Technotalk

Combining Technologies from Environment, Safety, and Information Sectors to Contribute to Global Society

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AGAINST a background that includes global environmental and energy problems, automotive systems are undergoing a major transformation in their role as part of the infrastructure of society. In response to national regulations on vehicle carbon dioxide (CO_2) and exhaust gas emissions, along with other factors such as the growing demand for cars in emerging economies in particular and the wider adoption of safe driving assistance systems developed with a view to the aging of the driving population, Hitachi is picking up the pace of its collaboration with leading research institutions and activities at overseas research centers. Here we discuss these activities, the challenges they face, and the prospects for the future.

Business Climate and Global Operations

Maekawa: In its automotive systems business, Hitachi is striving to contribute to global society through the environment, safety, and information. To begin with, can you please tell us more about the business concepts and management strategies behind these automotive systems.

Kawabata: The business concept of Hitachi Automotive Systems, Ltd. is to combine advanced technical capabilities in the fields of environment, safety, and information to generate new value for people, vehicles, and society, and to help create a prosperous society. In this way, we are seeking to become the world's most trusted global corporation, supplying environmental products in the form of efficient vehicle energy control; safety products that provide safe driving control through the optimal control of vehicle driving, cornering, and stopping; and information products in the form of information and communication solutions that improve comfort and convenience for society.

Our management strategy is to strengthen the foundations of our global management. With recent developments including the tightening of national emission standards, such as those regulating emissions of carbon dioxide (CO_2), nitrogen oxides (NOx), and particulates, and revisions to national new car assessment programs (NCAPs) to strengthen safety requirements, there is a need to comply with these various regional standards in a timely manner. This makes it essential that business decision-making and business operations take place close to the market, and Hitachi is now beginning to operate not only its production facilities but also research and development (R&D) centers throughout the world.

In the case of new technologies such as advanced driver assistance systems (ADASs), meanwhile, Hitachi seeks to develop "tool packages," including platforms, in Japan and then move swiftly to deploy them in other countries. We are accelerating our R&D to deliver more innovative products.

Maekawa: Next, can you tell us about the business climate in which the automotive systems business operates.

Kadomukai: When you look at vehicle production volumes in different regions, it is clear that strong growth is taking place in emerging economies. Such nations accounted for 48% of total production in 2012, and it is anticipated that this will grow to 58% in 2020. In terms of vehicle segments, the proportion of small cars is increasing, being forecast to grow from 62% in 2012 to 65% in 2020, of which about 70% will be destined for emerging markets. A point to note in all of this is that about 80% of vehicle production in emerging economies will be by what are known as "global car manufacturers." This means that Hitachi needs to examine carefully the question of what products and technologies it should be supplying to which regions.

While production of electrically powered vehicles such as hybrid electric vehicles (HEVs) and electric vehicles (EVs) is growing at 13% annually, production of vehicles with internal combustion engines, such as gasoline- and diesel-powered vehicles, is also growing strongly, with these vehicles still expected to account for 94% by volume of total production in 2020. Along with this, it is anticipated that further environmental regulations such as those covering CO_2 and exhaust emissions will progressively be introduced, not only in developed economies but also in emerging ones. Vehicle safety assessments, too, are likely to become more stringent,

with requirements extending beyond vehicle collision avoidance to include pedestrian safety.

Kawabata: Taking a broad view of technological trends in the global market, the environmental sector is seeing advances in sophisticated electronics and electric drive techniques, while there remains a need to improve the efficiency of internal combustion engines and electrically powered vehicles. In terms of safety, the objective is shifting from collision safety to preventive safety, with a need to focus on developing exterior recognition sensors and techniques for electronic chassis control in order to build cars that won't crash. In the case of information, I believe that advances are needed in digital technologies for linking vehicles to the outside world in order to improve comfort and convenience, and to add more value to vehicles. In other words, a fusion of information technology (IT), vehicles, and social infrastructure will be absolutely necessary.

Nunneley: Currently, the automotive market can be thought of as two separate growth markets in developed and emerging economies respectively, each of which demands different technologies. In developed markets like Japan, Europe, and North America, development is proceeding on advanced technologies, visual recognition systems, automatic parking, and automatic cruise control (ACC). In emerging markets on the other hand, there is growing demand for low-cost suspension, lightweight electronic stability control (ESC) units (anti-skidding systems), and products for small vehicles. These two markets appear set to continue their respective growth into the future.

Unification of Customer Strategies Regional Strategy of Local Production for Local Consumption

Maekawa: Given this environment, Hitachi has adopted a three-pronged global growth strategy consisting of a customer strategy, regional strategy, and product strategy. Can you first tell us about the customer strategy.

Nunneley: Our basic customer strategy is to pursue the three key pillars of environment, safety, and information. This closely matches the strategies of the major vehicle manufacturers. As part of this strategy, Hitachi appoints global account managers (GAM) to oversee its dealings with each of the major global vehicle manufacturers. This has allowed us to maintain an accurate and timely appreciation of our customers' business strategies. GAMs have the important role in more accurately ascertaining user needs.

Kawabata: Global vehicle manufacturers operate both production facilities and development centers throughout the world, and it is not uncommon for development work to take place outside its target market. Our customer strategy allows us to keep up with these developments around the world, and can be seen as the first step toward supplying better solutions to customers.

Maekawa: I understand that "local production for local consumption" is an important feature of Hitachi's regional strategy.

Nunneley: That's right. Because global vehicle manufacturers operate development centers around the world, we also need to build up our development centers at a global level. We are currently working on doing just this in the fields of vehicle tuning and the simulation and analysis of suspension and brakes. Similarly, to support global vehicle manufacturers, we intend to strengthen our design and development capabilities by increasing our global

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development workforce by 240% by 2015.

Product Strategy Involving Ongoing Global Standardization

Suga: Our product strategy includes work on building the next generation of environmental and safety systems, a key feature of which is standardization at the global level. An apprehension when technical development is conducted globally is that product designs and production processes will diverge, resulting in poor manufacturing practices. A key factor in avoiding this is modular design.

Nunneley: When modular design is used, designs can be put together on a global scale, allowing manufacturing to take place at any production site, no matter where in the world it is located. In the case of electrically controlled brakes (e-ACT), for example, sharing a standard core design means that the same design can be adapted for use in different models, ranging from small cars all the way up to comparatively large vehicles such as pickup trucks. This means that the system can be manufactured at brake production facilities around the world simply by changing the motor torques and ball screw mechanisms while keeping to the same core design.

Suga: Modular design is also used for valve timing control (VTC). By first studying the engines of customers around the world, we were able to narrow down to a small number of different types of VTC, and make it so that the provision of flexibility in the interface with customer engines was enough on its own to produce optimum results. Progress on standardization is being made not only in product design but also in the production machinery itself. To achieve this, we are producing more of our equipment in house, and have established production machinery facilities in China and the USA. To ensure quality, we are also working on the centralized collection of quality information from production sites around the world, and its collation in multi-lingual databases. This has given us the capability to share quality information globally.

Nunneley: Enhancing our system design capabilities is another major initiative that relates to product development. Suspension, brakes, and steering, once mechanical parts, have since become extremely complex systems. This is because they incorporate electronic control units (ECUs) and software, communicate between systems, collect data from the different actuator systems, and use these as the basis for control. Even brake and steering systems are no longer simple parts. Whereas brake systems of the past were limited to stopping the vehicle and operating the brake lights, they are now evolving into integrated vehicle systems with functions that include preventing skidding or operating in conjunction with external recognition sensors to brake automatically if a potential collision is detected. Enhancing our capacity for this type of system design so that we can keep ahead of other major suppliers is another important initiative that Hitachi is pursuing in the context of design. We need to be more than just a supplier of parts.

Kawabata: As you say, whereas the automotive systems business of Hitachi to date has focused on the supply of parts, in the future we need to supply new value in the form of packages that combine parts and involve a variety of different functions working together. Software modularization is an essential element in achieving this. By shifting to a development style that uses standard components for base technologies and then overlays these with only those additional features that vehicle manufacturers require for differentiation, our aim is to shorten development lead times, reduce costs, and supply products that are highly finished.

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Growing Proportion of Products that Incorporate Electronics

Maekawa: What about products that incorporate electronics, another important sector?

Kadomukai: Electronics are essential for making cars with better fuel economy for the benefit of the environment and with safety features to prevent collisions. It seems likely that the proportion of products that incorporate electronics will continue to grow in the future. Hitachi, too, sees these products as a key axis in its growth strategy.

Nunneley: With its many years of experience in manufacturing products such as ECUs and electric motors, Hitachi is well placed for integrating electronics into vehicle systems such as brakes or suspension.

Kawabata: With Hitachi having divisions that develop advanced technologies such as navigation systems and car navigation units that use communications for realtime interoperation with the outside world, we can supply a full range of various different types of systems.

I believe that simulation will become increasingly important in the development of these electronics products. A variety of new approaches are being adopted, including full-vehicle analyses and simulating the operation of platforms that include microcontrollers. In response, Hitachi has installed supercomputers at its Japanese sites and is developing systems that provide secure and high-speed access to these from development centers around the world.

Maekawa: While integrated systems need to satisfy both safety and economic requirements, development would be very time-consuming if we needed to produce a new prototype each time we wanted to test these. This means that computer-based design will also play an increasingly important role in reducing the costs from prototyping through to product development.

Training the Workforce of the Future

Maekawa: What about the development of the personnel who underpin the automotive systems business?

Kawabata: People are the most important component of technical development. Our challenge for the future is to get the most out of our workforce in all parts of the world, not just by sending out people from Japan, but also by measures such as bringing staff to Japan for training. To achieve this, I want us to strive to augment and train locally recruited development and management staff. I also believe we should be strengthening our relationships with our R&D divisions, overseas research institutions, engineering companies, and universities with strong automotive programs.

Nunneley: In the future, each region will require capabilities such as application engineering, vehicle tuning, and simulation so that they can perform their work in ways that suit local circumstances in accordance with customer expectations. Achieving all of this from Japan would be difficult. This is why we have augmented our engineering capabilities in China. We also need to be able to customize vehicles, powertrains, and other products to meet the requirements of vehicle manufacturers in the USA, Europe, India, and elsewhere.

Kawabata: This is because requirements differ significantly between regions. Different markets have very different characteristics, such as demand for ultra-small cars in Japan and vehicles featuring advanced technology in Europe, and the large and diverse market in America. Regulations and other laws also differ. While Hitachi is a Japanese company with core technology developed in Japan, I believe that customizing this technology for applications that satisfy the requirements of different regions is something that can only be done in the regions concerned.

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Furthermore, it seems likely that the number of customized applications will continue to grow. Taking the example of stereo cameras sold in Japan and North America, the specifications in each market are different. Naturally, the amount of work required at each site will increase as the number of customized products grows. To ensure that this proceeds smoothly, I believe that Japan's role is to make sure that the underlying technology is fully worked out, and to establish practices that will allow simple customization.

Nunneley: Stereo cameras make a good example. People in each region need to decide for themselves how they are to be used, and then create the framework for doing so. This is because a stereo camera is no more than a sensor, and given that laws, road markings, and customs are different in each region, it can be used in a variety of ways. It also means that a way of passing this information back to the stereo camera design team in Japan is vital.

Kadomukai: In this sense, there is considerable significance in having Mr. John Nunneley with us given that his former responsibility was for development in the USA. We can increase the development and other business capabilities in each region by having their top developers lead core development in Japan, and then take this knowledge back to their own markets.

Nunneley: In pursuing this approach, we also need to develop engineers who can avoid parochialism and look at issues from a global perspective. This is because the products that Hitachi designs and markets are sold to people from all over the world.

I believe it will be of significant benefit to Hitachi if we can bring people from Europe, China, and North America into the groups that handle core development and design so that these groups can incorporate knowledge from all parts of the world into their products from the basic design stage.

Maekawa: Finally, can you give me your views on the outlook for automotive technology.

Kawabata: Above all else, I believe that, rather than considering products individually, we will need to adopt viewpoints that are closer to the customer, such as "comfortable driving" or "safe and secure driving." In the future, it is likely that systems will work by taking the intentions of the driver, as transmitted via the steering wheel, brakes, and other controls, and then have a computer assess the surrounding conditions and determine how best to control the vehicle. The ultimate objective is to have vehicles drive themselves without requiring a human driver. I look forward to Hitachi supplying the parts and systems that will make this possible, while also engaging in debate that looks to the future.

Suga: We also should not forget about more routine measures. Taking the ongoing challenge of improving fuel economy as an example, this is an area where Hitachi is working on a number of different fronts. These include the transmission efficiency of the powertrain, energy recovery and storage, and of course weight reduction, which remains an important consideration.

A lot of attention is being directed at measures for reducing the weight of different systems or parts.

Kawabata: In this sense, there is no escape from ongoing routine development aimed at wringing out yet more gains. I expect to see unpredicted breakthroughs emerge from the linking together of components. As a corporate group, Hitachi supplies not only car parts but also services such as data centers and communication systems. This is a major strength.

Nunneley: Another feature of Hitachi is that it is one of the few car parts suppliers, perhaps even the only one, able to handle all aspects of hybrid electric vehicle systems, including inverters, electric motors, and batteries. I want us to keep working on initiatives that will allow us to utilize these strengths to achieve significant growth and become the world's most trusted global corporation.