



Activity3

Taking on **challenges** with construction machinery

Creation of new value that contributes to sustainable development and the resolution of social issues

Whether it's mining, construction, or civil engineering works, in order to improve labor shortages, site efficiency, and work quality, our customers' most important issues are "improved safety", "improved productivity", and "reduced life-cycle costs". At the same time, we are being confronted with various social and environmental issues that include resource and energy problems, climate change, and poverty.

We believe that our duty is to come up with solutions that contribute to sustainable development and respond to the development needs of various sites around the globe while tackling these issues.

In April 2016 the HCM Group launched a new organization called the "Customer Solutions Business Promotion Division". The division creates new solutions together with our customers under the "collaborative creation process with customers"

which Hitachi Group promotes, and then deploys the solutions developed through the mining business into other industries. When doing so, in addition to providing solutions through "One Hitachi" by making use of the Hitachi Group's big data analysis and cloud solutions, we are working towards business expansion using new solutions through the open innovation that makes proactive use of collaborations with other companies.

The HCM Group is taking on the challenge of providing new social value and creating new business value (Creating Shared Value).

Working on issues and vision together with our customers to open up new futures - Customer Solutions Business Promotion Division

In terms of improving on-site safety, since 2012 we have equipped our dump trucks with a full periphery safety confirmation support device called the Aerial Angle (jointly developed with Clarion), and in 2014 Nissan Motor and Clarion provided us with "Around View Monitor[®]*1" camera image-processing technology with moving object detection". We are currently adapting the features to hydraulic excavators.

In terms of reducing life-cycle costs, we are accelerating the penetration of the "ConSite" service program that makes use of the "Global e-Service" system which remotely monitors the operation of construction equipment. Making the operating status

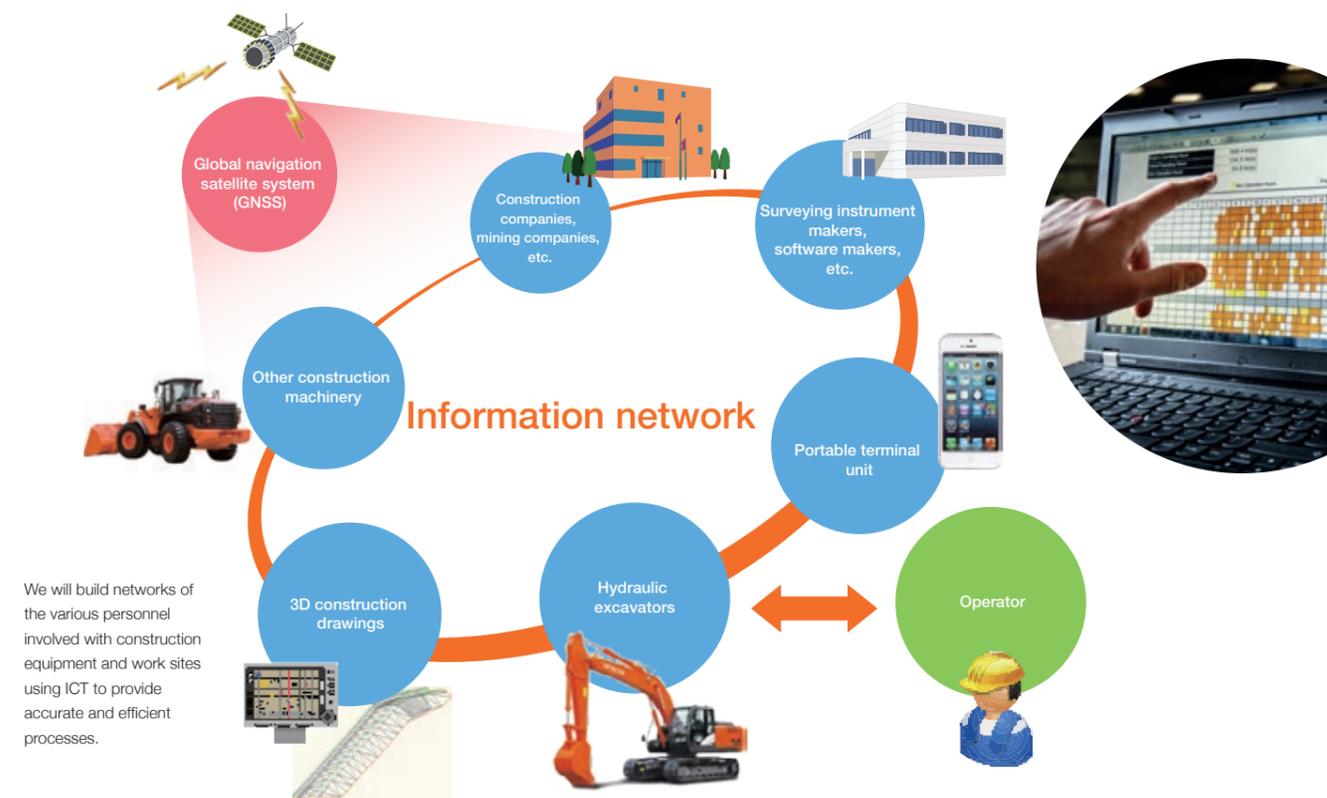
and malfunctions of machinery visible achieves reductions in maintenance costs through early preventive maintenance.

In addition, by implementing methods such as big data analytics we will provide optimal solutions that achieve increased efficiency for work sites and businesses as a whole, opening up entirely new futures.

*1 Around View and Around View Monitor[®] are registered trademarks of Nissan Motor Co., Ltd.

Solutions that resolve customer issues

<p>Customer issue (1) Improved safety</p>	<p>Customer issue (2) Improved productivity [mining]</p>	<p>Customer issue (3) Improved productivity [civil engineering works]</p>	<p>Customer issue (4) Life-cycle cost reductions</p>
<p>Visualizing peripheral information for machinery Expanding the on-board "Aerial Angle" product that displays peripheral information for machinery on a monitor inside the cab</p>	<p>Optimization of the operation process Mining operations management system through use of the Fleet Management System (FMS) for managing mining operations from the successful Wenco International Mining Systems Ltd. Currently conducting verification testing on autonomous (unmanned) dump truck driving systems</p>	<p>Use of information and communication technologies (ICT) adapted to customer needs on work sites Compliance with the "i-Construction" platform promoted by the Ministry of Land, Infrastructure, Transport and Tourism since FY2016. Expanding solutions from a customer perspective</p>	<p>Visualization of construction equipment operating condition and predictors of malfunction Staying on top of malfunction predictors and reducing machine down-time through thorough standardization of servicing via the "ConSite" remote monitoring system</p>



The advanced "ZX200X-5B" ICT hydraulic excavator that increases productivity through semi-automatic control of excavation work

As of June 2016 the HCM Group began rental of the "ZX200X-5B" information and communication technologies (ICT) hydraulic excavator that is the core of our information-oriented construction solutions, and we plan on beginning sales in November. The "ZX200X-5B" comes equipped with HCM's proprietary machine control functions and machine guidance functions that navigate the operator, and complies with the "i-Construction" initiative promoted by the Ministry of Land, Infrastructure, Transport and Tourism. Through semi-automatic control of front work in real-time by using 3D information on the position and orientation of the machinery calculated via the global positioning system (GPS) and other global navigation satellite system (GNSS) as well as angle sensors on the front and body that references the 3D layout data for the applicable construction site, efficient excavation without over-digging of the construction target surface is now possible. In addition to the finishing stake conducted at traditional construction sites becoming unnecessary, easing the workload involved in measurement, and the possibility of large-scale reductions in construction time, this contributes to the safety and productivity of construction sites. We also offer 2D specifications that greatly increase the productivity of construction worksites with small-scale construction or lack of positioning satellite assistance through 2D machine controls and machine guidance.

With the "ZX200X-5B" ICT hydraulic excavator as the centerpiece, the Hitachi Group collaborates with partner companies to combine advanced technologies such as 3D layout data, IoT, and drone measurement to achieve total ICT solutions and contribute to the resolution of various customer issues and agenda.

■ The main features of the ICT hydraulic excavator (proprietary technology)

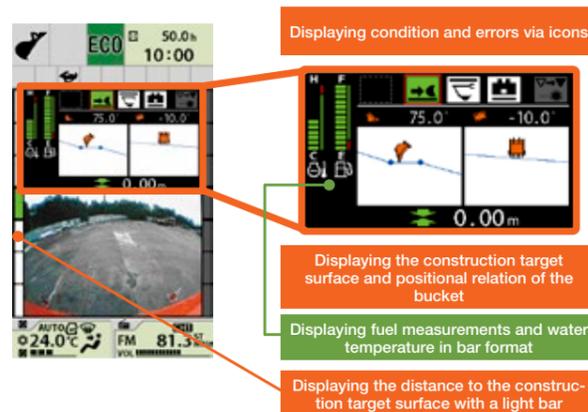
Improvements in productivity and quality through the 3D machine control system

Equipped with a "bucket angle retention mode" that allows work to proceed while maintaining the bucket at a certain angle. Slope and other finishing work is possible with operation of the arm and boom alone, achieving improvements in productivity and quality equivalent to those of veterans even for operators with little experience.



2D specifications allowing for implementation of information-oriented construction in small-scale construction

The 2D specifications come equipped with "2D machine guidance systems" that display information such as the construction surface and position and angle of the bucket on the same monitor as the standard machine (ZX200-5B). Greatly improves productivity on construction sites with small-scale construction projects that cannot make use of positioning satellite assistance.



Working towards Mining ICT commercialization using the collective strength of the Hitachi Group

The HCM Group is making efforts to commercialize Mining ICT (MICT) making use of advanced information technologies, such as through the Fleet Management System (FMS) that efficiently manages the operations of excavators and dump trucks operating at mining sites through ICT and the expansion of that technology to the cloud.

We have developed mining solutions involving upgraded data transmission and management that respond to customers' mining needs, including (1) phase progress management through a finished product/piecework management system, (2) machinery operations management through a dispatching operations management system, and (3) securing safety through a system monitoring proximity of vehicles. In future we plan on expanding these solutions to civil engineering works, construction, and other industries as well.

In addition, mines consist of an extremely wide range of facilities, equipment and machinery, including not only the mining site but also refineries, port facilities for loading product, and infrastructure for supplying power and water to each facility.



It is important to optimize the total "Pit-to-Port" process.

We will continue to take on the challenge of providing new solutions that revolutionize mining operation and management by making effective use of the collective strength of the Hitachi Group.

"Aerial Angle", a safety confirmation support device with a full peripheral view for vehicles

The "Aerial Angle" full peripheral safety confirmation support device jointly developed with Clarion Co., Ltd. provides a view from above centered around the machinery on the cab display through conversion and compositing of the images from each of the several wide-angle cameras equipped on construction equipment. The images can be switched back and forth by the operator from the "wide-area" and "close-area" displays centered around the vehicle to the "parallel" display with the conventional back monitor system images. This allows the operator to instantaneously identify the machine's peripheral situation, such as position relative to other construction equipment and service cars, making for an

even safer and more comfortable operating environment than ever before. In addition, as of 2016 the mid-size hydraulic excavator now also comes equipped with this system. From this point forward we will make use of the "Around View Monitor" camera image-processing technology with moving object detection" provided by the Nissan Motor Co., Ltd. and Clarion Co., Ltd. in 2014 and aim for further improvements in safety through the addition of functions that detect persons and objects in the proximity.



Hydraulic excavator equipped with "Aerial Angle"