

MECHATRO+ [PLUS]

ENGLISH EDITION

VOL. 2

Development Story

MV Series equipped with New Controller D-CUBES

Wire-cut EDMs

C80 Series

Computerized Numerical Controllers

Solution Case Study / Interview

Nihon Haken Co., Ltd.

YUWA Corporation

Seiryoh Co., Ltd.

TATSUMI SEISAKUSYO CO., LTD.



MECHATRO+ [PLUS]

Cover photo:
Meijo Park (Nagoya) and view towards Nagoya Station

Nagoya City has the third largest population in Japan and is part of the Chukyo region, which is the one of the three largest urban areas in the country. In the city, Meijo Park is located near Nagoya Station, the main crossroad for traffic. Opened in 1931, the park covers 80.41 hectares with Nagoya Castle as the centerpiece. There are approximately 2,800 cherry trees complemented by wisteria clusters, and many events are held there through the year.

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Message Marking the Launch of MECHATRO+(PLUS)

I would like to take this opportunity to express my sincere appreciation for your ongoing support of Mitsubishi Electric and our affiliate companies.

On this occasion, we have redesigned the Japanese-language version of MECHATRO+, which has been highly regarded since first publication in December 2015, and now offer an English-language version.

Over the 43 years since the Industrial Automation Machinery Marketing Division was established, we have helped to increase the competitiveness of manufacturing companies through R&D and the commercialization of electrical-discharge machines, laser-processing machines, and computerized numerical control devices, just to name a few items.

Currently, our co-workers in all areas of operations at every manufacturing and research site are combining their strengths and constantly challenging themselves to develop products that can contribute to the monozukuri of the world by tapping into Mitsubishi Electric's overall potential.

At the same time, in terms of initiatives for supporting our customers with after-sales service, we will further enrich our overseas after-sales service network by increasing the number of bases, speeding up our response, and other efforts, in addition to constantly evolving the services we provide.

Mitsubishi Electric will continue exerting every effort to provide leading technological development and services as your monozukuri partner.

Amidst this, the MECHATRO+ is an important tool that provides our valued customers useful information to serve as hints for business success. Moving forward, we will continue to further enrich and evolve the content of this publication. We thank you for your ongoing support and patronage of our products and services.

MV Series equipped with New Controller D-CUBES

Wire-cut EDMs

In November 2016, Mitsubishi Electric released a MV Series wire-cut EDM equipped with the New Controller D-CUBES. This is a new model in the MV series, which first appeared on the market in 2012 and has been well-received in Japan and overseas. This new model is equipped with numerous functions that achieve higher productivity and features a computerized numerical controller (NC) that provides superior operability similar to mobile device operation and the ability to support a new care service due to strengthened network functions.



MV Series MV1200R Wire-cut EDM equipped with New Controller D-CUBES, released by Mitsubishi Electric in November 2016



Comprehensive changes to NC in pursuit of user-friendliness

Hisashi Hara, Manager in the EDM Development & Design Section 1 of the EDM Manufacturing Department at Nagoya Works, was appointed leader of the new wire-cut EDM project launched by Mitsubishi Electric at the beginning of 2015. Mr. Hara was also project leader for development of the MV series, which was released in 2012, and is today the backbone supporting Mitsubishi Electric's EDM business.

Mitsuyoshi Wada, Senior Manager of the same section and overall coordinator presiding over this development, explained his reason for appointing Mr. Hara. "The MV Series was a major hit, so we had to ensure the new model wouldn't fail. Mr. Hara really understands the feelings of the engineers involved in the original MV Series development. I judged Mr. Hara to be the most appropriate person to understand his team and lead the project to success."

At the outset of the project, Mr. Hara also made the following pledge, "We will carry on the notions of the previous development team members while proactively changing that which needs to be changed."

Mr. Wada believes that one of the

reasons for the success of the MV Series is that they "thoroughly researched the opinions of users, including overseas users." Based on this kind of market research, they succeeded at significantly improving work efficiency through an automatic termination function and other features, thus achieving cost-performance that led to the project's success.

While adhering to this policy, Mr. Hara and his team took on a new challenge; specifically, "Previous interviews had focused on users of EDMs made by Mitsubishi Electric. This time we decided to look for development hints by focusing on users of other companies' machines by going into our competitors' strongholds."

What the team wanted to know was, "Why don't these users use Mitsubishi Electric's machines?" Ken Inukai, Manager of the same section was appointed overall coordinator for software development, aggressively approached users in the competitors' strongholds. He reflected, "Sometimes they wouldn't speak with me straight away even when I went to see them. There are some companies I visited

over fifty times."

Of the various issues, the one that users mentioned the most fell into was Mr. Inukai's territory—the NC. In developing the MV Series, most efforts were concentrated in evolving the hardware and the NC adopted was a conventional ADVANCE control unit, to which no major modifications were made. Perhaps due to this, users expressed their frank opinions of the NC, such as, "It's hard to operate. We want to be able to use it like a smartphone," and "It looks just like a plain box. Doesn't feel premium." (The first machine featuring the ADVANCE control unit was released in 2006.)

Unlike back then, today most users are familiar with operating mobile devices such as smartphones and tablets. There was a need to revise operating standards, such as being able to swipe and making it easy to search for targets. Moreover, users said the small screen and thick housing made the control unit seem "outdated".

The development team implemented drastic changes to the screen layout, directory and operating functions. It was decided that a new control unit based on the M800/M80 Series would



Mitsuyoshi Wada
Senior Manager, EDM Development & Design Section 1
EDM Manufacturing Department
Nagoya Works, Mitsubishi Electric Corporation



Hisashi Hara
Manager, EDM Development & Design Section 1
EDM Manufacturing Department
Nagoya Works, Mitsubishi Electric Corporation



Ken Inukai
Manager, EDM Development & Design Section 1
EDM Manufacturing Department
Nagoya Works, Mitsubishi Electric Corporation



Yoshinori Saegusa
Manager, EDM Development & Design Section 1
EDM Manufacturing Department
Nagoya Works, Mitsubishi Electric Corporation



Supporting a remote service offering remote management, and operations and maintenance care

be equipped on the new EDM.

In actuality, development of the new EDM was given a tough deadline from the outset of the project. It was decided that the machine would be exhibited at the Japan International Machine Tool Fair (JIMTOF), scheduled for November 2016. This exhibition attracts many machine tool users and is an excellent opportunity to promote new products.

For this reason, the new model had to be completed by September at the latest. Mr. Inukai commented, "Due to the short development timeframe, I initially believed all we could do was rearrange the display design." But after hearing the brutally honest opinions of users regarding their impression of Mitsubishi Electric's NC unit, Mr. Inukai made up his mind to develop a new one.

The screen of the new control unit was increased to 19in, 4in larger compared to the 15in screen of the ADVANCE control unit, and it was also made thinner. However, there remained an issue in that operations convenient on the small screen of a smartphone were hard to execute on the larger screen due to the wider arm movement required.

Accordingly, the development team exhaustively debated the best type of unit from the perspective of user-friendliness. Furthermore, just like a computer's browser, the number of operations to execute the machining of choice was reduced by conceiving an



New control unit. The screen has been made larger (19in) and thinner. A touch panel is incorporated, enabling operation similar to using a smartphone or tablet.

interface that makes the current step in operation easy to identify.

Meanwhile, Yoshinori Saegusa, Manager of the same section as Mr. Inukai, was put in charge of hardware design. The MV Series consists of two models, the MV-R, a high-end model with excellent machining accuracy, and the MV-S, which offers superior cost-performance. However, users said they were unable to differentiate between the two models in terms of design.

Regarding this, Mr. Saegusa made the following remark, "Up until now, we had mainly focused on functionality differences and simply used a different color for the exterior. So this was an opportunity for us to thoroughly reconsider how we could make the exterior look different, as this is what consumers demanded. But we had to avoid a significant increase in manufacturing cost for the MV-R. The part we really struggled with was how to select parts that could be made common between the R and S while, at the same time, achieve differentiation."

The door of MV1200S was kept manual, as it had been for previous models. However, a design with a more premium appeal was introduced for the R, including an automatic door on 1200R, a wire cover on the rear of 2400R, and making all of the corners curved among other changes.

Following repeated struggles such as these, a prototype of the new EDM was completed in the fall of 2015. However, many of the concerned members who saw the prototype made the comment, "The NC is too big and makes it look off-balance." The LCD screen was 19in, so naturally it was going to be bigger. The problem was that the housing for the screen was too large. Mr. Inukai and Mr. Saegusa asked for help from team members involved in the electronics aspect and implemented repeated revisions to the structural design and layout of electronic components. Finally, in summer of 2016, a prototype for mass

production was completed.

But Mr. Inukai still had one assignment left to complete. There was a requirement for the new EDM to also support iQ Care Remote4U, a remote service launched in April 2016 primarily for laser processing machines, and the instruction was to enhance functions unique to an EDM.

Mr. Hara explained, "When we asked users from our competitors' strongholds, they said 'Compared with other companies, what makes a product distinctly look and feel like Mitsubishi Electric?'. We thought about this and decided that Mitsubishi Electric is really about FA total solutions. As such, we decided to develop functions unique to EDMs that could utilize a remote service capable of remotely supporting management, operations and maintenance via the Internet, thereby improving our customers' productivity."

In addition to already revising the NC from scratch, now there was a need to develop a new function. Some members of the software development team expressed their discontent. However, Mr. Inukai persuaded them to exert their best effort by saying, "Many of our competitors are specialists in EDMs. Achieving this remote service, which is something only Mitsubishi Electric offers, is a major differentiation point."

In April 2016, the name for the new EDM was determined, the MV Series Wire-cut EDM with new "D-CUBES" control unit. While keeping "MV Series" in the name, Mitsubishi Electric originality is expressed using the first letters of "Dimension," "Connect," "Universal," "Brain," "Evolution" and "Smooth."

At long last, in late September of the same year, a prototype for mass production was completed and exhibited at JIMTOF as planned. Now it is a matter of waiting to see if this new model will also be a major hit. The development team is eagerly awaiting feedback from users.



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Nihon Haken Co., Ltd.

Supporting advancement of the automotive industry with diamond cutting tools finished on electrical-discharge machines

Nihon Haken is headquartered in the city of Anjo, Aichi Prefecture, and specializes in manufacturing special cutting tools using industrial diamonds and cemented carbide. The company has provided automotive-related manufacturers with premium-quality cutting tools for around 50 years and now has operations in Indonesia.

The late founder, Minoru Inagaki, first established Nihon Haken Kogyo in the city of Toyota, Aichi Prefecture, in 1967. "Our founder was a craftsman with advanced cutting skills, and was a diehard idea man at the same time. When he founded the company, he thought about whether to go into jigs or cutting tools, and decided that cutting tools had a higher business potential due to their consumable nature. He started operations with five employees," commented Tsuyako Iwase, CEO and President, a position she has held since 2011.

Initially, the company's primary business was re-grinding tools. However, when it relocated its head office to Kariya, also in Aichi Prefecture, in 1969, it began making special cutting tools from cemented carbide as products and this soon became the company's forte. These carbide tools were adopted by Nippon Denso Co. Ltd. (present day

Denso) and Toyota Industries Corporation, and business grew rapidly.

This was right around the time of full-scale motorization in Japan, and the automotive industry was experiencing rapid growth. As production volume was increasing in leaps and bounds, in order to increase production, parts manufacturers were looking for tools with good durability that didn't crumble or wear easily, even when used for high-speed cutting. Nihon Haken's carbide tools met these needs with certainty and earned a strong reputation.

The next turning point for the company came in 1995 when it entered the diamond cutting tool domain. Ms. Iwase reflected on the time, saying, "Machine tools used in automotive manufacturing were becoming capable of higher speeds and higher accuracies, and cutting tools needed to follow suit. We

responded to this issue by entering the business of diamond cutting tools, which are cutting tools with industrial diamond blades attached to the tip. These are even harder than cemented carbide. Diamond tools are not only capable of high-speed, high-accuracy machining, they also have a service life ten times greater than carbide tools. Not to mention they offer great cost performance as the price is only around three to five times more. At that time, diamond tools were only just starting to be used, so we made the decision to enter this domain at an early stage."

Improving productivity and reducing cost with Mitsubishi Electric wire-cut electrical-discharge machines

Diamond tools are manufactured by soldering diamond chips cut from wafers made of industrial diamond onto a tool made by machining



Manufacturing process for diamond cutting tools. Diamond blades for industrial use are processed in a wire-cut electrical-discharge machine (left) and accuracy is confirmed in a microscope. This process is repeated until the product is finished.



The diamond tool manufacturing line consisting of 20 wire-cut electrical-discharge machines, 19 of which are made by Mitsubishi Electric.

cemented carbide, then put through a finishing process to increase blade accuracy. Diamond is hard, therefore it is difficult to machine in anything other than a wire-cut electrical-discharge machine. Not to mention, it takes over one month to manufacture diamond tools, therefore a number of expensive wire-cut electrical-discharge machines are necessary to maintain operations. For this reason, many tool manufacturers were hesitant to enter the diamond tool business. However, Nihon Haken went out on a limb and purchased three wire-cut electrical-discharge machines all at once.

The first electrical-discharge machine the company installed was not made by Mitsubishi Electric, but by another company. The machine utilized a ball screw coated in grease for lubrication, therefore an issue arose in which the grease that dispersed during operation in the factory would adhere to the carbide grinding chips and wear away the ball screw. As such, the ball screw had to be replaced annually, resulting in excessive maintenance costs.

This problem was resolved by the FX Series, a wire-cut electrical-discharge machine made by Mitsubishi Electric and purchased by Nihon Haken in 1997. Due to this model having a design where the machining oil is automatically supplied, there is no concern that the ball screw will deteriorate due the

adhesion of grinding chips. As Senior Managing Director, Masao Inagaki reflected, "It helped Nihon Haken improve production efficiency and reduce cost at the same time." He added, "Mitsubishi Electric wire-cut electrical-discharge machines offer high processing accuracy, and are therefore highly compatible with diamond. We sincerely appreciate the level of after-sales support from Mitsubishi Electric. It really helps that they have a service base close by and always respond swiftly."

For this reason, every electrical-discharge machine installed by Nihon Haken since 1997 has been Mitsubishi Electric-made. Today they operate a total of 19 machines.

**Claiming a large share of the business in the Mikawa region
Constructing a new head office and plant to meet increased demand**

Diamond tools currently represent 70% of the company's net sales and while carbide tools account for the remaining 30%. The quality of Nihon



Diamond tools fresh off the manufacturing line. Made by soldering diamond chips onto a cemented carbide tool body.

Haken tools is highly regarded by automotive-related manufacturers and other companies in the Mikawa region. According to Hideshi Ito, Section Chief of the Sales Department, "Nearly 30% of all diamond tools used in the Mikawa region are made by Nihon Haken."

Production volume continued to grow, and in November 2016, the company relocated to a new head office and plant in Anjo, Aichi Prefecture. Ms. Iwase discussed the aim of building the new plant, "The number of orders for diamond tools had increased rapidly over the past several years. Our old plant in Kariya was quite small, so we couldn't increase the number of machines. Our new location is three times the size of the old one, so we had plenty of room to install existing equipment and we secured space for any equipment we may need to meet production increases or new product development purposes. We are now prepared to meet future increases in demand."



Diamond chips cut from a diamond wafer in a wire-cut electrical-discharge machine.



Nihon Haken Co., Ltd.

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Becoming a full-fledged electrical-discharge engineer in diamond tool manufacturing requires five years of experience

Masao Inagaki Senior Managing Director ▶



— What makes your company special?

Inagaki : Nihon Haken designs and manufactures entirely custom-made special cutting tools to suit our customers' specific processing needs. All of our 30 to 40 processes require advanced skills, knowledge and experience.

We have complete confidence in the quality of our skills and products. In that sense, our company's special feature is perhaps that we provide training and guidance to develop outstanding technicians.

Visualization of craftsman skills and nurturing of multi-skilled workers

— What type of skill is required for diamond tool manufacturing?

Inagaki : The wire-cut electrical-discharge machining of diamond is a manufacturing process that requires a particularly high level of skill. The two processes involved, machining the industrial diamond wafer into material for the blade and

finishing after binding the diamond to the tool body, have entirely different machining conditions, not to mention different blade thicknesses make it necessary to adjust machining conditions. Accordingly, this work is the responsibility of an experienced technician, a so-called "craftsman that handles CNCs."

Furthermore, the same tasks must be repeated over and over; specifically, each time a spot is machined, it has to be checked in a microscope, conditions adjusted appropriately, and then re-machined. By doing this, finish the blade with a unit accuracy of microns.

In the case of complex-shaped products, it sometimes takes more than 20 hours to perform the wire-cut electrical-discharge machining alone. A minimum of five years' experience is needed to properly acquire the high level of skill required for the electrical-discharge processing of diamond.

— What sort of HR training do you have in place to develop experts?

Inagaki : Basically, we rely on on-the-job (OJT) training, but that alone is problematic as we can't evaluate the skill level of each worker. For that reason, we began using a skill chart last year and now improve each employee's skill using this chart as a reference point. The X axis shows the

Profile

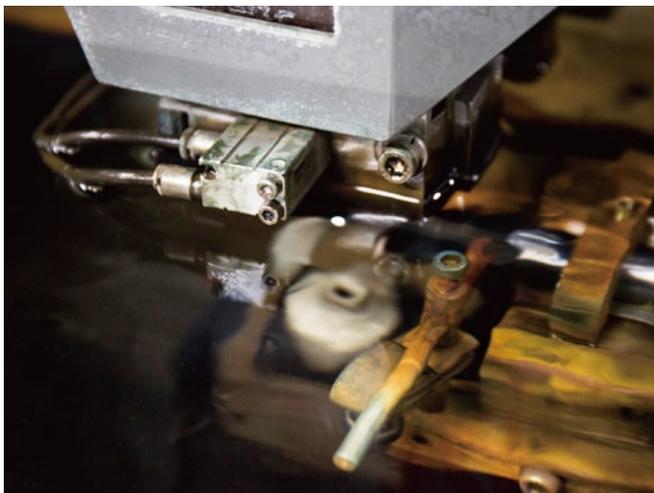
Born 1972. Joined Nihon Haken in 1995. In charge of electrical-discharge processing in the Diamond Manufacturing Department.
2007 Became General Manager of Diamond Manufacturing Department
2011 Became Senior Managing Director
2013 Appointed dual role as President of PT. NIHONHAKEN

various skills necessary for each process and the Y axis shows the name of the employee. They color in the skill they have acquired and this makes it possible to grasp individual skill level at a glance.

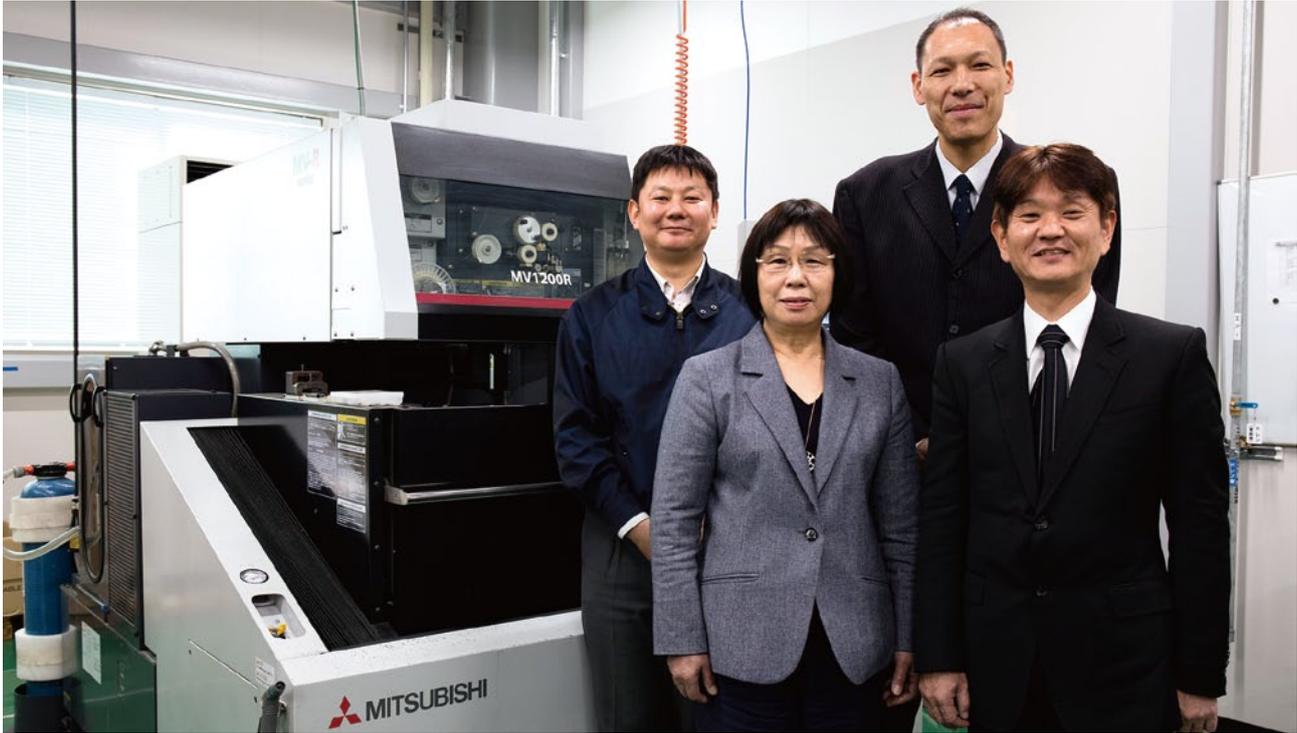
Utilizing this skill chart, we can systematically compensate for skills each employee may be lacking through OJT. We hope that this will result in developing multi-skilled workers capable of multiple machining.

— Why do you place more importance on developing multi-skilled workers than craftsmen with specialist skills?

Inagaki : For example, processes that require a high load, such as electrical-discharge machining, have a tendency to take longer to complete. Therefore, people in the downstream processes waiting for products have a lot of spare time on their hands. If all of our workers are multi-skilled, those normally in charge of downstream processes can support those working on electrical discharge, thereby enabling us to balance out the work load and improve yield. In the past, we had a policy of training experts; however, Japan's automotive industry seems to be shrinking and there is a risk that orders will decrease. Therefore, I believe it is important to develop multi-skilled workers and maintain a balance between demand and equipment.



A diamond tool being processed in a wire-cut electrical-discharge processing machine



(front row, from left) Tsuyako Iwase, CEO & President, Masao Inagaki, Senior Managing Director (back row, left) Hideshi Ito, Section Chief Sales Department. (back row, far right) Hiroyuki Tomonaga, Nihon Haken's Sales Account Manager and Manager of Electrical-Discharge Machines, Industrial Automation Machinery, Chubu Branch, Mitsubishi Electric Corporation (currently Senior Manager, Kyushu Industrial Automation Machinery).

Establishment of an Indonesian base in response to customers' overseas expansion

— It is said that Nihon Haken's first overseas expansion was to Indonesia. Is that right?

Inagaki : Yes. This is because our major customers are automotive-related manufacturers and they are accelerating their overseas expansion. Unlike Japan, the automotive market in Asia and the rest of the world is still very much in the process of expanding.

Diamond tools are still not commonly used in regions other than Europe, the U.S. and Japan, so we decided to establish an overseas base where we foresee a potential for future market growth.

We studied China, Mexico, Germany and the U.S. as candidate locations, but ultimately we chose Indonesia in light of the low labor cost and relatively good public order.

In 2013, we took one Mitsubishi



Skills are essentially passed on through OTJ. The photo shows a cemented carbide tool being machined by a worker during OTJ.

Electric wire-cut electrical-discharge machine from Japan and first began a re-grinding service for special cutting tools for local automotive parts manufacturers. The local Mitsubishi Electric person in charge visits our plant regularly to perform maintenance on the machine, which is extremely helpful.

Business is going smoothly and we currently have the equipment there in full operation.

— Do you provide the same training for local Indonesian employees as you do for Japanese?

Inagaki : The culture is different from that of, so we do take a different approach to training. But Indonesian people are nimble with their hands and very quick to learn. In general, I am satisfied with our decision to expand into Indonesia.

— What is your strategy is for future growth?

Inagaki : My dream is that Nihon Haken will specialize in diamond tools and expand its share of the



Final inspection prior to shipment. An experienced worker confirms processing accuracy by viewing a microscope image on an expanded display.

global market. Particularly, in regards to Southeast Asia, the adoption of diamond tools is behind the rest of the world, so first I'd like us to focus on leveraging our Indonesian presence. Back home in the Japanese market, I'd like us to concentrate on R&D so we can also develop new special cutting tools.

— Finally, please comment on what you think of Mitsubishi Electric and any requests you may have of them.

Inagaki : The development of new processing technologies is absolutely essential to the R&D of new tools. I'm looking forward to being able to continue consulting with Mitsubishi Electric on various topics into the future.

Corporate Data

Nihon Haken Co., Ltd.

Head office

1-1 Matsubara, Enokimae-cho, Anjo City, Aichi Prefecture

No. of employees

84

Main Products

Special cutting tools (diamond tools, carbide tools)

History

1967 Established in as Nihon Haken Kogyo, Toyota City, Aichi Prefecture

1969 Relocated head office and main factory to Kariya City, Aichi Prefecture

1980 Changed company name and established Nihon Haken

2013 Established T. NIHONHAKEN in Indonesia

2016 Relocated head office and main factory to Anjo City, Aichi Prefecture



Proud of the dies produced in-house, we are delivering high-precision plastic parts to the world

YUWA Corporation is a precision parts manufacturer that makes plastic parts for the connectors used in smartphones and other devices. Its integrated production system incorporates everything from dies to injection molding, enabling the company to make high-precision parts with a short lead-time. YUWA also has production bases in China and Vietnam.

YUWA is a precision injection molded parts manufacturer that produces plastic parts for connectors and other components. The company was established in 1975 by Yorikatsu Watanabe, YUWA's chairman and father of the current CEO, Minoru Watanabe.

Yorikatsu made the decision to establish YUWA while he was working for a condenser manufacturer, as he realized the number of plastic electronic components was increasing. The company was established in Komoro City, Nagano Prefecture, originally under the name Yuwa Dies Manufacturing, Inc. The word "Yuwa" means "friendship and harmony" in Japanese and expresses the bond among company employees. In 1989, the name of the company was changed to what it is today when it was reorganized into a publically

traded stock company.

As the company name suggests, the founding business of YUWA was die manufacturing.

However, in 1977 the company introduced two injection molding machines and began producing plastic parts using its own dies. At the time, it made plastic parts for the relays and connectors used in electronic components, as well as parts for syringes, cassette tapes and more. Even today, it does not sell dies externally, but rather specializes in the manufacture and sales of precision injection molded parts.

An integrated production system from die manufacturing to injection molding

The key feature at YUWA is that the company offers integrated

production from die manufacturing to injection molding. When the company first began its injection molding business, the accepted style was for die manufacturers to make dies and molding manufacturers to make molds. It was rare to find a manufacturer with an integrated production system offering everything from die manufacture to molding. But YUWA decided to take this direction based on the policy of "Good molds aren't possible without good dies" (Chairman Watanabe). This policy is upheld even today, reflecting the fact that YUWA continues to make all of its dies in-house, even as a major group with consolidated annual sales exceeding 10 billion yen.

The main focus of current business are the fine-precision connectors used in smartphones, plastic parts for cameras and insert molding products.

It also produces electronic components for automobiles and precision plastic parts for medical measuring instruments. In 2003, YUWA established Yuka Precision (Wujiang) Co., Ltd. in Wujiang District, China as a joint venture with a Taiwanese company. In 2007, YUWA independently established YUWA VIETNAM in the suburbs of Ho Chi Minh City, Vietnam, where it started producing injection molded parts in 2008 and dies in 2010.

The company's Japanese production base for injection molded parts is the head office and main plant in Komoro City, which began operation in 1994. The aim of the Komoro plant is "automated dust-free manufacturing," and as such, has implemented comprehensive dust



"EASPV ADVANCE" is a die-sinking electrical-discharge machine (EDM) equipped with an automatic electrode changer—called an "ATC"—and workpiece changer. With Mitsubishi Electric's cooperation, the EDM is made to YUWA's specifications.



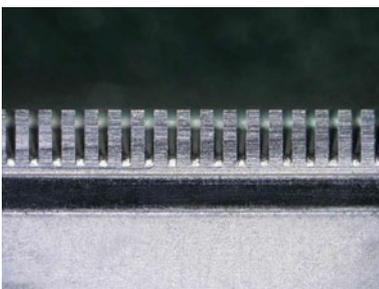
The wire-cut EDM line at the Die Technical Center is where YUWA manufactures its dies. The room temperature is maintained to within $\pm 0.5^{\circ}\text{C}$ in order to secure high machining accuracy, and the machining water used is filtered rainwater that is almost entirely mineral-free.

prevention measures and automatic collection of the regranulates generated during materials supply and the molding process. Currently, the Komoro plant operates a total of 88 injection molding machines with just two operators on night shift.

The heart of the company is its die plant located adjacent its head office and main plant. This plant was built in 2007 and is named the Die Technical Center as the core of YUWA Group's die technologies.

Dies are made by first fabricating parts through machining using wire-cut EDMs, surface grinding, die-sinking EDMs and other processes, and then assembling these parts. President Watanabe describes the accuracy of dies used to produce smartphone parts as follows;

"When cell phones first became popular in the 1990s, the connector pitch was 0.75mm. Over time, this grew narrower to 0.5mm, 0.4mm, 0.3mm, and smaller. Now YUWA mass produces connectors with a pitch of 0.175mm. In line with this



The teeth of a comb with a width of $0.08 \times 0.5\text{mm}$ made in a die-sinking EDM.

increased demand for accuracy, our dies are required to machine with a precision in the realm of microns."

In order to produce high-precision dies with good stability, the Die Technical Center, which maintains an ambient room temperature at $\pm 0.5^{\circ}\text{C}$, and features 9 wire-cut EDMs, 11 die-sinking EDMs, 8 machining centers (MCs), 19 grinders and many other machine tools. All die-sinking EDMs and most wire-cut EDMs are Mitsubishi Electric products. President Watanabe emphasizes that, "In order to ensure all of our machine tools achieve high accuracy and micro-machining, they have been improved in collaboration with the machine manufacturers and customized to YUWA's unique specifications."

Pursuing a better operation ratio for EDMs
Targeting automatic operation at night and on weekends

YUWA not only focuses on the machining accuracy of its dies, but



A completed die for producing moldings used in precision electronic components.

also proactively engages in efforts to improve the operation ratio of its machinery. President Watanabe discussed the current status, commenting, "The target we are aiming for is the same as that of our molding plant, automatic operation of our wire-cut EDMs, die-sinking EDMs, MCs and other equipment during the night and on weekends. Currently, we are at the stage where our machines operate 640 hours out of the 720 hours in a month."

In regards to the die-sinking electrical-discharge process, YUWA introduced an ATC, which was improved with the cooperation of Mitsubishi Electric, and a processing machine with a workpiece changer. This means that automatic operation 24 hours a day, 365 days a year is already possible.

Meanwhile, automatic operation has not yet been achieved for wire-cut electrical-discharge machining due to the issue of automatic wire connection and various factors, such as wire disconnection and roller wear, that lead to short stops. In particular, automatically connecting fine wires, which is essential in precision machining, was a major issue. However, as President Watanabe explains, "When we introduced the MP1200, we asked Mitsubishi Electric to improve the automatic connecting unit, making it possible to achieve automatic connection."



Don't foster craftsmen... Anyone can be a technician performing high-accuracy, highly reliable machining

◀ CEO

Yorikatsu Watanabe

— Around when did YUWA start using Mitsubishi Electric EDMs?

Watanabe : I think it was around 1990. When I joined the company in 1993, there were already Mitsubishi Electric-made EDMs in operation. What really left an impression on me is when we newly constructed the Sakushi Die Plant in 1994. As a new employee, I was working with my senior colleague in developing a program to machine multiple parts using a die-sinking EDM. It was at this time that we received a lot of help from Mitsubishi Electric technicians.

It was through this experience that I gained a strong impression of Mitsubishi Electric as not only a company that sold machines of set specifications, but also a company that supported its customers by working closely with them. I also understood that Mitsubishi Electric promotes a system whereby it reflects its customers' needs into its development projects and leverages them in future machines.

Technological innovation in the field of electronic mobile devices, YUWA's specialty, is fierce. But it would be too slow to respond to technological innovation requests by customers after they are made. We must always stay ahead of our customers. For example, if a customer says to us, "The pitch for the next connectors used in smartphones need to be 0.4mm," we have to prepare for this becoming 0.3mm or even 0.2mm sometime in the future.

If we are able to propose a specification that exceeds a request a customer makes, we can increase that customer's development potential and earn a reputation as a reliable company.

This kind of manufacturing technology, one that anticipates future progress, is not possible with an off-the-shelf machine. It can only be achieved through various efforts on our part, and improving machines to meet our desired specifications by addressing high-level issues with the

Profile

1971 Born in Nagano Prefecture, Japan
1973 Began working for YUWA Corporation
2001 Appointed director
2012 Appointed CEO after serving as senior managing director

machine manufacturer.

Mitsubishi Electric is the EDM manufacturer that has responded to our toughest requests. For this reason, the number of Mitsubishi Electric-made EDMs used by YUWA has increased.

**"A machining accuracy of $\pm 1\mu\text{m}$ "
Achieving a target that was a
long-term goal**

— Currently, what kind of machining accuracy level are you achieving with your dies?

Watanabe : For ten years, inside the company I have been constantly saying I wanted a machining accuracy of $\pm 1\mu\text{m}$. Initially, others in the company thought I was being unreasonable and didn't take me seriously. But after persistently saying this for ten years, we did indeed achieve an accuracy of $\pm 1\mu\text{m}$.

Of the various processes involved in die manufacturing, the one that ultimately determines the accuracy is the die-sinking electrical-discharge process. YUWA's customers demand a parallelism and flatness for their moldings on the order of micrometers. For this reason, the die-sinking electrical-discharge process must achieve a machining accuracy of $\pm 1\mu\text{m}$. YUWA exerted maximum effort to achieve this, but it was thanks to Mitsubishi Electric's support that we succeeded in achieving a high-accuracy die-sinking electrical-discharge process.

— That kind of high-accuracy machining must require skilled craftsmen, right?

Watanabe : Actually, my approach is, "Don't foster craftsmen." Rather,



Plant 1 features a long line of 88 injection molding machines. In order to manufacture moldings for precision electronic components, the plant maintains an environment equivalent to a Class 100,000 clean room.



Second from the left is Tetsuya Sato, manager of the Die Business Department at the Die Engineering Center. Next to him is Yoshinori Ichikawa, manager of the center. Pictured on the far right is Keita Minamine, the Mitsubishi Electric salesperson affiliated with the EDM Section of the Industrial Mechatronics Sales Department at the FA System Business Headquarters.

“Look for expert techniques and crush them.” In the past, achieving machining accuracy meant it was necessary to possess a certain skill in, for example, setting a workpiece inside a magnetic chuck. A craftsman would tap on the workpiece and judge whether it was good or bad depending on the amount of vibration in his fingertips. But that was a big factor inhibiting improvements in efficiency and reliability.

Our company now focuses on “eliminating special skills,” which means we find tasks that depend on those skills and change them into tasks that anyone can perform easily and with confidence. Moreover, we make it so machines can perform such work. I think a good technician is able to achieve machining that anyone can perform with high accuracy and high reliability.

— **In that case, how do you train technicians to be that way?**

Watanabe : At YUWA, we value our training culture. Currently we produce dies in China and Vietnam as well, and we dispatch young employees



A grinder developed specifically for YUWA (both machine and grinding stone) in collaboration with the grinder manufacturer in order to achieve high accuracy.

who have gained two years’ experience in Japan to these overseas bases as “sensei (teachers).” Of course, they encounter things they don’t know as they teach. But when this happens, they fervently seek advice from their mentors back in Japan. By becoming teachers themselves, our employees can objectively assess their own skill level and gain an understanding of the level they need to reach and what they still need to learn; meaning they understand the need to study with a strong sense of purpose. It’s like a tough version of on-the-job training.

— **It will be a major focus to develop globally minded professionals moving forward, won’t it?**

Watanabe : In order to develop globally minded professionals, we currently accept students from Vietnam’s Ho Chi Minh City University of Technology on internships, during which they gain experience at Yuwa for a period of three months. We select particularly outstanding students from these



The die inspection process. Completed dies have a high machining accuracy of within $\pm 1 \mu\text{m}$.

interns, and then invite them to Japan to join a Master’s course at Shinshu University as exchange students.

— **Yuwa specializes in a field where technological innovation is fierce so you can’t afford to relax, can you?**

Watanabe : In the world of smartphones and automobiles, companies jump on the latest technological trends all at once, so there is a need to start mass production as early as possible. In order to stay on top in this kind of world, we must continue refining our die technologies, which is YUWA’s core specialty, and become a company that can respond to changing times. This what I firmly believe.

Corporate Data

YUWA Corporation

Head office
1-700, Nishihara, Komoro City, Nagano Prefecture

No. of employees
210 (500 at China plant, 1,300 at Vietnam plant)

Main Business
Small, precision plastic molding

History
1975 Founded as Yuwa Die Manufacturing, Inc.
1977 Began molding business
1989 Changed name to YUWA Corporation
1994 Commenced operation of new plant in Komoro City, Nagano Prefecture
2003 Established Yuka Precision (Wujiang) Co., Ltd. in China
2007 Established YUWA VIETNAM in Vietnam
2016 Selected as a “GANBARU (Vibrant) Small and Medium Enterprises 300” by Japan’s Ministry of Economy, Trade and Industry



Seiryoh Co., Ltd.

Fulfilling the needs of local small factories One of Hokuriku's leading laser processing companies pursuing high quality and short lead-time

Seiryoh is a laser processing company that represents the Hokuriku region of Japan. Due to its policy of pursuing high quality and short lead-time since its founding in 1988, it has raised its business performance. Leveraging five Mitsubishi Electric laser processing machines, it processes a variety of materials.

Seiryoh focuses on laser processing for various industries, including can manufacturing, construction and sheet metal, as well as serving as a job shop for steel shaping, pipe bending and so on. The company has an established reputation, particularly regarding the quality of its laser processing. It receives consignment-based processing work from various companies in the Hokuriku region, and currently derives approximately 95% of its net sales from laser processing.

Seiryoh was established in 1988. It was a joint venture with a company that conducted equipment maintenance for major manufacturers and a 2D laser processing machine was promptly installed. Seiryoh opened its doors as a cutting contractor servicing local ironworks and canning factories. At that time, practically no other company in the Hokuriku region owned a laser processing machine. Therefore, it

became inundated with orders from suppliers of construction and machinery manufacturing companies. Due to the high demand for its services, Seiryoh purchased two more laser processing machines the following year, 1989, followed by three more in 1991, resulting in a six-machine strong business operation. When Japan's bubble economy was at its height, there was active demand from construction, steel-making, bridge construction companies and so on in the Hokuriku region.

Consistent customer of Mitsubishi Electric due to reassuring support

In order to compare machine manufacturers, Seiryoh installed three Mitsubishi Electric laser processing machines, and purchased the remaining three from another

company. However, afterwards Seiryoh has consistently only chosen Mitsubishi Electric products.

Mr. Shoji Hirooka, Production Manager at Seiryoh, states the reason for this as follows, "Mitsubishi Electric laser processing machines are developed and made entirely by Mitsubishi Electric, even the resonator. Due to this, when problems arise, all we need to do is call and they take care of everything. The other company would say, 'Problems with the resonator are a matter for the resonator manufacturer' and so on, with the responsibilities for different parts being separate, so it took time to resolve issues. Naturally, another reason is due to the high quality of the laser beam itself."

In 1997, at the same time as installing a Mitsubishi Electric CO₂ laser processing machine with a power of 3kW, Seiryoh installed a laser cutting machine that use nitrogen as the assist gas in order to prevent the black oxidized membrane that forms on the stainless steel cut face. Since then, one of the company's major pillars has been the laser processing of stainless steel.

Further additions to Seiryoh's operations included a 4kW ML3015LVP-40CF with a pallet changer in order to enhance productivity in 2003, and in 2005, a ML3015HVP-40CF, also 4kW, that is capable of machining iron up to a thickness of 22mm and stainless steel up to a thickness of 16mm.

In 2012, Seiryoh installed the large



ML3015eX-F40. Mitsubishi Electric 4kW fiber laser processing machine purchased by Seiryoh in 2015 to expand its business beyond the cutting of steel and stainless steel.



To prevent rust transfer, the ML3015eX-F40 and ML3015eX-60XF—a 6kW CO₂ laser processing machine—are installed in a different building than the other three machines. The ML3015eX-60XF is dedicated to stainless steel cutting.

4.5kW ML6030XL-45CF-R laser processing machine, capable of processing material up to 6100 × 3050mm in size, and this was followed by a 6kW ML3015eX-60XF in 2014, which is capable of processing stainless steel with thicknesses up to 25mm. More recently, in 2015, the company installed a 4kW ML3015eX-F40 fiber laser processing machine capable of processing aluminum, brass and copper, which had been difficult to achieve using a CO₂ laser. Presently, Seiryoh operates all five laser processing machines it installed from 2003 onwards.

Responding to a broad range of requests and accumulating processing know-how

Seiryoh responds to a broad range of machining requests from various industries and uses each of its five laser processing machines for different applications. The company has 900 registered clients, with operations in Toyama and Ishikawa prefectures, and receives machining requests from around 300 companies each month. It can accommodate material thicknesses of up to 28mm for iron and 25mm for stainless steel.

In addition to metal, “Seiryoh also handles acrylic, polycarbonate and other types of plastics. Once we even received a request to cut a combined material consisting of plywood attached to stainless steel,” says Managing Director Tahachiro Yamada. “Compared to when Seiryoh was founded, there are more companies with laser processing machines. So in order to stay ahead

of the pack, we absolutely cannot say ‘No, we can’t do that,’ no matter how difficult the request. We will wring out every ounce of our knowledge in this field to fulfill every processing request we receive.” By repeatedly undertaking such challenges and accumulating know-how, Seiryoh has earned the trust of its customers.

The quality of the company’s processing is also highly regarded and it is public knowledge that all of Seiryoh’s processing machines are essentially capable of processing to an accuracy of within plus 0.1mm. The company is also passionate about employee training that focuses on OJT in order to maintain high quality. Project Manager Hirooka stated, “Recent laser processing machines offer stable performance and good operability, so it doesn’t take long to learn how to use them. From there, operators acquire Seiryoh-specific know-how within two to three years.”

In order to improve the quality of its stainless steel processing, Seiryoh uses its 6kW ML3015eX-60XF exclusively for processing stainless steel and has it installed in a separate building from the one housing laser processing machines for steel.

Mr. Hirooka explained, “Previously, we processed both stainless steel and steel on the same machine, but doing this sometimes meant the stainless steel would ‘catch rust’ from the steel. Therefore, in order to consistently provide processed parts with brilliant cuts on par with machining, we not only made the processing machine and fixtures exclusively for stainless steel processing, but we also store the material separately to be very thorough in our efforts to prevent rust transfer.” However, the fiber laser processing machine that handles aluminum, copper and other specialty materials does not have an impact on rust transfer to stainless steel. Therefore, it is located in the same building as the ML3015eX-60XF.

In 2015, Seiryoh started a QC Circle activity with the aim of improving productivity and work efficiency. Management Department General Manager, Ms. Shoko Nakamura, is confident this activity is bearing fruit, saying, “All employees participate in the QC Circle. We are only in our third year, but employees’ attitudes towards participating in improvement efforts has changed. Productivity is also improving.”



An example of stainless steel processing. The part on the left is 20mm thick and the part on the right is 16mm thick. Seiryoh guarantees being able to bore holes the same size as material thickness and can reduce the hole diameter by half depending on the application.



ML6030XL-45CF-R with a power of 4.5kW. Production Manager, Mr. Hirooka, spoke highly of the model saying, “The beams of Mitsubishi Electric’s laser processing machines are good quality.”



Rising to the challenge of new processing Persistent trial-and-error develops young engineers

◀ Kosaku Kaneda CEO & President

— What are Seiryoh's strengths?

Kaneda : Seiryoh's strengths are high quality and short lead-time. Many of our customers are local backstreet factories that supply major corporations. Major corporations can produce products steadily based on a production plan, but backstreet factories are constantly being abruptly called upon by customers to perform a task "ASAP". For this reason, I believe it is important to be swift on our feet and nimbly respond to even unexpected, abrupt orders.

— What creative methods do you apply to achieve a short lead-time?

Kaneda : Seiryoh has 34 employees and we operate the plant on a two-shift system. This means that, if necessary, we can operate the machines through the night and provide the requested product the following day.

Moreover, since establishment, we have had a CAD/CAM system that

increases work efficiency. This also helps achieve a shorter lead-time. When the company was established in 1988, I don't think there were many small-to-medium businesses with CAD/CAM. But our three founders had worked for a supplier of a major manufacturer and were very aware of the need for short lead-time. Lately, there are many backstreet factories where the technicians have grown older and retired, creating the issue of personnel shortages. As a result, we are receiving more drawing development work from customers.

— Seiryoh is a job shop, but you keep a large quantity of steel material on your premises, don't you?

Kaneda : This is so that we can also respond immediately to our customers' requests. We keep a stock of all standard steel materials, including steel, stainless steel and aluminum. We put each steel type on a separate pallet and make sure we can set them up for a laser

Profile

Born 1940 in Toyama Prefecture. After retiring as the director of a prefectural listed company, appointed CEO & President of Seiryoh in 2008.

processing machine as soon as we receive an order.

Our website also provides details on the steel material we keep in stock. This is to let our customers know that we can deliver products right away, no matter the material.

Proactively installing new laser processing machines to promote employee training

— How did you accomplish your other strength of high quality?

Kaneda : Our laser processing machines prior to the year 2000 were extremely unstable. It was often the case that we could successfully perform a certain type of processing one day and then not the next, despite using the exact same conditions. The machines were extremely sensitive and often broke down.

Because of this, we had to adjust the machines and try different conditions based on advice from the machine manufacturer and acquired a range of know-how through this process. I believe this is what helped us become a company capable of high quality.

In contrast, recent laser processing machines are superior in performance and basic processing is possible without needing to make any such adjustments. As such, one major issue that emerged was how to pass on the know-how of expert technicians acquired by thinking matters through themselves, to the younger generation of employees.

To deal with this issue, we proactively engage in the processing of various materials other than iron



The large ML6030XL-45CF-R laser processing machine is capable of processing materials up to a size of 6,100mm x 3,050mm. It also comes with a pallet changer.



(from left) Mr. Shoko Nakamura, General Manager, Management Department; Shoji Hirooka, Production Manager at Seiryoh, Tahachiro Yamada, Senior Managing Director. (far right) Toshihiko Shimizu, Senior Manager, Hokuriku Industrial Automation Machinery, Mitsubishi Electric and in charge of the Seiryoh account

and stainless steel. Processing of non-standard materials is an excellent opportunity to pass down know-how.

The expert technicians tend to try and do it themselves because it's faster but I always tell them to leave it up to the younger workers. They need to face problems, think for themselves and go through a process of trial-and-error. Then, if they still can't solve the problem, they can seek advice from expert technicians. By completing this process, an employee can thoroughly acquire know-how for the first time and this helps them to grow.

We may be a job shop, but we have no future if we simply do the work our customers request us to do. We have to take up new challenges, keep on absorbing new know-how



The CAD/CAM system used to achieve short lead times since the time of Seiryoh's founding.

and acquire the strength to proactively propose solutions to the issues our customers face. Challenging ourselves to undertake new processing tasks is the most effective form of training.

— **I heard that, over the past couple of years, you have proactively installed new model laser processing machines, is that so?**

Kaneda : Of course, broadening the scope of our machining by purchasing new processing machines is a major aim, but another aim is to train our employees. If the same machine is used for years, the employees tend to become blasé. But when we install new machines, this provides great stimulation and employees take a positive attitude towards learning new skills. This leads to their development as professionals.

For this reason, I want Mitsubishi Electric to keep on churning out new laser processing machines.

— **I hear you make a commemorative item every year**



Commemorative Chinese zodiac ornaments made with laser processing delivered to regular customers every New Year's.

based on the 12 Chinese zodiac signs, is that right?

Kaneda : Yes, every year as a New Year's greeting, our sales team personally make these for our regular customers. It is a good way to make our technology known, and our customers really seem to like it, so we've been doing it for around 20 years now. Last year we made the commemorative item from thin brass and aluminum to demonstrate the type of materials we can process with our fiber laser processing machine. This year, to show our talents at processing thick materials, we made a rooster from thick stainless steel and inserted some acrylic. The customers loved it, but our sales team was a little upset saying, "It was hard work carrying those as they were heavier than usual!"

Corporate Data

Seiryoh Co., Ltd.

Head office
328 Higashinaka, Tonami City, Toyama Prefecture
Annual sales
862.7 million yen (term ending May 2016)
No. of employees
34
Main Products
Providing products made by cutting, steel shaping, and pipe bending with laser processing machines
History
1988 Established with paid-in capital of 10 million yen and began operation of laser plant
1990 Began operation of bending plant
2006 Introduced own production management system, renewed CAD/CAM system
2012 Renewed production management system

TATSUMI SEISAKUSYO CO., LTD.

Leveraging six laser-processing machines to establish a firm position in the Chukyo region, primarily in automotive parts prototyping

Tatsumi Seisakusyo is a machining company that primarily focuses on prototyping automotive parts and other components. Leveraging six laser-processing machines, it delivers high-quality prototype parts quickly and efficiently. The company has established a firm position for itself in the Chukyo region, and has earned the trust of customers across a broad range of industries; in particular, automotive parts. We talked the president of Tatsumi in an attempt to understand the company's success.

With its headquarters located in Hashima City, Gifu Prefecture, Tatsumi Seisakusyo is a leading prototype parts manufacturer in the Chukyo region. Prototyping focused on automotive parts accounts for 80% of net sales. The remaining 20% is comprised of laser-based machining and other forms of machining. The company receives orders from between 70 and 80 clients spanning a broad range of industries, from semiconductors to nuclear power.

When Tatsumi Seisakusyo was

founded in 1980 it had just one welding machine in a factory next to the home of Tatsumi Itoh, who still serves as the company's president today. Work was steady and Mr. Itoh took on a number of employees over the next few years. But it was difficult for the company to grow providing welding services alone. Just when Mr. Itoh was considering his next business move, a company approached him to discuss prototyping automotive parts. This was a number of years after the company had been founded.

At the time, the types of vehicles being produced by Japan's automotive industry were increasing and model changes were being carried out more frequently, thereby resulting in an ongoing rapid increase in the volume of prototype parts required.

Prior to this, the common approach was for automotive parts manufacturers to produce prototype parts in-house and companies specifically dealing in prototype parts were practically non-existent. However, in line with the increasing need

for prototype parts, it was no longer possible to keep up with production through in-house prototyping alone. Accordingly, automotive parts manufacturers began looking for companies to which they could subcontract the work.

Tatsumi Seisakusyo had never before engaged in manufacturing automotive parts prototypes. But, as Mr. Itoh commented when reflecting on the time, "I made the decision to start taking on prototyping jobs as I saw it as a good opportunity to expand our business scope."

Initially, the company made prototype parts by hand. However, competitors began introducing laser-processing machines and became able to perform the same work at a much greater speed and with much higher accuracy. "I knew if we didn't adapt, we'd lose our work to the competition," explains Mr. Itoh when asked why he made the decision to also introduce laser-processing machines.

After struggling with the first laser processors, Tatsumi switched to all Mitsubishi Electric machines

In 1987, Tatsumi Seisakusyo introduced its first laser-processing machine. At the time, there were hardly any laser-processing machines in Japan. The company's first laser-processing machine was not made by Mitsubishi Electric and it struggled with numerous breakdowns and other problems.



"ML3015eX-F60" - The fiber laser machine with an output of 6kW introduced in March 2017. This machine is preferred for two-dimensional machining.



The employees of Tatsumi Seisakusyo. A company with an extremely low turnover rate.

In 1990, Tatsumi Seisakusyo decided to purchase its first Mitsubishi Electric-made laser-processing machine. As a result, it experienced much less trouble and enjoyed lower running costs. There was also a thorough maintenance support system, and Mitsubishi Electric's response was swift once it was notified by phone of any trouble. It was also possible to seek advice regarding difficult machining tasks from Mitsubishi Electric representatives. For reasons such as these, Tatsumi Seisakusyo made the decision to purchase only Mitsubishi Electric laser-processing machines thereafter.

The company is currently using a total of six laser-processing machines. Three are three-dimensional CO₂ laser processors: the 4kW ML3122VZ20-40CF-R and the 2kW ML3122VZ20-20CF3 and ML1515VZ20-20CF3.

Mr. Itoh explained, "3D laser-processing machines are essential to prototyping automotive

parts. All three of our machines have a high operating rate."

Meanwhile, in regards to two-dimensional machines, the company has a ML3015eX-F60 fiber laser-processing machine with an output of 6kW, a ML3015eX-45CF-R CO₂ laser-processing machine with an output of 4.5kW, and a ML3015NX-40CF-R, which has an output of 4kW.

Of these, the fiber laser-processing machine was purchased most recently, in March 2017. "This fiber laser-processing machine is capable of faster machining than our CO₂ machines, offers good work efficiency and has outstanding cost performance, so we plan to fully utilize fiber laser machining from here on." (Mr. Itoh)

Passing down machining know-how while learning from seasoned technicians

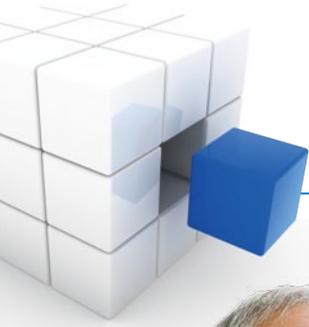
Mr. Itoh emphasizes, "Laser-processing machines are

becoming increasingly user-friendly, and the machines these days enable practically anyone to machine with ease. However, in order to achieve the quality for which our company is known, we need to maintain the know-how we've accumulated throughout our history and extract the full performance potential of our machines."

Employees new to the company first complete a course on laser-based machining using Mitsubishi Electric machines, and then begin helping seasoned technicians with their work. This is done so that they can fully understand the overall flow of work before learning detailed machining operations. Once employees are able to do the machining work on their own, they grow more accustomed to incorporating their own creativity while receiving advice from senior employees. Mr. Itoh explained, "We have a very low employee turnover rate at Tatsumi. So it is the ideal environment to pass down know-how."



A 3D laser-processing machine machining parts for construction machinery



TATSUMI SEISAKUSYO CO., LTD.

Our motto is “Trust, Skill and Speed” We are determined to offer prototyping unaffected by price wars

◀ CEO

Tatsumi Itoh**Profile**

Jan 1, 1953 Born in Gifu Prefecture
1980 Founded the business in Hashima City,
Gifu Prefecture
1985 Established company as TATSUMI
SEISAKUSYO CO., LTD.

— **What are your company’s strengths?**

Itoh : Our motto is “Trust, Skill and Speed.” We compete by offering unmatched quality and speed in our prototyping and machining, and manage the company in a way that earns our customers’ trust. I think our present scale as a company with 22 employees is suitable to maintain our current course.

If the company gets any bigger, we would have no choice but to take on a high number of low-priced mass-production parts. We can predict a stable income, but it would mean having to turn down urgent prototyping requests. Then, ultimately, it would lead to a price war. We want to be thorough about running a company in a way that we can avoid price wars by offering customers the benefit of getting the prototyped part they need anytime. At Tatsumi, we refer to this as “convenience store-style management.”

— **You proactively install the**

latest laser-processing machine models, don’t you?

Itoh : I am the kind of person who becomes motivated to take on a new challenge when someone asks me, “Can you do this kind of work?” New machines are absolutely essential in order to support new forms of work.

I do my best to ensure we install the latest cutting-edge machines before our competition, and master how to use them by the time those other companies decide to install the same machines. Some people think it is taking a risk purchasing the latest-model machines, but I believe it creates profit because we can set ourselves apart from our competition by being the one to lead the way.

If we get the latest machines, we are able to do what we do faster, cheaper and with greater precision. We can even make a profit when receiving orders from our competition.

— **I heard that you are thorough about no-debt management despite having the latest models.**

Itoh : That is correct. Beginning from our very first laser-processing machine, I’ve been a proponent of no-debt management. This is because I believe if we put ourselves into debt purchasing a machine, we will become desperate to make payments. That might lead to taking on work that generates very little profit, and ultimately result in compromising on price.

Even when I want a new machine, I hold out until we have sufficient funds in reserve. Then I make sure we purchase the latest and most advanced machine. This enables us to easily perform high-speed, high-quality work and set ourselves apart from the competition. That is the policy that we have always continued to uphold.

Investment in software is equally as important as investment in hardware

— **You have also installed a variety of machining software, haven’t you?**

Itoh : I believe that investment in software is equally as important as investment in hardware. Even if you get an outstanding machine, it won’t demonstrate its maximum potential if the software is insufficient. That becomes wasted opportunity, doesn’t it?

At Tatsumi Seisakusyo, we always do our best to deliver with a short turnaround. This means, the higher the performance of the laser-processing machine, which results in a faster machining time, the more important it is to shorten the time required for processes other than machining, such as preparation and set-up.



Part prototypes for automotive airbags. These are made by completing the processes of five-stage stamping, bending and curved surface drilling using a 3D laser-processing machine. Tatsumi Seisakusyo is given the freedom to decide the manufacturing methods used.



From left: President Itoh, Takako Itoh (wife and director overseeing everything from accounting to the production shop floor), and Shogo Itoh (second eldest son, director of laser business and in charge of the production shop floor). On far right: Yoshifumi Kobayashi, Laser Machining Section, Industrial Mechatronics Department, Mitsubishi Electric Chubu Branch (Japan).

These days, we receive specifications from our customers in the form of data, not drawings. A key point is how to speed up the processing of this data. We have had offline teaching software for 3D laser-processing machines for some time, but now we are migrating to CamMagic TL-II, an offline teaching system created by Mitsubishi Electric. By processing our customers' design data using this system, we can complete jig fabrication and machining data preparation in the same time it takes to complete the stamping processes. This makes it possible to proceed directly to laser machining.

If we provide the latest, state-of-the-art environment, employees develop autonomously

— It is said that Tatsumi Seisakusyo also uses iQ Care Remote4U, Mitsubishi Electric's remote service that enables

confirmation of the laser-processing machine operating status from remote locations.

Itoh : Yes. We find this service invaluable as it makes it possible to watch the operating status, machining forecast time and other information related to the laser-processing machines on a computer or other mobile terminal. This enables us to respond to customer inquiries immediately. There's no need to run back and forth between the shop floor and office to confirm if machining has actually finished or not. Once completed, we can easily read the numbers for laser-processing machine operating cost. This is very helpful as it allows us to prepare quotes with greater accuracy and ease.

By providing an environment equipped with the latest software and hardware, employees confidently use trial and error when working on various things and develop autonomously. An important part of

employee development is providing a work environment where they can grow.

— In thinking of your customers, in what direction are you steering the company in the future?

Itoh : Tatsumi Seisakusyo often serves as a "last minute haven" for its customers. Up until recently, I had done the set-up for difficult rush jobs, but the capabilities of our younger-generation employees have improved tremendously. So now I leave it up to them. It will be this younger generation leading the company in the future, and I will watch carefully to ensure that they always adhere to our fundamental policy of "unmatched quality and speed." That is what I've asked for.

Corporate Data

TATSUMI SEISAKUSYO CO., LTD.

Head office
27, Osu 5-chome, Kuwabara-cho,
Hashima-shi, Gifu Prefecture
No. of employees
22

Main Products
Laser machining, stamping, welding,
prototype sheet metal, etc.

Main Products
1980 Company founded, offered welding services
1985 Established as TATSUMI SEISAKUSYO CO., LTD.
1987 Began 2-dimensional machining using laser-processing machines
1988 Began 3-dimensional machining using laser-processing machines
1990 Installed first Mitsubishi Electric 3D laser-processing machine
1993 Installed first Mitsubishi Electric 2D laser-processing machine
2017 Installed a Mitsubishi Electric fiber laser-processing machine



Tatsumi Seisakusyo's factories. The building in the foreground is where 2D laser processing is performed, while the building in the background is where 3D laser processing is performed.

How to Make a Smart Factory

The key to enhancing productivity on the machining shop floor is reducing the “3 wastes” not related to machining.

Factories can be made smarter by utilizing the Internet of Things (IoT) to collect and analyze all data and optimize manufacturing. It is not an overstatement to say that the greatest aim of this concept is “improving productivity.” To achieve this, natural development of innovative production technologies is important. However, another major factor is revising production processes and costs so as to eliminate waste. However, in today’s manufacturing industry, the majority of wastes have already been identified and improved. From now on, the key to improving productivity will be how much we can reduce “wastes that have gone unnoticed until now.” The machining shop floor is no exception to this.

Electrical-discharge machines (EDMs) and laser-processing machines affect productivity depending on how many workpieces can be machined in a given period of time. Machine manufacturers continuously engage in efforts to improve machining speed, but there is a limit to how much this can help raise productivity. In order to raise overall productivity in the machining shop, there is a need to not only increase machining efficiency, but also reduce wastes not related to machining.

Broadly speaking, there are three types of waste not related to machining. One is the “emergency stop,” whereby the machine can no longer be operated. For example, a wire-cutting EDM will stop if the chips created during machining become lodged between the workpiece and wire or the workpiece becomes distorted due to over-heating of the portion being machined. This doesn’t pose too great a problem if there is an operator present to resolve the situation immediately. However, there are cases where production stops as no one notices that the machine has stopped operating.

The second waste is prolonging the set-up changeover work necessary between the machining of different workpieces, as this increases machine downtime. Even though these stops can be considered necessary to continue machining, the more this time can be shortened, the greater productivity can be improved. The length of this time depends on the level of experience of each operator. Therefore, it is a reality that this is not being managed properly.

The third waste is operating costs, such as consumables. Consumables are

directly related to cost as there can be too many or too few (which stops machining) depending on the work. Accordingly, this too can be considered a priority issue for improvement.

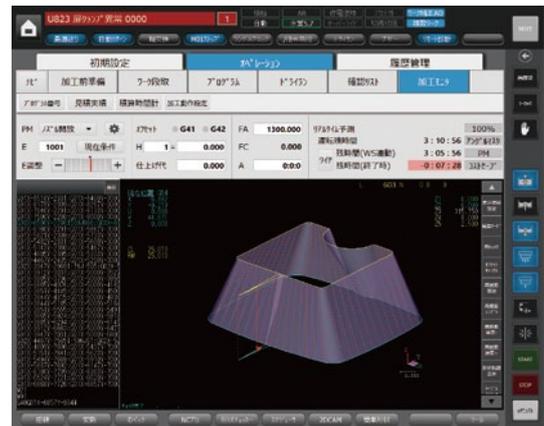
The “visualization” of machines is essential to reduce these wastes. With each machine manufacturer exerting efforts to achieve this, visualization by displaying the operating status of a machine is becoming commonplace. However, there are many companies that don’t understand how to properly take advantage of this, and there are numerous requests from the machining shop floor for data that is easier to use. Moreover, due to issues such as the large-scale retirement of the baby boomer generation and an aging society, it is becoming difficult to hand down technical know-how. This makes it necessary to achieve not simply visualization, but also the visualization of data that can be utilized ways irrelevant to the operator’s level of experience.

iQ Care Remote4U is one of the first initiatives that responds to such demands. It is a machine remote service already in full operation being used with e-F@ctory.

Keeping downtime to the bare minimum with “email alerts” and “remote diagnosis” to enable recovery in the shortest time possible.

iQ Care Remote4U is a service launched by Mitsubishi Electric in April 2016. It enables the status of EDMs and laser-processing machines to be confirmed by operators and managers remotely and in real-time. Utilizing IoT, users can check the operating status of a machine in real-time regardless of their location or time of day.

In relation to one of the three wastes, “emergency stop,” iQ Care Remote4U has an email alert function that is proven effective. By sending an email alert to operators when an emergency stop occurs, it prevents situations where the stop goes unnoticed. During machining over an extended period of time, sometimes operators need to make a special trip to work on the weekend to



Machine operating screen

check the status of the machine. iQ Care Remote4U eliminates that need.

Moreover, mechanical stops such as running out of consumables, like wire electrodes, can be identified in advance through sensing analysis and prevented by sending the operator an email alert regarding the situation.

Moreover, some emergency stops cannot be rectified by the machine operator and the support of a technician from the machine manufacturer is required. For these situations, iQ Care Remote4U features a “remote diagnosis” function whereby the machine’s screen is shared with technicians in a call center, enabling them to assess the details of the situation. As such, call center technicians can identify the factor causing the machine stop and incorrect parameter settings by the operator among other things, and perform remote troubleshooting or prepare parts with accuracy if they must physically go to the machining site. This makes it possible to avoid extra work caused by taking the wrong part to a site and further speed up production recovery.

Invisible until now, detailed visualization of “set-up changeover work.” Increasing productivity with optimal training matching operator experience.

To reduce the waste related to “set-up changeover work” on wire-cut EDMs, the “set-up changeover breakdown visualization” provided by iQ Care Remote4U is highly effective.* It analyzes and shows not only the time the machine was down in order to conduct set-up

changeover work, but also how much time each task involved in the set-up changeover work required. Based on this, users can verify and implement effective improvement measures.

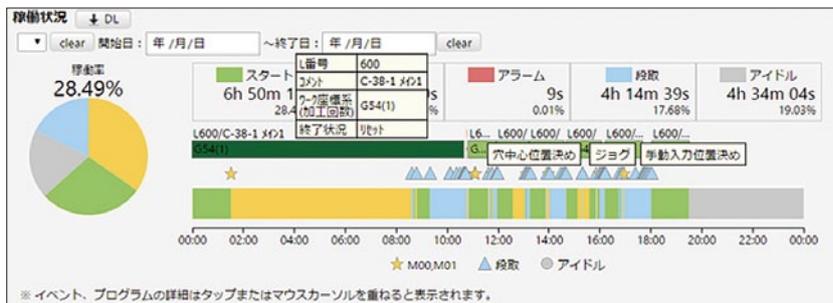
* Only supported by iQ Care Remote4U for wire-cut EDMs

For example, if an operator is taking a long time to perform set-up changeover work, iQ Care Remote4U makes it possible to compare the breakdown of individual tasks with other operators to clarify which particular tasks are taking longer than usual. Training or improvements focused on those particular tasks can then be implemented to remove the waste efficiently in a short period of time. In the reverse, if there is an operator who is completing set-up changeover work faster than others, this function can be used to share the operator's know-how with others and gradually improve their skills.

In order to reduce the waste related to set-up changeover, one approach is to introduce conveyors and other equipment, and shift towards automation; but that requires significant investment. However, with iQ Care Remote4U, there are naturally benefits in terms of the cost aspect, but it also fits well with shop floor kaizen (improvement) activities that have supported productivity improvement in Japan's manufacturing industry to date.

Visualization is helping reduce wastes that people had given up trying to eliminate until now, drastically slashing running costs.

The cost management screen is effective



Set-up changeover breakdown screen

見積・実績時間		
見積	運転時間	12h 11m 52s
	ワイヤ使用時間	12h 05m 18s
	ワイヤ残時間(終了時)	2h 56m 21s
実績	運転時間	0s
	ワイヤ使用時間	0s
	ワイヤ残時間(終了時)	0s

Remaining wire on bobbin

for reducing operating cost waste, such as that associated with consumables. For example, in the case of wire-cut EDMs, the screen can compare the "remaining amount of wire on the bobbin" and "wire amount required for machining" to show the operator whether or not there is enough wire for machining, and if not, how much extra is needed. This helps the operator to select a bobbin with the optimal wire amount for machining and prevents a machining stop due to wire shortage, as well as prepare a replacement bobbin to suit the timing the wire is predicted to run out, and otherwise use the wire bobbin more effectively.

Moreover, there is also a screen that

リアルタイム予測	
運転残時間	3h 10m 56s
ワイヤ残時間(現在WS連動)	3h 05m 56s
ワイヤ残時間(終了時) !	-7m 28s

enables remote confirmation of various information produced during machining, such as the time required until machining is complete. The predicted machining completion time varies depending on the progress of machining, but with iQ CareRemote4U, the latest machining prediction time is provided in real-time, making it easy to plan downstream processes. Filters and many consumables other than the wire are used in EDMs. However, using iQ Care Remote4U, the duration of use and appropriate replacement timing of these consumables can be displayed, enabling costs related to waste to be reduced through preventive maintenance.

It's not just about reducing waste. Clues to solving issues faced by modern-day production shops made visible using iQ Care Remote4U.

Currently, there are people in the machining field that believe it will be difficult to improve productivity any more than it has been following the increased efficiency of machines and reduction of waste in production processes. However, there is yet unlimited potential if IoT is used. It is even possible to not only help increase efficiency further, but also compensate for issues faced by modern-day industry in line with the decrease in seasoned workers, such as "handing down skills" and "personnel shortages."

The key to improving productivity is thoroughly eliminating all wasted time, which also leads to standardizing machining quality and ensuring product quality. iQ CareRemote4U is a key service that is capable of determining whether or not the productivity of modern-day machining shop floors can be improved further.



Remote service for reducing waste in production processes

iQ Care
Remote4U

How to Make a Smart Factory

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C80 Series

Computerized Numerical Controllers

In November 2016, Mitsubishi Electric launched the C80 Series, a new series of computerized numerical controller (CNC). While inheriting the highly regarded functions found in the existing C70 Series, the C80 Series has substantially renewed hardware and software, and enhanced functions that focus on the five attributes of productivity, scalability, operability, maintainability and functional safety.



▲ The new CNC devices of the C80 Series offer enhanced productivity, scalability, operability, maintainability and functional safety, exemplified by the incorporation of touch-panel operation and other unique features.

Enhanced productivity, scalability, operability, maintainability and functional safety

“We need a new product that incorporates the operability and new improved functions of the M800/80 Series (M80)...” The development team of the CNCs for the C80 Series (hereinafter “C80”) first received this request in the spring of 2013.

Mitsubishi Electric CNC products were previously sold under the “MELDAS” brand name. However, today products are released using only a single letter to identify flagship products, such as the “M Series” and now the “C Series.”

M Series products are controllers for general-purpose machine tools that can also be used stand-alone. Meanwhile, C Series products are primarily CNCs for controlling overall machining cells comprised of a number of machine tools, conveyors, etc. C Series products are predominantly used for the machining of automotive parts and electronic parts that are manufactured in large quantities and at a comparatively higher speed.

The C80 is the successor of the C70 Series (hereinafter “C70”), which was released in 2007. Development of the C80 began based on the concept of

inheriting the highly regarded functions of the C70 when supporting machining lines and cells, while incorporating the operability and new functions that improved the M800/80 Series.

M80 Series CNCs are equipped with a newly developed, high-performance, special-purpose CPU. The software has been updated, with many new functions incorporated, including touch panel-based operation. In the same way, functions of the C80 CNCs have been significantly enhanced as well.

At the time, the project leader was Yoshifumi Mita, manager of NC Systems Section 5, NC Systems Department, Nagoya Works (currently manager of the IT Planning Group, Development Department, Nagoya Works). Mr. Mita reflected back on the development project: “Incorporating a large number of new functions in the C80 in the same way as we did with M80 wasn’t an easy task. The M80 has a big housing, so we could easily fit various electronic components inside. But the C80 housing is small and there wasn’t much spare room. We were afraid that if we forcefully packed in too many electronic components, it would

be hard for the heat generated to escape.”

At that point in development, it had already been decided that the C80 housing would be smaller than the C70. For this reason, the printed circuit board (PCB) was a mere 100 x 100mm in size. This created headaches for Tatsuya Itoh who, as a dedicated member of the NC Hardware Engineering Section in the NC Systems Department (currently a dedicated member of the NC Systems Planning Group of the same department), was in charge of hardware at the time. He commented: “Not only was the model smaller, but we also had to equip it with electronic components to support a new programmable logic controller (PLC). This was a tall order considering the size of the PCB.”

Project planning was finalized in November 2013 and development began in 2014. Could the team implement a large number of electronic components on a small PCB? First, Mr. Itoh ranked each component in order of priority: “We went about it sort of like putting the pieces of a puzzle together. There wasn’t enough space though, so we prioritized the functions that were absolutely necessary and did our best to eliminate components that could be substituted using other FA functions.”

However, just as Mr. Mita had feared, the issue of trapped heat emerged. The team creatively arranged high-heat-generating components in a dispersed way and changed the memory to one that had low heat generation, but they still weren’t able to get below the calorific value specifications.

How could this additional heat be discharged became the problem. After much hardship, the development team managed to complete the first



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Substantially renewing hardware and software through steady, continual repetitive trial and error

prototype in 2015. Even so, despite their best efforts, it was not possible to get the model within the required temperature specifications. Mr. Itoh and his colleagues revised the component arrangement yet again, conducted simulations using computers and experimented with an actual prototype. It was only through great persistence and continual efforts that they finally resolved the heat issue; an issue that perplexed Mr. Itoh and his team until the very end.

The members of NC Systems Section 5 oversaw software development, and were also engrossed in steady work in the same way. Kenji Katoh, a dedicated member of the section and leader of the software team for C80 development, reflected upon the experience as follows: “The underlying concepts of the M Series and C Series differ. Our customers naturally assumed that the C80 and C70 can be used together in their facilities. Therefore, we needed to maintain compatibility within the C Series. As such, it was essential that we also develop new software that was sufficiently significant to incorporate the new functions of M80.”



The size of the main unit is a mere 110 × 106 × 27.8mm. Various functions that have been significantly enhanced are provided in a compact body.

Mr. Katoh was involved in C70 development just after he entered Mitsubishi Electric. However, despite his extensive experience, he still hadn't mastered the C70 software. Mr. Katoh and his team began by identifying each individual C70 source code. They then incorporated the newly-equipped functions and changed the code to suit the C80.

Mr. Itoh and his team, in charge of hardware development, ultimately found the solution to the heat issue in the spring of 2016. He explained, “We changed the position of the connector to one where there is minimal heat generation.”

But this then impacted the software development being conducted Mr. Katoh, as a change in connector position meant the software had to be changed as well. It had been decided the C80 would be launched during the 28th Japan International Machine Tool Fair (JIMTOF2016), which was held in November 2016. Not much time remained for the development project.

Mr. Katoh commented, “The basis for the foundation was all but complete at the time, and I didn't want to have to change it at that late stage. But I knew it had to be done because I was aware of the overall direction of the project.” There was simply no time to spare, and with all manpower physically available working on the project at the same time, the development team somehow completed the mission in July and was able to give the green light to launch the product and exhibit it at JIMTOF2016 as planned.

The C80, which took three and a half years to develop, offers the following features.

1. Enhanced productivity

Basic performance significantly improved owing to incorporation of a CPU designed specifically for CNCs. Moreover, with the newly developed

high-speed system bus (i.e., approximately 50 times faster than conventional buses), large volumes of data can be communicated at a dramatically higher speed.

2. Enhanced scalability

In order to reduce the overall costs for development, production and maintenance, the C80 supports the “iQ Platform”, an integrated FA platform.

3. Enhanced operability

The C80 utilizes a touch-panel display for operation in the same way as the M80. Operations are significantly faster.

4. Enhanced maintainability

Maintenance cost has been reduced thanks to making the C80 a battery-free product. The alarm/warning history acquires three times more data than previously possible.

5. Reinforced safety functions

The safety standard functions of the overall system are significantly reinforced, and various safety functions have been equipped as “smart safety monitoring functions.”

In regards to the C80 CNCs, which provide all of the above-mentioned functions, Mr. Katoh emphasized:

“When we went to visit our customers for the maintenance of the C70 and other devices, we were presented with a variety of requests regarding future needs. With that input, we somehow managed to create the C80. With a feeling of great responsibility as the person in charge of software overall, I completed my assigned mission and feel very emotionally attached to this product.”

Mr. Mita, development project leader, summed up the project as follows: “I can say with pride that the C80 CNC is my pride and joy. We will aim to exploit new markets and spread the product even further.”

Product

Computerized Numerical Controllers

For customers to use Mitsubishi CNC with confidence, Mitsubishi Electric offers the service from the three points of view : Technical support, Training, and Service parts/repair.
With Mitsubishi CNC global service network, Mitsubishi Electric is ready to support the customers who have production bases around the world.



Mitsubishi CNC Lifecycle Management

For the customers to use their familiar machines for many years, Mitsubishi Electric continues to offer services:

Whenever Wherever Forever

We provide the best service to support customers' production environment indefinitely

Technical Support **Minimizing Downtime with Professional Support**

Need to know how to cancel CNC alarm immediately!

Our call centers in various regions around the world can support customers quickly.



We have call centers in each overseas base to respond quickly to customers having trouble with the CNC. Our skilled engineers support customers to accurately resolve problems over the phone. We ship out service parts or send field engineers as needed to ensure a timely recovery of your machine.

Need support to recover the machine quickly!

Our field engineer visits customers' site to repair the CNC system.



Our specialists who acquired high skills on CNC system repair visit the site immediately based on the customer's request. We make full use of measuring instruments, etc. to precisely understand the machine state, and then adjust the faulty items or replace the parts. As a result, the machines are recovered quickly

After machine restoration we are also making efforts to prevent machine failures, suggesting preventive solutions by measuring the battery voltage of CNC and drive units and the insulation resistance of motors.



Our call centers and field engineers around the world are working hard day to day to enable our customers to safely use their machines. Please feel free to contact the nearest service center with any tiny issue.



Product

Processing machines

We offer worldwide support for Mitsubishi Electric's state-of-the-art Industrial Automation Machinery



Our rich lineup of EDMs cater to diverse processing needs ranging from parts processing to ultra high precision processing. Utilizing our advanced laser technologies, our laser processors deliver high productivity, stability, and low running costs. Service and support of these Industrial Automation Machines is available worldwide through Mitsubishi Electric's extensive global network. Our local staff will provide a prompt response to your various needs from inquiries about processing applications to requests for training and repair.



Applications

We can propose optimum processing applications to cater to your needs before and/or after installation. If you have any questions about processing applications, please feel free to contact us.



Showrooms

EDMs, laser processing machines, and various other Mitsubishi Electric mechatronics products are displayed in our showrooms. Our dedicated engineers are always ready to help you.



Service and Repairs

We offer repair services, dispatch of engineers to the field, replacement parts sales, and technical support in close cooperation with our local distributors. In case of a malfunction, we will promptly assist you to fix the problem.



Training

We offer wide variety of regular training courses to give engineers the ability to use our products quickly after purchase. We offer basic operations to applied programming using actual products.

Water Technology

High precision and high productivity
of Japanese quality supporting
factory floors around the world.

 D-CUBES MP1200



 D-CUBES MP2400



 D-CUBES MP4800

Innovative technologies raising manufacturing to the next stage

Mitsubishi Electric Electrical-Discharge Machines

- Machining speed for Rz0.6 μ m tungsten carbide finish is up to 30% faster than conventional oil-dielectric fluid wire-cutEDM.
- Longer and more precise dies achieved by improvement of Axis-movement accuracy
- New- D-CUBES control device and Automation elevating tank improve workability

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