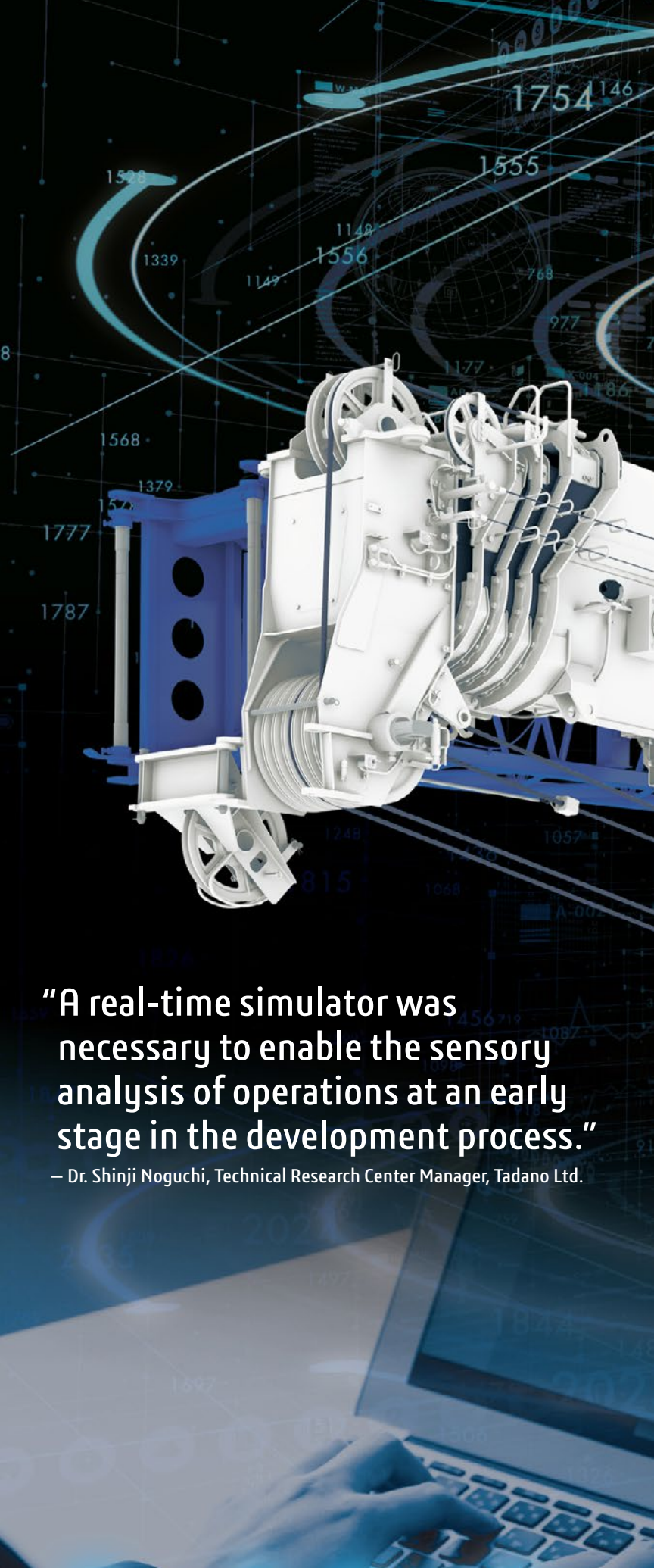


# LIFTING YOUR DREAMS

Tadano Ltd. is engaged in the manufacturing and sales of products including construction cranes, vehicle-mounted cranes, and aerial-work platforms. They celebrated their 100th anniversary in 2019 as one of the world's leading construction crane manufacturers. Currently, the group's business domain has been defined as machines for anti-gravity and aerial work called lifting equipment (LW), and it is engaged globally in locations including Europe, North America, South America, Asia, and Oceania. Among its construction cranes, Tadano is a global leader in the number of shipments of rough terrain cranes that are in high demand in Japan because they can maneuver rough terrain. Tadano offers work vehicles optimized for customer needs in the market through its abundant line of construction cranes, including the active use of M&As for the market roll-out of all terrain cranes that lift up to 1,200 tons and crawler cranes that have a traveling body equipped with a crawler belt device (crawler).

Tadano has leveraged its advanced technological capabilities including the development of Japan's first hydraulic crane named the OC-2 actively engaging in construction crane technology development. They have also aggressively invested in further technical innovation in order to respond as quickly as possible to the needs of the market through means such as establishing the Advanced Technology Research Division in 2017 as an independent organization under the direct supervision of the president to enable prompt decision-making. The Technical Research Center located in Takamatsu City, is where Kagawa Prefecture plays a central role in this R&D process. Under the Center's vision of "polishing skills and polishing usability" they are looking to achieve dramatic transformation in the construction industry in regards to safety and productivity. They have worked day and night to develop new technologies that resolve various social issues, including the use of advanced technologies to provide support in response to the lack of skilled operators because of a decrease in the number of construction workers, and also to reduce accidents at construction sites.



**"A real-time simulator was necessary to enable the sensory analysis of operations at an early stage in the development process."**

— Dr. Shinji Noguchi, Technical Research Center Manager, Tadano Ltd.



**TADANO**

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**“It is not possible to change and evaluate parameters with actual crane. Only the simulator makes easy to change and confirm various simulation variables.”**

—Hiroki Ichikawa, Technical Research Center, Technical Research Unit, Doctor of Science, Tadano Ltd.

A crane boom that is equal to an arm of a crane can cause boom crane deflection and load swing when it attempts to lift a load. To understand the physical property of a load swing and how cranes are actually used at construction sites, it is essential to consider the control method of a load swing. However, designers are not able to enter construction sites where cranes are at work due to hazardous areas. Therefore, as explained by Shinji Noguchi, Technical Research Center Manager, “We have worked to quantify the line of sight of well-experienced crane operators during their work through measurement and analysis. Although sense is important when people operate things, this is not something that has been sufficiently incorporated in product development up until now.” According to Kazuya Tanizumi Technical Research Center Chief and Doctor of Engineering when considering development time, “Evaluation based on the sensibilities of the person operating a crane is of course only when that person actually gets on the crane and operates it. For this reason, a lot of time has been necessary just for evaluation, including

prototype manufacturing and test environment preparations. Therefore, it was necessary to develop a simulator that would enable sensibility evaluations at an earlier stage in the product design and development process.”

#### **DEVELOPMENT OF A REAL-TIME CRANE SIMULATOR THAT ENABLES SENSORY ANALYSIS**

The simulator was required to accurately model a crane boom and reproduce that behavior in real-time. For this reason, what caught the interest of the company was the multibody simulation software, Simpack, as offered by Dassault Systèmes. According to Tanizumi, “We considered multiple software products in the product selection process. While there were products capable of real-time simulation in the case of a rigid body, there were no products besides Simpack with its advanced technologies that enabled the accurate reproduction of the crane boom deflection that is important when simulating a construction crane. In addition, it was only Simpack that made real-time simulation of a human sensory analysis possible.”

Being able to generate a physical model for simulation based on accurate design information was another important point that led to the selection of Simpack. According to Noguchi, “What we wanted was not a simple simulator such as those that are used in training by operators, but a high-precision development tool with a high level of reproductivity. Our engineers need to be able to generate and analyze a physical model for structures based on accurate design information.”

## NOT ONLY ACCELERATES THE SPEED OF R&D, BUT CAN ALSO BE USED AS A COMMUNICATION TOOL

The simulator was built with the support of Dassault Systèmes and it was used to develop a model for major types of rough terrain cranes that are a mainstay product of Tadano. The actual simulator was developed in an integrated manner that includes hardware, such as the cabin that is ridden by operators, operating levers, an overload preventive device called an AML, and displays along with a large one that visualizes the Simpack calculation results in real-time. The simulator makes it possible to directly operate Simpack and confirm the results, including making changes to parameters such as crane conditions and load weight, executing the simulator, and displaying results. Because intermediate files are not required, it is possible to change the type of crane and run a simulation even without any model knowledge. The simulator has contributed to a reduction in manpower hours, which has reduced the product development period from one year to about six months with the release of new functions accelerating.

The simulator is also used as a tool for the development department to understand the ideas of the research department. Tanizumi praises Simpack, stating that “Although there were cases in which it was difficult to convey the functions in new design proposal up until now, virtual experiences using the Simpack simulator have improved the understanding of the people involved compared to before and helped facilitate development in many cases.”

**“It is necessary to remodel boom from the model in order to change and evaluate crane parameters. These modifications are simple with Simpack because the GUI and simulator are directly linked.”**

— Kazuya Tanizumi, Technical Research Center Chief and Doctor of Engineering, Tadano Ltd.

## EXPANDING THE SCOPE OF USE WHILE DEVELOPING MODELS FOR MAJOR TYPES OF CRANES

As explained by Dr. Hiroki Ichikawa, Technical Research Center, Technical Research Unit, who is currently developing new hydraulic valves for systems, “There are plans to create a hydraulic valve simulation code, link it with Simpack, and create co-simulations in real-time. I hope that motion response evaluation for the mechanism including hydraulic characteristics (a crane model created with Simpack) will make it easier to find areas for improvement with the valve.” Ichikawa relays that, “In addition, there are also plans for coupling with MATLAB that is broadly used in control system design, and I also hope that Dassault Systèmes will provide ongoing support going forward regarding the response that is required to expand the scope of utilization.”

For More Information  
[www.tadano.com](http://www.tadano.com)

