

# Feature Article

## Trend of Automotive Testing Business in China 中国における自動車計測事業の動向

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HORIBA Automotive Test Systems is a leading supplier in the fields of engine test systems, driveline test systems, brake test systems, wind tunnel balances in addition to emissions test systems. These mechatronics (MCT) products have become more important in the fast-growing automotive industry in China. The report outlines the trends in the automotive testing industry in China and overviews the testing solutions HORIBA can offer.

HORIBAグループは、エンジン試験設備、駆動系試験設備、ブレーキ試験設備、車両試験設備、風洞天秤、電気モータ試験システムなど、エンジン排ガス計測機器以外にも多くの自動車計測関連設備を提供している。これらのメカトロニクス (MCT) 製品は、成長著しい中国自動車業界でも近年とみに重要性を増している。本稿では、中国における自動車計測事業の動向と、HORIBAグループが提供できる設備の概要を紹介する。

### Introduction

Today China, the most populous country in the world, has achieved a remarkable economic growth while the global economy suffers from a recession. Such is the case with the automotive industry in China. The automotive production has outstandingly expanded in a short period of time. China is now the world biggest automotive manufacturer. In particular, the production of passenger vehicles for individuals has sharply increased as the personal income level rises in China.

The circumstances have also brought about a change in the automotive testing market in China. The recent sales records of HORIBA group to the market show an increase in sales of advanced testing systems for research and development, in addition to the testing systems for performance and durability test of engine and vehicle, of which sales used to be predominant. It means that the automotive industry in China has stepped forward from a stage where they expanded their production via technology alliance with foreign companies followed by technology acquisition. The industry has come into the next stage of own development, where they may well

evolve into consolidation and expansion of the industry and improvement of R&D capabilities. Chinese government also positively supports the cultivation of engineers and the establishment of research laboratories. In fact, state-of-the-art research and development facilities are being installed in the universities such as Automobile Engineering Institute and the relevant public institutions. Considering the needs of further quality improvement and future overseas deployment in business, more facilities for research and development will be in demand.

This article outlines the trends in the rapidly-growing automotive testing industry in China and overviews the testing solutions HORIBA group can offer.

### Automotive Testing System in China

The keywords of today's automobile trend, passenger vehicles in particular, are safety, comfort and energy saving. So many automobiles are equipped with high-tech devices controlled by sensors and electronic control unit (ECU) such as antilock brake system (ABS). Consequently, the trend has triggered the automotive indus-

try in China to introduce the testing systems needed for developments of such high-tech devices. Here are some features of the typical testing systems introduced in China.

### Engine Testing System

Engine testing can not be fulfilled without dynamometer which serves to simulate an engine load. Economical domestic dynamometers are widely used mainly in the engine manufacturing factories which do not require high performance for testing. On the other hand, dynamometers of higher functionality such as eddy-current dynamometer (WT Series) and hydraulic dynamometer (DT Series) from HORIBA group are used for the testing requiring high reliability such as engine performance testing and endurance testing. A full-featured testing system is available for further sophisticated testing such as engine R&D, ECU map matching, etc. Such a system is configured with an AC dynamometer (DYNAS3 Series) which can perform as a vehicle simulator, and also engine test automation system (STARS, Figure 1) or ECU automatic matching system (STARS Calibrate, Figure 2).

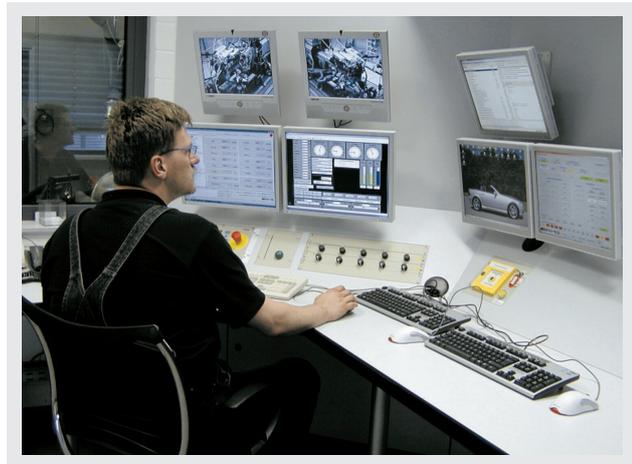


Figure 1 STARS, Engine Testing Automation System

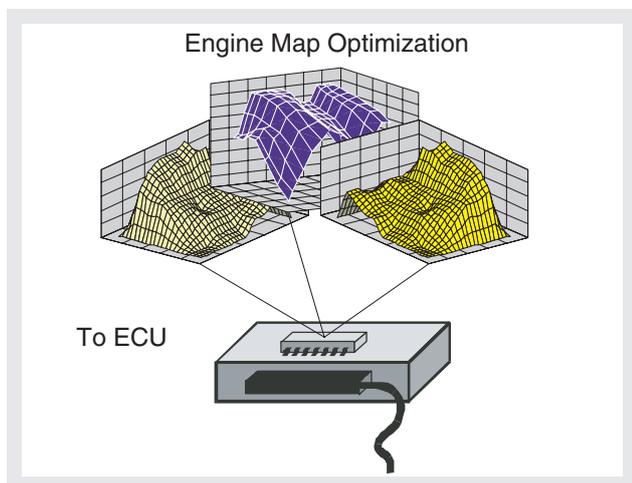


Figure 2 STARS Calibrate, ECU Automatic Optimization Aid System

Lately, China pays attention to basic research and development of engine, e.g. developments of combustion chambers using single cylinder engines, study of variable compression ratio, etc. Therefore, China is looking towards the introduction of the advanced testing systems. China will make a good use of the testing systems eventually to develop China's own engines.

### Driveline Testing System

Driveline means parts and components for power transmission from engine to tires. Figure 3 outlines a configuration of driveline. Driveline testing needs to be separately implemented in the automobile development process. For example, optimization of transmission control unit (TCU) and ECU, so-called shift calibration, is conducted in the development stage of automatic transmission (AT) vehicles, which are increasing in number in China.

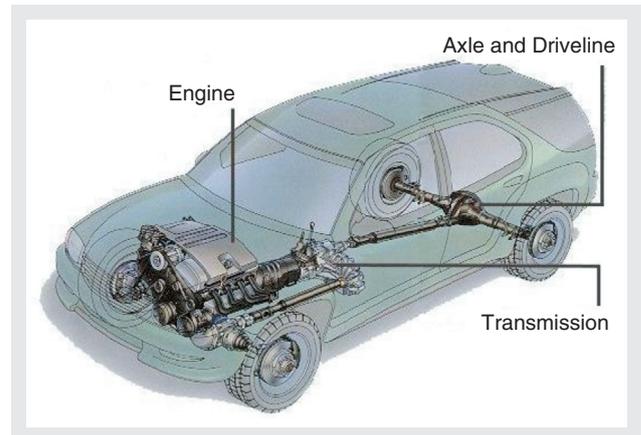


Figure 3 Example - Driveline

In the tests of development stage it is common that some of driveline elements are still in the pre-prototype phase. In such cases virtual testing<sup>[1]</sup> where the final elements are simulated by hardware or software is often employed. Figure 4 shows a block diagram of virtual testing system.

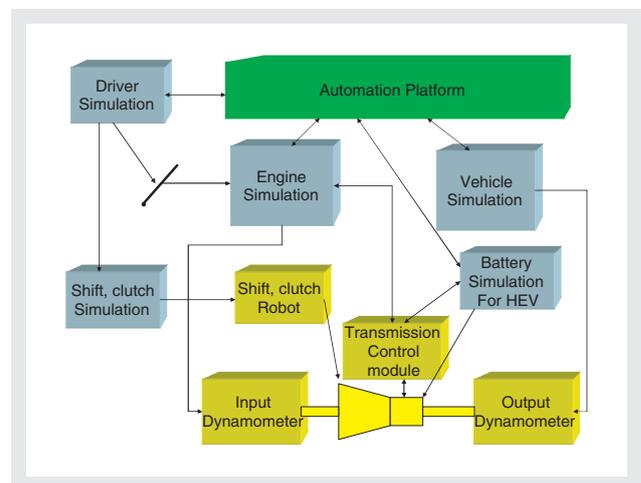


Figure 4 Example – Virtual Testing System<sup>[2]</sup>

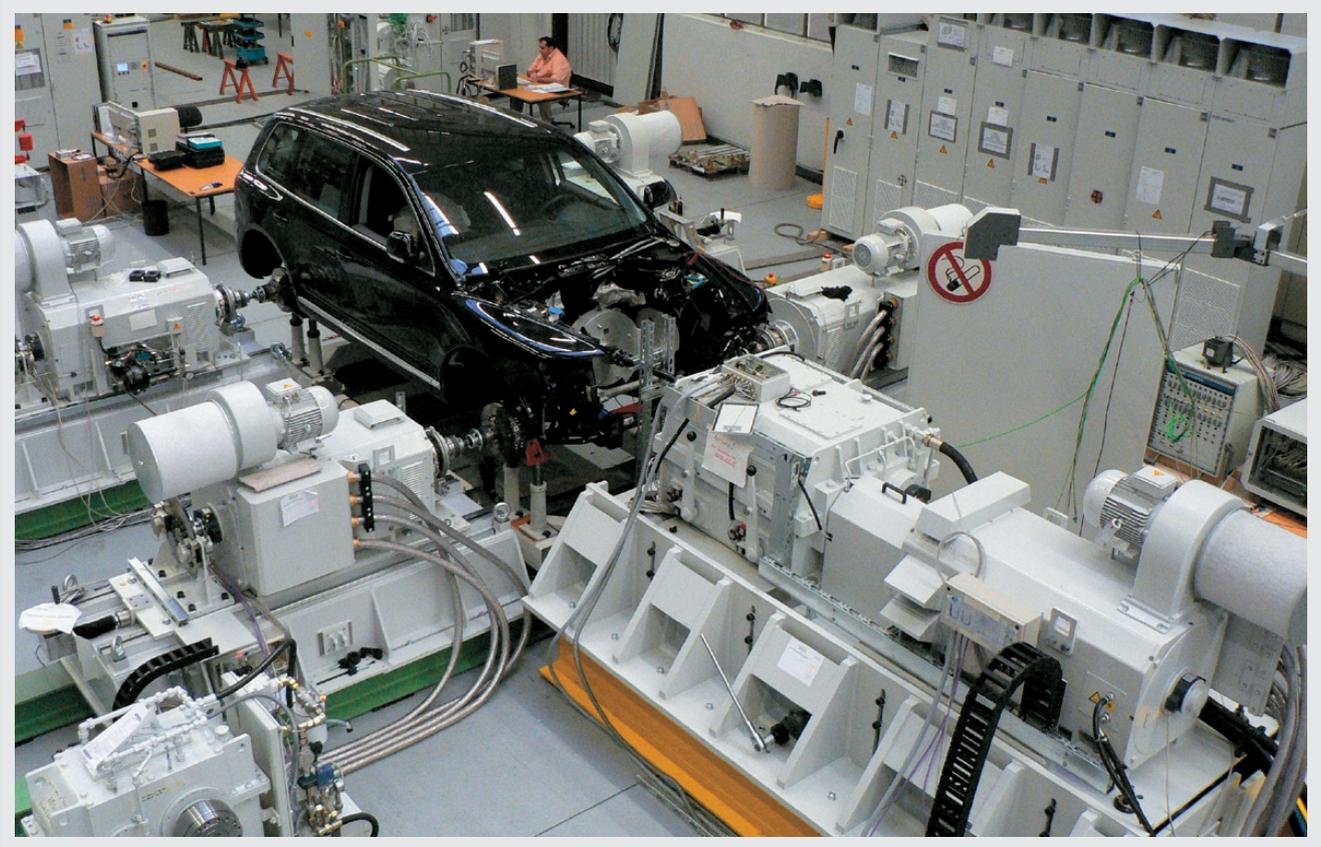


Figure 5 Example – Complete Driveline Testing System

Engine is one of the typical components to be simulated. Dynamometer controlled by special simulation software as a virtual engine reproduces the forces of the driveline components in the running condition. Such virtual engines will be used increasingly in the field of driveline development in China.

As shown in Figure 5, the complete driveline testing system mounted with a vehicle body and other parts to simulate the complete vehicle, has been innovated as well. In this system, wheels are simulated by wheel dynamometers and engine is configured by a virtual engine or a real engine. The system can cover the needs of various tests from complete vehicle to drive-line components.

Automobile manufactures in China often purchase engine and main components of driveline from overseas partners and assemble them with other components into completed vehicles. Taking the situation into account, the next great tasks to them will be acquisition of drive-line control optimization technology and system development technology as well as self-development of major components followed by mass production. Therefore, high technology driveline testing system such as virtual testing system referred here will be of more importance

to Chinese automotive manufactures who aim to obtain and improve their own development technology.

## Brake Testing System

Today vehicle brake has been regarded as not only braking device but also important element of vehicle kinematic control, because operational safety and comfort cannot be realized without adequate brake systems. Brake testing system of consistent performance is indispensable to develop a brake system with less noise, reliable functionality and durability. A couple of brake testing systems are shown in Figure 6 and 7. In general, the inertia brake testing system (Figure 6) is used extensively in the automotive industry worldwide including China. The brake testing systems of HORIBA group have been delivered mainly to public research laboratories and foreign brake suppliers. It will be worthy to note that foreign brake suppliers have a tendency to introduce the same testing systems to their R&D centers in China that they have in their home countries to expedite brake development along with the market needs in China.

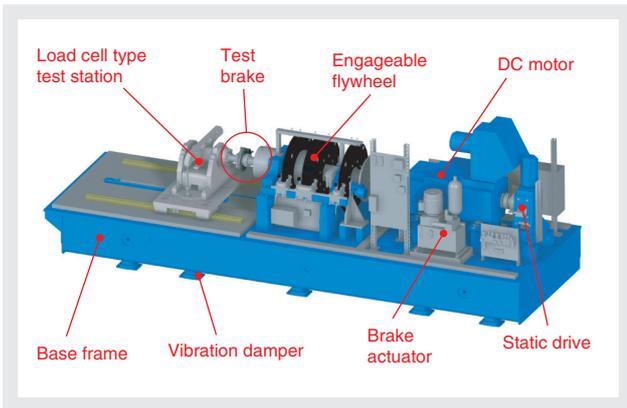


Figure 6 Brake Testing System (Inertia brake tester)

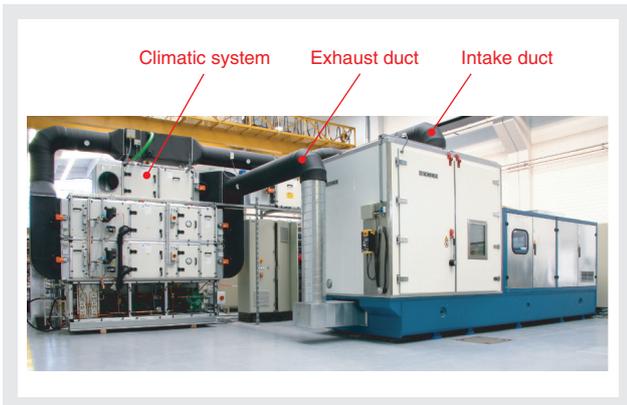


Figure 7 Brake Testing System (Environmental test)

## Vehicle Testing System

Chassis dynamometer is used for testing completed vehicles. Chassis dynamometer, of which main component is a set of rollers with dynamometer coupled, is a system

to provide simulated road load and vehicle inertia in a laboratory. Figure 8 shows a chassis dynamometer for 4WD. HORIBA group has accumulated experiences as a manufacturer of vehicle testing systems as well as brake testing system since 1930's, and provided China with many systems together with emission analyzers and environmental testing equipment.



Figure 8 Chassis Dynamometer

## 6-Component Wind Tunnel Balance System

Vehicle aerodynamic resistance sharply increases in proportion to the vehicle speed and also has a significant influence on fuel consumption at high-speed running. This is why aerodynamic analysis through wind tunnel testing is required to be made. A wind tunnel balance system is exclusively designed to measure aerodynamic forces and moments loaded on vehicles in the wind tunnel. Figure 9 outlines the wind tunnel balance. The

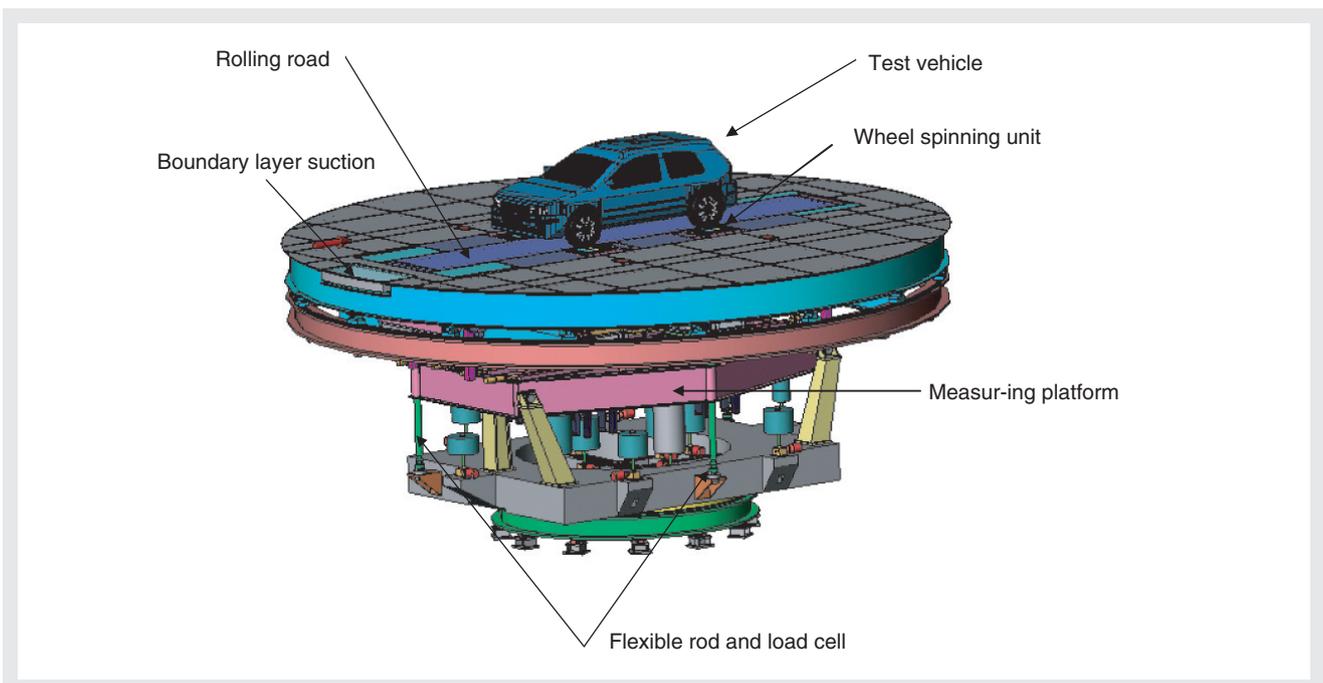


Figure 9 Wind Tunnel Balance

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wind tunnel balance simulates a realistic air flow in the vehicle underbody area which has an important impact on driving stability of vehicle. To ensure a realistic simulation, belt rolling road and wheel spinning units are used in the system. HORIBA's 6-component wind tunnel balance system provides the ability to measure 3 direction forces and 3 direction moments. High accuracy and repeatability of 6-component measurement are important factors to know how to design the vehicle body and how aerodynamic resistances relate to each other. The measuring platform of the balance on which a test vehicle is mounted is supported by 6 connecting rods. Due to its simple structure without mechanical coupling it requires minimum maintenance and will keep the measuring accuracy for a long term as needed. Therefore, leading universities and public institutions in China show their interests in introducing the new wind tunnel balance system equipped with rolling road.

### Future of Automobile Industry and Testing System in China

It is assumed that the automotive market in China will continuously expand according to the increase of personal income with support by the government policies taken after joining in WTO. In the meanwhile, aside from possible slowdown of the growth in the future, it is also a fact that there are many issues to be resolved; e.g. globally opening Chinese market, meeting diversifying users' demands as well as quality improvement and needs for self development of vehicles in consideration of the market demands. While the domestic automotive market in China settles down, China will proceed in the direction of expanding into the overseas market as a major manufacturing center in the world. In this regard China is urged to establish its own technology for China brand-building, which cannot be achieved without high-level testing systems.

Meanwhile, the automotive industry in China seems to be interested also in hybrid electric vehicles (HEV) and electric vehicles (EV). Additionally, the environmental problems have been often brought up for discussions since the emission regulations modeled on Europe were introduced nationwide. The fact that China is abundant in rare earth metals which are essential to manufacture fuel cells (FC) and electric motors may prompt the country to develop HEV, EV and FC-EV. It will result in the rise of the needs for the testing systems of electric motors (E-motors). HORIBA group has a wide lineup of

products such as battery simulator, standardized testing system for E-motor, etc., and will be sure to serve the growing needs.

### Summary

This gives a brief report on MCT products and its market trend in China. Now that China has become the top automotive manufacturer in the world, China is focusing on self development of automobile. From the perspective of resource and environment, it is predicted to facilitate the movement towards energy conversion and low-emission. One of the indications of the movement is the steady penetration of electric motorcycles and ultralightweight electric vehicles into the market. The hope is that HORIBA group properly serves the growing needs of developing and acquiring own technology and accordingly enhancing the relevant research laboratories in China, and eventually HORIBA group can be of any help in development of China's automotive industry.

#### Abbreviation

ABS: Antilock Brake System  
 AT: Automatic Transmission  
 DC: Direct Current  
 ECU: Electronic Control Unit  
 EV: Electric Vehicle  
 FC: Fuel Cell  
 HEV: Hybrid Electric Vehicle  
 MCT: Mechatronics  
 TCU: Transmission Control Unit  
 4WD: 4 Wheel Drive

### References

- [1] Bruno Thelen: Virtual Test Case (Schenck Pegasus) Engine Technology International issue 2/01 P 78 - 82
- [2] Bryce Johnson: Engine, Battery and Vehicle Simulation Strategies for Transmission Testing, Proceedings of the 2009 Ground Vehicle Systems Engineering and Technology Symposium (2009)



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