

WE CAN MAKE IT MORE POWERFUL & ENVIRONMENT-FRIENDLY

By CHINAMOTOR Team



CHINAMOTOR Interviewing Mr. Greg Marier, Vice President of Technology and Mr. Eric Zbytowski, Two Wheel Engineering Manager with Walbro Engine Management LLC

Background: Walbro Engine Management is the world's largest manufacturer of carburetors for the Outdoor Power Equipment industry and a major manufacturer of ignition systems, fuel injection and air/fuel management components, and fuel tank and fuel delivery components for the global off-road and non-automotive small engine market including lawn & garden, powersports, marine and small-displacement motorcycle applications. Walbro has recently introduced an electronic fuel injection system that specifically targets the small-displacement motorcycle market and has started the collaboration process with some leading China motorcycle companies. In Talk column of this issue, Mr. Greg Marier will cover Walbro Engine Management's technology development history and Mr. Eric Zbytowski, who has been highly involved with developing Walbro's new EFI system, will talk about the opportunity that EFI technology can bring to China motorcycle manufacturers.



Walbro Engine Management Interviewees: Eric Zbytowski; Two Wheel Engineering Manager (left) Greg Marier, VP Technology (right)

CHINAMOTOR: Walbro Engine Management has been well known as a leading manufacturer of carburetors and ignition systems by many people in the global motorcycle industry. Since there may be still some Chinese motorcycle companies who are not quite familiar with Walbro, would you please tell us more about what Walbro does?

Greg: Walbro Corporation was established in 1950. Over the course of its history, Walbro Corporation developed two separate businesses – one that targeted the automotive market and one that targeted the small engine market. The business that served the small engine market is now known as Walbro Engine Management. Today, Walbro Engine Management is the world's largest manufacturer of outdoor power equipment carburetors, supplying

diaphragm and float carburetors to customers around the globe. In the early 1980s, the automotive side of Walbro Corporation entered the original equipment fuel injection market, building on its fuel management expertise. The automotive EFI experience helped expand Walbro Engine Management's small engine product portfolio, which now includes complete fuel injection systems, throttle body assemblies, digital and analog ignition systems, fuel pumps and low emission fuel tank technology specifically developed for the global off-road and non-automotive markets.

Much of the technology originally developed for automotive applications is currently used by Walbro Engine Management customers to meet the technical and regulatory challenges now occurring in lawn and garden, marine and powersports applications including the motorcycle market. Important examples include Walbro's Electronic Engine Management (Walbro EEM™ Injection) fuel injection systems, advanced electric fuel pump designs and low-evaporative, multi-layer fuel tank technology. Walbro Engine Management's combined expertise in engine air, fuel and ignition management plus electronic engine control technology makes Walbro Engine Management an effective partner to help customers meet the product development challenges brought by current and future emission regulations.

CHINAMOTOR: Walbro Corporation's automotive EFI experience is interesting, but what

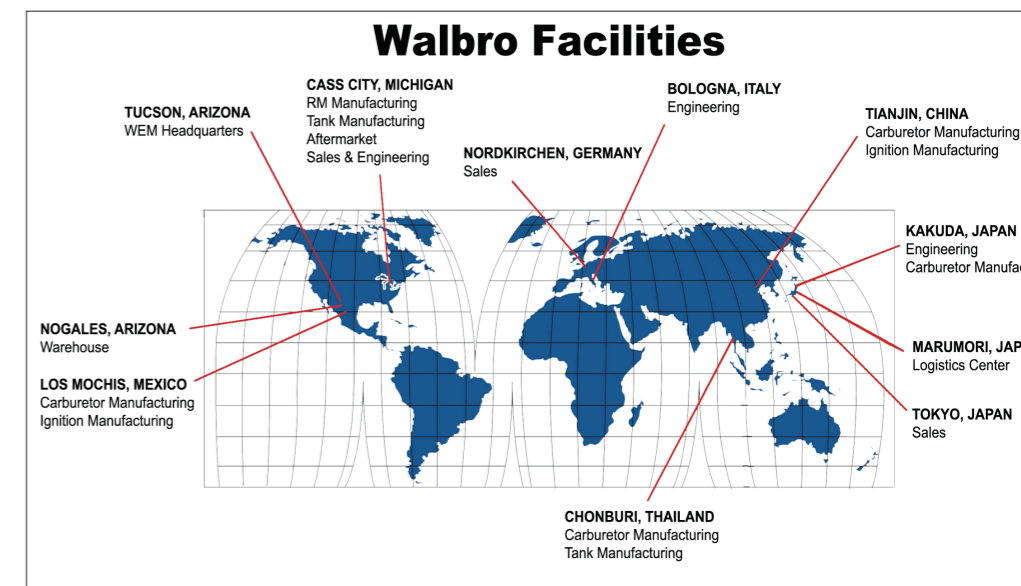
actively engaged in developing fuel injection systems and providing key system

components for both small and large displacement motorcycle applications for many major US and European brands



Greg Marier

since the



about the motorcycle market?

Has Walbro Engine Management been involved in developing EFI systems for major motorcycle applications?
Greg: Yes. Walbro Engine Management has been

mid-1990s.

CHINAMOTOR: Walbro Engine Management has facilities in the United States, Mexico, Japan, Thailand, Germany and China - what do these facilities do respectively?

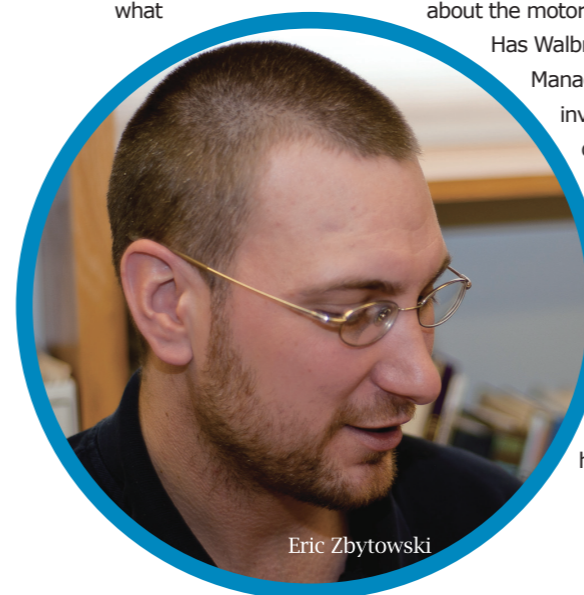
Greg: Walbro Engine Management's Headquarters are located in Tucson, Arizona, USA

Carburetor manufacturing takes place at Tianjin, China; Los Mochis, Mexico, Chonburi Thailand, and Kakuda, Japan.

Ignition production takes place at Tianjin, China and Los Mochis, Mexico.

Fuel tanks are produced in Cass City, Michigan, USA and Chonburi, Thailand.

Powersports and marine products are manufactured in Cass



Eric Zbytowski



Environmental chamber testing of EEM fuel pump

City, Michigan USA.

Service parts distribution operations are based in Cass City, Michigan, USA.

R&D and Product Engineering operations are in Cass City, Michigan, USA, Bologna, Italy and Kakuda, Japan.

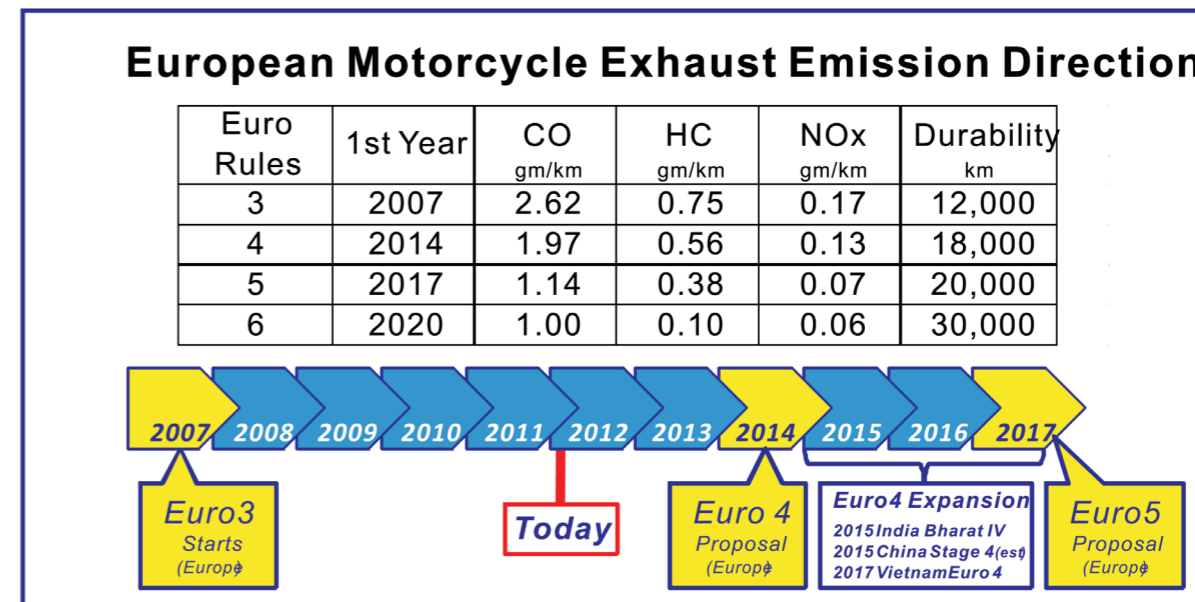
Sales offices are located in Cass City, Michigan, USA; Tokyo, Japan, Tianjin, China, and Nordkirchen, Germany.

CHINAMOTOR: Worldwide, there are quite a few carburetor and ignition R&D institutions and manufacturers in the two wheeler industry, what is Walbro Engine Management's competitiveness

compared to your counterparts?

Greg: We have a history of supplying engine control solutions for over 60 years. In that time, the automotive and small engine management businesses of Walbro Corporation have been involved in the development of EFI systems for the automotive and large-displacement motorcycle market in addition to the continued carburetor and ignition system product development for non-automotive customers. With that history, we at Walbro Engine Management believe that the additional cost of an automotive-based EFI system will be very difficult for the small displacement motorcycle manufacturers to accept – but we also believe that EFI technology will be needed to meet future emission regulations. Walbro Engine Management's goal was to develop an EFI solution specifically designed for small displacement single-cylinder motorcycles to meet future emission regulations in a cost-effective manner. The introduction of the Walbro Electronic Engine Management (EEM™) fuel injection system is the result of meeting that goal. The major advantage of Walbro's EFI technology is that it allows customers to meet the upcoming motorcycle exhaust emission standards – but with an easy-to-install package that eliminates many of the engine-

Chart showing Current/Future Euro emission direction

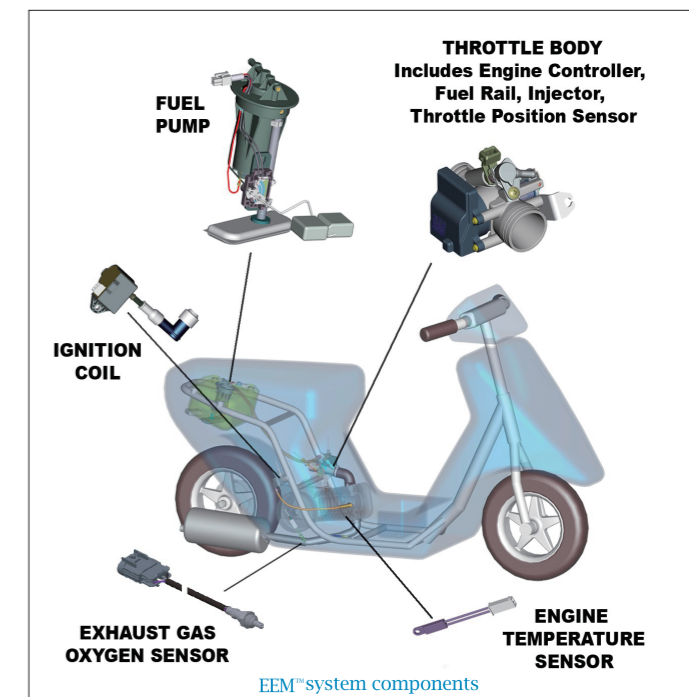


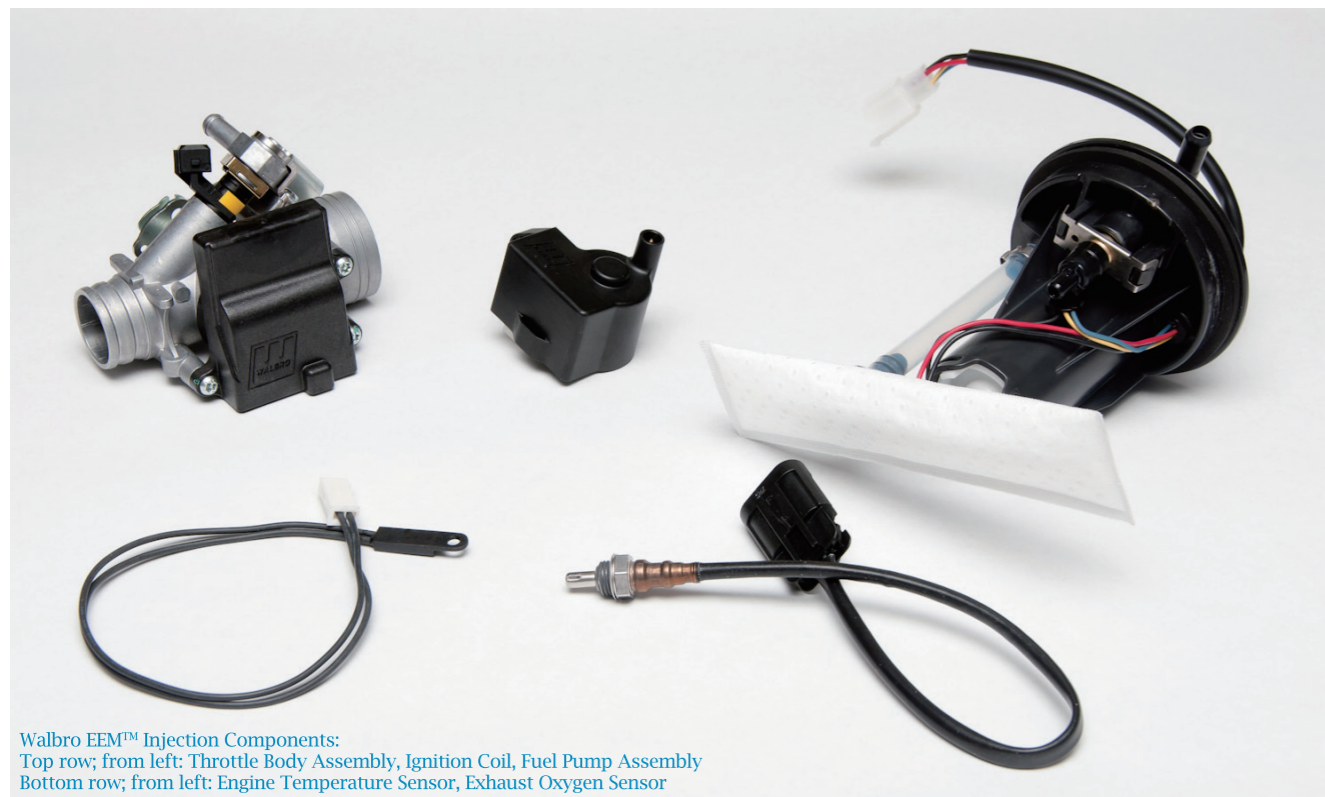
tooling changes and expensive sensors required in typical automotive-based designs. Our customers can introduce a true high-performance EFI system with the ability to meet future Euro 4 exhaust emission regulations at a lower total cost than using an automotive-based design.

CHINAMOTOR: Many people are concerned about the implementation of the EURO 4 standard, especially smaller motorcycle companies that may be lacking the technical expertise required to meet these upcoming emission regulations. Could you give our readers the basic background on the upcoming EURO standards and, according to your knowledge, when will it be carried out?

Greg: When discussing emission regulations, it is important to focus on specific products and engine displacements since the regulation introduction timing, the allowed emission levels and many other areas can vary among products. For this discussion, I will summarize my understanding of the current European Euro 3 and proposed Euro 4, 5 and 6 regulation levels for the most popular China motorcycles exported to Europe - 100cc to 250cc two-wheel motorcycles and scooters that do not exceed 130 km/hr. To allow direct comparisons between Euro levels, I have listed the Euro 3 emission level when using the optional World Motorcycle Test Cycle.

The European motorcycle emissions regulations as proposed today target about a 25% total emission reduction from the current Euro 3 level starting in 2014 (Euro 4) and an additional 40% reduction starting in 2017 (Euro 5) (see chart) Walbro Engine Management (or simply Walbro) believes that EFI technology will be required to meet these upcoming





Walbro EEM™ Injection Components:
Top row; from left: Throttle Body Assembly, Ignition Coil, Fuel Pump Assembly
Bottom row; from left: Engine Temperature Sensor, Exhaust Oxygen Sensor

European Euro 4 emission reduction levels, and EFI use will expand as other countries adopt emission reduction targets similar to the Euro 4 levels. So I feel the real challenge for motorcycle manufacturers looking for future growth opportunities should be to decide when to start the move from carburetors to EFI and then select who should supply this EFI technology.

I believe the combination of Walbro's cost-effective EEM™ fuel injection technology, decades of expertise in engine air, fuel and ignition management and Walbro's strong commitment to product engineering and production support will bring success to manufacturers looking to make the move to EFI.

In summary, to address the concern of where to find the technical expertise needed to meet future emission regulations – I feel the expertise is available if the manufacturer teams up with the correct EFI partner, and that partner should be Walbro.

CHINAMOTOR: Can you please make a brief introduction of the EEM™ injection system? How does it work to enable the emission reaching the EURO 4 standard? How does the Walbro EFI system compare to a carburetor?

Eric: As Greg mentioned, "Walbro's goal was to develop an EFI solution specifically designed for small displacement single-cylinder motorcycles to meet future emission regulations in a cost-effective manner" - That goal really drove the engineering development direction.

Walbro's EEM™ Injection system consists of 5 major components; 1) Throttle Body with integrated engine control module, Injector, and throttle position sensor; 2) Ignition Coil; 3) Oxygen Sensor; 4) Temp Sensor; 5) High pressure fuel pump.

To meet future emissions levels, engine air/ fuel ratio control needs to be very precise. Therefore Walbro's EEM™ Injection system uses closed-loop feedback with an exhaust oxygen sensor to achieve this goal. Feedback allows EEM™ Injection to correct fuel delivery in 'real-time' because engine conditions are always changing. Current carbureted systems have fixed jets and fuel passages that cannot compensate for changes in fuel, temperature, and altitude. In addition, more precise air/ fuel ratio control allows a significant reduction in catalyst and associated exhaust system costs versus a Euro 3-compliant carburetor/catalyst system while meeting the more stringent Euro 4 exhaust emission levels.

Other areas of cost optimization were a reduction in



Walbro Engine Management Tianjin, China Facility



USA Development Center

the number of sensors required. Walbro's wide range of engine and market knowledge from 25cc powertools to 1500cc motorcycles has provided the experience to design and specify both the right sensors and number of sensors to meet current customer requirements for each specific application. Walbro's EEM™ Injection throttle body has an integrated engine control module, injector, and patented non-contact throttle position sensor that does not wear out, is not affected by vibration and is 100% hermetically sealed. Walbro's EEM™ Injection also uses the existing customer crank position sensor (with a simple change to the flywheel). The engine temperature sensor was designed to be attached to the engine with no changes to the engine casting or added machining. Of course, the oxygen sensor will need to be installed in the exhaust system per Walbro specification to allow closed loop feedback control.

Generally speaking when comparing to a carbureted system, Walbro's EEM™ Injection replaces a carburetor with a Throttle Body Assembly (with integrated engine control module, injector, and throttle position sensor) and the current CDI box and ignition coil is replaced by Walbro's ignition coil. Other modifications required include slight changes to the electrical wiring harness, fuel tank modifications to install a fuel pump, and a simple flywheel assembly change (note that a multi toothed gear is not required). Add the engine temperature sensor, oxygen sensor, and low cost catalyst and the hardware is complete.

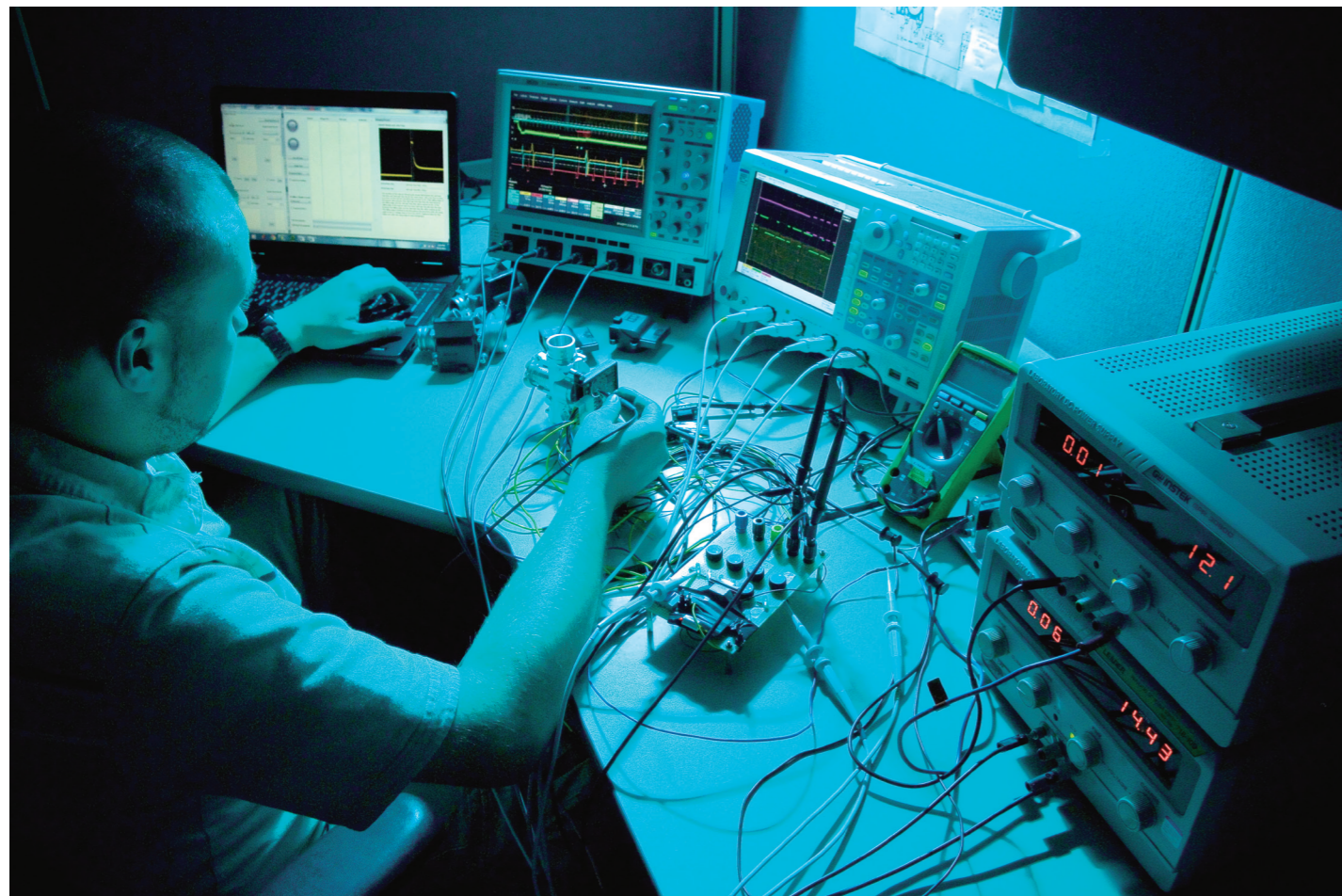
But Walbro delivers more to the customer than just hardware. Walbro also delivers key vehicle and engine calibration support needed to make the successful switch to EFI.

CHINAMOTOR: When did Walbro come to China and how many Chinese enterprises have started collaboration with Walbro?

Eric: Walbro entered the China market in the 1990's and started local carburetor production at the Tianjin factory in 1995. While Walbro has been in China for a long time, the EEM™ fuel injection history in China is much more recent. After decades of EFI development and innovation in the US, the EEM™ fuel injection technology was presented to China government officials, key technical organizations and select motorcycle manufacturers in China. In 2010-2011, the EEM™ fuel injection system exposure was increased with introductions at major Chinese industry trade shows and through technical presentations made at many major motorcycle manufacturers across China. Through this effort, Walbro has made many industry contacts, but since future product development plans



Wangye Scooter



Electronic evaluation of prototype EEM™ Engine Control Module during product development

should remain confidential until announced by our customers, it is difficult to mention specific manufacturers. I can say that the first company to introduce EEM™ to the market has been Zhejiang Taizhou Wangye Power Company Ltd. and I feel that the Wangye collaboration has gone well.

CHINAMOTOR: Since you have mentioned that Walbro is working closely with Wangye, can you please tell us how the co-operation is going at present?

Eric: Wangye and Walbro promoted the EEM™ fuel injection system at the Canton Fair in China and the Milan Motorcycle show in Europe. While Walbro is under a confidentiality agreement covering the specific details, I can say the EEM™ development team has enjoyed an exceptionally close working relationship with the people at Wangye and they are very interested in promoting Walbro's EEM™ technology. The EEM™ application and introduction is a big step in demonstrating Wangye's commitment to advanced technology and reduced

emissions.

CHINAMOTOR: China produced approximately 27 million motorcycles in 2011 and leads the world in motorcycle production. Because of this, many people believe China's motorcycle manufacturing technology is sufficient, especially for motorcycles less than 250cc. However, we feel there is still a gap between them and the big global brands – where do you think the gap may be?

Eric: It appears that many China manufacturers have been primarily focused on producing motorcycles at the lowest cost, while the major global brands have been focused on increasing product features, introducing new technology and developing strong brand awareness. However, I have seen some China manufacturers that are interested in new technology and building a brand strategy, so hopefully the gap will close in the future.

CHINAMOTOR: We feel the Chinese motorcycle industry should increase its technical expertise to drive future

growth, especially in the field of emission control. What do you think this technical challenge means to Walbro, and how do you plan to assist your customers in this area?

Eric: The key to increasing technical expertise is to pay attention to the details required to deliver consistent product quality. When a manufacturer has consistent quality, it is much easier to apply the new technology needed to meet future challenges such as emission control.

The Walbro EEM™ team brings over 60 years of engine and application experience to assist customers in successfully meeting future emission control challenges. When working with customers new to EFI, Walbro reviews the customer's key engine design areas and the actual production quality achieved in these areas. Walbro then works closely with the customer to improve these areas so EEM™ will achieve its full potential in production.

CHINAMOTOR: The China motorcycles currently compete on price in the worldwide market, but EFI adds much cost. How much does EFI cost and what do you expect from the China market?

Eric: EFI technology does add cost when compared to the current carburetor-based products, but the Walbro fuel injection system costs less to adopt than competitors automotive-based designs due to two key reasons: the reduction in number of required sensors and the reduced changes needed to adopt EFI to current product designs. Using the EEM™ injection system allows the China-based manufacturer to add the much-needed EFI feature in order to meet the upcoming Euro 4 regulations at a lower cost than other competitors. This allows Walbro customers to keep exporting into the European market and still maintain a cost advantage.

CHINAMOTOR: What type of Chinese bike makers are your targeted potential partners?

Eric: The first targeted customers for our EFI system are the China scooter and motorcycle manufacturers that export to countries that care about emissions. These manufacturers already realize that EFI technology expertise will be required in order to grow their export market sales, and they will be in an excellent position when China Stage 4 emission regulations are adopted in the domestic China market.

CHINAMOTOR: India's motorcycle industry is developing at an amazing speed, so there should be an excellent opportunity for Walbro in this market. What are your thoughts

on the India market?

Greg: With Walbro's China-based factory, the current EEM™ business direction is highly focused on the China market. However, due to the announcement of the upcoming 2015 Bharat IV emission standards, I feel that India will also be a major EFI growth opportunity in the future.

CHINAMOTOR: Will Walbro release new fuel injections system products in 2012? In which regards will Walbro further optimize the EEM™ system?

Greg: Walbro is always open to hear about new opportunities, but the focus today is to introduce our EEM™ system to selected 100cc to 150cc scooter manufacturers in China. In the near future, Walbro will expand our EEM™ product line to deliver a full line of motorcycle-based EFI systems specifically designed for the China market.

CHINAMOTOR: Thank you for your time. I am sure that CHINAMOTOR readers will find the Walbro story interesting.

Greg: I enjoyed the interview. I have been following China market trends through my CHINAMOTOR subscription, so I am happy to be involved in this opportunity.

Eric: Thank you for the chance to tell some of the EEM™ development story and the positive results achieved so far. I am looking forward to working with more China motorcycle manufacturers in the future. **CHINAMOTOR**



Walbro EEM™ Injection Throttle Body Assembly