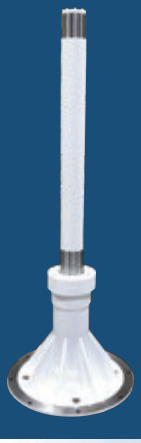
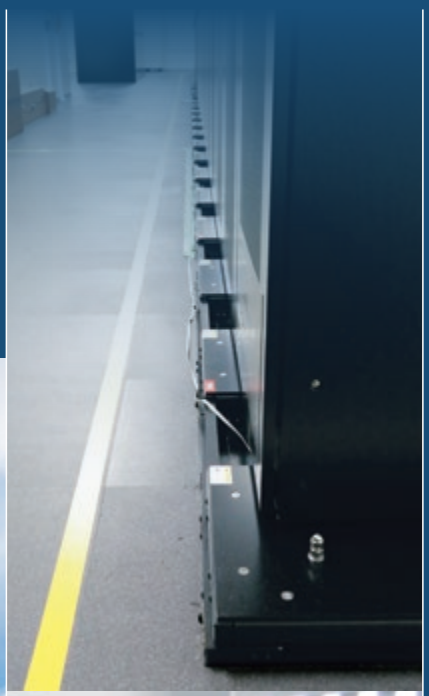
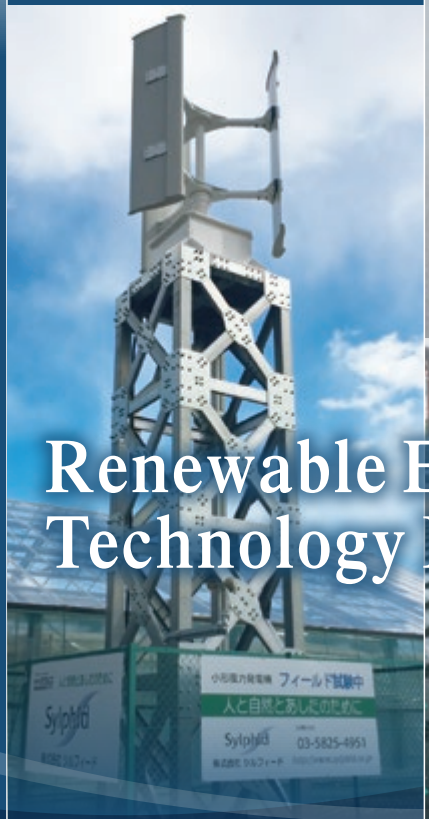
Special Feature

THK's Ability to Create Value







Robot Technology Initiatives

Renewable Energy Technology Initiatives

Seismic Isolation Technology Initiatives

THK INTECHS

Providing the Optimal Robotics Engineering for Our Customers' Needs

Takashi Teramachi
Representative Director and
President of THK INTECHS CO., LTD.

The THK INTECHS homepage states, “We provide the optimal robotics engineering for our customers' needs.” We say this because, as the birth rate declines and the population ages in Japan, it is expected that labor shortages in production facilities will continue to worsen. In order to maintain our production capacity and improve our productivity under these circumstances, we believe one answer is to have robots perform simple, repetitive, and/or hazardous work, and have people engage in tasks that have a high added value (process management, kaizen activities, craftsmanship, etc.).

Robot development has centered around the automotive industry. Robots are already performing tasks that humans cannot. However, human labor has certainly not gone away. The reason is that there has been a need for features that robots until now have not possessed. There is also demand for robots that are *simple, fast, inexpensive,* and *safe*. The NEXTAGE® robots we have been developing with Kawada Robotics Corporation have the following features:

1. The robots can be set up without an enclosure.
2. The heads are equipped with two “eyes” (cameras) that can check the condition of the robots' surroundings and automatically make corrections.
3. With their *humanoid* design, the robots' movements can be planned out by intuitively imitating the work of humans.

These features differentiate them from previous industrial robots, removing the need for fixing the robots in one location, and allowing them to move around freely. We also develop standard optional parts, such as hands and mobile carriages, that can be installed on the robot. These are the parts equivalent to human hands and feet. Naturally, our customers have many different challenges and requests for their production processes, so it is our role and our function as engineers to provide optimal solutions that best utilize the special features of these robots. Toward this end, we also develop peripheral equipment. By introducing robots to processes while utilizing the current human work environment as much as possible, we are striving to achieve LCA (Low Cost Automation). The number of examples of customers incorporating our robots has increased every year. For instance, our robots have been utilized for working overnight at work stations to perform tasks that humans do during the day, as well as for operating equipment and performing repetitive loading and unloading tasks that humans once did. From an IoT perspective, we also anticipate that using NEXTAGE® hand cameras to inspect parts and gather data will be useful for improving traceability and quality.

In April this year, the Chubu Technical Support Center was established at the THK TOYOTA Branch, which counts THK INTECHS employees among its staff. Because of this, we are now able to investigate product processes at a laboratory and immediately rush in if we are notified of an on-site issue. This year, we are striving to further strengthen our domestic support structure. In the future, we intend to use our business activities to try to become a company the local community thinks highly of.

NEXTAGE® performing assembly work at the YAMAGATA Plant

* **NEXTAGE®:** *Two-armed industrial robot made by Kawada Robotics Corporation. As a joint venture between the THK Group and Kawada Robotics Corporation, Kawada Robotics Corporation manufactures the robot body, while THK INTECHS handles sales and develops optional parts.*

The University of Tokyo Jouhou System Kougaku Laboratory (JSK) **Bunkyo, Tokyo**

High Expectations for the Widespread Use of Robots Made with THK's Globally Competitive Technology

Masayuki Inaba
Professor, Dr.Eng.
Department of Creative Informatics / Mechano-Informatics
Graduate School of Information Science and Technology
The University of Tokyo

Kotaro Nagahama
Assistant Professor, Ph.D.
Department of Creative Informatics
Graduate School of Information Science and Technology
The University of Tokyo

Hiroaki Yaguchi
Lecturer, Ph.D.
Department of Creative Informatics
Graduate School of Information Science and Technology
The University of Tokyo

In the past, robot software was developed separately by each university and manufacturer, creating a major hurdle for newcomers in the field. Then, a movement centered around the Ministry of Economy, Trade and Industry arose to construct a software environment with standardized specifications and make that software available so that it could be freely used to accelerate robot development. For instance, with machine components being standardized under JIS, parts can be replaced even with those from a different manufacturer. The same principle applies to software. We at JSK are pursuing robot research capable of interoperability between the Japanese RTM*1 and American ROS*2 software environments.

Our collaboration with THK began with the development of the robot hand when we were participating in the DRC*3 emergency-response robot challenge in the US in June 2015. For the DRC, we needed sturdy hands that could not only grasp various objects, but could also be attached to four legs to walk on. However, we only had one year to prepare. That was when we requested the help of THK, who had experience in and knowledge regarding robot hand development. There were many people at THK who had polished their skills by participating independently in numerous robotics competitions in Japan, and we were amazed by how easily they created their design. They also had highly experienced staff with a deep understanding of how the product would be used. The world of robotics evolves at a rapid pace. Organizations cannot keep up with the latest trends without people who can grasp the developments that come out every day. Their success depends on whether they have those people.

Grabbing an object and checking the color

Even after the DRC, we have been doing joint research and development with THK, combining ROS and a large, life-sized robot constructed with **SEED Solutions**. The objective is to develop robots for research and education that can be used in experiments at university laboratories. There are many university laboratories in Japan that would like to use robots, but are not capable of making them. Because people unfamiliar with robots will be running experiments, it is crucial that the robots do not break easily. Operability is also important, as it enables robots to be brought to and used in many different locations. In the past, robots were largely unable to be disassembled, so it was very difficult to transport them. However, the robot with **SEED Solutions** has few wires and can be easily disassembled, so its transportability is a plus. The robot has actually fallen over and been treated somewhat roughly during experiments, but it never broke, and it has been easy to transport to competitions and exhibitions.

The creation and practical application of robots is difficult for a university laboratory to accomplish on its own, so we value our partnership with THK, which makes the actual products through our joint research. If other educational institutions see the fruits of our labor, they will definitely be asking for one of their own. We think it's very important for more young people to gain experience by actually touching and working with complex robots.

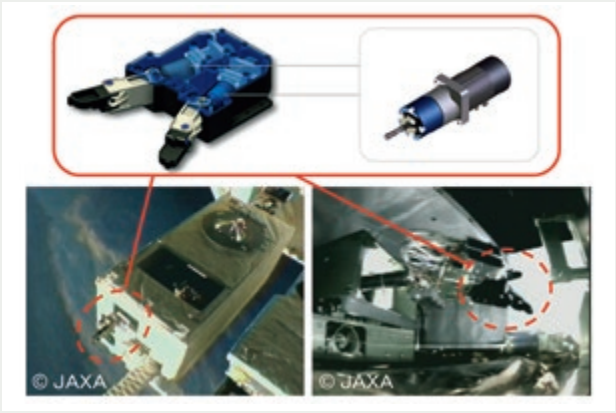
*1 **RT-Middleware:** *Middleware for robots developed by the National Institute of Advanced Industrial Science and Technology.*
*2 **Robot Operating System:** *Robot software development platform managed by the Open Source Robotics Foundation.*
*3 **DARPA Robotics Challenge:** *Emergency-response robot competition held by the US Defense Advanced Research Projects Agency.*

Robot Technology Development

One could say the core principle of THK's technology is to create products that use little force to move heavy objects. THK is utilizing this technology to develop next-generation robot technology for the society of the future, which will face low birth rates, an aging population, and labor shortages.

A robot hand that our company developed has already been used for the extravehicular robot experiment (REX-J) on the International Space Station. In addition, the development and clinical study of a walking assist robot to support the rehabilitation of people who have undergone knee surgery has advanced through an industrial-academic collaboration between the University of Yamanashi, Kofu Municipal Hospital, and private industry. There are various **SEED Solutions** made by THK in this robot, which allow it to not only control the amount of assistance and measure walking training data, but also wirelessly communicate with an external terminal.

We will continue to pursue technological developments that anticipate societal needs.



REX-J hand used in the extravehicular robot experiment on the International Space Station

SEED Solutions *built into the walking assist robot*

Sharing THK's Service Robot Technology with the World

Yasuto Shiigi
Industrial Machinery Company
Engineering Division Business
Development Department
Nagatsuka Business Unit

Ever since I was a university student, I wanted to work at a robotics laboratory and be involved in space robotics. One of the deciding factors for me choosing to join THK came when I was visiting a former graduate of my university who worked at JAXA. There, I heard about the "robot hand launched to space," which was introduced in our CSR Report 2013/2014, and learned that THK's technology was useful for developing space robotics.

My wish was granted; I was assigned to the department that handles robot development, and now I am in charge of joint research with the University of Tokyo. We are still at the research stage, but I am proud of our technological developments, which are necessary for THK's service robots to gain widespread use.

SEED Solutions, which are the core of THK's service robot technology, are a group of RT (Robot Technology) components that are compact, have few wires, and anyone can easily use. Through **SEED Solutions**, we hope that we can lower the hurdles for people who had given up on robot development, encourage new people to enter the field, and contribute to the development of the service robot industry. Additionally, with the joint research between THK and the University of Tokyo, we are striving not just to work with component parts, but to get involved in the development of platform robots for research and academia that can easily be used by anyone. I hope that the technology we have developed, with the University of Tokyo developing the system based on ROS (Robot Operating System) for the software environment and THK developing the service robot as the hardware environment, will be shared with the world.

As I gain a broad scope of knowledge through this work, I hope to become a robot engineer well versed in everything, from software, to hardware, to electronics.