty engine will be joining the lineup in the coming months.



The MBE 900 engine powers trucks spanning a wide variety of applications, including beverage, utility, construction, and fire/emergency.

An inline six-cylinder with a 14.8-L displacement will represent the first version of the engine. Emissions requirements will dictate certain technology considerations.

"The engine will be specifically developed in each market to conform to the required emission regulations. In North America for 2007, we will employ higher exhaust gas recirculation, closed crankcase breather, and particulate filters. In addition, the heavy-duty engine is being developed to accommodate additional NOx-reduction strategy and aftertreatment devices that will be required in 2010," said Gray. "And while there is new technology to meet the challenging emission standards of 2007 and 2010, we are also investing heavily to minimize life-cycle costs to the customer."

Unlike the current heavy-duty Series 60 engine—which is the first fully integrated heavy-duty diesel engine with electronic controls—the next-generation engine will provide a framework for covering a broad range of power applications from a common engine concept.

Driving technology into the future

Every long-distance commuter has the same dream: to program their car to do the driving for them. The realization of that dream may now be on the horizon, as 40 teams are preparing to compete in a road race of driverless vehicles. The teams must travel over a 175-mi (280-km) course over desert terrain featuring natural and man-made obstacles within 10 h, without any human intervention.

But the payoff has even more significant implications. The race sponsor, U.S. Defense Advanced Research Projects Agency (DARPA), wants to use this technology to program future vehicles to perform vital functions during wartime and other military situations without endangering humans.

The 2005 DARPA Grand Challenge is a driverless desert race that was scheduled to take place October 8 in the southwestern U.S. University and industry teams have designed and built electronically controlled autonomous vehicles, and the one that finishes the designated route most quickly (within 10 h) will receive the \$2-million first prize. Teams are told of the exact route only 2 h before the race begins and must then program their vehicles for final race directions.



Introduced into the North American market in 2001, the MBE 4000 has been used for a wide variety of applications serving the on-highway and vocational markets.

"It is also being developed to incorporate many improvements previously made to existing engines as standard base engine features at today's emission levels and customer expectations," Gray said. The Series 60 will be sold in tandem with the all-new heavy-duty engine for an extended period.

Production-floor renovations include the installation of an 85,000-ft² (7900-m²) axle gear set assembly zone. The approximate \$31-million investment means the **Axle Alliance** (part of the Freightliner Group) will produce gear sets for North America within the Redford facility rather than shipping the parts stateside from a European facility. Axle Alliance will continue to build front and rear axles for heavy- and medium-duty commercial vehicles.

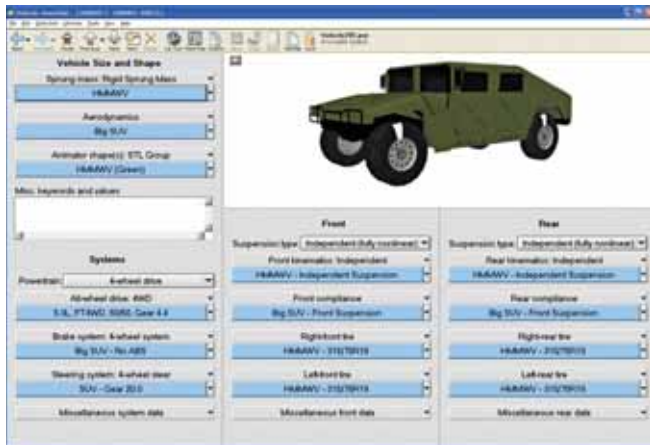
Detroit Diesel's Redford complex also gains new tenants as **Sterling Trucks** and **Western Star Trucks** (Freightliner companies) relocate headquarters from Willoughby, OH.

Kami Buchholz

The Grand Challenge is intended to accelerate the development of autonomous vehicle technologies for both military and civilian use. "DARPA and other U.S. agencies are already funding numerous robotic vehicle development programs, and the Grand Challenge is targeted to find innovative solutions that are being tested in realistic conditions," said Gerardo Pardo-Castellote, Chief Technology Officer of **Real-Time Innovations** (RTI).

Flying Fox, built by **Autonomous Vehicle Systems** (AVS), will rely on RTI's Network Data Distribution Service (NDDS) middleware for synchronized, distributed sensor integration for its unmanned autonomous vehicle in the Grand Challenge race. NDDS is an open-architecture platform based on the **Object Management Group's** Data Distribution Service standard, and it offers middleware with fully integrated tools for system visualization, analysis, and real-time debugging.

The Flying Fox vehicle is built on the chassis of an all-terrain vehicle by AVS, a collaboration between **Michigan State University**; **University of California, San Diego**; **American Institute of Aeronautics and Astronautics**; and



CarSim vehicle dynamics software from Mechanical Simulation Corporation is being used at Carnegie Mellon University to predict vehicle behavior over a wide variety of road conditions in an effort to win an autonomous vehicle race.

other industry professionals. AVS uses NDDS to communicate with advanced sensor systems that work in various ranges of the electromagnetic spectrum to provide the eyes and ears for the autonomous vehicle and integrates with a modular software system that allows sensors to be added or removed as the mission requires. Some sensor systems include adaptive vision, Ladar, and other sensors to provide feedback as to the vehicle's state. Flying Fox is among the first to demonstrate a neuroscience-inspired adaptive vision system in an off-highway environment that allows the vehicle to learn the best path through training examples.

Over the past year, a team of roboticists, automotive professionals, and students from **Carnegie Mellon University** (CMU) in Pittsburgh, PA, has spent endless hours equipping two vehicles with the latest drive-by-wire technology, electronic controls, and computer-assisted programs for suspension, steering, and braking. CMU's Red Team is competing for the second year. While no team actually finished the inaugural DARPA Grand Challenge in 2004, CMU's Sandstorm, a modified Hummer H1, went the furthest. Sandstorm is returning for this year's competition, and will be joined by H1ghlander, another modified Hummer.

Caterpillar strengthened its support of CMU's Red Team this year. The company, an early supporter and enduring technical pillar of the team, has stepped up to provide additional resources and is now its premier sponsor.

"We are pleased to be part of this innovative and challenging race, designed to test the next generation of automated equipment so essential to the advancement of America's industrial sector where Caterpillar is such a key component," said Mark Pfloderer, Vice President of Caterpillar's Technology & Solutions Division. "Working closely with Carnegie Mellon gives us a unique window into the cutting-edge world of robotics and information technology."

The CMU/Caterpillar collaboration is built on a long-standing relationship to co-develop automated equipment, including driverless trucks and unmanned excavators. Caterpillar and CMU are co-inventors of GPS guidance for off-highway machines, computer planning for robotic digging, and operator assistance for loading trucks.

Many Caterpillar technologies like steering, sensing, and software are embedded in the Red Team's robots. The company's MorElectric system generates power and regulates cooling. Its electronics control the engines.



The Carnegie Mellon Red Team is one of the finalists in the 2005 DARPA Grand Challenge with its modified Hummer vehicle.

Based in Ann Arbor, MI, **Mechanical Simulation Corporation** has also worked closely with the Red Team, providing CarSim vehicle dynamics software for use in predicting vehicle behavior over a wide variety of conditions. CarSim simulates the dynamic vehicle behavior of cars and light trucks, generating more than 500 output variables that are automatically plotted and animated for ease of analysis.

For this year's competition, the CMU team is taking predictability to a new level. "One tactic that will give us an advantage over all the other competitors is to have the best, most detailed understanding of the kinds of road conditions our vehicle will find on the course, and, more importantly, how it will react to those conditions," said Daniel Bartz, a member of Red Team and a CMU specialist in automated vehicles and road data collection. The team collected more than 2000 mi (3200 km) of 3-D road data in Nevada deserts and then entered these into CarSim, along with the functional design details of its vehicles. CarSim could predict how the vehicles would perform under a wide range of potential course obstacles and weather conditions.

"CarSim is designed to be extremely flexible with the type of data it receives," said Bartz. "The benefits of simulation are significant—accurate vehicle test results using experimental systems without spending large amounts of time in road testing. And you save the vehicle from potential damage on the rough course. We developed algorithms based on our models, using different speeds, soil, and other road conditions, including natural impediments such as rocks or trees. CarSim helped us see how the vehicle would react to every condition at various speeds. We were able to better understand when the vehicle will be stressed so we can avoid accidents that would eliminate us from the race."

The Red Team conducted extensive preliminary testing before taking the vehicles to Nevada in early August for final tests. One of the most significant tests was covering 200 mi (320 km) on a race course near Pittsburgh. They completed the test in 7 h, averaging 28 mph (45 km/h) and reaching a top speed of 36 mph (58 km/h).

"Being able to predict vehicle reaction under actual road conditions is of paramount importance to success in this event," Bartz said. "But the real-world rewards are in terms of new vehicle design and military technology. We're confident that much of what you see used in the DARPA Challenge will be used on vehicles in a few years."

David Alexander

Delphi goes to a medium

Having produced more than 4.5 million Multec DCR (diesel common-rail) systems since 2001 for light-duty vehicles, it did not take a trip to a psychic for **Delphi** to decide to leverage "selected components" of that technology for the off-highway and commercial vehicle markets, as well as passenger vehicles such as SUVs.

"We see growing demand for state-of-the-art diesel engines in all of these sectors," said Peter Lakin, Business Line Executive for Diesel Systems at Delphi.

The company's MDCR 1800 (medium-duty common rail) addresses the growing need for engines from 4 to 9 L that meet upcoming global emissions standards and "car-type refinement" combined with the durability and economy necessary for off-highway and commercial vehicle users. For higher-rated off-highway engines, standards compliance will require what Delphi describes as "a substantial step beyond" the traditional injection technologies used in the majority of current medium-duty engines.



Delphi's new medium-duty common-rail injection system is based on selected components of its proven Multec DCR light-duty system.



Delphi claims its solenoid injectors allow the smallest injection quantities and highest precision fuel delivery of any common-rail system available today.

At the heart of its system is an advanced solenoid injector that Delphi says allows the smallest injection quantities and highest precision fuel delivery of any common-rail system available today, including those using first-generation piezo injectors. The system has a maximum rail pressure of up to 1800 bar (26 ksi) and can deliver up to five injection events, giving engine designers more flexibility to select the most appropriate combination of durability, driveability, noise, and emissions. Control over each event is so precise, claims Delphi, that the system can enable compliance with Tier III regulations for off-highway vehicles at 1400 bar (20 ksi) with just two injection events and no aftertreatment.

The MDCR 1800 should allow for overall system simplification because its injectors operate at battery voltage with the lowest energy requirements of any common-rail system, according to the company, allowing simpler, more cost-effective electronics. The system's electronic control unit can be engine-mounted, allowing engine manufacturers to supply complete engines with a high level of customization (for different markets and engine applications) possible just through software changes.

Support for users of the new MDCR system will be courtesy of Delphi's recently strengthened global network of diesel applications engineering centers, which now covers Europe, the U.S., and Asia.

Jean L. Broge

Demand heating up for brazed copper-brass radiators

Worldwide use of brazed copper-brass heat exchangers will climb to 1 million units by 2007, according to Staffan Anger, President of **Outokumpu Copper Strip Oy**.

Sweden-based Outokumpu makes copper and brass strip, and is a member of the **CuproBrazo Alliance**, which is promoting brazed copper-brass heat exchangers over aluminum and soldered-brass types because of the formers' advantages in durability and efficiency.

At a press conference, Anger said, "The growth in CuproBrazo production in the past three years has been spectacular."

There are nine companies in production with the technology, and another 13 are about to make a decision on whether to begin production, Anger said. "And with about 80 more companies currently evaluating the technology, these numbers

are skyrocketing. As a result, the CuproBrazo Alliance predicts 500,000 heat exchangers in service by the close of 2005 and more than a million in service by the close of 2006."

CuproBrazo technology was conceived in the 1990s to compete against the aluminum-brazing process for a wide range of mobile heat-exchanger applications. The technology is now beginning to take off, with **SHAAZ** of Shadrinsk, Russia, opening a plant employing CuproBrazo technology in February 2003. The most recent major development in CuproBrazo was the opening of a plant in Nanning, China, operated by **Nanning Baling Technology**.

"The CuproBrazo Alliance has proven that it can ramp up manufacturing capacity to any level required, including high-volume production for OEM manufacturers," said Anger. "We knew that competitive high-volume manufacturing processes

Young Touchstone, a Wabtec subsidiary and member of the CuproBrazed Alliance, produces these Flat-Round tubes. (Photo courtesy of Young Touchstone)



could easily be developed because of the inherent simplicity of CuproBrazed technology."

CuproBrazed results in more durable, more efficient heat exchangers compared to alternative materials technologies such as aluminum or soldered copper-brass. Brazing occurs at higher temperatures than soldering, so brazed joints are much stronger than soldered joints.

According to Anger, another factor that has contributed to the rise in interest is that CuproBrazed remains strong at high temperatures—temperatures that would turn aluminum into

putty. The operating temperatures of charge air coolers (CACs) are increasing from 150°C (300°F) level up to 300°C (570°F) level. The strength of CuproBrazed fin and tube alloys will be good enough at these elevated temperatures whereas aluminum will lose its strength at much lower temperatures. For this reason, the alliance expects CuproBrazed to take market share from aluminum in CACs in heavy-duty trucks within the next few years.

Strength at elevated temperatures is in great demand for new clean diesel engines. The adoption of CuproBrazed technology is being driven by the more stringent diesel emissions standards scheduled to take effect around the globe over the next few years.

With more and more CuproBrazed heat exchangers in service, the door is open for copper-brass radiators to make a comeback in passenger cars, where aluminum has dominated since the 1980s. "Since under-the-hood temperature in passenger cars is predicted to rise in the years ahead, some major vehicle manufacturers have shown considerable interest even towards this market segment," Anger said.

Patrick Ponticel

Trelleborg reduces the vibes

Reducing vibration in the cabs of off-highway vehicles is an important element in helping to avoid driver fatigue while increasing efficiency and safety. **Trelleborg Industrial AVS**, a specialist in the design and manufacture of rubber-to-metal bonded components for anti-vibration applications and suspension systems, has worked closely with **JCB** on the application of components for the 722 model, the latest addition to JCB's articulated dump truck range.

The 722, with a maximum operating mass of 35.7 t (39.4 ton), has been designed for all-year operation in a wide variety of applications including building, quarrying, landfill, forestry, and drainage. Trelleborg, based in the UK and Sweden, has developed a center-split Spherilastik mount, used as a resilient



JCB's 722 articulated dump truck uses Trelleborg components to help reduce vibration.



Way Industry's Locust 752 skid steer loader uses Trelleborg's Metacone engine mounts from Trelleborg.

spherical joint to allow pivoting of the 722's A-frame suspension. The company also provides interleaf springs and conical bearings in the control equalizing beam. The combination of these systems has been designed to minimize noise levels and vibration.

Trelleborg's mounts also isolate both cab and transmission (six forward speeds, three reverse, auto and manual shift modes), and the 722's turbocharged 5.9-L engine is positioned on three pairs of Trelleborg MDS mounts, two at the rear and one at the front, to accommodate shock loads and torque reactions. The latest center-split Spherilastik mount has been designed for maintenance-free operation. The 722 has a cast center articulation with 360° oscillation to provide cab stability.

Trelleborg is also supplying **Way Industry** of Slovakia with Trelleborg's Metacone engine mounts for the Locust L 752, a universal mini skid steer loader on a four-wheel chassis.

Stuart Birch

Iveco looks to expand

After seeing solid, double-digit growth in 2004, **Iveco** is moving to continue increasing its market share. **Fiat**, Iveco's parent, is reorganizing the powertrain group to address the changes in diesel as governments set new emissions levels.

In 2004, Iveco sold 434,800 engines, a rise of 15% over 2003's 378,660. Roughly three quarters of those went into vehicles, with most of the rest going into industrial, and a small percentage going to power generation and marine applications.

"Our goal is 600,000 by 2008," said Ricardo Tardi, Senior Vice President of Iveco Trucks and Industrial. Iveco is the fourth-largest engine maker, with market share rising from 4.3% in 2003 to 4.6% in 2004, Tardi added.

As the company pushes to grow market share, it is being reorganized within the Fiat family. Fiat Powertrain Technologies will now include the powertrain operations of Fiat Auto, **Magneti Morelli**, and Iveco, as well as the relevant operations at the Fiat Research Center. The 23,000 employees are from 26 plants in 12 countries.

Part of the growth will come by addressing an expanded range. Next year, the company plans to extend its line upward with 30- and 40-L engines that offer 1800 and 2400 hp (1340 and 1790 kW), respectively. Iveco currently offers engines with displacement of 2 to 20 L, with ratings from 100 to 1200 hp (75 to 895 kW).

Currently, the company is focused on meeting Euro 6 and Tier 4 U.S. requirements.

"The main difference is that we're looking at aftertreatment particulate matter traps or SCR (selective catalytic reduction) for Europe," said Gian Maria Olivetti, Product Development

Iveco is decreasing engine emissions and extending its line of diesel engines.



Director at Iveco Trucks and Industrial. Like most vendors, Iveco is encouraging regulators to harmonize their requirements so manufacturers can design a single product for global markets.

Among the techniques for Euro 6 and Tier 4 are low-pressure loop EGR (exhaust gas recirculation) and increasing injection pressure to 2400 bar (35 ksi). Peak cylinder pressure will be greater than 200 bar (2.9 ksi).

Beyond 2010, Iveco is exploring alternatives to diesel such as diesel-electric hybrids, fuel cells, and biomass-to-liquid vehicles.

Terry Costlow

Separating gyroscopes from Greek sandwiches

An engineer looking for the latest in gyroscopes for a key project can use a general-purpose search tool on the Internet, enter "gyros," and then sift through up to 3.9 million Web pages that may have what he or she is looking for amongst all the recipes and local food shops. Or he/she could log on to the **GlobalSpec** Web site and with the same search word be offered 39 companies that make inertial gyroscopes, or 131 companies that make accelerometers.

The difference is intelligent searching. The goal of a more productive business search is not to cast the widest net, but to

divide the deepest and look only for relevant results. GlobalSpec is trying to create a community anchored by a specialty Web search engine that is dramatically different than general-purpose mass-market tools. It works best for engineers who are at the stage of a job that they know what they need.

Ten years ago, four engineers working at a **GE** corporate R&D lab estimated that they spent at least 20% of their time searching for suitable components. The business concept they created then, and have been refining ever since, is of a catalog library online that is constantly updated. Today, that library contains more than 85 million searchable product specifications in 1.2 million product families from more than 15,000 supplier catalogs.

Suppliers pay an annual fee to be listed in the system, which means that more than 2 million registered users get access to all that data at no charge. And with more than 2.3 million visits logged per month, the service is growing in popularity.

Engineers at GlobalSpec make updates every two weeks, adding new content and revising existing data. Every one of the product areas has 20 to 60 parameters defined by the staff engineers, which makes it easy for users to compare products across suppliers. The company sees itself as a matchmaker, and has made it easy for an engineer to generate an RFQ (request for quote) or get detailed technical information. Suppliers get feedback on how many engineers have looked at their products.

Beyond just product catalogs, www.globalspec.com provides access to more than 200-million pages of organized and filtered information, including material properties, patents, standards, application notes, and proprietary content unavailable with other search engines.

David Alexander



The GlobalSpec search engine is designed to be the place for engineers to get their work done. Intelligent searching allows the user to find suitable products by specifying desired performance parameters.