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# Introduction of New Products and New Functions (FA)

## Fast Cycle-time Technology Contributes to Cycle-time Reduction

Processing worksites make various efforts to reduce cycle times and improve productivity. For this we offer Fast Cycle-time Technology, our name for CNC and servo technologies that help reduce cycle times.

The following processes are implemented from the time CNC analyzes the machining program until the machine tool starts to work: analysis/interpolation of the program, acceleration/deceleration process, servo/spindle process, and sequence process. Each process element affects cycle times significantly. The Fast Cycle-time Technology contributes to reduced cycle times by optimizing these processes. The core function of this technology is the Fast Cycle-time setting.

### Fast Cycle-time setting

FANUC recommends that users take advantage of all the latest functions we've developed that contribute to reduced cycle times. The Fast Cycle-time setting helps you optimize the setting of these latest functions. Functions effective for reducing cycle times are gathered together on one screen, and the CNC then automatically selects the settings that most effectively reduce cycle times by comparing the currently set parameter settings with FANUC's recommendation settings. As the selected settings can be reflected directly onto the parameters, you can easily perform setting and adjustment work.

The diagram illustrates the Fast Cycle-time Technology process flow. It starts with a 'Machining program' (G0 Program) which goes through 'Program analysis/interpolation' in the 'CNC' block. This is followed by 'Acceleration/deceleration process' and 'Servo/Spindle' control, leading to the 'Machine tools'. External signals and operational state are also inputs to the CNC. Below the flow, a blue oval highlights the 'Fast Cycle-time Technology' components: Command path optimization, Reduced sequence process time, Smooth acc./dec. and faster positioning, Best use of spindle performance, Setting and tuning support, and Compatibility with new machining technologies.

Below the diagram, the 'Fast Cycle-time setting screen' is shown as a screenshot of a CNC control interface. To its right is an 'Example of application' showing a metal part. Below the part, a comparison shows the cycle time 'Before application' at 4 min 47 s and 'After application' at 4 min 4 s, resulting in a 'Reduction by approx. 15%'.

## AI Servo Tuning provides advanced automatic servo tuning

AI Servo Tuning is the generic name including all FANUC servo tuning technologies that use AI. Among them, AI feedforward is our first achievement.

AI feedforward is an AI Servo Tuning function that achieves high precision due to avoiding machine vibration during acceleration/deceleration. You can use an advanced AI feedforward control which is superior to conventional feedforward with manual tuning. SERVO GUIDE equipped with a machine learning algorithm automatically changes parameters, performs testing, and conducts evaluation to determine optimum parameters. Tuning of two axes will be completed in approx. 15 min. It achieves automation of advanced servo tuning, and contributes to higher-speed and higher-precision machining.

The diagram shows the control loop for AI Servo Tuning. A 'Motion command' is sent to the 'CNC', which outputs to 'Servo control'. The servo control includes 'AI feedforward control' and 'Position control'. The output goes to 'Velocity control', which drives the 'Motor'. Feedback from the motor is sent back to the servo control. Below the diagram are two graphs comparing 'Before tuning' and 'After tuning' performance at a velocity of 500mm/min/div. The 'Before tuning' graph shows a large position error of 5 μm/div during acceleration and deceleration. The 'After tuning' graph shows a significant 'Reduction in position error during acceleration/deceleration'. A scale bar indicates 100ms/div.

The diagram illustrates the workflow of the 'SERVO GUIDE equipped with machine learning algorithm'. It starts with a laptop displaying the SERVO GUIDE software interface. An arrow labeled 'Parameters' points from the laptop to the 'CNC' (Control Panel). Another arrow labeled 'Command' points from the CNC to the 'Machine tool'. A return arrow labeled 'Servo data' points from the Machine tool back to the laptop.

## FANUC Robot R-2000iC/190U

As a new variation in the R-2000iC Series, one of our most popular robot products, FANUC has developed and launched the new robot, R-2000iC/190U that can be mounted upside down from ceiling or frame.

- This is a robot dedicated to ceiling-mounted use with a reach of 3.1 m and a payload of 190 kg.
- With the robot ceiling-mounted, it can approach workpieces from above to perform work such as welding, assembly, and transfer. In addition, the floor space can be used effectively, because no floor space is needed for installing a robot.
- We have other large robots that can be mounted on a ceiling, such as M-900iB/360 Series. However, they use a support-link mechanism, which restricts the arm working angle range. And because servo motors protrude from both sides, the large turning radius tends to cause interference with neighboring equipment.
- By using a newly developed balancer mechanism, this robot has a compact and slim robot arm and enable to move more quickly. In addition, as the turning radius is minimized, multiple units can be tightly-packed and installed in a small area.

The R-2000iC Series, boasting the high reliability and production efficiency, can now be used in an even wider range of fields.



## New Functions of FANUC ROBOGUIDE

New functions of the PC software ROBOGUIDE that supports designing robot application systems are described below.

### ● CAD Data Converter

3D CAD data with various formats can be imported to ROBOGUIDE to build a simulation environment. This function is compatible with various CAD systems such as CATIA™, Autodesk® Inventor®, NX™, Pro/Engineer®, PTCCreo®, JT™, Solid Edge®, SolidWorks®, Parasolid®, STEP, and IGES.

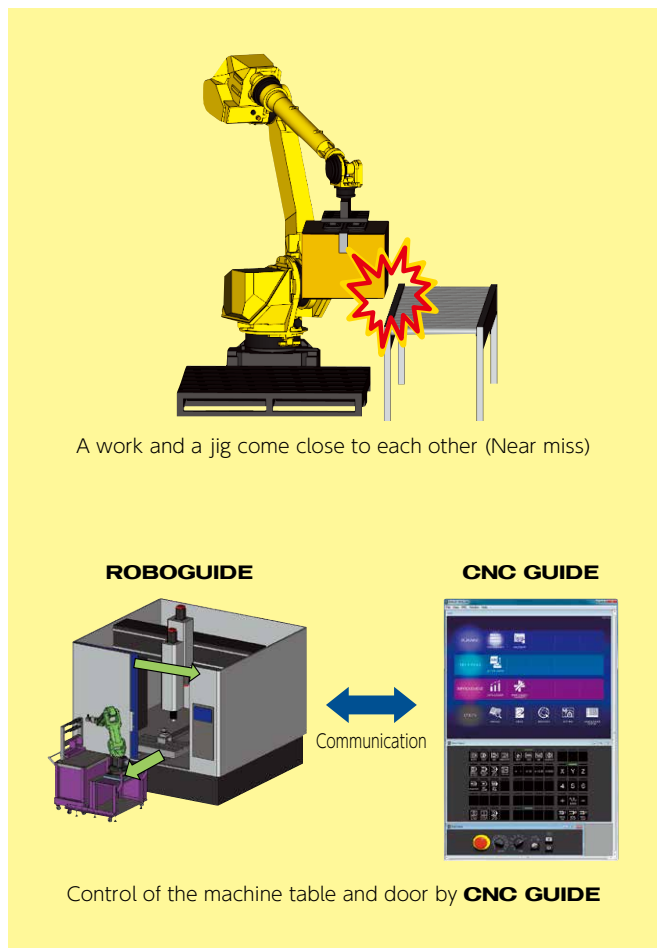
### ● Near-miss Checking Function

The conventional system detected interference only when objects collided with each other on the motion simulation. This new function can simulate motions of objects in advance and check for cases where objects come too close to each other exceeding a pre-set distance, that is to say, near-miss cases. You can work on a robot program while checking distances between objects.

### ● Simulation by Linking CNC GUIDE and ROBOGUIDE

You can create programs and sequences of both CNC and robots on a single PC to check the motions of machine tools, robots, and peripheral devices that are linked to each other. The simulation software for CNC and robots cooperate and support to design machine tools systems with robots and start them up.

FANUC will continue to improve and enhance ROBOGUIDE functions to make designing robot systems easier.



# Introduction of New Products and New Functions (ROBOMACHINE)

## Improvement of ROBOMACHINE operability

The new user interface *i*HMI improves the operability of each ROBOMACHINE by collectively supporting planning, machining/molding, and improvements at machining and molding worksites.

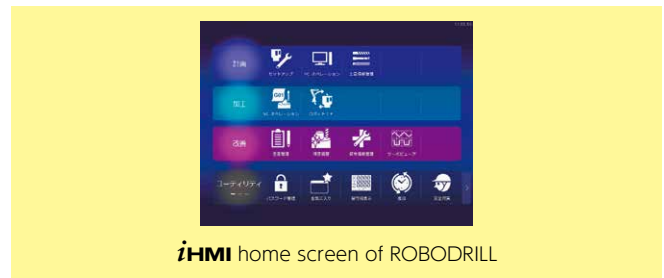
Moreover, we have developed series of a new *i*HMI functions that operates measuring instruments, sensors, and peripheral equipment related to ROBOMACHINES. By using this function, we are now working to improve the operability of each unit of machining cell or molding cell.

## ROBODRILL

The peripheral equipment of ROBODRILL includes touch probes for on-machine measurement of workpieces, additional rotary tables for four or five-axis machining and so on.

To improve the operability of ROBODRILL, We have developed a new function that executes unique screens (custom screens) which peripheral equipment manufacturer has created by FANUC PICTURE and integrated into ROBODRILL *i*HMI.

Custom screens can be called from the *i*HMI home screen. They are unified with the ROBODRILL main system operation.

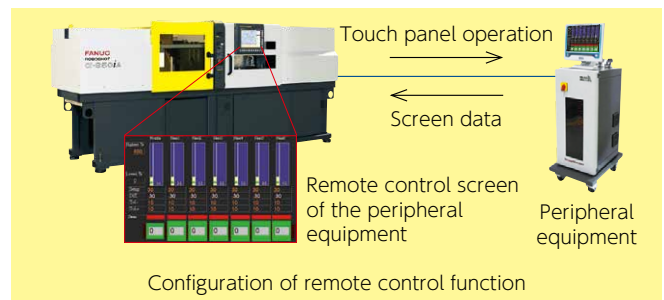


## ROBOSHOT

A molding cell that includes ROBOSHOT typically uses various peripheral equipment such as product take-out robots and mold temperature controllers.

To improve the operability of ROBOSHOT, we have developed a new function that connects peripheral equipment to ROBOSHOT via the network and operates them by remote control from ROBOSHOT.

Peripheral equipment screens can be called from the *i*HMI home screen. They are unified with the ROBOSHOT main system operation.

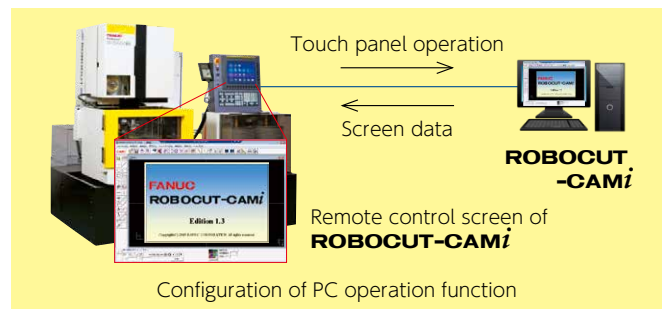


## ROBOCUT

ROBOCUT-CAM*i* is the CAM system dedicated to ROBOCUT. This system operates interactively to help you create NC programs easily.

To improve the operability of ROBOCUT, we have developed a new function that operates ROBOCUT-CAM*i* by remote control using the PC operation function of *i*HMI.

The ROBOCUT-CAM*i* screens can be called from the *i*HMI home screen. They are unified with the ROBOCUT main system operation.

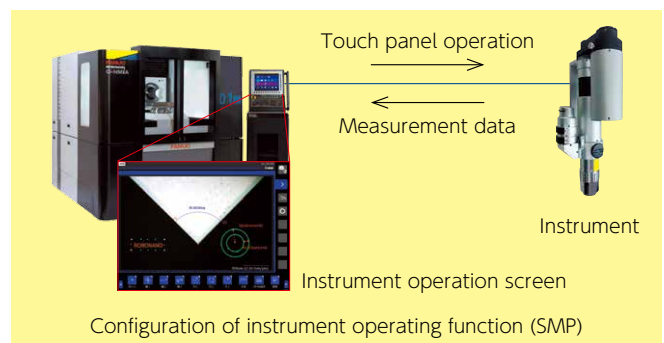


## ROBONANO

At the ultra-precision machining worksites with ROBONANO, various measuring units such as microscopes, electric micrometers, and field balancers are used.

To improve the operability of ROBONANO, we have developed a new function called SMP (smart measurement package) that connects measuring units to ROBONANO and operates.

Operation screens for measuring units can be called from the *i*HMI home screen. They are unified with the ROBONANO main system operation.



## Winner of the 2018 (61st) Nikkan Kogyo Shimbun Ten Great New Products Awards Main Prize Winner of the 2018 Nikkei Outstanding Products and Services Awards Highest Award

FANUC ROBONANO  $\alpha$ -NMiA, which achieves stable ultra-precision machining, recently received two awards: the Main Prize in the 2018 (61st) Nikkan Kogyo Shimbun Ten Great New Products Awards Main Prize and 2018 Nikkei Outstanding Products and Services Awards Highest Award/Nikkei Sangyo Shimbun Award.



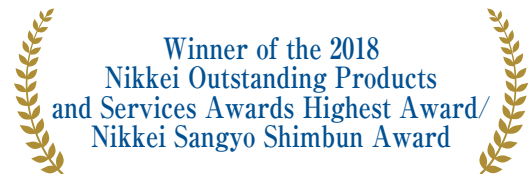
### About FANUC ROBONANO $\alpha$ -NMiA

FANUC ROBONANO  $\alpha$ -NMiA is an ultra-precision machine that brings together FANUC's CNC and servo control technology and pushes machining to its limits.

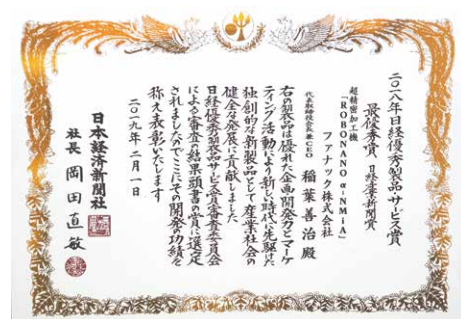
It can be used for a wide range of purposes from R&D to mass production of parts for high-tech equipment that requires nano-level surface roughness and quality in areas such as automotive watch, bio-technology, and medical service, not to mention optical electronics. It achieves a command resolution of 0.1 nm in the linear axis and 0.000001 degrees in the indexing axis, and in order to handle large-scale machining, it enables up to A4-size machining work. Its screen, dedicated to ROBONANO operation, also allows display and operation of peripheral devices.



Winner of the 2018 (61st)  
Nikkan Kogyo Shimbun Ten Great  
New Products Awards Main Prize



Winner of the 2018  
Nikkei Outstanding Products  
and Services Awards Highest Award/  
Nikkei Sangyo Shimbun Award



The Ten Great New Products Awards are awarded by Nikkan Kogyo Shimbun Ltd. to products developed or commercialized by participating companies during the award year that support the development of manufacturing industries and improve the international competitiveness of Japan. The award ceremony was held at Keidanren Hall on January 24, and Nikkan Kogyo Shimbun President Imizu presented a certificate of commendation and plaque to Senior Executive Vice President Uchida (General Manager, ROBOMACHINE Business Division).

The Nikkei Outstanding Product and Service Awards are awarded by Nikkei Inc. once a year to outstanding new products and services. The awards ceremony took place at the Imperial Hotel Tokyo on February 1st, and Nikkei President Okada presented a certificate of commendation and a trophy to Chairman Inaba.



At the awards ceremony for the 2018 Nikkei Outstanding Products and Services Awards, Preferred Networks, Inc., which develops deep learning and the FIELD system with FANUC, received the Nikkei Outstanding Products and Services Awards (Best Award/Nihon Keizai Shimbun Award) for its open-source deep learning framework "Chainer."

Second and third from left is Preferred Networks President Nishikawa and Chairman Inaba, respectively.

Juraron Industries Inc. is a manufacturer of optical plastic lenses with more than 70 years of history.

We visited the head office plant in Katano, Osaka, to interview Senior Managing Director Shinji Yamamoto.

### Please tell us about your company's history and business domain.

**SMD Yamamoto:** Juraron Industries was founded in Osaka in 1948. Immediately thereafter it produced urea resin materials, but later shifted focus to molding and has since molded engineering plastic products.

In 1986, we succeeded in developing and mass-producing aspheric lenses for plastic CD, and based on this, we are now developing plastic lenses as one of our core businesses. In addition, in 1994, we began expanding production overseas. Currently, we have plants in Hong Kong, China, and Vietnam, where we produce engineering plastic precision parts centered on gears for OA equipment.

### Please tell us about the strengths of your company.

**SMD Yamamoto:** More than 30 years have passed since we started producing plastic lenses, and the strength of Juraron is its integrated manufacturing system covering all processes including proposing optical solutions to customers, optical design, mold manufacturing, molding, vapor deposition, and assessment.

Based on the lens mold machining technology we have long cultivated, we are also building an ultra-precision machining business using nano-machines, including FANUC's ROBONANO, and plan to develop it into a new pillar of our business.

### Can you tell us what led you to introduce FANUC products and what you think of them when you use them?

**SMD Yamamoto:** We have introduced over 80 units of ROBOSHOT and two units of ROBONANO. Furthermore, in 2018, we introduced FANUC robots to load and unload ROBOSHOT work.

The first FANUC product we introduced was ROBOSHOT. We introduced AUTOSHOT *a-35*, a lens molding machine, in 1993. It had what was then an extremely innovative "pressure profile trace control" function, and we found it interesting because it was not seen in other companies' products and was only provided by FANUC. At the same time, by introducing MOLD24, FANUC's operation monitoring system, we became able to ensure stable operation.

Experiencing the successful introduction of ROBOSHOT enhanced our confidence in FANUC products, and in 2009, by introducing ROBONANO *a-07B*, we successfully began in-house production of complicated ultra-precision molds, which until then had been outsourced.

In 2018, we introduced the new ROBONANO *a-NM1A* to expand our ultra-precision machining business. Improved



Senior Managing Director Yamamoto

machining strokes and greater ease of use allowed us to apply the model to larger ultra-precision mold machining.

### Please tell us your evaluation of FANUC and your requests to us, if any.

**SMD Yamamoto:** We manufacturers pay a great deal of attention to equipment maintenance and management. In this respect, FANUC has a well-developed, full-service system in Japan as well as overseas, and this gives us a great sense of security.

About two years ago, I visited the FANUC head office plant in Yamanashi Prefecture to see a repair workshop where you repaired control boards and other parts. I learned that you provide "lifetime maintenance" by repairing even the boards produced immediately after FANUC was founded and having a stock of parts for such boards. I was impressed by this policy, which gave us a sense of security again. Our request to FANUC is for our employees to be able to receive training even in Osaka and its vicinity, because your training facility FANUC ACADEMY is extremely popular among those who wish to receive training and because some of them were unable to take courses on their desired dates.

Your consideration would be appreciated.

(Interviewer: Shingo Numoto, Public Relations Department)



Outside view of the head office



Inside view of the head office plant

**Juraron Industries Inc.** (<http://juraron.co.jp/>)

▷Representative Director & President: Susumu Yamamoto

▷Capital: ¥54 million   ▷Number of employees: 110

(Head office) ▷Address: 51-8, Kozu 2-chome, Katano-shi, Osaka-fu 576-0053 Japan

▷Phone: 072-891-5515   ▷FAX: 072-892-1710

## FA Foundation Award Ceremony



President Matsuno



Chairman Inaba

On December 14, the FA Foundation hosted an awards ceremony for its fiscal 2018 thesis awards at Kazan Kaikan. The foundation, originally the Advanced Automation Technology Promotion Foundation, was established in 1989. Its mission is to contribute to the Japanese industry and economy by improving automation technology for machine tools and industrial machinery, mainly through official commendation of research achievements related to FA and industrial robot technology.

At the thesis awards ceremony, seven theses chosen based on impartial examinations from among those published in the journals of the Japan Society for Precision Engineering, Japan Society of Mechanical Engineers, Robotics Society of Japan, and other associations were presented as winners.

## New Year's Celebration



Chairman Inaba



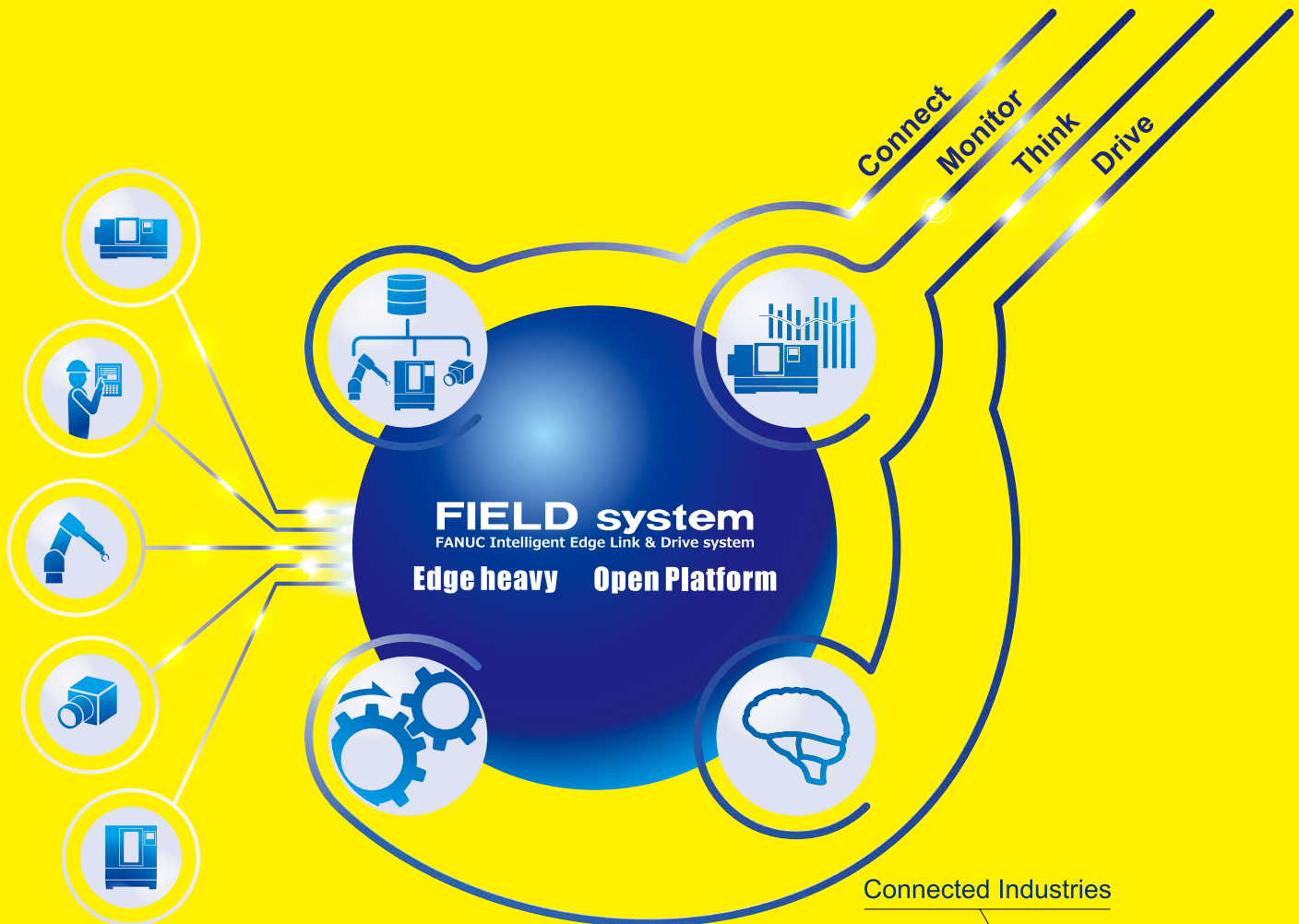
Party at FANUC Square

On January 6, a 2019 meeting to exchange New Year's greetings was held on the third floor of the Performance Evaluation Building at the FANUC head office. Over 450 people, including business partners as well as executives and employees attended the ceremony. Chairman Inaba began the meeting with a compelling address, saying, "The Japanese and international markets generally remained strong until the first half of last year, but since then, the economic environment has changed. Given this, last year we sought to open up new markets, including by introducing the FIELD system and ROBONANO. We also improved the technological levels of FANUC Group companies worldwide, continue with research and development for improving usability, and increased production capacity in the manufacturing unit. Thus, we are pushing forward with a strategy based on forecasts which look to the future of one or two hundred years ahead. Under FANUC's basic policy, 'preciseness' and 'transparency,' we will drive our business forward with all our resources."

# Smart Machine Smart Factory

Driving machinery smartly and efficiently for a smarter factory

Discover new *value* with FIELD system: an ecosystem for manufacturing that utilizes production data more effectively.



FIELD system is a platform open to everyone, and was developed for edge-heavy computing by bringing together the latest IoT and cutting-edge AI technologies.

By using this system,  
FANUC aims to work with partners around the world to  
innovate manufacturing.

FANUC News 2019-1

## FANUC CORPORATION

Oshino-mura, Minamitsuru-gun, Yamanashi 401-0597 Japan

<https://www.fanuc.co.jp/>

Phone: (81) 0555-84-5555

Fax: (81) 0555-84-5512

Person in charge of publishing:

Yoshihiro Gonda, Representative Director, Senior Executive Vice President and CFO (General Manager, Corporate Administration Division)

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