

Technotalk

Utilizing ICT and the Combined Power of the Group to Help Build a Prosperous Society

Toshihiro Oono

Vice President and Executive Officer, CTO, President of Development & Production Group, General Manager of Development Group, and General Manager of Environment Policy Div., Hitachi Construction Machinery Co., Ltd.

The construction machinery that underpins the progress of society has undergone a variety of technical innovations in the past. In recent years, meanwhile, there have been demands for further gains in productivity together with operational and safety improvements from customers such as the mining industry, which is facing an increasingly difficult business climate, and at construction workplaces beset by concerns about staff shortages. Hitachi Construction Machinery is creating new value in construction machinery by utilizing ICT, sensor, and other technologies where advances are being made, including functions for optimizing maintenance and helping operators drive the machinery. In this article, Toshihiro Oono, Vice President and Executive Officer of Hitachi Construction Machinery Co., Ltd. describes the development of technologies for achieving ongoing advances and the company's development organization that meets regional needs.

Uses for ICT that Boost the Productivity of Construction Machinery

—While the marketplace for construction machinery faces increasing uncertainties that include cheap oil and concerns about economic recessions in Europe and China, what do you see as the important factors for achieving ongoing business growth?

Oono: While the market for construction machinery used for tasks such as urban development, infrastructure construction, and resource development will continue to experience industry growth in the medium to long term, it is affected by global economic trends and there is no prospect of a rapid rise in demand in the near future. Meanwhile, along with these circumstances, demands also include reducing the load on the environment and enabling customers to produce more efficiently so they can cut costs. The thing that Hitachi Construction Machinery Co., Ltd. emphasizes to increase its presence is to earn the trust of our customers by expanding services that utilize information and communication technology (ICT) to encompass the entire machine lifecycle from finance to after-sales service and resale, while also seeking to differentiate ourselves by providing our construction machinery with added value that makes use of advanced technology. “Reliability and differentiation” are the key words of our GROW TOGETHER 2016 Mid-term Management Plan

that commenced in FY2014 and these are important elements in working toward our 2020 VISION mid-term management vision.

While construction machinery has achieved a degree of maturity in terms of the functions it incorporates to carry out various work, there remains scope for the development of technology in areas such as reducing the load on the environment, improving safety and reliability, providing driving assistance, and improving operator productivity. In these areas, we are striving to develop and supply construction machinery that creates value for customers not only by using the technologies we have built up for ourselves, but also by taking advantage of the technologies and advanced research and development work that the wider Hitachi Group has acquired through its involvement in a diverse range of businesses.

—Can you give us some specific examples of what you mean by services that utilize ICT?

Oono: We fit communication devices into our construction machines and operate our Global e-Service, which performs remote management of operational and location data in realtime in a wide range of countries and regions. This helps minimize faults and the consequent work delays by using the collected information as a basis for undertaking maintenance, spare parts procurement, and other such tasks at the

appropriate timing.

We used this Global e-Service system to introduce the ConSite* suite of services throughout the world in April 2014. In addition to sending regular reports containing operational data from construction machinery to customers, the service also sends emergency reports if it detects a change in a machine that could potentially lead to a fault. This helps prevent machines from going out of service and enables a quick recovery when problems do occur.

Because construction machines are part of a customer's plant and equipment, it is important to consider how to improve availability and reduce costs over the entire machine lifecycle. Along with supplying highly reliable machines, we are also putting effort into utilizing Hitachi's expertise in ICT to identify the warning signs of problems at an early stage and to advise customers on the appropriate maintenance to perform. In addition to improving availability by avoiding machines unexpectedly going out of service, this also reduces total lifecycle costs by extending product life.

In the future, we will be able to collect more data of different types by expanding the scope of communications and sensing. We are currently working with research and development divisions of Hitachi, Ltd. to find techniques for analyzing huge quantities of collected operational data in order to provide customers with more useful information, such as warning sign diagnoses.

New Value Generated by Collaboration within Hitachi

—I understand that the operational data collected via Global e-Service and other means is also put to use in the development of construction machinery. What can you tell us about that?

* ConSite is a trademark of Hitachi Construction Machinery Co., Ltd.

Oono: We are working to develop better construction machinery that takes account of operational data and the latent needs of customers. In the case of the ZX-6 Series of hydraulic excavators currently under development, for example, in addition to seeking to improve reliability, durability, and ease-of-maintenance as we have on past models, we are also striving to reduce fuel consumption.

The EH-3 Series dump trucks, which have an alternating-current (AC) drive that uses AC motors powered by electricity generated by the engine to drive the vehicle, achieve precise controllability and a high level of traction and braking by using a highly responsive Hitachi insulated-gate bipolar transistor (IGBT) inverter and an AC drive with control software jointly developed within Hitachi. The latest model in the series incorporates sensors that provide feedback on the status of the vehicle body and control equipment with enhanced performance together with a ride stability control system that minimizes slip, tire lock, longitudinal pitching, and side slip even when driving over rough roads. Along with providing smooth driving, this also helps boost productivity by enabling the dump trucks to be used in poor weather conditions.

We are also working on adopting hybrid drive in construction machinery to reduce fuel consumption and carbon dioxide (CO₂) emissions. We released the ZH200-A hybrid hydraulic excavator in 2011 followed by the even more fuel-efficient ZH200-5B in 2013. We developed an industry-first prototype hybrid wheel loader in 2003 and have since been working on research and development with a view toward commercialization. Like the dump truck with AC drive, the hybrid wheel loader uses the engine to drive a generator and supplies the generated electric power to the traction motors that drive the vehicle. Because this eliminates the need for a torque converter and



Toshihiro Oono

Vice President and Executive Officer, CTO, President of Development & Production Group, General Manager of Development Group, and General Manager of Environment Policy Div., Hitachi Construction Machinery Co., Ltd.

Joined Hitachi Construction Machinery Co., Ltd. in 1979 after graduating from the Department of Mechanical Engineering, School of Engineering, Tokyo Institute of Technology. He worked on the design and development of large excavators. Following appointments as manager of the Resource Development System Business in 2007, Director of Product Development and Construction System Business in 2009, and Director of Construction Machinery System Business in 2010, he became an Executive Officer, CTO, and General Manager of the Development and PDI Divisions in 2012. He was appointed Vice President and Executive Officer, CTO, and General Manager of the Development and PDI Divisions in 2014. He took up his current position in April 2015.

transmission, it not only significantly reduces energy losses in power transmission, it also provides more comfortable driving due to the lack of gear changes. It also boosts efficiency further by storing the regenerative energy produced when decelerating in electrical form and reusing it for traction when accelerating. The ZW220HYB-5B developed in 2014 achieves even better fuel consumption, due to being fitted with a hybrid system developed in collaboration with other parts of Hitachi.

Reducing fuel consumption does not just provide benefits to customers in the form of lower lifecycle costs, it is also important for minimizing global warming. To help reduce the load on the environment, we have set a target of halving the fuel consumption of our construction machines by 2020 relative to 2010, and we are working on technical developments on a variety of fronts.

Use of Cloud Technology to Make Mining More Efficient

—Hitachi has identified the mining industry as one of the key focuses of its Social Innovation Business. Please tell us about your activities in this field.

Oono: The challenge at resource development sites is not just to improve the productivity of individual machines but also that of the overall mine operation. Wenco International Mining Systems Ltd., a Canadian subsidiary of Hitachi Construction Machinery Co., Ltd., has incorporated cloud technology of Hitachi, Ltd. into a fleet management system (FMS) for mines to create a cloud-based system that enables more efficient and sophisticated mine operation through the centralized management of the operation of dump trucks, excavators, and other mining machinery, including vehicle dispatch and route optimization and support for performing maintenance appropriately.

A number of companies within Hitachi are currently working together to develop technology for autonomous haulage dump-trucks, including running trials at a test site in Australia. Further improvements in mining operations will be made possible in the future through the integration of autonomous haulage dump-trucks with the FMS.

Our involvement in the mining industry to date has centered around machinery like dump trucks and excavators. But mine operations extend beyond excavation to encompass large-scale activities in a variety of fields, including the transportation of ore

and other material, and the power plants at coal mines. This makes it an industry where the wider Hitachi Group has the potential to play a role in a variety of areas. Having identified the mining industry as one of the key focuses of its Social Innovation Business, I believe that, by drawing on Hitachi's areas of expertise that include big data analytics, we will be able to help improve efficiency throughout the mining industry.

Autonomous Haulage System with Potential Applications in Various Fields

—While autonomous haulage systems (AHS) have attracted attention in the automotive sector, I understand you are also working on research and development aimed at its use in mining machinery. What can you tell us about that?

Oono: Further improving the productivity of mining machinery will require measures such as optimal route selection and driving practices to reduce fuel consumption, more efficient operation, interoperation between machines, and the elimination of human error to improve safety. Along with advances in driving support, there is also potential for the use of other technologies such as AHS and robotics.

Current mining machines incorporate a variety of control systems intended to boost their performance. We are honing this technology and working on the development of technologies that support the operation of mining machines with a view toward future AHS, including the adoption of automatic driving technology from the automotive sector, which is a particular focus for Hitachi.

For example, we have already installed peripheral vision support devices that were jointly developed with Clarion Co., Ltd. in our large dump trucks, and in December 2014 we signed a technology licensing arrangement for the "Around View Monitor with moving object detection function" developed by Nissan Motor Co., Ltd. and Clarion. In the future, we intend to continue making improvements to safety by fitting such systems to dump trucks to provide vehicle drivers with better peripheral vision.

In addition to these technologies that augment driver notification functions, we are also proceeding with the commercialization of technologies such as the use of sensors to take realtime measurements, or the use of ICT to help drivers do their jobs. Other work includes the development of technology that

combines Hitachi's railway system technology with the Wenco FMS to enable large numbers of mining machines to operate alongside each other safely. Our aim in integrating these diverse technologies is to take on such challenges as AHS and robotics.

Technologies for things like AHS and robotics are already deployed at disaster sites for rescue and recovery work. The dual-arm excavator developed by Hitachi Construction Machinery incorporates techniques from robotics to provide intuitive control of complex operations using its two arms. In addition to use in rescue work by civil defense agencies, the excavator also helped clear rubble following the Great East Japan Earthquake. We also intend to contribute to work on decommissioning the Fukushima Daiichi Nuclear Power Station by accelerating the development of AHS and wireless remote control systems.

A concern with construction work is the shortage of labor and lack of experienced operators. Meanwhile, as infrastructure ages, society is facing the problems of how to reduce the labor requirements and improve the efficiency of inspection and repair work on bridges and other structures. We are putting a lot of effort into the adoption of AHS and robotics in construction and mining machinery, and into the accompanying technologies that assist operation and driving, because of the key role these will play not only in mining but also in the construction, maintenance, and management of social infrastructure.

Cultivation of Ability to Identify Workplace Needs and Offer Solutions

—Please tell us about the development capabilities you have established to contribute to the global market.

Oono: We are working to expand the scope of simulation technologies and boost the speed and efficiency of development in order to establish a reliable supply chain for serving emerging markets and for opening up new markets. Meanwhile, we are also seeking to raise standards and improve quality across the development process by taking steps to review past projects and pass on accumulated knowledge.

Because of the requirement for the functions and specifications of construction machinery to suit the specific circumstances and needs of different regions, we have adopted a development approach that

involves designing and building the main modules in Japan and adding “applications” locally for the various functional requirements. Accordingly, along with having Japanese designers become familiar with the local needs of sites around the world so that they can incorporate these into their application designs, we are also building up design techniques suitable for local use by establishing design offices at our overseas operations and training local designers.

Design and development in the global era requires not only satisfying the needs of specific markets but also the ability to suggest how an application that is used for some other purpose in Japan, for example, can be adopted to satisfy particular requirements. On the basis that there is always more than one way (work practice or function, etc.) to achieve any particular objective, fostering the ability to understand the work undertaken at various different workplaces and how they use their machinery, and combining these together, will be major aspects of future staff development.

To become a close and reliable partner anywhere on the earth, as put forward in our 2020 VISION, Hitachi Construction Machinery Co., Ltd. intends to further hone its development and technical capabilities and to work in collaborative creation with other Hitachi companies to continue supplying construction and mining machinery that help build prosperous societies.