boostermagazine

SEPTEMBER 2007

NEW TURBO HORIZONS

Pushing Boundaries Through Innovation

Honeywell

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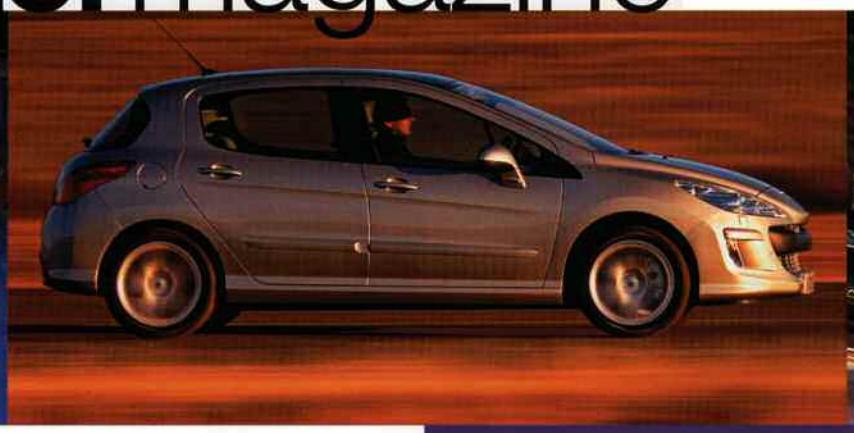

On Track

+ Small diesel engine sales are expected to double from four million units to about eight million over the next five years, as auto manufacturers tackle the twin challenges of CO_2 reduction and fuel efficiency.

+ Tata Motors has an eye on both export and domestic markets with its Safari SUV, which features a new 2.2L, Euro IV compliant diesel engine. It is the first Indian SUV equipped with the Honeywell VNT™ technology.

+ Auto manufacturers are turning to gasoline direct injection (GDI) and turbocharging as the perfect technological fit in their strategies for driving up fuel efficiency and driving down levels of CO_2.

+ Delivering optimal engine performance and longer turbo lifespan, innovative speed sensor technology from Honeywell looks set to be integrated into some select passenger car turbochargers from 2008 onwards.

+ A new high-cetane green diesel that is clean burning and compatible with today's petrol diesel engines is about to be launched, thanks to collaboration between Honeywell's UOP and Italian refiner Eni.

+ Two of the world's biggest automotive brands went head-to-head at the 24 Hours of Le Mans – and not even a flooded racetrack could dampen the spirits of Audi and Peugeot as the two Honeywell-boosted turbodiesel sportscars claimed the top two podium places at the world's most famous endurance race.

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Photos: Alfa Romeo, Audi, DaimlerChrysler, DPPI, Getty Images, GM, Honeywell, Hyundai, Mercedes-Benz, Mitsubishi, Nissan, Peugeot, Renault, Tata Motors, Tony Perez, Transtock

Listening and Learning

Dear Readers:

It's the time of the year again when OEMs are launching their newest vehicles. It's an exciting time and it's impossible not to marvel at the pace of change in the automotive sector – and the remarkable feats of innovation that characterize today's business environment.

As always, it is the boldest innovations that attract the most attention. I've long believed that boldness counts in our industry and that the bar is continually being raised with development of new vehicles that are not only stylish, but are ever more fuel efficient, cleaner and safer than ever. And a lot of them are incredibly fun to drive.

At Honeywell, we understand keeping pace with these bold moves isn't enough. Instead, we see our role as developing technologies to help drive those changes and push geographic, environmental and technological boundaries.

As we celebrate the new turbo applications that are inside many exciting new vehicles this fall – from Peugeot 308 to Audi Q7, we are reminded again of the importance of building strong partnerships with our OEM customers. We are keenly aware that this partnership is founded on a shared appreciation of technological innovations – as evidenced by our latest advances in turbo speed sensors for passenger vehicles.

All these achievements are set in the context of helping our OEM customers optimize fuel efficiency and reduce CO_2 emissions, without sacrificing performance. From introducing premium boosting technologies into small diesel engines to introducing Euro IV compliant VNT™ technology to India, Honeywell is committed to thinking boldly.

And it's more than just our Turbo Technologies business. Honeywell's business overall has nearly 50 percent of its product portfolio linked to energy efficiency, so we thought it fitting to also feature the latest Ecofining™ green diesel technology from our UOP business. It's through working together, within or outside Honeywell, that we can turn bluer skies into reality. As always, thanks for your ongoing support.

COVER:
The Audi A5 turbocharged by the Honeywell 3rd generation VNT™ turbocharger

Adriane M. Brown

Adriane Brown
President and CEO
Honeywell Transportation Systems

+ TURBO TECHNOLOGIES SET THE STANDARD
+ BOOSTING PERFORMANCE ACROSS EVERY PASSENGER CAR SEGMENT

Boosting Success...

Hyundai i30

Engine Specifications

- Engine Layout: 4 inline
- Displacement: 1582cm³
- Maximum Power: 116hp @ 4000rpm
- Maximum Torque: 255Nm @ 1900rpm
- Diesel direct injection common rail

Turbocharger Features

- GT15 VNT™ 2nd generation
- D5S turbine housing
- Pneumatic actuator

Peugeot 308

Engine Specifications

- Engine Layout: 4 inline
- Displacement: 1560cm³
- Maximum Power: 110hp @ 4000rpm
- Maximum Torque: 240Nm @ 2000rpm
- Diesel direct injection common rail

Turbocharger Features

- GT15 VNT™ 2nd generation
- Die cast compressor housing
- Pneumatic actuator with/without position sensor

GT15 VNT™ Turbo

Fuel economy and performance without compromise

GT15 VNT™ Turbo

Optimal driveability with a small diesel engine

As auto manufacturers grapple with tightening CO_2 targets, turbo technologies are increasingly a feature of smaller displacement diesel engines. While turbocharging was originally focused on premium power units of 1.7L and above, today there is an emerging trend that is driving the technology deeper into the powerplant range in order to deliver fuel economy and performance.

Mercedes C-Class

Engine Specifications

- Engine Layout: 4 inline
- Displacement: 2148cm³
- Maximum Power: 170hp @ 3800rpm
- Maximum Torque: 400Nm @ 2000rpm
- Diesel direct injection common rail

Turbocharger Features

- GTB17 VNT™ 3rd generation
- High torque rotary electronic actuator (REA)
- Low nickel content turbine housing

Audi A5

Engine Specifications

- Engine Layout: V6
- Displacement: 2967cm³
- Maximum Power: 240hp @ 4000rpm
- Maximum Torque: 500Nm @ 4000rpm
- Diesel direct injection pump injector

Turbocharger Features

- GT22 VNT™ 3rd generation
- Controlled by simple rotary electronic actuator (SREA)
- Low nickel content turbine housing

GTB17 VNT™ Turbo

Sophisticated power and control for a premium engine

GT22 VNT™ Turbo

Best-in-class diesel for exceptional driving fun

...Around The World

Alfa Romeo Brera

Engine Specifications

- Engine Layout: 5 inline
- Displacement: 2387cm³
- Maximum Power: 210hp @ 4000rpm
- Maximum Torque: 400Nm @ 4000rpm
- Diesel direct injection common rail

Turbocharger Features

- GT20V VNT™ 3rd generation
- D5S turbine housing
- Aerodynamically optimized compressor inlet

Renault Laguna

Engine Specifications

- Engine Layout: 4 inline
- Displacement: 1995cm³
- Maximum Power: 175hp @ 3750rpm
- Maximum Torque: 380Nm @ 2000rpm
- Diesel direct injection common rail

Turbocharger Features

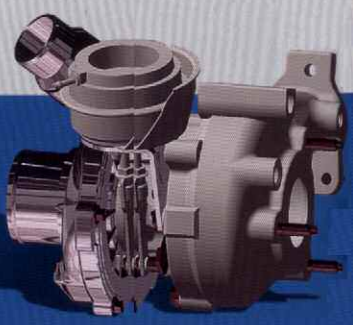
- GT15 VNT™ 2nd generation
- Water-cooled center housing
- Pneumatic actuator

GT20V VNT™ Turbo

Third generation VNT™ lifts performance

GT15 VNT™ Turbo

Premium performance and refinement



Never has consumer demand for performance and fuel efficiency been so great – and auto manufacturers are responding with new models that not only have the power to deliver, but also optimize engine efficiency. Honeywell's VNT™ technology continues to be the turbo system of choice for enhanced power output and driveability, improved boost control and great transient response.

Jeep Cherokee

Engine Specifications

- Engine Layout: 4 inline
- Displacement: 2776cm³
- Maximum Power: 177hp @ 3800rpm
- Maximum Torque: 460Nm @ 2000rpm
- Diesel direct injection common rail

Turbocharger Features

- GT17 VNT™ 3rd generation
- Controlled by rotary electronic actuator (REA)
- Low nickel content turbine housing

GT17 VNT™ Turbo

Performance and fuel economy in the SUV segment

Audi Q7

Engine Specifications

- Engine Layout: V8
- Displacement: 4135cm³
- Maximum Power: 326hp @ 3450rpm
- Maximum Torque: 760Nm @ 1800rpm
- Diesel direct injection common rail

Turbocharger Features

- GT17 VNT™ 3rd generation
- D5S turbine housing
- Controlled by rotary electronic actuator (REA)
- Water-cooled center housing

GT17 VNT™ Turbo

Impressive torque and driveability

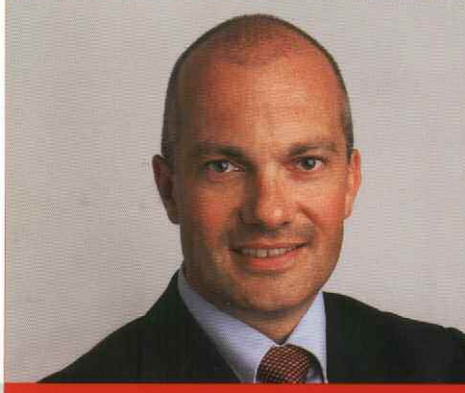
+ DIESEL ENGINE DOWNSIZING EXPANDS AROUND THE WORLD
+ HONEYWELL EMERGES AS KEY PLAYER IN SMALL DIESEL SEGMENT

Small Diesels Gain

When Honeywell first introduced its groundbreaking VNT™ turbocharging technology in the early 90s, the focus was mainly on boosting premium diesel engines, or those with displacement of 1.7L and above. More than a decade later, as CO_2 and fuel economy gain parity with vehicle performance, VNT™ technology is migrating to smaller engines.

Booster Magazine **recently sat down with Olivier Rabiller, Vice President, Customer Management, Passenger Vehicles at Honeywell Turbo Technologies to get his take on the current status and future trends for boosting small diesel engines.**

Momentum



Olivier Rabiller

Olivier Rabiller is Vice President, Customer Management, Passenger Vehicles at Honeywell Turbo Technologies, a position he was appointed to in August 2006. In this role, he oversees Honeywell Turbo's global customer-interfacing activities for passenger vehicles that include marketing, sales and application engineering.

Before this appointment, Olivier Rabiller served as Vice President, European Sales and Customer Management from October 2005 after serving as Director of Marketing & Business Development for the European region, with responsibility extending to cover the passenger car segment worldwide.

Olivier joined Honeywell in 2002 as Senior Program Manager & Business Development Manager for Turbo Technologies EMEA after having spent seven years at Renault where he worked in Customer Services & Powertrain Purchasing.

What are the trends for small diesel engines worldwide and how do they play out?

On the small diesel front, we are seeing two patterns working their way through different parts of the world.

In developed economies, engine downsizing is increasingly adopted as an effective way of lowering CO_2 emissions while continuing to meet the customers' need for great performance and driveability.

In Europe, small diesel engines below 1.7L are expected to increase their share of all diesel engines produced from 33 percent to 55 percent within the next five years.

In emerging markets, high fuel prices mean that car buyers tend to pay greater attention to a vehicle's fuel economy. As a result, there is a shift from small gasoline engines to small diesel engines – and this phenomenon is more noticeable in countries where diesel fuel enjoys a price advantage, as is the case in India,

How do small diesel engines differ from large diesel engines?

As engine size gets reduced, transient response tends to suffer. To compensate, the boosting system needs to provide better low-speed response. Also, a small engine size requires more compact solutions, which applies to turbocharging as well.

What does Honeywell bring to the table?

Honeywell has been considered a trusted partner due to our strong expertise in diesel turbocharging. In terms of innovation, Honeywell pioneered variable geometry technology for large diesel, and has just successfully completed the adaptation of its third generation VNT™ to small diesel engines. Honeywell engineers are also developing specific balancing technology to address the low noise level requirements of small diesel engines.

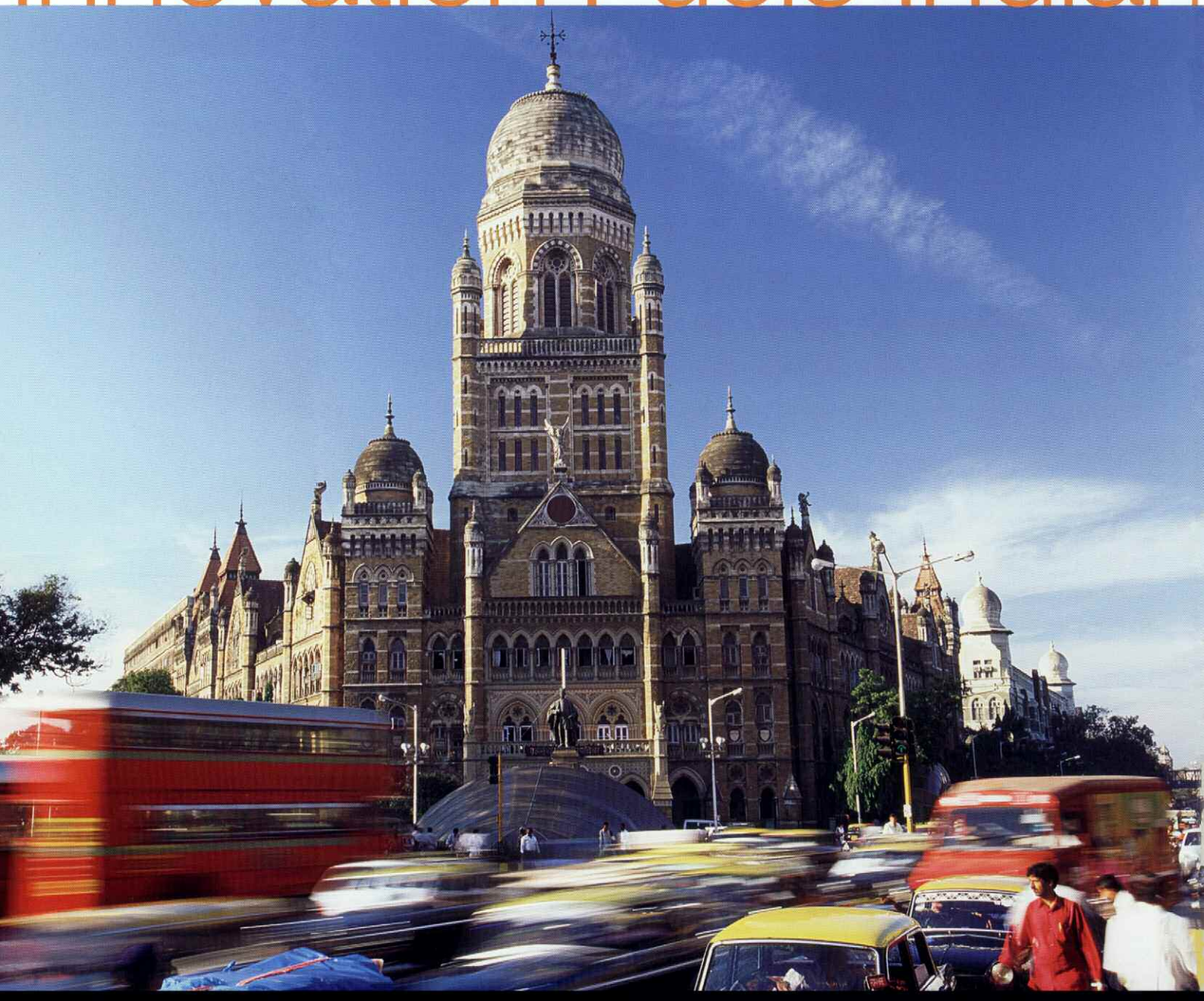
In addition, we enjoy significant benefits in terms of scale and global presence, both in engineering and manufacturing. We are capable of supporting customers wherever they are based.

What does the future hold?

Small diesel engine sales are expected to double from four million to close to eight million in the next five years, and this presents tremendous growth opportunity for Honeywell. In the next year or two, Honeywell will be launching 11 small diesel applications with eight global car manufacturers. The best is yet to come...

+ INDIAN MANUFACTURERS LOOK TO DIESEL FOR FUTURE GROWTH
+ HONEYWELL VNT™ MAKES DEBUT ON TATA SUV

Innovation Fuels Indian



India is on the verge of a turbo revolution, with automotive manufacturers such as Tata Motors leading the way. While the diesel boom is especially noticeable in the small diesel segment, the availability of advanced diesel technologies, including turbocharging, is also enabling Indian OEMs to upgrade their larger diesel engines in both performance and emissions compliance.

Diesel Boom

Tata Motors has just updated the existing Safari SUV and the Xenon pickup with a brand new 2.2L Euro IV engine, initially with an eye on Europe, but also intending to use this new engine to generate interest domestically.

At the heart of the new Tata Safari and the Xenon lies the advanced, Honeywell-boosted diesel engine which not only conforms to the Euro IV standards, but also delivers exceptional levels of performance on the road. At 2.2L, the engine is bigger than the norm in a country where small cars are much in demand – but there is growing interest in larger displacement vehicles as affluence levels rise.

"We are proud to introduce our VNT™ technology with Tata – the first time VNT™ technology has been used in the SUV segment in India," says Sanjay Sondhi, Managing Director of Honeywell Turbo Technologies in India.

Tata is certainly at the front of the pack in developing Euro IV compliant engines in a country which has adopted a two-tier emissions control regime. Currently, the 11 largest cities are at Euro III and the rest of the country at Euro II. By April 2010 these standards will change to Euro IV and Euro III respectively – and that will herald a major ramp-up of turbocharged diesel models.

Prakash M. Telang, Executive Director, Commercial Vehicles at Tata Motors, predicted significant demand for this new engine when he was interviewed recently by the *Booster Magazine*. "We needed an engine which meets Euro IV in order to export to Europe. Honeywell's VNT™ technology came in very useful in developing a state-of-the-art engine that meets Euro IV emission norms. We believe this engine will provide significant benefits to our customers by delivering higher power, better fuel efficiency and driveability," says Mr. Telang.

"Engines with greater power-to-weight ratio will be more popular..."

He added: "Engines with greater power-to-weight ratio will be more popular as investment in the India road network pays off, and that means much greater emphasis will be placed on technology such as turbocharging. We see an increased demand for this engine as we launch newer vehicles over the next few years, and we have developed a very good working relationship with Honeywell in India," said Mr. Telang. "They have been able to present a very good value proposition in terms of technology and engineering support, and as a result we have been able to take advantage of VNT™ technology in our latest engines."

Honeywell set up its plant in India in 2005 and has since invested significantly in establishing a local supplier network, local engineering for Indian customers and a state-of-the-art manufacturing facility located in Pune. "Indian car manufacturers clearly have an eye on the incoming legislative requirements, but what Honeywell VNT™ turbocharging technology provides is performance as well as emissions control," says Sanjay. "And Honeywell is uniquely positioned to support the country's increasingly vibrant auto manufacturing sector."

Rising Diesel Demand in India

According to an August 7 article in the *Economic Times* of India, diesel vehicles now account for one-third of the Indian market backed by new technologies and cheaper operating costs. And the demand from consumers for diesel vehicles is rising.

Diesel cars are currently growing at about six to nine percent every year, and it is expected to account for 40 to 45 percent of the total market by 2010, according to the *Economic Times*. In all the dual-powertrain cars launched recently, the diesel versions have stolen the thunder from their gasoline counterparts, reports the Indian newspaper.

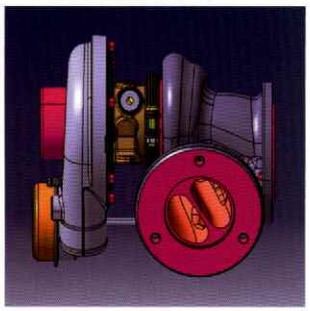
The rationale for diesel cars' popularity is quite straightforward. Diesel engines enjoy up to 40 percent fuel economy advantage, and the fuel is 30 percent cheaper than gasoline. The availability of cleaner diesel fuels also helps.

+ TWO COMPLEMENTARY TECHNOLOGIES ENHANCE FUEL EFFICIENCY
+ HONEYWELL FOCUSES ON DIVERSE GASOLINE TURBO SOLUTIONS

Turbocharging And G

Gasoline direct injection (GDI) is gaining momentum as a key technology of the future, working in tandem with turbocharging to help auto manufacturers achieve the goal of better fuel efficiency.

GDI is a variant of fuel injection employed in modern four stroke petrol engines. The gasoline is injected directly into the combustion chamber of each cylinder, as opposed to conventional multi-point fuel injection that happens in the intake port, and uses a high pressure injection pump and common fuel line.



The cooling effect brought about by GDI improves the knock resistance of the fuel – this increases the ability of the engine to accept higher intake pressures, making GDI and turbocharging a perfect combination.

"With GDI and turbocharging working together, we could see up to 20 percent improvement in fuel efficiency and in corresponding reduction of CO_2 emissions," says David Paja, Director of Marketing for Passenger Vehicles at Honeywell Turbo Technologies

Since GDI offers the flexibility to adjust air and fuel independently and enables strong residual gas scavenging, the turbo needs to generate as little backpressure as possible to take full advantage of this GDI attribute. Twin scroll technology in particular provides significant benefits as it improves scavenging by forcing flow separation.

For gasoline engine downsizing, whether GDI (direct injection) or MPFI (port injection), the goal is to deliver transient performance and driveability in smaller engines that are comparable to a bigger displacement engine. Turbocharging could deliver further performance enhancement through inertia reduction and, more importantly, by improving low-speed turbo efficiency.

Beyond the current technology offerings, Honeywell is looking to introduce variable geometry boosting to gasoline engines rather than transferring current diesel technology (which was pioneered by Honeywell) into gasoline. The requirements of gasoline engines in terms of rpm range, working temperatures (1050°C in gas as opposed to 830°C in diesel) and turbo efficiency at low end do not make the diesel variable-geometry concept the most suitable solution for gasoline.

"We see great potential in variable turbine geometry technology for GDI gasoline engines," says David Paja. "We believe that gasoline engines will follow the same evolutionary path as diesel, with boosting moving quickly from wastegate to variable geometry."

GDI: A Timeline of Evolution

1952
The first direct injection system was developed by Bosch, and was introduced by Goliath and Gutbrod in 1952.

1955
Mercedes-Benz 300SL, the first sportscar to use fuel injection, featured direct injection.

1996
Gasoline direct injection reappeared in the automotive market. Mitsubishi Motors was the first with a GDI engine in the Japanese market.

DI–The Perfect Fit

1999
Renault became the first European OEM to introduced GDI on its Megane coupe.

2000
Toyota introduced direct injection engine D4 (Toyota AZ engine) in the Toyota Avensis.

2001
Volkswagen/Audi introduced their GDI engine under the product name Fuel Stratified Injection (FSI).

2002
Alfa Romeo introduced their first direct injection engine JTS.

2006
BMW introduced its second-generation High Precision Injection system on the updated N52 straight-6 after introducing the GDI V12 BMW N73 engine in 2003.

+ NEW SENSOR TECHNOLOGY UNLEASHES ENGINE POWER
+ LONGER TURBO LIFE AND BETTER PACKAGING FLEXIBILITY

Speed Sensor For Optim

As all turbos have a speed limit above which the turbo reliability may be compromised, today's passenger vehicle engines are calibrated to ensure that the turbo operates at all times below its maximum speed limit. Speed sensors, through direct communication of the instantaneous turbo speed to the Engine Control Unit, allow the rpm safety margin to be optimized, resulting in improved engine performance and longer turbo lifespan.

Simulations undertaken by Honeywell on a 2L engine have shown that with the help of a speed sensor, there is a four percent increase in engine power for every 10,000 rpm increase in turbo speed, making the 2L engine perform like a 2.2L turbocharged engine that is not equipped with the speed sensor.

al Performance

While turbo speed sensors have become a regular feature for commercial vehicle engines, their adoption by passenger cars is still in an early stage. As car engines become more advanced, incorporating speed sensors into turbocharged passenger vehicles becomes of increasing interest.

And the timing couldn't be better. "EGR rates and rising power densities in passenger vehicles continue to raise the bar. As a result, turbos have moved closer to their maximum mechanical speeds," says Chris Greentree, Platform Manager for Commercial Vehicle Actuation and Sensors at Honeywell Turbo Technologies. "Turbo speed sensors allow car makers to produce maximum engine power without reducing the reliability of the turbocharger."

"Additionally, once you have a speed sensor on board, you can take advantage of the speed control to regulate boost control for enhanced accuracy and dynamic boost management," says Chris.

The task for Honeywell engineers was to overcome some technical hurdles as they converted this commercial vehicle technology for passenger vehicles.

The first challenge involves finding a material that is not cost prohibitive. Due to recent advances in plastic technology, a new type of plastic has emerged that was stable enough to handle temperatures up to 230 degrees Celsius, a 50 degree increase over past component material. "This increase in temperature-resistant capability enables us to make speed sensors an affordable feature for passenger cars," says Chris.

"Turbo speed sensors allow car makers to produce maximum engine power..."

The next hurdle involves ensuring the precise tolerance, or the miniscule gap between the sensor and the compressor wheel. "The clearance between the sensor and the wheel should be between 0.3 and 0.5mm on a passenger car – that's how much gap there is between the wheel spinning at 200,000 rpm with the sensor sitting still," says Chris. "Honeywell has gained the manufacturing ability to control this tolerance so that the sensor could fit inside this acceptable gap and function correctly."

The third challenge is related to the much smaller size of a speed sensor for passenger vehicles. A typical sensor for a truck is 10mm in diameter at the tip compared to about 6mm for a car. Since a smaller speed sensor means that weaker signals would be generated, a strong computer modeling capability is required to tease out valid signals from the "noise". "After extensive lab work, we have developed the right computer modeling programs that enable us to optimize the performance of the speed sensor," says Chris Greentree.

As a turbo expert that pioneered speed sensors for commercial vehicle applications, Honeywell is currently working with several OEMs and expects to launch the first speed sensor passenger vehicle application next year.

Turbo Speed Sensor: How it Works

Honeywell is a pioneer in introducing speed sensor technology for commercial vehicle applications. First beginning to show up in heavy-duty trucks more than seven years ago, speed sensors were initially installed into the turbocharger's center housing to help balance the truck engine's power and improve the reliability of the turbo since commercial vehicles are typically exposed to more severe conditions. As the sensor technology evolved over the years, Honeywell engineers have succeeded in extracting additional performance gains through this technology.

"The purpose of the speed sensor is to measure the rotational speed of the turbocharger," explains Chris Greentree, Platform Manager for Commercial Vehicle Actuation and Sensors at Honeywell Turbo Technologies. "As the blade of the compressor wheel passes by the nose of the sensor, it creates a electro-disturbance in the sensor's coil, which sends an electric signal back up the cable. That electro-disturbance is then processed and turned into a signal that is sent to the Engine Control Unit (ECU). This communication between the turbo and ECU allows the turbo performance to be perfectly matched to that of the engine without the drawback of either underperformance or turbocharger over-speed."

+ HONEYWELL UOP USHERS IN GREEN DIESEL FUEL
+ NEW UOP/ENI ECOFINING™ PROCESS FOR HIGH-CETANE RENEWABLE FUEL

A New Approach to Ren

A ground-breaking refinement process from Honeywell's UOP looks set to usher in a green diesel that is cleaner-burning, perfectly suitable for engines using petrol diesel while fully compatible with existing distribution infrastructure.

The new high-cetane fuel is the result of collaboration between UOP, a subsidiary of Honeywell and a global technology leader in refinery and petrochemicals industries, and Italian refiner Eni.

The UOP/Eni Ecofining™ process injects hydrogen into a feedstock such as vegetable oil or grease, removes the oxygen and makes a hydrocarbon product, or green diesel fuel, with attributes similar to regular petroleum diesel.

Where the green diesel produced by the Ecofining process really excels is in its composition, which is similar to the fuel that consumers already use, that automobiles are already optimized for and that the existing distribution infrastructure can easily accommodate.

ewable Energy

"The green diesel will be a great fuel choice for both carmakers and engine component suppliers who are looking for a cleaner-burning diesel that requires no re-validation of the engine," says Jennifer Holmgren, Director of Renewable Energy and Chemicals at UOP. "In addition, carmakers can even choose to optimize future applications that utilize a fuel with a higher cetane level."

Up until now, biodiesel and ethanol have been the two most explored renewable fuel options. However, they are very dissimilar in molecular structure to conventional petroleum-based fuels. As a result, their mass production distribution may prove very costly for a number of industries.

Compared with biodiesel, which is made by adding methanol to vegetable oils and greases, the Ecofining-produced green diesel fuel has excellent properties such as very high cetane levels, little to no sulfur content and reduced NOx emissions. In addition, unlike renewable fuels that lack stability due to oxidation, the green diesel is completely stable. All these make the green diesel an excellent blending component for upgrading low quality fuels. Moreover, with the characteristics of green diesel being very close to petrol diesel, there is no need for compatibility validation of diesel engines associated with biodiesel.

With the first Ecofining facility going into production in 2009 – Eni being the first to produce it and other refineries expected to follow suit – Honeywell's UOP is fulfilling its goal of developing next generation fuel processes that satisfy the worldwide craving for cleaner fuel.

Looking forward, Honeywell's UOP is already developing second generation technology that uses waste or non edible oils from various land or water-based plant sources instead of vegetable oils. "We are also exploring the use of algae, which can grow and produce more oil in a much smaller area, more quickly and in a more cost-effective fashion," concludes Jennifer Holmgren.

Green Diesel vs. Petro. Diesel and Biodiesel

	Petro. Diesel	Biodiesel	Green Diesel
NOx Emission, %	Baseline	+10	-10 to 0
Cloud Point, °C	-5	-5 to 15	-30 to -10
Density, g/ml	0.83-0.85	0.883	0.78
Cetane Number	40-55	50-65	75-90
Sulfur	<10 ppm	<2 ppm	<2 ppm
Oxidative Stability	Baseline	Poor	Baseline
Distribution Infrastructure	Existing	Not compatible	Compatible

About UOP

Today, more than 60 percent of the world's gasoline and 85 percent of biodegradable detergents are made using Honeywell's UOP technologies. For more than 90 years, UOP engineers and chemists have brought laboratory science to industrial reality by developing technologies, products and services that serve its customers well.

UOP boasts a rich portfolio of refining, petrochemical and gas processing technologies, products and services that addresses shifting global demands brought about by such factors as growing population, changing environments, and tightening of government regulations.

UOP is headquartered in Des Plaines, Illinois with sales, manufacturing and engineering sites in the U.S., Canada, Europe, Asia and the Middle East.

+ MARTY LADWIG HEADS NHRA SPORT COMPACT PRO FWD CLASS
+ HONEYWELL GT45R BALL BEARING TURBO A KEY DIFFERENTIATOR

Marty Ladwig–A R

Basics of Drag Racing

A drag race is an acceleration contest from a standing start between two vehicles side by side over a measured distance. The accepted standard for that distance is either a quarter-mile (1,320 feet) or an eighth-mile (660 feet). A drag racing event is a series of such two-vehicle, tournament-style eliminations. The losing driver in each race is eliminated, and the winning drivers progress until one driver remains.

Two separate performances are monitored for each run: elapsed time and speed. Upon leaving the staging beams, each vehicle activates an elapsed-time clock, which is stopped when that vehicle reaches the finish line. The start-to-finish clocking is the vehicle's elapsed time (e.t.), which serves to measure performance. Speed is measured in a 66-foot "speed trap" that ends at the finish line. Each lane is timed independently.

ace To The Top

Marty Ladwig heads the field when it comes to setting records. He regularly tops 200 mph in his Honeywell-boosted Cobalt – and that's why he's a serious contender for this year's NHRA Xpld Pro FWD title.

On May 6, 2007, Marty delivered a record-setting performance at the 7th annual NHRA Sport Compact Spring Nationals at Englishtown, New Jersey by capturing his second straight win in the Pro FWD category, driving his Ecotec-powered, Honeywell turbocharged Cobalt to a final-round victory over Ed Bergenholtz.

In winning the event, Marty Ladwig set both the elapsed time and top speed record, and posted all three eliminator runs in excess of 200 mph. Marty's achievement was all the more spectacular considering that he is the first person to pilot a front wheel drive car in breaking the 200 mph ceiling.

Marty defeated Chris Rado in round one, resetting the national e.t. record with a run of 7.274 seconds at 200.50 mph. In the second session, and in one of the closest and quickest side-by-side races ever seen in the Pro FWD category, Ladwig defeated fellow Chevy Cobalt driver Gary Gardella by .047 of a second, and crossed the finish line first with a 7.317 e.t. at a national-record top speed of 201.55 mph.

In the finals against Ed Bergenholtz, Ladwig once again busted through the 200 mph barrier, defeating the defending NHRA Pro FWD champion with a 7.303 e.t. at 200.77 mph. The margin of victory for the Chevrolet was .155 of a second.

When *Booster Magazine* recently caught up with Marty, he was emphatic about the role Honeywell turbos have played in his race wins: "It comes down to the turbos. With the Honeywell turbo, you get more reliability at the same power rating."

In drag racing, engine – and turbo – reliability is key because of time pressures. If a turbo fails, a racer has less than 45 minutes between races to replace it. "I don't even have to worry about the Honeywell turbos, while other teams quite often have problems with other manufacturers' turbos," says Marty. "I have tried different turbos in the past, but the Honeywell turbos are the most reliable, consistent, and they deliver the most power. And the boost comes on much quicker."

Now running his own team, Marty spent much of his time perfecting his GM Chevrolet Cobalt boosted by the 2.2L Ecotec engine that delivers 1500 hp and more than 1000 lb.-ft. (1356 Nm) of torque. The engine is equipped with a catalogue Honeywell GT45R ball bearing turbocharger that is also available from authorized Performance Distributors (www.turbobygarrett.com).

So far, the two-time NHRA Hot Rod Champion has had 15 career NHRA wins and is the most consistent Pro FWD driver to go over the 200 mph barrier with a total of five passes exceeding the top speed mark.

During drag racing events, vehicles are classified into different classes by various criteria to ensure that the cars are evenly matched during the race. Drag racing vehicles are special in that they are modified to be lighter and more powerful than in their standard form.

+ AUDI AND PEUGEOT POWER TO SUCCESS
+ 24 HOURS OF THRILLS AND SPILLS

Turbodiesels Domin

Not even a flooded racetrack could dampen the spirits of Audi and Peugeot as the two turbodiesel sportscar pioneers claimed the top two podium places at the world's most famous endurance race.

In claiming victory with the R10 TDI, Audi not only took the checkered flag at the 24 Hours of Le Mans with turbodiesel technology for the second successive year, the OEM team also notched up its seventh victory in the last eight years, with Honeywell boosting all seven wins – five for gasoline and two for diesel.

ate Le Mans

For Peugeot, the prototype 908 HDi FAP made an impressive debut in the marathon event – and then confirmed its remarkable potential just a few weeks later by finishing first and second in the Nürburgring 1,000km.

"If 2006 heralded the arrival of a new turbodiesel era in motorsports, this year confirmed the technology as a dominant force for the future in endurance racing," says Doug Milliken, who oversaw Honeywell's engine boosting support for both Audi and Peugeot.

"The performances of both Audi and Peugeot were stunning – they've proven to a worldwide audience just how exciting turbodiesel technology can be."

This year's race had more than 260,000 fans on the edge of their seats, with both the Audi No. 2 and No. 3 cars crashing out before torrential rain brought out the safety car. Marco Werner took the Audi R10 TDI No. 1 car over the finish line with a ten lap lead over the nearest rival, cheered on by team-mates Frank Biela and Emanuele Pirro.

"The performances of both Audi and Peugeot were stunning..."

Peugeot survived a last hour technical hitch before Sebastian Bourdais piloted home the 908 HDi FAP on behalf of teammates Stéphane Sarrazin and Pedro Lamy.

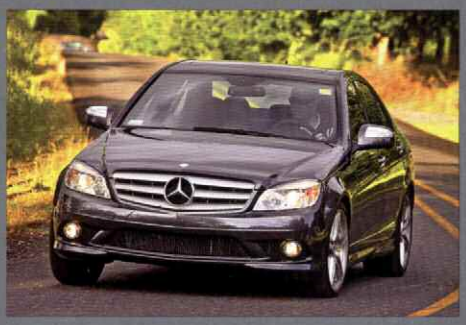
The feat for both teams was particularly special as this year's diesel-powered sportscars were compelled to race with smaller fuel tanks. The latest triumph places Audi at an all-time third place in the record books - only Porsche and Ferrari have won at Le Mans more often.

"This was certainly the most difficult race that we have ever contested at Le Mans," said Rupert Stadler, Chairman of the Board of Management of AUDI AG. "So this victory counts even more. On the race track, we have shown once more that we have the best technology, the best drivers and the best team. Everybody within Audi can be proud of this success."

Frédéric Saint- Geours, Executive Vice President, Automobiles Peugeot, described the result as excellent and very promising for the future. "All the resources we have invested in this endurance program both financially and in human terms are based on a long term presence."

Media Talk

Honeywell technology spans the globe – and its turbos are also helping its customers grab the headlines in some of the world's leading media titles as journalists hand out plaudits for passenger cars with power, performance and miserly fuel consumption.



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"It (Mercedes-Benz C-Class 2.2L diesel model) delivers its power in a relaxed yet sporty way, and pulls well, too. What's more, with low noise readings and minimal engine intrusion, it's the most refined engine in its class."

"Mercedes-Benz new C-Class"

Auto Express, June 2007

"The (Hyundai i30 1.6l) diesel, smooth with its vibration-quelling balancer shafts and responsive with its variable-geometry turbocharger, is a much better bet: its 188 lb.-ft. of torque gives it a relaxed pulling and overtaking ability, and its CO_2 emissions figure is just 125 g/km."

"Hyundai i30 1.6 CRDi: C'eed and the harvest"

Belfast Telegraph, July 24, 2007

"The performance is there, the fun is there, and the fuel economy is there. It's only a matter of getting the (BMW 330d) over here"

"Power, fuel economy seal the diesel"

Los Angeles Times, May 23, 2007

^^

"Nissan's new compact crossover, Qashqai, has picked up its first award. The 2.0 dCi with all-mode transmission has been voted Best SUV in the What Diesel Car? 2007 awards."

"Nissan Quashqai wins diesel car award"

www.greencarsite.co.uk, June 18, 2007

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"Under the hood of this car (Audi A5), you may find a 2.7L turbo-diesel that pumps out 190hp, propels the car to 62 mph in 7.6 seconds, and does this all while maintaining a fuel economy rating of 35.3 mpg. Sippy-sippy, but speedy-speedy!"

"Audi A5 received two new engines: one with power and one with MPG"

Mobile Magazine, August 8, 2007

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September 2007

Printed in USA

Honeywell Booster Magazine

Honeywell