

U l t i m a t e i n V a c u u m

ULVAC

A Community Magazine of ULVAC Group



EXECUTIVE GUEST ● **Aspiring to Be a Sustainable Value-Generator for People and the Earth that Is Qualitatively and Quantitatively Superior**
OMRON Corporation

VISION ● **Curiosity Drives Research Activity - A Strong Desire to Know and Learn**

LIVING & ULVAC ● **Developing Sabatoba: An Innovative Way to Preserve Mackerel at Room Temperature**
MARUKANE, LLC

VISITING ULVAC ● **Introducing Japan's Two Main Production Facilities**
TOHOKU: ULVAC TOHOKU, Inc.
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President, Industrial Automation Company
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ULVAC KOREA, Ltd.**



Cover Photo:
“Shimin no Mori Narawazudake (Hachinohe) in Spring”
Photographed by:
Tatsuya Kawabe
ULVAC TOHOKU, Inc.
Materials Production Dept., Materials Division

Narawazudake is a forest that is popular among the people of Hachinohe City. There is a walking path perfect for viewing nature, which makes it possible to enjoy the abundant natural beauty of all four seasons, including animals, plants, insects, and birds. This photograph captures the new green of spring in late May.

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PRODUCTION ASSISTANCE: Adopa Corp.

Aspiring to Be a Sustainable Value-Generator for People and the Earth that Is Qualitatively and Quantitatively Superior: OMRON Principles Yield Excellence

— Driving Innovation in Manufacturing Through “innovative-Automation!”



● Interviewer

Setsuo Iwashita

President & CEO, ULVAC, Inc.

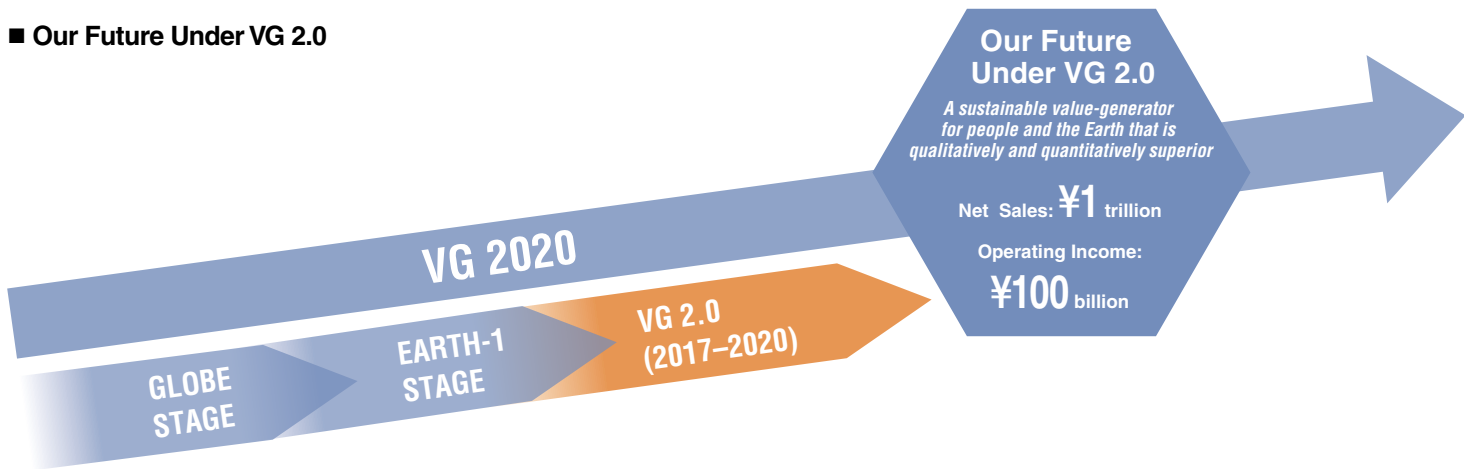
● Guest

Mr. Yutaka Miyanaga

Executive Vice President, OMRON Corporation
President, Industrial Automation Company

OMRON Corporation was founded as Tateishi Electric Manufacturing Company in 1933 by Kazuma Tateishi. It is now a time-honored electronics company that the world regards as a symbol of Japan. OMRON has differentiated itself by growing a company for the ages that continues to stay true to the founder's intention to “contribute to global society through our business.” In 1990, the company changed its name to OMRON Corporation, and at the same time initiated long-term strategic planning with 10-year goals in order to build a stronger management structure. In this interview, I spoke about OMRON's creation of corporate value and the fundamentals of business development with Executive Vice President Yutaka Miyanaga, who is one of the planners of VG 2020, the long-term management strategy announced in 2011.

■ Our Future Under VG 2.0



OMRON's Long-Term Strategy: AI, IoT, and Robotics at the Forefront

Iwashita: OMRON and many other companies in Kyoto are active globally and doing extraordinarily well. Why is this? Today I am visiting Vice President Miyanaga to find out, and I hope he will also share some of the energy of these Kyoto companies with me. (laughter)

Miyanaga: Kyoto has an image of being traditional and historical, but I think the people of Kyoto are actually fascinated by anything new, and they care a great deal about the city's cultural identity. People joke that Kyotoites still think of Kyoto as Japan's capital somehow. (Laughter) Because of this, they are very conscious of not bowing down to Tokyo. I also find that, as I mentioned, they have a heightened sensitivity to new things. One characteristic of Kyoto companies, in my



Setsuo Iwashita,
President & CEO, ULVAC, Inc.

view, is that they focus on their own identity without imitating others and without trying to grow just for the sake of size.

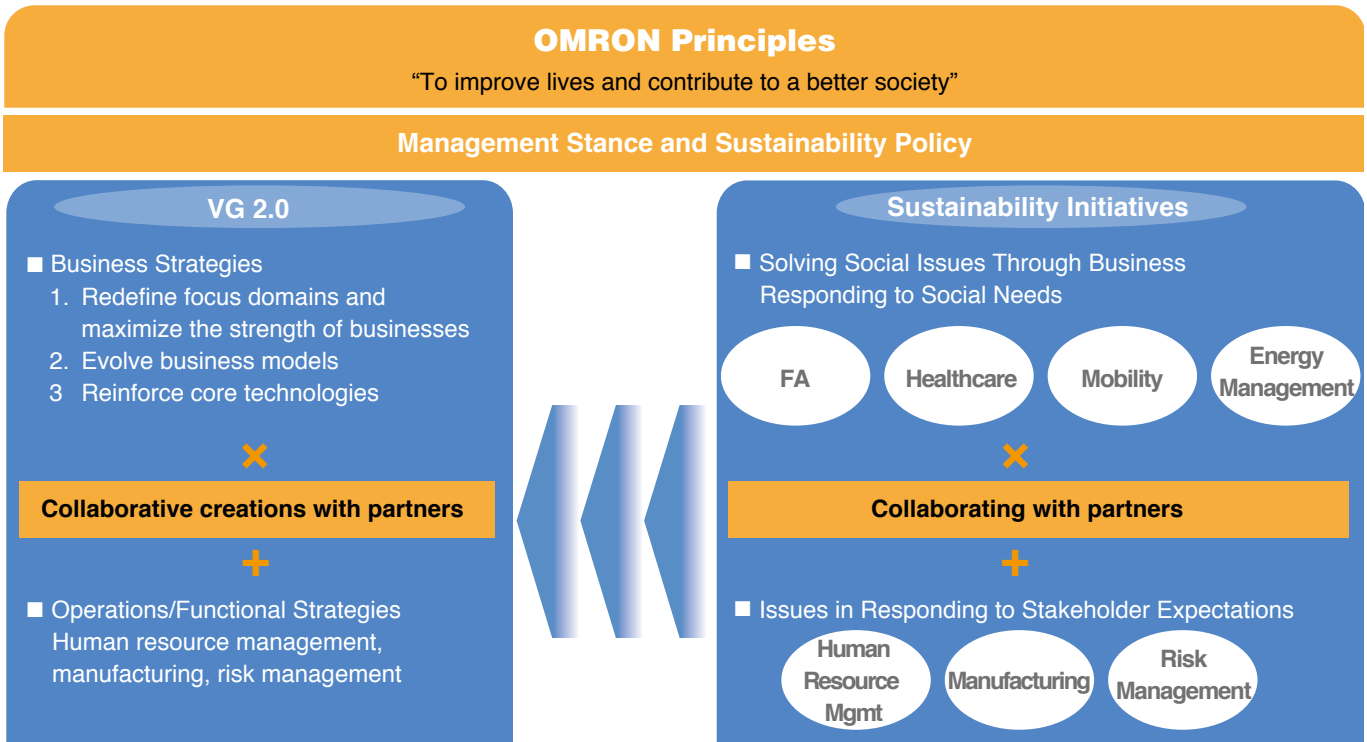
Iwashita: I became president of ULVAC in 2017. The market at that time was just heading into the Fourth Industrial Revolution, a technological revolution in AI, IoT, and robotics that represents a huge business opportunity for our company. This technological revolution calls to mind some of the words used in OMRON's VG (Value Generation) 2.0 medium-term plan. How is OMRON taking advantage of this big wave?

Miyanaga: As a result of this technological revolution, the market is expecting our automation products to solve social issues such as labor shortages, high labor costs, and the large-scale retirement of skilled workers. Particularly in the factory automation (FA) market, people at their desks sensed that innovation was happening, so in order to dramatically change direction starting in 2017 and keep growing through 2020 and then 2030, we decided to hit the accelerator again.

VG 2020, our long-term strategy that began in 2011, focuses on our corporate vision through 2020 and divides this 10-year period into three stages. We called the first subdivision (from 2011 to 2013) the GLOBE stage, and the strategy was to broaden our stretch geographically - for example, by leveraging growth in emerging markets to help us expand further. We called the second stage (from 2014) the EARTH-1 stage, and its aim was to pursue growth by creating new value. The EARTH-2 stage would then take this growth one step further. This was how we originally thought of these three stages. However, in the initial GLOBE stage, growth in emerging markets went so well that in the second stage, EARTH-1, we tried to launch another growth rocket by leveraging urban expansion in China and Southeast Asia. However, economic growth in China slowed a bit, and Southeast Asia did not grow as much as expected.

Meanwhile, the business environment has been changing at breathtaking speed because of the desire to solve various

■ Sustainability Management



social issues through new technologies, such as AI, IoT, and robotics. Therefore, we shifted our policy significantly. Instead of viewing the EARTH-2 stage (which started in 2017) as an extension of what came before, we revised our goal to promoting growth largely through innovation and called this VG 2.0. “VG” stands for Value Generation, which conveys our initiative to grow by creating new value. VG 2.0 starts with aspiring to be a sustainable value-generator for people and the Earth that is qualitatively and quantitatively superior as intended in VG 2020, and improves on VG 2020 by planting new seeds for realizing innovation.

Major Goals of the Long-term Strategy Based on the OMRON Principles

Iwashita: The 10-year span of OMRON’s long-term strategy is impressively long. In my experience, long-term plans are usually around three years. Can OMRON read as far as ten years into the future?

Miyanaga: This is OMRON’s third long-term plan. The first was the G’90s (Golden Nineties) in 1991, and then there was the GD2010 (Grand Design 2010) in 2001. I myself was involved in the planning of this third long-term strategy right at the time of the Lehman Brothers shock. People wondered how we could calmly and confidently set such a long-term plan when times were so difficult. In fact, this is exactly why a solid long-term strategy is important. Rather than predicting

the direction of world affairs and business over the long term, our long-term strategies have aimed to define OMRON. This has been one of their major goals. Ten-year plans allow us to return to this fundamental issue in ways that medium- and short-term plans do not. Many of our employees participate in deep-seated and passionate arguments about this every ten years. For these reasons, I think a long-term strategy is very meaningful.

Of course, our predictions do not always hit the mark, so we correct our direction with a plan called “VG Rolling.” Our strategies require that we keep abreast of changes in the environment each year, and that we remain flexible enough to change our goals. We improved in this regard with the second long-term strategy. As a result, we are able to keep each long-term strategy open to changes at all times during the 10-year period so that the plan does not lose its effectiveness. We are seven years into the current VG 2020 long-term strategy, and it has become so deeply ingrained in employees’ minds that they talk about it all the time.

What is the Significance of a 10-Year Plan That Takes Two Years to Develop?

Iwashita: How do you approach the important process of making a plan?

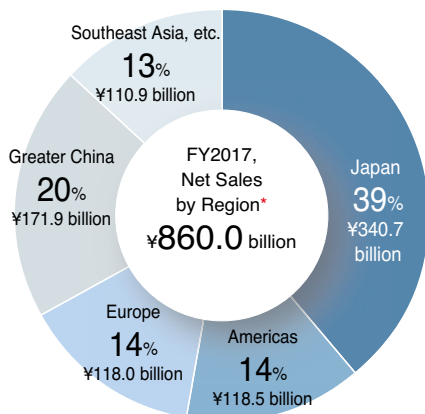
Miyanaga: Until very recently, long-term strategies were developed only by certain people in the company. This time,

■ **TOGA (The OMRON Global Awards)**

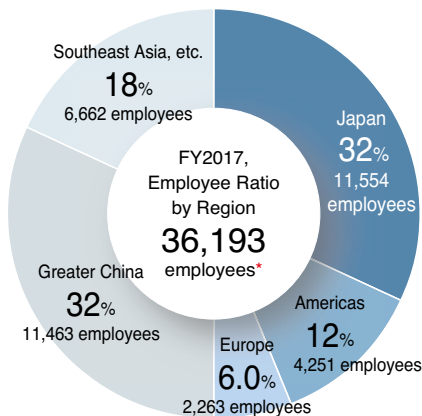
Launched in 2012, TOGA is an awards system designed to encourage employees to declare their own challenge projects based on OMRON Principles. Employee teams around the world then take these on, and through TOGA, we support and recognize their achievements.



■ Percentage of Overseas Sales: Approx. **61%**



Percentage of Overseas Employees: Approx. **68%**



* As of 3/31/2018

Notes: The countries or areas in each geographic segment are as follows:

- Americas: Includes North, Central, and South America
- Europe: Includes Europe, Russia, Africa, Middle East
- Greater China: Includes China, Taiwan, Hong Kong
- Southeast Asia, etc.: Includes Southeast Asia, Korea, India, Oceania

we tried our best to listen to the opinions of employees worldwide, and we spent two years making this long-term strategy so that everyone would feel heard.

Iwashita: That’s a long time to spend planning!

Miyanaga: We could not allow ourselves to spend two years working on a 5-year medium-term plan, but because it was ten years, we were able to set aside a two-year preparation period. I traveled worldwide, heard honest opinions, provided immediate feedback, and had discussions based on management opinion as well. I think this period of two years helped in terms of reaching employees.

Iwashita: In VG 2.0 this time, you included sustainability issues and strategies in response to social changes. How is this significant?

Miyanaga: Last year’s sustainability and SDGs (Sustainable Development Goals) are related to one of the fundamental elements of management that I have long supported. OMRON management always keeps in mind the OMRON Principles: “to improve lives and contribute to a better society.” In other words, we always want to work towards creating a better society by solving social issues through business.

OMRON’s current business domains are in factory automation, healthcare, social infrastructure such as traffic control systems and railway station equipment, vehicle parts (automotive electrical equipment), and so forth. All of these business areas address social needs and social issues. OMRON is a company that has grown because it has contributed to the world by helping resolve social issues. In VG 2.0, OMRON would like its investors to understand this management stance and approach, and to make new investments.

How TOGA helps to Instill OMRON Principles in Employees Worldwide

Iwashita: Does OMRON consciously conduct evangelism-type activities in order to instill this “OMRON-ism” in its employees?

Miyanaga: Yes, we consciously do this to excess. We promote the OMRON Global Awards, which we abbreviate as TOGA, in order to further global employee understanding of our social approach and OMRON Principles. The awards are in their sixth year and involve all employees worldwide. Employees enter challenge topics, and then regional winners compete in a final competition held in Kyoto, where they present their ideas. This final competition is broadcast to all employees around the world.

Iwashita: What kind of topics are entered?

Miyanaga: They change year by year. The keyword is “challenge.” One of OMRON’s principles is “Challenging Ourselves,” so the goal is to create an environment and culture in which everyone down to the local level pursues challenges.

These are not individual challenges, but group entries. Entries reporting on the results of the year’s activities are submitted at the beginning of the fiscal year and are evaluated by everyone. The process of participating and entering is just as important as the results.

The teams that win in the preliminary competitions make their final presentations on May 10, the day the company was founded. A big trend this year is how to contribute to society by pursuing challenges.

For example, some young people at my company noticed a serious labor shortage at factories in the cold region of Hokkaido and worked with a local SIer (systems integrator) to develop a fully automated foodstuff “picking” system that functions without human labor. As a result, the factory’s productivity increased considerably. The title of their entry is “Rescuing Japan’s Food Supply.” This group courageously took on the challenge of doing work that would make a difference not only to customers, but also to society at large.

Iwashita: That is a very large-scale, progressive project. Wow!

Miyanaga: At the final presentations, the executives all highly praise the teams chosen for TOGA. Having held these awards for six years now, we are confident that employees worldwide understand that contributing to society through business is an OMRON Principle. OMRON has a total of 36,000 employees, and almost all of them participate. The number of participants is greater than the number of employees, because some employees are involved in more than one entry. The number of participants and entries increases each year. TOGA has been a natural way to achieve our goal of instilling OMRON Principles in employees throughout the world.

The Key to Managing Globalization is Maintaining a High Rate of Local Hiring

Iwashita: The geographical distribution of OMRON employees seems to be well-balanced.

Miyanaga: Yes, around 40% of our employees are in Japan, and the rest are around the world.

Iwashita: You must have many ideas about global human resources and recruiting people from different countries and cultures, particularly from a diversity perspective, as mentioned in VG 2020.

Miyanaga: I think diversity is still in the developmental stages. OMRON focuses not only on gender diversity, but also on integrating our human resources across racial boundaries at every locale in which we do business. Many Japanese companies tend to appoint Japanese nationals as presidents and executives of their U.S. and European subsidiaries, but OMRON is trying to increase the number of local hires, which



Profile of Mr. Yutaka Miyanaga
Executive Vice President, OMRON Corporation
President, Industrial Automation Company

Apr., 1985 Joined Omron Corporation
Sep., 2004 General Manager, Application Sensors Div., Sensing Devices & Components Division HQ., Industrial Automation Company
Mar., 2008 General Manager of Corporate Planning Dept., Group Strategy H.Q.
Jun., 2010 Executive Officer
Mar., 2011 Senior General Manager of Global Strategy H.Q.
Apr., 2013 Managing Officer
Mar., 2014 President of Industrial Automation Company
Apr., 2014 Senior Managing Officer
Apr., 2017 Executive Vice President

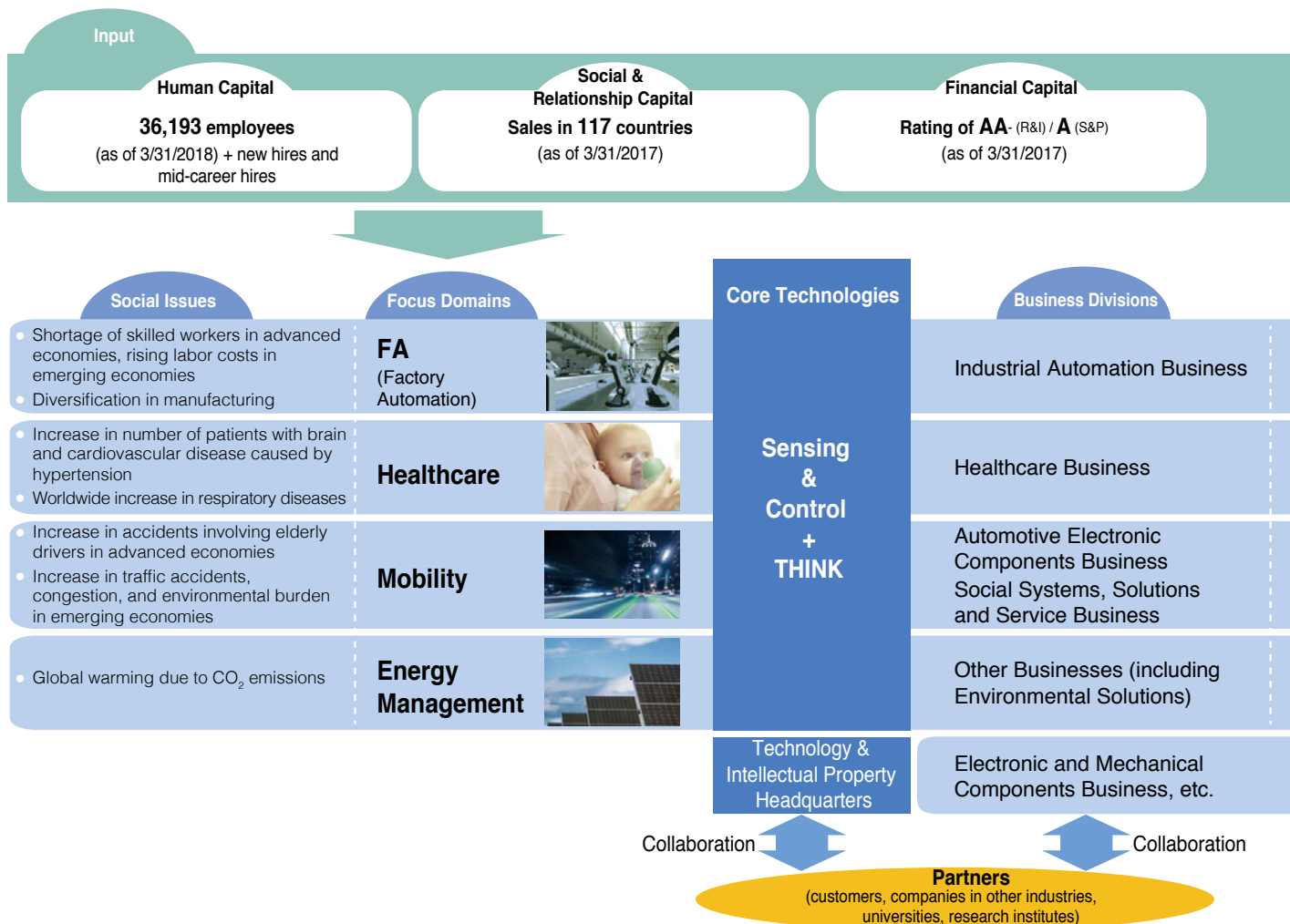
Corporate Profile (as of March 31, 2018) OMRON Corporation

Head office: Shiokoji Horikawa, Shimogyo-ku, Kyoto 600-8530 Japan
Representative: Yoshihito Yamada, President & CEO
Established: May 10, 1933
Incorporated: May 19, 1948
Capital: ¥64.1 billion
Net Sales (consolidated): ¥860.0 billion (2017)
No. of employees: 36,193

currently comprise approximately half of the executive-level management in these regions. At first, there were concerns about this, and it felt daring to try it, but it soon became clear that our worries had been for nothing. Giving responsibility to local hires has produced results beyond expectations.

Very recently, for example, a Korean person was appointed as president of a subsidiary in Korea. Now Korean employees there believe that they too can aspire to top positions, which completely changed the local mood. This belief that one can be appointed to a variety of important posts eliminates the perception of a “glass ceiling” that prevents promotion on the basis of gender, race, and so forth.

Value Creation Model



Core Position Strategy is Key to Top-Down Human Resource Development

Iwashita: In developing a business, I think success depends on how much passion managers bring to the task. What is the secret of OMRON's success?

Miyanaga: Our success rate is not always 100 percent, but we have a core position strategy for our global human resource system. We have established 200 core positions that have a major impact on our business. These include division general managers, presidents of acquired companies, and the like. Mr. Yamada, our corporate president, holds all authority over personnel decisions for these 200 posts.

Iwashita: Does this mean that if an employee of Industrial Automation Company, the company of which you are president, holds one of these core positions, President Yamada's instructions with regard to that employee must be followed?

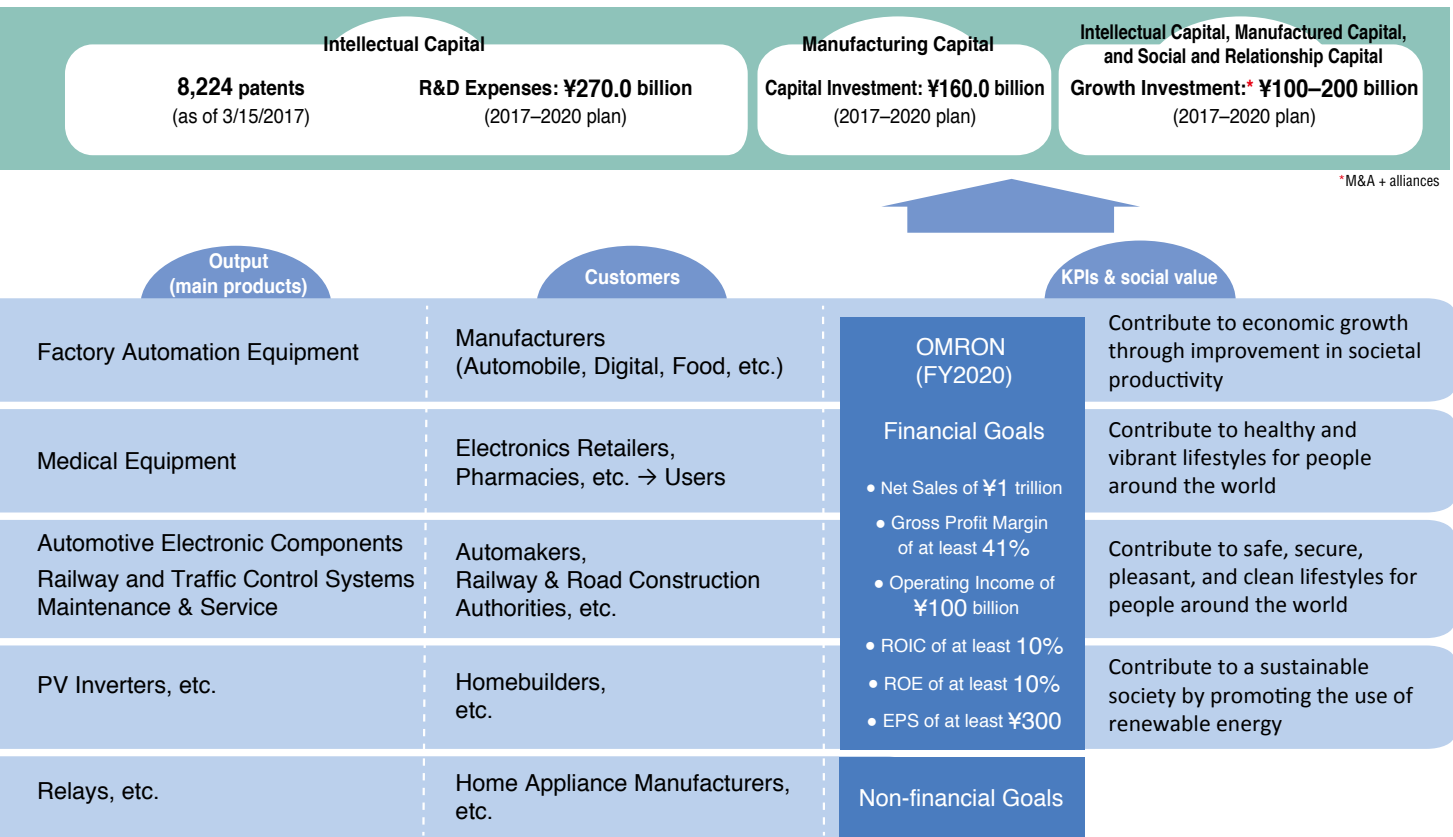
Miyanaga: If President Yamada says to make a change, then I have no right to refuse. Whether the 200 core positions are filled by people who are capable and dedicated are based on their ability and value to the company. If an employee does not produce results, he or she will be moved. In this

manner, core positions are always filled with capable, motivated people. Potential management personnel for these core positions are developed by keeping close tabs on them, and having them experience many highly challenging situations.

Advantages of OMRON's Long-term Strategy in the Transition of Power Between Generations

Iwashita: OMRON is close to reaching annual sales of ¥1 trillion. Will you need to change how you do things because of your large size?

Miyanaga: In our long-term strategy, we are indeed aiming for ¥1 trillion in sales. President Yamada often says, "Let's become a company that the world can depend on. Living up to the expectations of people all over the world leads to growth, and continuing to meet customer and market expectations instead of simply increasing sales will generate new expectations. That will be a huge advantage for our company in the form of sales. Growth means that we are a company the world needs." We will not be satisfied with ¥1 trillion. We will treat it as just one point along the way.



Iwashita: It is just another goal for OMRON, isn't it?

Miyanaga: When we were formulating the previous long-term strategy, many senior employees in the company said, "We won't be here in 10 years, so you guys do it yourselves this time." They wanted employees to plan the strategy who would be able to participate fully for all of the next 10 years.

When I started on VG 2020, I was in my forties, so I was at an age where I could participate fully for the following 10 years. For the next long-term VG 2020 plan, looking towards 2030, we will probably gather together young employees who can support OMRON's future and start preparing a new post-VG plan around 2019. I suppose this is how OMRON shifts power to the next generation.

Sensing & Control + THINK: Broadly Interpreted Automation Technology

Iwashita: When you make the next 10-year plan, what kinds of new domains do you think will be included?

Miyanaga: The next ten years will be a period of extremely fast change, but even so, I think factory automation is a key area where OMRON will be able to contribute to society.

However, I also think we will need to broaden our interpretation of automation to society in general instead of only factory automation. For example, social issues such as labor shortages and the aging of many populations are going to change the world. OMRON's idea for how to handle these changes is a new kind of automation that connects society with Control & Sensing + THINK as the core technology.

Iwashita: In the near future, if the average lifespan becomes 100 years, it would be great to have home automation that combines sensing technology, control technology, and robotics within a home. There is no end to the work OMRON can do!

Miyanaga: OMRON is aiming for the kind of automation that enables humans and machines to live in the closest possible harmony. At factories, people's movements and physical condition are sensed and monitored. Automation that contributes to society does not just mean fully automated or minimally-staffed factories, but a balanced society where humans and machines bring out the best in each other.

VG 2.0 is a plan made for innovative times. I do not think OMRON will change its focus on innovation in the next plan from 2020 to 2030.

- **FORPHEUS**, a robot table tennis coach that embodies the concept of Sensing & Control + THINK



The *FORPHEUS* System

Sensing

Senses the speed and trajectory of the ball.

+ THINK

Assesses the characteristics of the ball hit by the opponent. Predicts the location of the hit and the speed at which the opponent will most likely return the ball.

Control

Controls the position for returning the ball.

True interaction between human and machine

OMRON's "innovative-Automation!": Innovation in Manufacturing with the World's Most Extensive Control Technology

Iwashita: It sounds like things are set up so that only OMRON makes money. (Laughter)

Could you give ULVAC some advice?

Miyanaga: You certainly do not need advice, but allow me to propose one thing. (Laughter) At OMRON we have quite a variety of equipment and technology to assist in the automation of devices and production lines. We call this ILORS: I is Input, L is Logic, O is Output, R is Robot, and S is Safety. I take pride in the fact that OMRON is the only company in the world that can provide one-stop solutions for sensors, controllers, motors, robots, and safety equipment to protect people from danger. Our aim is to connect ILORS with software based on the customer's plant and equipment needs, and to achieve innovation in manufacturing, which we call

"innovative-Automation!"

At OMRON, in order to resolve various issues relating to control, SE and field engineers from our Automation Center go to the customer's site and sometimes spend several months there. They gain experience on the factory floor, make software parts, and then improve them further with the customer. There are currently 150 programmable logic control (PLC) software parts that were made in this way, and they are able to control advanced machinery like never before. I hope that ULVAC, as a device maker, will work with us to achieve "innovative-Automation!" as well.

Technology HQ Responsible for Advanced Innovation Amidst Rapid Change

Iwashita: How does OMRON handle its technology development strategy?

Miyanaga: By and large, OMRON has two development systems. One consists of the development system in each business unit. The other is the Technology HQ (Keihanna Innovation Center), which is linked to all of the units. The Technology HQ develops more advanced technology, and its role has grown rapidly since the adoption of the VG 2.0 plan. As IoT, robotics, and other fields change faster and faster, OMRON's own development team cannot keep up with progress by itself. The Technology HQ therefore functions as a hub for alliances with various companies, universities, and venture enterprises. Until now, development has been handled by individual business units, but going forward, it will be led by the Technology HQ.

Iwashita: What areas do the development departments of the companies work on?

Miyanaga: One thing is product development. Another is technology development that strengthens product development. The companies pursue technology development using a two-tiered system, one by means of the technology departments and one in collaboration with the Technology HQ.

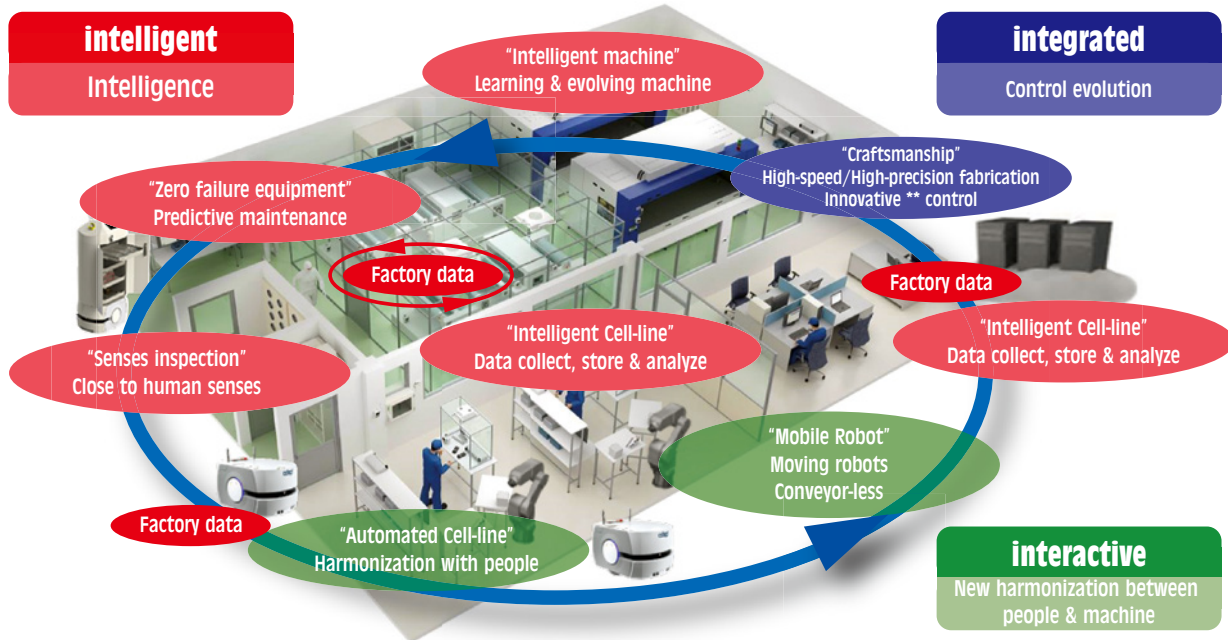
Iwashita: Are there any boundaries between the companies and the Technology HQ?

Miyanaga: There are organizational boundaries, but each year the companies and the Technology HQ split the workload and decide what topics to focus on. The personnel of both units interact very closely. Although they decide on topics together, the Technology HQ has external technologies and takes charge further into the future. As a result, they each have their own roles, and the Technology HQ pursues its own initiatives even though these may be somewhat less likely to result in successful products.

Iwashita: Does the Technology HQ receive an operating budget from the companies, or does it operate on a separate budget?

■ **innovative-Automation!**

Leads to Innovation in Manufacturing Based on OMRON's Three "i"s



Miyanaga: There is a separate budget. The Technology HQ falls completely under the jurisdiction of the President. We actively collaborate with them, but they launch new technologies and businesses, so they are a completely separate organization with a separate budget.

Possible Collaboration Between OMRON and ULVAC

Iwashita: ULVAC is a vertically divided organization with a division system, but I would like to establish a development center responsible for the control equipment of each business division across the organization. For example, value that will soon be added for devices is the ability to check device health. But if functionality that accurately responds to the data from the health check is not available, no added value will be realized.

Miyanaga: I think your idea of linking control devices across the organization is fantastic. I think control technology is one of the keys to creating a mesh network that makes the knowledge that machine manufacturers have about their machines available through data processing and communication.

Iwashita: I have a proposal. ULVAC's devices involve IoT, AI, and sometimes robotics. OMRON as a factory automation company and ULVAC as a device maker could become business partners. ULVAC could be used as a testing ground, and 4th Industrial Revolution

technology could be incorporated into ULVAC devices to increase their value. A joint team could be stationed permanently at ULVAC's main plant. Please consider collaborating with a device maker – we also want to grow.

Miyanaga: At OMRON, we collaborate, and we plan to achieve "innovative-Automation!" together with customers. Data is the key, particularly in the worlds of IoT and AI. How can large data be analyzed and utilized? We have reached a point where development is not possible without manufacturing. For example, a new control algorithm based on onsite data could be tested together with ULVAC and incorporated into a device. This would be true collaboration. We would be happy if we could collaborate with ULVAC.

Iwashita: We would definitely appreciate OMRON's partnership. Thank you for joining me today.



An exceptional math teacher in junior high helped me decide to pursue a career in math and science

What was your childhood like?

Someya: Two things stood out. The first was having a truly excellent math teacher in junior high school. Thanks to him, I fell in love with math. The second was the fact that my father was an engineering

researcher. I was strongly influenced by him from an early age.

So I chose to study math and science. After entering the university, I was again fortunate to have many wonderful teachers, who guided me in finding a path as a researcher.

■ VISION 43 ■

Profile of Professor Takao Someya

Takao Someya received his Ph.D. degree in Electrical Engineering from the University of Tokyo in 1997. Since 2009, he has been a professor of the Department of Electrical and Electronic Engineering at The University of Tokyo. From 2001 to 2003, he worked at the Nanocenter (NSEC) of Columbia University, and at Bell Labs and Lucent Technologies as a Visiting Scholar. He also conducts the NEDO/JAPER Project as Project Leader (since 2011) and the JST/ACCEL Super-bioimager Project as Research Director (2017–2022).



Professor, Department of Electrical Engineering,
School of Engineering, The University of Tokyo

Dr. Takao Someya

Curiosity Drives Research Activity – A Strong Desire to Know and Learn

— What makes a researcher successful in creating skin-like wearable devices?

At one time, it was generally thought that semiconductor devices had to be made on a hard silicon substrate. Then, in the 2000s, researchers started exploring flexible electronic devices, although most of the research focused on display devices. In this environment, in 2004, Prof. Takao Someya (who specializes in electrical engineering at the University of Tokyo's Graduate School of Engineering) developed artificial skin ("E-skin") for use on robots. More recently, he has earned acclaim by successfully developing an ultra-light nanomesh sensor that causes no inflammation even when it is left attached to human skin for a week. We interviewed Professor Someya for this article.

What are your hobbies?

Someya: In junior high school, I joined the astronomy club. We observed and photographed the stars and planets at night and developed the photos the next day. Photography is still my hobby. For nearly 10 years after my research lab got started, I took most of the photos destined for external publication. Some of these were featured on the covers or in the opening articles of well-known magazines, including TIME.

In senior high school, I was a member of a chorus club. I sang bass, and I continued to sing in university. Although I like classical music best, I also developed an interest in jazz after coming into contact with it while studying in the U.S.

Studying in the U.S. inspired an interest in organic electronics

What led you to become involved in your current research?

Someya: In university, I chose engineering because it is a field that can be directly useful to people. I became interested in semiconductors, which were said to be Japan's key industry, and I decided to major in electronic engineering.

I studied at a research lab where nanostructures of inorganic compound semiconductors – one type of semiconductors that are microfabricated - were created. The physical properties of the electrons sealed inside them were also examined. My supervisor at the time was Prof. Hiroyuki Sakaki, who has been active in many fields and has made distinguished contributions. It was also in that lab that I encountered ULVAC equipment.

After graduation, I began to do research on the optical and engineering properties of nanotechnology in the lab of Prof. Yasuhiko Arakawa. Although it did not lead directly to my current area of interest, it was so-called mainstream research, focusing on semiconductor miniaturization.

The trend toward miniaturization was approaching its physical limits, and yet I had just begun research and had more than thirty years to go before I would reach retirement age at 65! So I began to think about taking on a subject in a new, slightly different field that had never before been tackled.

In 2001, I received a scholarship to study for about two years at Bell Laboratories in the U.S. That is where I learned about a research project in which organic semiconductors were being applied to transistors. This was my encounter with organic electronics.

Development of “E-skin” for robots as the second step

How did you proceed after that?

Someya: At Bell Laboratories, I was researching how to produce electronic circuits of organic transistors on plastic film using a stamping method. While I was studying there, a Bell Laboratories researcher successfully developed a prototype of the world's first electronic paper. This was really big news, but back then all research on flexible electronics was on display devices. Nevertheless, this gave me a great opportunity to transition to a new field and its challenges.

After coming back to Japan, I began researching organic transistors jointly with Prof. Takayasu Sakurai at the University of Tokyo's Institute

of Industrial Science. Prof. Sakurai is one of the best-known Japanese researchers of silicon integrated circuit designs.

He also had experience working in private industry and was an authority on reducing both the power consumption of silicon devices and the cost of circuit designs. Back then, it was said that circuits could be made inexpensively if printing was used. Prof. Sakurai already knew the truth, which was that printing would not necessarily make circuits less expensive. However, he has continued to identify other good reasons to use printing.

Since the use of silicon allows a large number of transistors to be microfabricated on a small area, the cost per transistor is low. However, silicon is not good for making transistors sparsely on a large area. If you want to make circuits on a large area, printing has an advantage. It seemed possible that if we used printing on a film, it might be possible to produce flexible sensors over a large area. Silicon would be unsuitable for this. I decided to begin research on developing such sensors.

In the period from 2003 to 2004, I developed a prototype of E-skin, which feels similar to human skin and can be applied to robots. In 2005, TIME magazine featured this as a cover story.

This was the second leap for me. E-skin has kept evolving, and we are now developing sensors that can be applied not only to robots, but also to human skin. For the results of our latest research, please see Latest Research Trends [1] and [2] (p. 16-17).

The next research step was hidden within failure

What is your philosophy as a researcher?

Someya: I always try to make tasks enjoyable for myself and others. Research means doing something nobody has done before. Since there are naturally more failures than successes, it is extremely important for a researcher never to give up, even after failing, but to keep going and be very persistent.

When things are not going well in research, it's easy to get discouraged. However, the hint for the next step often lies precisely amidst the things that have not been going well. So even if you have failed, you need to learn from the failure and keep challenging the problem. This process is apt to be difficult, but we can devote ourselves to it if the subject is something we find interesting and we enjoy the process. If we genuinely enjoy something, we can keep doing it.

If you can convince yourself of how interesting it is, you will discover the spirit of research and the joy of trying to create something new. You will feel that the process is your life's purpose. Then, you might become completely absorbed in the project. Research is something you cannot do unless you have this kind of fresh engagement and passion. Curiosity—the strong desire to know and learn—is the main driving force behind research activities at universities. In corporations, profitability as a business is required, but at universities, the researcher's interest and curiosity are the starting point. Therefore, university research can

sometimes lead to a discovery that would not be possible if one were only concerned about the market or business feasibility. From a corporate viewpoint, reaping the fruits of such research activities could lead to more academic-industrial collaboration.

Research on organic electronics leads to a better understanding of humans

What is the roadmap to commercialization, and what is your dream?

Someya: Among the ideas we have been researching, some are finally entering the commercialization stage and are approaching the verification phase. Therefore, I want to expand collaboration with outside organizations to move towards verification.

For example, we have received an offer from a hospital to immediately start a trial of a device that involves applying a stretchable sensor directly to the skin. However, we can make only a small number of prototypes at the university.

To validate the usefulness of a product, we need a technology that will allow us to produce 100, or in some cases 1,000, product prototypes with a reasonable level of quality. Universities are limited in this sense. I think that bridging the gap between universities and corporations, and fostering more academic-industrial collaboration, will help technology advance.

What is your dream?

Someya: My research is extremely focused on producer-driven solutions. The starting point of my research is how to produce soft devices with the idea that they could become one of

the major means of narrowing the gap between artificial things and living organisms. The research on narrowing that gap must first identify exactly where the gap exists.

Obtaining information from a human body involves measuring what kinds of signals the body is emitting, and what kind of activity the person is engaged in while living in a natural state. This information can yield a better understanding of human beings. So improving the performance of semiconductor devices can deepen our understanding of human beings. This relationship is quite intriguing, isn't it?

Since measuring and understanding the activities of human bodies in their natural state requires carrying out a long-term plan, what I can hope to accomplish in the remaining years of my career is limited. I hope the members of our lab will continue this research based on their own interests, so that the project keeps evolving even after I stop being an active researcher.

I think the term “flexible electronics,” which is being used right now, will disappear in the future. That is, nearly all electronic devices will begin to use flexible technology, making the term redundant. Even though flexible circuit boards are currently used in devices such as smartphones, most consumers do not realize that their devices use flexible electronics. As these technologies advance, flexible sensors and semiconductors will continue to be incorporated into people's daily lives without their realizing it. When that happens, as a future development of wearable devices, devices

will be capable of collecting data from various symptoms users are experiencing - such as how well the wearer is coping with stress, and any resulting rise or fall in blood pressure. Data collected via such a device will be able to add a scientific basis to measurements of human behavior and essential characteristics.

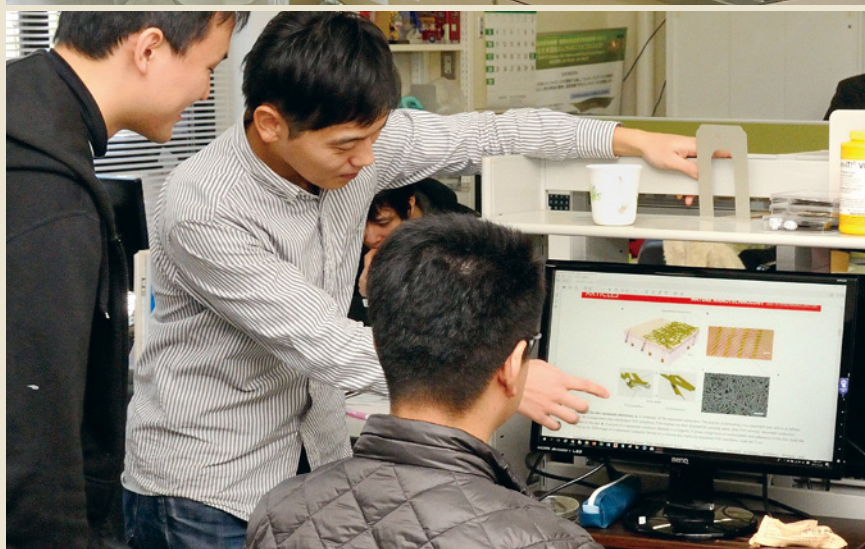
I hope for further advances in research on wearable devices, such as a new scientific measurement method that will lead to a more essential understanding of what it means to be human. That is my dream.

We need technologies and devices that support individual customization

What would you like ULVAC to do?

Someya: Wearable devices for humans need to be custom-made for each individual. One thing I would like ULVAC to do is develop manufacturing technologies capable of inexpensively customizing electronic parts to fit the wearer's body. This is not limited to ULVAC equipment. I think we will see increasing demand for such equipment throughout the industry.

During the course of my research on skin-like flexible sensors, they have been made manually one by one, like artisanal pieces. We cannot produce a large volume of industrial products this way. I would like to ask ULVAC to develop equipment that could inexpensively maintain high throughput while keeping a high yield, and that would keep costs low even when making different devices to suit different individuals.



More than two-thirds of the members of the Someya Lab are students from other countries. Citizenship is varied, and therefore research discussions are carried out in English, as a rule. The power of the world's young people is working to open the door to a bright future through research on "intriguing" devices.

Elastic Conductor with Highest Performance in the World

Promising application to new materials based on discovery of natural formation of silver nanoparticles in rubber

Takao Someya (Professor, Graduate School of Engineering, University of Tokyo)
Naoji Matsuhisa (PhD Candidate in Electrical Engineering, Graduate School of Engineering, University of Tokyo)

We have succeeded in developing an elastic conductor that demonstrates the world's highest conductivity of 935 S/cm, even when stretched to five times its original length. This elastic conductor can be used to make free-form wiring patterns, using a printing technique to apply a paste material onto an elastic material such as rubber or a textile. When we observed the structure of the new material using a high-resolution electron microscope, we discovered a phenomenon in which simply mixing micrometer-sized silver flakes into rubber caused nanometer-sized silver particles to naturally and uniformly occur inside the rubber.

Printable elastic conductors represent a technology that will be essential for achieving sportswear-type wearable devices requiring a high degree of stretchability, as well as artificial skin for robots, which requires a higher degree of stretchability than human skin. Conventional elastic conductors had a problem in that their conductivity dropped significantly when stretched, but this problem can be solved by the new phenomenon discovered in our research. Our research findings make it possible to easily form highly stretchable sensors on sportswear and the joints of robots. These are expected to be utilized in a variety of applications in the future, such as healthcare and artificial tactile sensing.

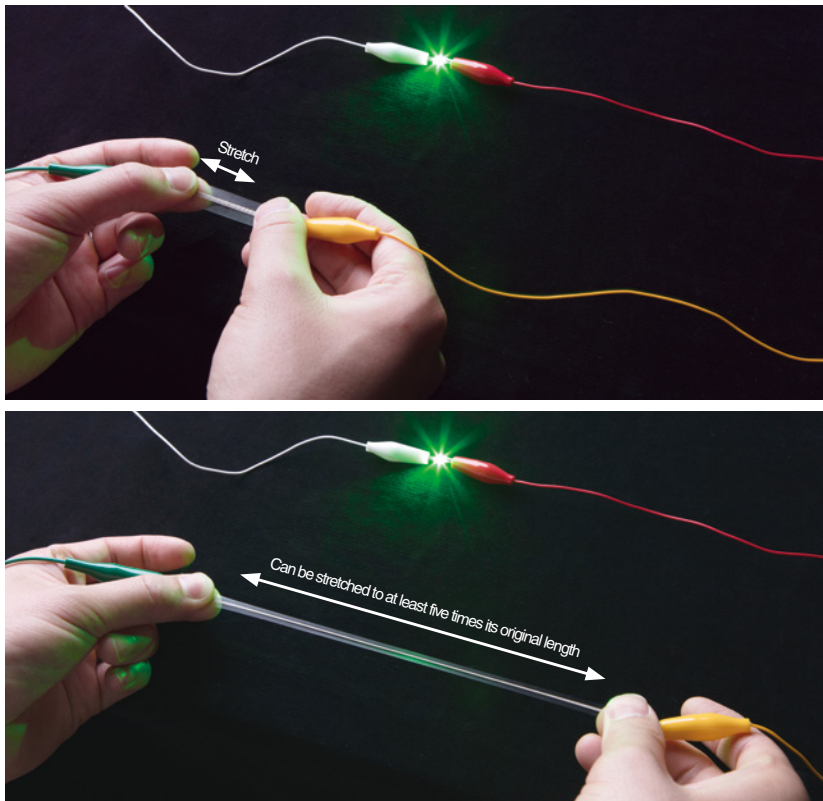


Figure 1: Since the elastic conductor printed on a rubber sheet maintains a high degree of conductivity even when stretched to five times its original length, it is still capable of brightly illuminating a light-emitting diode (LED). The top photo shows the conductor's original state; the bottom photo shows the results of its being stretched to at least five times its original length.

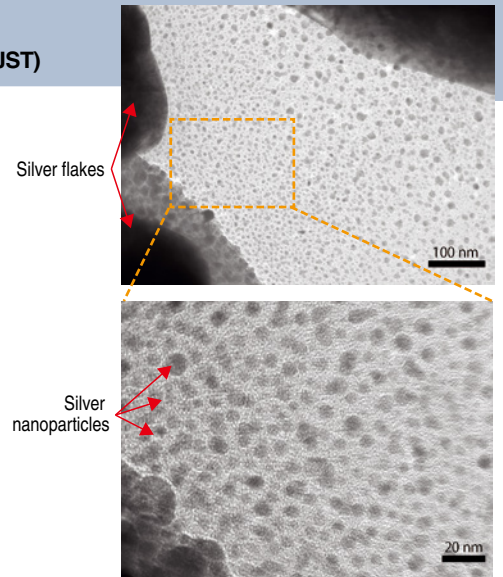


Figure 2: Transmission electron microscope (TEM) image of the newly-developed elastic conductor. High-density silver nanoparticles naturally formed among silver flakes are uniformly dispersed.

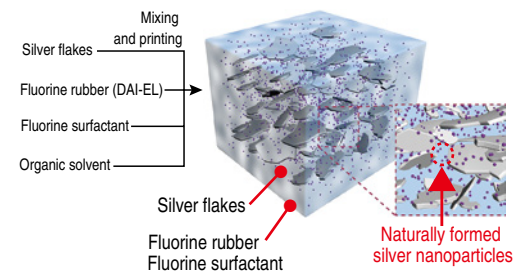


Figure 3: This figure shows a schematic diagram of the production process for the newly developed elastic conductor and its material structure. Silver nanoparticles, which were not originally contained in the material, form naturally inside the fluorine rubber. DAI-EL is the name of a product made by Daikin Industries, Ltd.

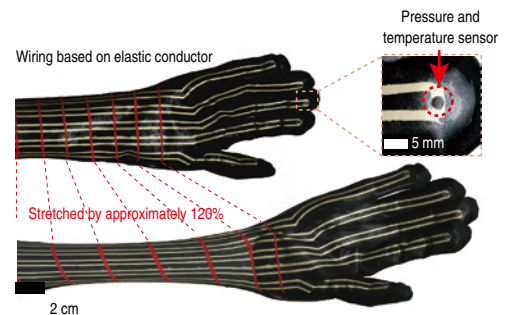


Figure 4: Elastic pressure and temperature sensor made by printing. It can be easily affixed to a textile substrate using hot melt adhesive.

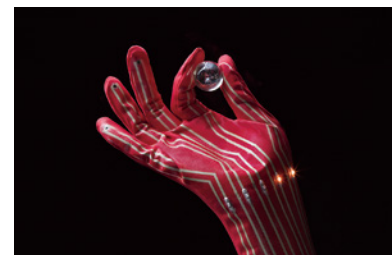


Figure 5: Sensors mounted on the fingertips of a glove are used to measure the intensity of the pressure at the fingertips, and the LED illumination intensity varies accordingly. This makes it possible to know how strongly force is being applied, which image data cannot indicate.

Wearable nanomesh sensor that allows the skin to breathe naturally

Promising for long-term health monitoring because the sensor does not cause inflammation, even after being worn on the skin for a week

Takao Someya (Professor, Graduate School of Engineering, University of Tokyo)

Masayuki Amagai (Professor, School of Medicine, Keio University)

We have successfully developed a nanomesh electrode that does not cause any apparent inflammation, even after being continuously worn on the skin for a week. It is so light and thin that users forget they even have it on. This electrode (hereafter referred to as "nanomesh electrode") was constructed from nano-scale meshes containing gold and a polymer, polyvinyl alcohol (PVA)—materials considered safe and biologically compatible with the body. This nanomesh electrode can be easily applied to the skin using a tiny amount of water. We conducted a week-long patch test—for irritation and skin allergies—on 20 subjects and detected no apparent inflammation on the participants' skin. We were able to achieve this high level of biological compatibility because the nanomesh structure is highly gas permeable, allowing the skin to breathe naturally, which could not be achieved using conventional substrates made of film or rubber sheet.



Figure 1: Wearable nanomesh electrode affixed to an index finger, with power supplied from a flexible battery that turns on an LED

Furthermore, we measured changes in resistance when the nanomesh electrode came into contact with or was removed from a conductive material such as metal, and we verified the operation of the temperature and pressure sensor. We also measured the electrical activity of arm muscles to prove the nanomesh electrode's applicability to health monitoring. The electrode does not cause inflammation, even after being continuously worn on the skin for a week, and is so light and thin that users forget they even have it on. Thus, the nanomesh electrode represents an essential technology for making long-term measurements in medical applications, and for achieving detailed analyses of bodily motions in sports. It can be expected to be utilized in a variety of applications in the future.

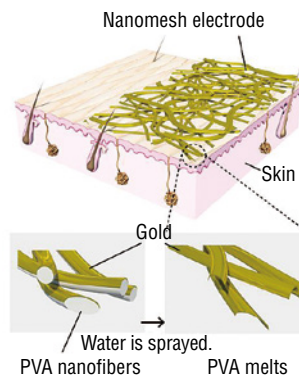


Figure 2: Nanomesh electrode structure and how it is worn. Nanomesh structure in a sheet form constructed from gold and polyvinyl alcohol (PVA)—materials considered safe and biologically compatible with the body—can be affixed to the skin by placing it on the skin and then spraying a tiny amount of water.

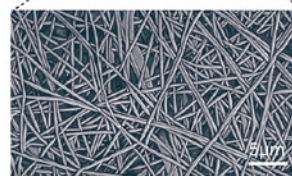
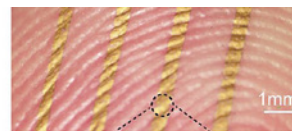


Figure 3: Nanomesh electrode applied to the fingerprint side of a finger (top); a scanning electron microscope (SEM) image of an electrode formed on a skin replica (bottom). This shows a state in which 300- to 500-nm mesh conductors are intertwined.



Figure 4: Wearable nanomesh electrode applied to the back of a hand. The electrode closely follows the skin contours. It lets the skin breathe naturally and is so thin and light that wearers forget they have it on.

Developing Sabatoba: An Innovative Way to Preserve Mackerel at Room Temperature

— Yuru Dry® Vacuum Food Drying Technology Brings New Culinary Life to Aomori's Hachinohe City!

MARUKANE, LLC (Hachinohe City, Aomori Prefecture)



The new “golden sabatoba.” Soft and tender, and it can be kept at room temperature!

Workers carefully and precisely process the mackerel one by one. In 2015, Aomori Prefecture certified the Shimesaba Production Department as A-HACCP, making it the first in Hachinohe to gain this distinction.

Saba, or mackerel, is a very widely-consumed fish worldwide, along with tuna and horse mackerel. Mackerel is a versatile fish that can be eaten grilled, dried, or pickled. In terms of nutrition, it is well-known for containing generous amounts of highly unsaturated fatty acids such as docosahexaenoic acid (DHA) and eicosapentaenoic acid (EHA), which can help prevent health problems like arteriosclerosis and thrombosis. Despite its health benefits, mackerel does not appeal to everyone due to perceived drawbacks such as its odor or short shelf life.

The water temperature at Aomori's Hachinohe Port, located at the northernmost tip of Honshu, is so low that the hachinohe maekisaba fish caught from autumn to winter are rated as having the highest fat content of all mackerel in Japan. This fat is quite healthy but also quick to oxidize, which until now has limited the available options for processing these mackerel.

Located a stone's throw from Hachinohe Port, MARUKANE LLC (hereinafter, Marukane) specializes in processed seafood products. It develops, produces, and sells a number of easy-to-eat products that have managed to overcome the shortcomings of mackerel. For example, Marukane has recently developed sabatoba, which can be stored at room temperature. For these efforts, the company was awarded the innovation special prize of the 2017 Aomori Industry, Academia, and Government Gold Collaboration Innovation Awards. LIVING & ULVAC took the opportunity to interview Mr. Kaneo Akiyama, a Marukane representative.



Marukane representative Mr. Kaneo Akiyama (left) and factory director Mr. Toshihiro Ohama

Company Profile

Company Name: MARUKANE LLC
 Home Office: 5-5-4 Minatotakadai, Hachinohe City, Aomori Prefecture
 Tel: +81-178-32-0196
 Locations: Shinminato Daiichi Food Factory, Shinminato Daini Food Factory, Shinminato Sales Office
 Representative: Kaneo Akiyama
 Established: July 6, 2011
 Business Areas: Production and sale of processed seafood products

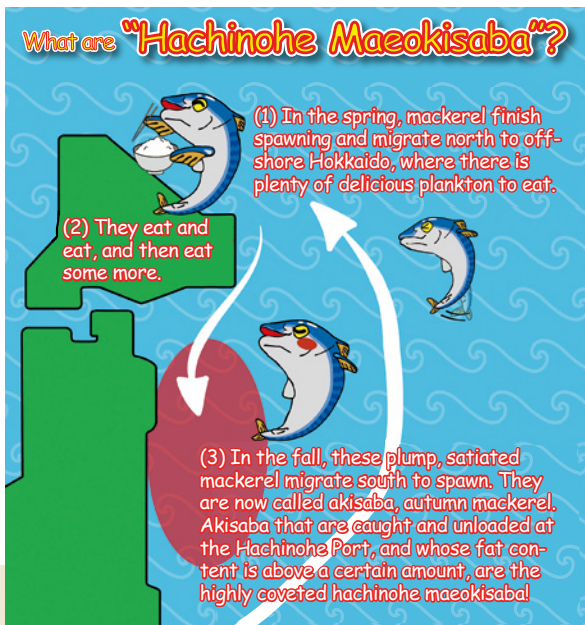


Marukane started from zero after the Great East Japan Earthquake. It now sells the best hachinohe maeokisaba mackerel in the country at one of Japan's largest markets, Tatehana Ganpeki Morning Market

Marukane was established only four months after the Great East Japan Earthquake, which occurred on March 11, 2011. The local fish processing company where Mr. Kaneo Akiyama worked at the

time suffered severe damage, causing Mr. Akiyama to lose his job. However, customer demand for Hachinohe mackerel was high. This inspired Mr. Akiyama to partner with Mr. Toshihiro Ohama (now Marukane's factory director) to launch a company. With little more than knives and cutting boards and a corner of a factory to call their own, the two began producing and selling processed seafood products immediately after the earthquake. They started sales by opening a stall at the largest Sunday morning market in Japan, Tatehana Ganpeki. Early every Sunday morning, over 10,000 visitors flock to this market held along the harbor wall of the town Shinminato in Hachinohe. The line of more than 300 stalls stretches 800 meters. This morning market played a major role in revitalizing the disaster-stricken region, and Mr. Akiyama launched his business as a way of contributing to the community. In addition to Marukane's Sunday morning market stall, the company has set up a direct sales office, Asaichiya, at the JR Hachinohe Station, as well as a home office, Marukane Kitchen. These three locations provide the company with valued opportunities to hear customers' voices. Conversations with customers at these shops have led to ideas for new products. Some products are also available for purchase online.

Marukane products use torosaba and hachinohe maeokisaba. Torosaba is a general term that refers to mackerel with a high fat content. Hachinohe maeokisaba refers to mackerel that is caught north of offshore Sanriku in Japanese waters, and is unloaded at Hachinohe Port during an official period of time certified by the Brand Promotion Council. This brand of mackerel is larger than average, with some weighing in at over 600 grams, and has been rated as having the highest fat content of all mackerel in Japan. The Hachinohe Port is the northernmost fishing ground in Honshu, and the water temperature there drops sharply in September. This accounts for the fish's high fat content. The Marukane factory is located directly facing Hachinohe Port. Mackerel unloaded at the port are immediately processed to be delivered to our dinner tables.



The stall at Japan's largest morning market, the Tatehana Ganpeki Morning Market, which receives over 10,000 visitors every Sunday



Hachinohe maeokisaba, the brand with the highest fat content of all mackerel in Japan



Marukane Kitchen (home office)



The direct sales office, Asaichiya, located in front of the Ekimae Yokocho Youtree (the Hachinohe Regional Industrial Promotion Center)



Marukane's online shop
<https://www.saba-marukane.com/>

**The human innovation behind the flavor:
 An original formula based on the Kamiwaza® technique and Just In Time principle**

The water content in mackerel is high, which can cause the meat to fall apart or the skin to peel when the fish is grilled and cut with a knife. Marukane addressed this issue by devising the Kamiwaza® technique: each cut mackerel is first coated with the company's proprietary blended powder seasoning, then wrapped in a paper towel and left overnight. This process removes excess moisture, enhances the refreshing texture of the fish, and concentrates its flavor as if the fish had been dried overnight using a traditional method.

At the factory, Marukane aims to recreate the process that cooks use when preparing and serving food right in front of the customer. To this end, the company carefully processes each piece by hand. Although this method may seem inefficient at first glance, it allows each delicate piece of fish to be processed quickly in small lots. Few fish are damaged, which lowers the defect rate and thus actually increases efficiency. The Just In Time principle of "only producing the right product at the right time" has allowed the company to deliver fresh and safe products to satisfied customers.

Marukane has developed one innovative and original product after another, such as its saba garlic miso (developed jointly with Hachinohe Technical High School), which uses garlic grown locally in Aomori Prefecture; its saba apricot miso, which uses locally grown apricots; and its fatty pickled saba, which has a slightly acidic and sashimi-like flavor. By listening and responding to customer suggestions, and by insisting on using only ingredients that are produced locally in Aomori Prefecture, Marukane has created these and many more original products.

**Sabatoba: Room temperature preservation
 Keeping fish moist and tender with Yuru Dry® vacuum food drying technology
 Industry, Academia, and Government Gold Collaboration Innovation**

As part of an effort to revitalize regional industry, Iwate University, ULVAC Tohoku, Inc. and ULVAC, Inc. partnered with Marukane to develop a new product called "golden sabatoba." Golden sabatoba is processed mackerel prepared using ULVAC's Yuru Dry® vacuum food drying technology to lock in the soft, tender texture of the fish and concentrate its flavor to an extent unachievable through previous methods (such as sun drying, cold-air and hot-air drying,

freeze drying, etc.), while preparing the product for long-term storage at room temperature. While the well-known saketoba (salmon toba) can be processed using conventional methods, mackerel is not quite so lucky. The rich fat content of the fish leads to oxidation, the effects of which prevent easy processing. With Marukane's method, each mackerel is deftly cut into three pieces, deboned, seasoned with the least possible amount of salt, and placed in a vacuum unit to dry. The vacuum state allows the fish to dry at a low temperature and locks in its flavor by preventing the fat from oxidizing. This vacuum state is controlled in order to produce a delicious finished product that is easy to enjoy. Refrigeration or freezing used to be essential for transporting mackerel, resulting in a fish that looked fresh but had actually gone bad due to a rapid, inevitable decline in freshness. This new method, on the other hand, allows mackerel to be transported safely at room temperature and maintains its health benefits as well as its fresh texture and flavor.

For these efforts, Marukane was awarded the special prize of the 2017 Aomori Industry, Academia, and Government Gold Collaboration Innovation Awards. The company is driven by its strong desire to revitalize local industry and help the Tohoku region recover from the disaster. This drive will lead Marukane to explore new possibilities in a wide range of applications in order to expand its distribution area and offer specialty products from regions throughout Japan. Mr. Akiyama said, "Given how far we've come with mackerel, which is notoriously difficult to process, we should be able to apply this technique to a wide range of other marine products. We would also like to apply it to fruit and to other Aomori agricultural products. We want to deliver more flavor to more people." And thus Marukane will continue on its path of innovation.



ULVAC's Yuru Dry® vacuum food drying technology being used to process golden sabatoba

* Trademark registered in 2015. Patent pending

Introducing Japan's Two Main Production Facilities

TOHOKU KYUSHU

ULVAC TOHOKU, Inc. (ULVAC Tohoku) functions as a production center for ULVAC, Inc., with its headquarters and factory in an industrial park in Hachinohe City, Aomori Prefecture. Hachinohe is home to Hachinohe Port, which functions as both a fisheries port and an industrial port. Large-scale equipment is exported from this port to locations around the world. In this edition of VISITING ULVAC, we asked Kazuo Ikeda, ULVAC Tohoku's President and CEO, about current operations and his vision for the future.



ULVAC TOHOKU, Inc.

www.ulvac-tohoku.com

6-1-16 Kita Inter Kogyo Danchi, Hachinohe, Aomori, Japan

Tel: +81-178-28-7733

Producing the World's First G10.5 by "Conceptualizing Production Technology" Leading the Flat Panel Display Industry as Products Become Large-Scale

— Implementing cost reduction by pursuing production technology strengths



Company building
and cherry blossoms

With Hachinohe Port only a ten-minute drive away, ULVAC Tohoku is well-situated for exporting and importing.



Vacuum chamber soldering



Soldering sites with multiple vacuum chambers



Large-scale equipment uses many power sources

View of production facility for G10.5 LCD manufacturing equipment

Introduction

ULVAC Tohoku was established as Tohoku Vacuum Engineering Corporation in 1987. Its main business was the manufacture of vacuum heat-treatment furnaces for automobile parts, aimed at boosting the production capabilities of large-scale equipment produced by Japan Vacuum Engineering Co. Ltd. (now ULVAC, Inc.). Later, it expanded its business to include flat panel display (FPD) and electronic component manufacturing equipment, semiconductor fabrication diffusion furnaces, and decompression CVD systems. In 2010, the materials unit was consolidated.

At present, the company is engaged in an integrated production system for its various business areas: the equipment business (FPD, semiconductor fabrication equipment, general industrial equipment, etc.), the processing business (such as vacuum chambers), and the materials business (targeted toward semiconductor and electronic components and FPD).

In recent years, ULVAC Tohoku has become skilled in precision processing for increasingly large-scale equipment by producing G10.5 liquid crystal display fabrication equipment. It has become an important production site within the ULVAC Group, with FPD manufacturing equipment bringing in over 70% of the company's revenues.

As of May 2018, the company has 498 million yen in capital and 336 employees.

The only factory where G10.5 LCD manufacturing equipment production is possible

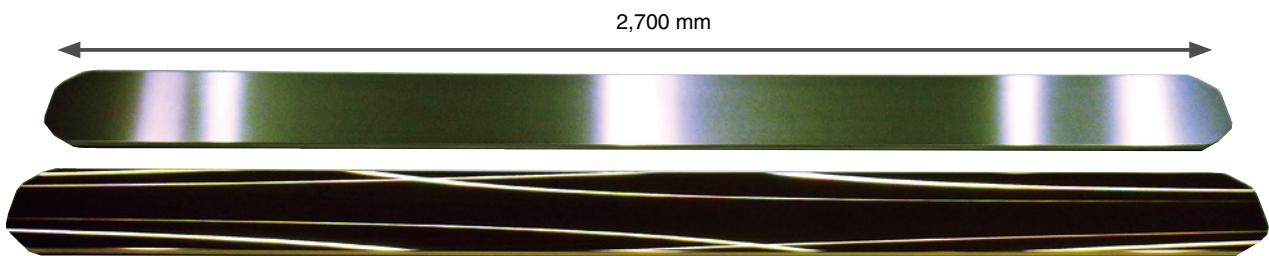
In 2016, ULVAC Tohoku became the world's first company to launch manufacturing of the "SMD-3400" sputtering system

for the manufacture of G10.5 liquid crystal displays. Since its introduction in 1992, this "SMD Series" has held more than 80% of the world's market share for sputtering systems designed for LCD manufacture (for TFT array), and in 2012 it delivered over 1,000 units. The latest model, "SMD-3400," has a height of 5 m and a length of approximately 35 m.

Among the ULVAC Group companies, FPD manufacturing equipment is produced by ULVAC Kyushu (in Kirishima City, Kagoshima) and at our group's companies in Korea, Taiwan, and China, but ULVAC Tohoku is the only place where G10.5 LCD manufacturing equipment is produced.

Normally, as the size of the glass substrate becomes larger, the equipment becomes larger as well, requiring the expansion of factory facilities. But at ULVAC Tohoku, G10.5 is produced using the same facility as G6* production. We were able to do this by asking ourselves the question: "How can we produce a larger glass substrate within the limited space of our factory?" Instead of investing in a larger facility, employees brainstormed with each other and found ways to respond gradually to increasing equipment sizes by "development of new production technology" for G6, G8*, and G10.5.

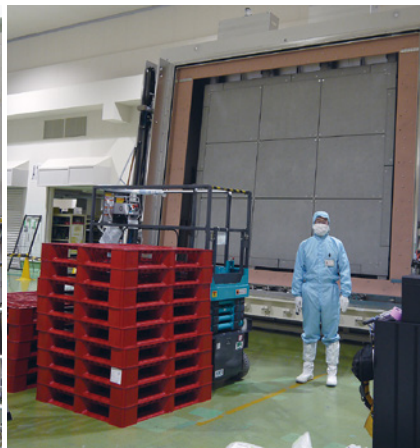
Furthermore, larger equipment tends to limit the number of partner companies that can be involved in production processes. But ULVAC Tohoku has achieved efficiency in the work process and a reduction in shipping costs by stationing the company in charge of surface processing (electrolytic polishing) within its grounds. This has allowed for mechanical processing of large-scale equipment, surface polishing (electrolytic polishing), and assembly of the equipment.



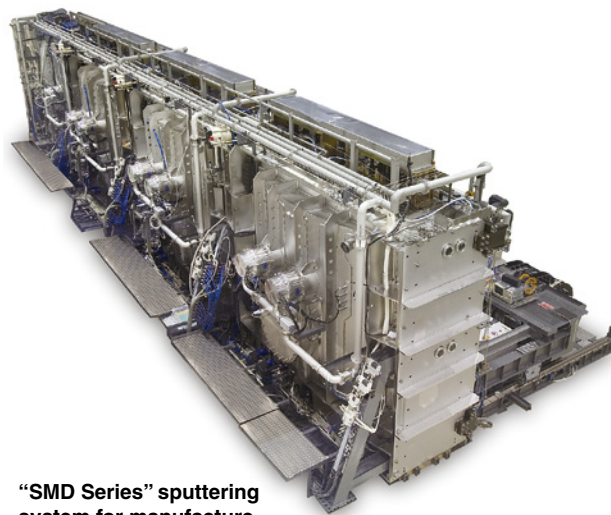
Target material for G8 liquid crystal display manufacturing equipment (from top: MoTi, Cu)



Assembly in clean room



Equipment height can reach 5 m



“SMD Series” sputtering system for manufacture of liquid crystal displays

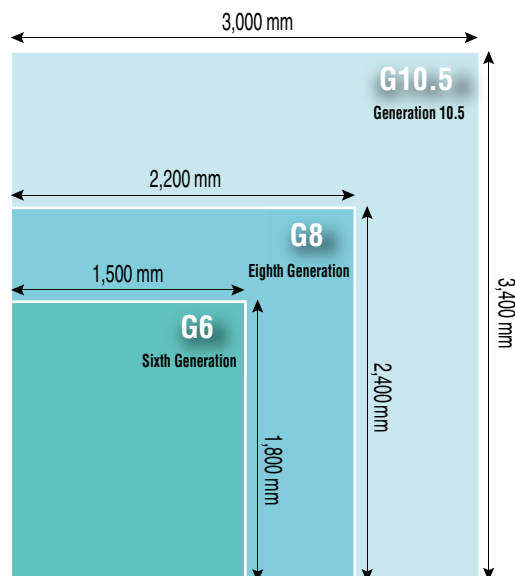
Aiming to become a “model factory” for a shared services company with advances in production engineering capabilities

Processing techniques involve high levels of technical skill, which workers gain only through extensive training. In particular, soldering for vacuum equipment requires a level of technical expertise that, until very recently, depended largely on an individual worker’s abilities. We are training technicians by turning production techniques into “formalized knowledge,” so that in the future, the desired quality standard can be maintained regardless of the worker’s abilities. We are also building a smart factory system that allows real-time information sharing and maintenance by advancing “explicit knowledge” for test data and tracking the progress of certain processes.

ULVAC Tohoku is not merely a production sharing facility. It promotes “conceptualizing production technology” by leveraging its experience and tenacity in becoming the world’s first G10.5 manufacturer. President Ikeda speaks enthusiastically [pictured at right] about ULVAC Tohoku’s production technology.

The ULVAC Group companies “want to learn from ULVAC Tohoku’s ‘monozukuri’ methods,” making Tohoku the ULVAC Group’s “model factory.”

* Substrate size



• Future Vision •

ULVAC Tohoku:
Pioneering spirit
ULVAC Kyushu:
Explosive power
Harnessing the strengths
of both companies



ULVAC TOHOKU, Inc.
President and CEO
Kazuo Ikeda

Since FY 2017 I have been president of ULVAC Tohoku, and for a year I have had a joint appointment as president of both ULVAC Tohoku and ULVAC Kyushu. Being in charge of these two companies with entirely different sets of characteristics has been invigorating.

The strength of ULVAC Tohoku is its pioneering spirit. No one there says something can’t be done, even if Tohoku is the first of the Group companies to take on a task or type of production. Tohoku employees think about what needs to be done, and then work earnestly, persistently and diligently to make it possible. The people at ULVAC Kyushu, on the other hand, are very lively. They argue passionately until something has been decided. But once a decision has been made, they have the explosive power needed to sprint ahead as one.

A key strength of both of these companies, Tohoku and Kyushu, is their ability to grow by taking advantage of each other’s standout capabilities.

**Introducing
Japan's Two Main
Production Facilities**
TOHOKU KYUSHU

ULVAC KYUSHU CORPORATION (ULVAC Kyushu) is located in Yokogawa-cho, within the Kokubu Hayato Technopolis, with a view of the Kirishima mountain range. It is a convenient twenty-minute drive from Kagoshima Airport and a five-minute drive from the Yokogawa interchange of the Kyushu Expressway. Since the opening of the ULVAC Kagoshima Industrial Park in 1982, the company has grown with the development of Kyushu, which is often referred to as "Silicon Island," by producing semiconductor manufacturing equipment. In this edition of VISITING ULVAC, we introduce ULVAC Kyushu, one of ULVAC Group's two major domestic production facilities.

ULVAC KYUSHU CORPORATION

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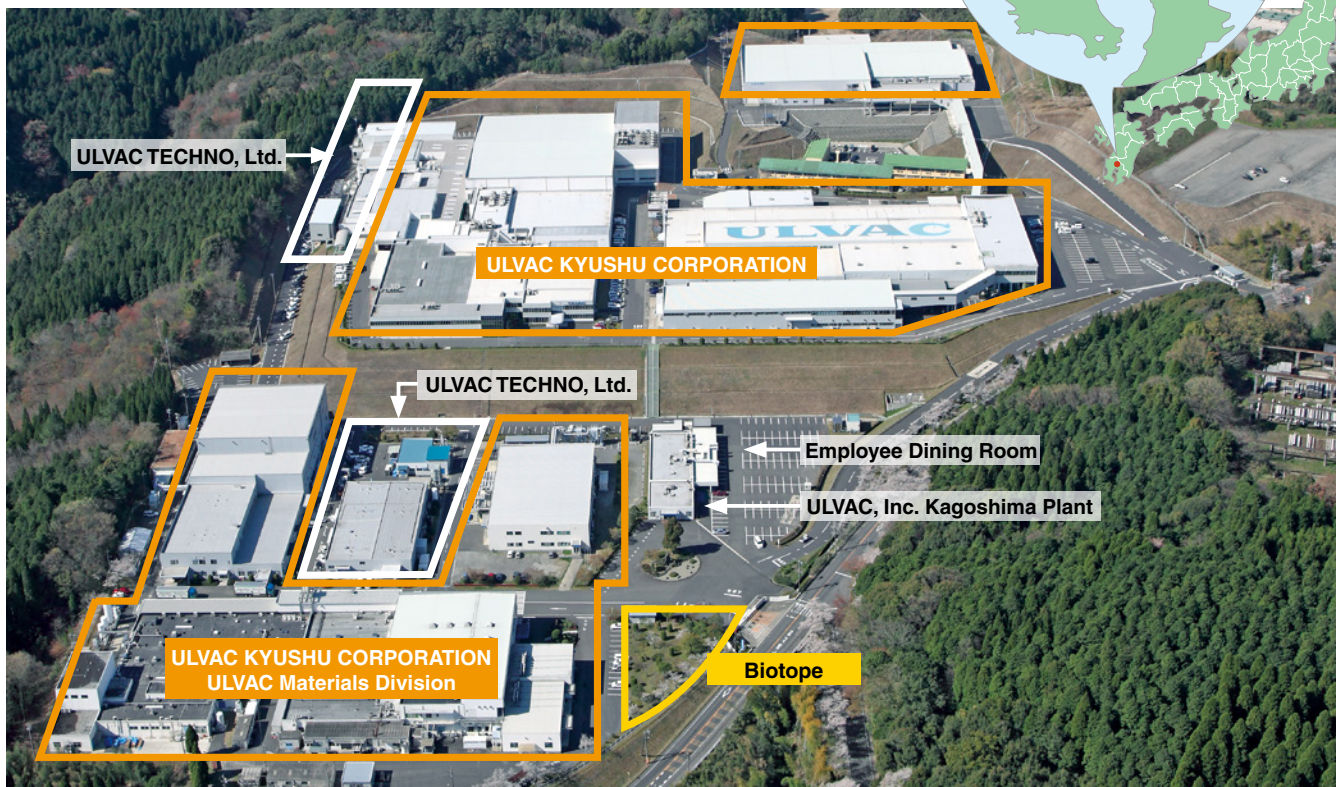
ULVAC, Inc. KAGOSHIMA PLANT

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Driving the ULVAC Group's Global Supply System

— Aiming to become the "mother ship" of the shared services corporation with advanced technology and development capabilities cultivated by producing semiconductor manufacturing equipment



Headquarters factory exterior



Testing sputtering target material



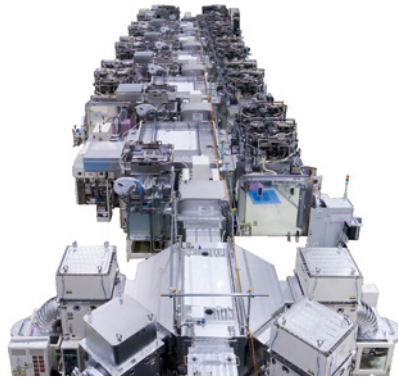
Kumamoto Processing Technology Center



Manufacturing of large-scale vacuum equipment



“QAM Series” vacuum deposition system for research and development



“ZELDA Series” organic EL manufacturing equipment



ULVAC Kyushu manufactures “ENTRON™ Series” sputtering system for semiconductor manufacturing, for delivery to a major U.S. semiconductor manufacturer

Introduction

ULVAC Kyushu was established in 1977 as Kyushu ULVAC Corporation, a sales company. In 1981, it changed its name to ULVAC KYUSHU CORPORATION and expanded its business to shared production of various equipment and after-sales service for Japan Vacuum Engineering Co., Ltd (now ULVAC, Inc.).

In 2003, the vacuum equipment production plants at several Kyushu locations (Oita, Kumamoto, Kagoshima) were consolidated at the Kagoshima site. In 2010, the sales unit was shifted to ULVAC ES Corporation (now ULVAC EQUIPMENT SALES, Inc.) and the service, surface treatment, and wet cleaning businesses were transferred to ULVAC TECHNO, Ltd. Merging with ULVAC Seiki Corporation, and adding a materials production division, the new ULVAC KYUSHU CORPORATION started operations. In the same year, the headquarters moved from Fukuoka to Kagoshima, where it operates today.

Currently, ULVAC Kyushu engages in equipment production for semiconductors, electronics components, FPD manufacturing equipment, and general production equipment; and component production and machine processing for various types of vacuum pumps and valves.

As of May 2018, the company has 490 million yen in capital and 378 employees.

Strengthening global alliances through interaction with Group companies

Using production techniques cultivated by producing semiconductor manufacturing equipment in accordance with strict customer requirements, and drawing upon its field support experience, the company has expanded to produce FPD manufacturing equipment, such as organic EL materials. It now delivers many types of equipment both domestically and abroad.

ULVAC Kyushu also participates in frequent personnel

exchanges with Group companies abroad. Since production of organic EL display manufacturing equipment is centered in ULVAC Kyushu but also takes place at facilities in Korea, Taiwan, and China, mutual visits between Group company employees for technical support are frequent. All work is performed following standardized procedures because modules produced at various domestic and overseas manufacturing facilities must be assembled at the customers’ sites. Therefore, close cooperation among Group companies is extremely important.

ULVAC Kyushu has gained its expertise in production techniques from its role in shared production. By sharing this know-how, it aims to be the “mother ship” of the overseas production locations, which will grow in the future.

Development of “QAM Series” vacuum film deposition system for R&D purposes

In 2014, ULVAC Kyushu developed the “QAM Series” vacuum deposition system for R&D purposes. This is small-scale vacuum deposition system for substrates of less than four inches, accommodating the needs of universities and research institutions and leveraging the rich deposition technology offered by the ULVAC Group. Low cost and high performance were achieved, and various functions can be added on after the equipment is purchased.

Thanks to the “Firefly Project,” fireflies flit around the factory grounds

At ULVAC’s Kagoshima Plant and ULVAC Kyushu, a biotope was constructed on the grounds using waste water from the factories with the aim of engaging in nature conservation and promoting corporate social responsibility. Fireflies are raised from the larval stage and can be seen flitting about each year. The companies also help local grade school students learn about the environment by inviting them to take part in the release of Japanese medaka fish into the water.



Festival at Nanpu community center. Involvement in the community is encouraged through a variety of activities: cleaning seniors’ homes and local areas, walking events in the local Yamagano district, and relay races with local people.



Biotope where fireflies fly



Releasing Japanese medaka fish

ULVAC's 9th President Takes Office

Aiming to create an *inspiring, stimulating* workplace that keeps growing

ULVAC, Inc.
President and CEO **Setsuo Iwashita**



My name is Setsuo Iwashita, and on July 1, 2017, I had the honor of being appointed ULVAC's president and CEO. As successor to Chairman of the Board Mr. Hisaharu Obinata, I will do my very best to steer this company toward further development.

In 1952, our business group was founded with the principle of "utilizing vacuum technology to contribute to industry." This principle inspired us to take on challenges boldly, and as a result, we developed Japan's first vacuum devices. The source of all this value creation came from people first and foremost. Based on this conviction, upon taking office as president, I called upon all of our group companies to create a growth-minded workplace where each individual employee engages in enjoyable and stimulating work. Our new medium-term management plan supports this, and aims to strengthen our management foundation with a focus on "developing human resources."

As the manufacturer of a full range of vacuum technology-related products, this group has grown and developed not only in the production of vacuum devices, components, and materials, but also in surface analysis and other areas. The synergistic effects that derive from all of our businesses collaborating and working together is one of our key strengths. However, this is not enough. In order to accelerate the pace of our global development and expand the contributions that our vacuum technology is making to the field of industry, it is vital that all of our group companies be involved in each other's activities. They must deepen their understanding of other business domains and strengthen their horizontal connections. We will strive to enhance inner-group information sharing and communication functions, and we will promote personnel exchange so that we can develop human resources capable of working beyond the framework of the organization. This will help us build an environment in which synergistic creation can flourish - which, in turn, will lead us to our goal of making the most extensive use of vacuum technology.

I have personally observed our overseas activities for nearly 30 years. I spent some of those years managing our subsidiaries in China. This perspective has shown me that the ULVAC group can and will grow even further. My mission is to reorient the awareness of all employees, so that we think globally, strengthen our foundation for growth, and open up new possibilities for the company as a full-range vacuum manufacturer.

Profile of Setsuo Iwashita
Date of Birth: February 4, 1953
Hometown: Kumamoto Prefecture

Career Overview

- Mar. 1978: Graduated from the Faculty of Science at Kagoshima University
- Mar. 1984: Joined ULVAC
- Aug. 1992: Manager of Beijing Business Office and Shanghai Business Office, Overseas Operations Division
- Sept. 1995: Director and CEO of ULVAC (NINGBO) Co., Ltd.
- July 1998: General Manager for Chinese Region, Asia Division
- Mar. 2006: Director and CEO of ULVAC (CHINA) HOLDING Co., Ltd.
- Oct. 2006: Chairman of ULVAC (Shanghai) Trading Co., Ltd
Chairman of ULVAC (SUZHOU) Co., Ltd.
- Sept. 2011: Director of the Company
- Sept/ 2013: Managing Executive Officer
- July 2015: Senior Managing Executive Officer Chairman of ULVAC (CHINA) HOLDING Co., Ltd.
- Sept. 2016: Director and Senior Managing Executive Officer of the Company
- July 2017: President and Chief Executive Officer (current position)

... My motto ...

"Opportunities of time vouchsafed by Heaven are not equal to advantages of situation afforded by the Earth, and advantages of situation afforded by the Earth are not equal to the union arising from the accord of Men." (Mencius) It is important to answer when opportunity knocks, but to get there first, you need to prepare and be in the right position. Don't just wait for opportunity to come to you - take action to go and find it. Human effort is more important than anything else. We should discover and develop our individual strengths, and we should value communication highly. I would like to focus on human resource development and create a company in which everyone can play an active role.

... In my free time ...

My passion is to communicate with anyone and everyone. I also enjoy dining out often. When I was in college, I practiced Okinawan karate. Currently, I work out at the gym to stay healthy and keep my brain active.



Certified by Japan's Ministry of Economy, Trade, and Industry as a 2018 "White 500 Company" Having Outstanding Health and Productivity Management

— Health Management at ULVAC



President and CEO Setsuo Iwashita (left) and Personnel Department, Health Promotion Office Physician Hiroyasu Ito

On February 20, 2018, ULVAC was recognized as a 2018 "White 500 Company" Having Outstanding Health and Productivity Management. This certification is awarded jointly by the Ministry of Economy, Trade, and Industry and the Nippon Kenko Kaigi (Japan Health Conference). It honors large enterprises, SMEs, and other corporations that engage in superior health and productivity management through initiatives for overcoming health-related challenges in regional communities, or by promoting health-conscious activities led by the Nippon Kenko Kaigi. The certification committee gave ULVAC particularly high marks in the fields of management philosophy, policy and evaluation, and improvement.

Ito: ULVAC received the White 500 certification this year. What exactly does "health" mean in this context?

"Health" isn't simply the absence of illness. I believe it's also a state of "wellness"; when we know what will make for a more successful life, and we actively pursue that life. Mr. Iwashita, what state of health do you think is best for ULVAC?

Iwashita: Well, I think mental health is important. ULVAC's motto is "the

company will prosper or perish by its people." I want to create a growth-minded workplace where each individual employee engages in enjoyable and stimulating work.

Ito: How would you describe "enjoyable and stimulating"? Why is enjoyable and stimulating work important?

Iwashita: When we're happy or having fun, we get excited and are able to give 120%! I think that's how a workplace should be, too. That's what would make me happiest. I think that true health is a state in which we have a dream, our work is fun, and we look forward to going to work. I want everyone to feel a sense of accomplishment and to experience success. To get to that point, it's the



The footprints on the walkway represent proper stride lengths by height, to help employees be mindful of improving their posture and leg strength.

responsibility of management to start by getting to know in depth the atmosphere of the workplace and each individual employee's morale.

Ito: I agree. Healthy thinking on the part of an organization leads to healthy living. ULVAC is actively pursuing initiatives such as management-led organization revitalization programs, a walking plan in which many different company departments participate, and a cafeteria committee. Exercise directly activates the brain and thus is good for work efficiency. It can also serve as a catalyst for communication.

What sort of things are you doing to manage your health day to day?

Iwashita: I do quite a bit. I train at the gym, and I'm also getting into walking. It helps clear my head.

Ito: Yes, exercise is essential for good health. What sort of people are a good fit for ULVAC?

Iwashita: A wave of change is coming over our business environment right now, and this is the perfect opportunity for dramatic growth. I want each employee to have his or her own sense of purpose, and to hone personal strengths to work toward that purpose. I want everyone to take on new challenges without being afraid of failure. I believe that ULVAC can contribute to society and create value only when we are healthy and active in both body and mind, and when we demonstrate the full potential of our abilities. To achieve this, we must make the promotion of employee health a key management issue, and we must continue our current health management initiatives and develop new ones.

Ito: The company must create an even healthier environment and healthier systems. I hope we can have a workplace in which every individual asks himself or herself, "What can I do to help make the people around me healthy and active in both mind and body?", and then acts accordingly. We will continue to work towards achieving this environment.

ULVAC CRYOGENICS INCORPORATED

**Expanded Production of Cryopumps in China and Korea
Established Kyoto Cryogenic Technology R&D Center**



Kyoto Cryogenic Technology R&D Center



ULVAC CRYOGENICS KOREA INCORPORATED, exterior

With its expanded production of cryopumps, ULVAC CRYOGENICS INC. relocated Chinese affiliate ULVAC CRYOGENICS (NINGBO) INC. within the city of Ningbo in July 2017 and built an addition onto the ULVAC CRYOGENICS KOREA INC. building in April 2018. The company's share of the global market of cryopumps for production of flat panel displays is 90% or more.

The relocation and building addition increased the factory floor area by approximately 1.7 times in China and 1.9 times in Korea. In Korea, workbench heights on production lines were standardized and robotics were

introduced to reduce workloads, which increased production efficiency. In China, the goal is to expand production and upgrade services by installing automation equipment on the test line in order to eventually manufacture cryopumps domestically in China.

The company also established the Kyoto Cryogenic Technology R&D Center in the Kyoto Factory in November 2016. The company began to manufacture and sell 4K cryocoolers in 2009. It began to sell cryogenic equipment after taking over the manufacture and sales of cryogenic equipment from IWATANI INDUSTRIAL GASES CORPORATION in May 2014.

Cryogenics technology is becoming more important in a wide range of fields, from space engineering to medicine and general industry. It is being used in elementary particle research that attempts to explain the origins of the universe, as well as in quantum computers and in the search for new superconducting materials. Only high-performance cryogenics systems can be used in these applications, and in order to meet customer needs for such equipment, the Kyoto Cryogenic Technology R&D Center is working with the world's leading cryogenics technology centers on advanced product development.

- Number of employees (as of April 2018)
 - ULVAC CRYOGENICS INCORPORATED 130
 - ULVAC CRYOGENICS KOREA INCORPORATED 95
 - ULVAC CRYOGENICS (NINGBO) INCORPORATED 38



Cryopump assembly plant (Korea)



Compressor unit assembly (China)



Robot assistance reduces workloads (Korea)



ULVAC CRYOGENICS (NINGBO) INCORPORATED, exterior (1st and 2nd floors of the building)



Cryopump test (China)

- **Contact Information**
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ULVAC-PHI, Inc.

Relocation of Headquarters and Factory to the ULVAC Building Complex

— Potential Synergy Effect for ULVAC and ULVAC-PHI



Headquarters entrance



Product inspection



Equipment demonstration

ULVAC-PHI, Inc. was established in 1982 as a joint venture between Japan Vacuum Engineering Co., Ltd. (now ULVAC, Inc.) and the U.S. company Physical Electronics Inc., and is currently a wholly owned subsidiary of ULVAC. ULVAC-PHI is the world's leading manufacturer of surface analysis equipment using all three types of surface analysis: XPS, AES, and SIMS.

On August 15, 2017, ULVAC-PHI moved its headquarters and factory to a new location in the ULVAC building. The company's analytical laboratory,

which functions as a demonstration room, tripled in size. Each unit is now placed in a separate room, which provides a better environment in which to operate. Customers visiting the laboratory can also use the newly-added lounge to watch equipment demonstrations. The increase in the number of units from 7 to 10 has also allowed better customer service and application development.

The factory, previously located in two areas, is now integrated into one area, which has been equipped with new production facilities and cleanrooms,

contributing to improvements in productivity and efficiency.

ULVAC's Research & Development Division's analysis team also occupies the same floor as ULVAC-PHI's laboratory. The easier access to each other allowed by this arrangement should benefit both teams by increasing opportunities for collaboration in technical fields and other areas.

- Number of employees: 134 (as of April 2018)

- Analysis equipment in the lab (technique/models/quantity)
 - X-ray Photoelectron Spectroscopy (XPS) / 4 models / 6 units
 - Auger Electron Spectroscopy (AES) / 2 models / 2 units
 - Time-of-Flight Secondary Ion Mass Spectrometry (TOF-SIMS) / 1 model / 2 units



Factory integrated in one space



Individual room for each unit



Rest area in the analysis room

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“New Human Resource Center and Integrated Group Personnel Strategy Lead to Changes in Awareness and Sharing of Values”

— ULVAC, Inc.

ULVAC, Inc. established a new Human Resource Center in January 2018. Its purpose is to create a “corporate culture that strives to empower employees to be an active part of ULVAC’s next leap forward.” ULVAC’s Mid-Term Management Plan for FY2017 cites the creation of this culture as one of its objectives.

The business environment is experiencing a tumultuous wave of changes, but corporate development, technological innovation, and product competitiveness all still depend on people. People are the most important resource for the ULVAC Group. We intend to build a cross-Group personnel training system, to recruit and train global personnel, and to encourage personnel to engage actively with the outside world.

ULVAC Global Festival 2017

— ULVAC, Inc.



On November 11, 2017, at the Chigasaki Head Office and Factory, ULVAC, Inc. held the ULVAC Global Festival 2017 to thank all of its stakeholders.

On the day of the festival, there were factory tours, vacuum experiments, booths run by employees, mochi making, a Greenery Day corner, a gourmet grand prix by Japanese and overseas Group companies, and many other events. Over 5,000 people attended.

ULVAC Boy, a character unveiled at the festival, was also very popular, and many children had their pictures taken with him.

● **Contact Information**

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ULVAC and MIT Establish Hayashi-ULVAC MISTI Seed Fund

— ULVAC, Inc.

In June 2017, ULVAC, Inc. established the Hayashi-ULVAC MISTI Seed Fund to support collaborative research between researchers at the Massachusetts Institute of Technology

(MIT) and their counterparts in Japan. This initiative was made possible by the generosity of the late Dr. Chikara Hayashi, former ULVAC president, who established funding for it in 2008.

ULVAC has a rich history of collaboration with MIT that dates back to the company’s establishment. In its early years, ULVAC received support in the form of free technology from the National Research Corporation (NRC), founded by an MIT alumnus. ULVAC has established this Fund not only to give back to the MIT research community, but also to build a bridge that will help maintain the close relationship between ULVAC and MIT and foster new exchanges.



Photo of a visit to MISTI in Boston, when the Hayashi MISTI Seed Fund was first established in October 2008 (the late President Chikara Hayashi is second from the left)

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Hayashi-ULVAC MISTI Seed Fund
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ulvac-hayashi-misti-seed-grant

Agreement Signed to Establish Joint Research Office with the Chinese Academy of Sciences’ Institute of Microelectronics

— ULVAC, Inc.



IMECAS, as China’s top semiconductor research institution, leads the Chinese semiconductor industry in the application of advanced manufacturing technology and new materials, and in the development of verification technology. As such, it will play an important role in future developments of the Chinese semiconductor industry.

In its ten-year Made in China 2025 plan, the Chinese government indicates its intention

to strengthen the semiconductor industry. The Chinese semiconductor industry is important to ULVAC not only as a market, but also as a partner for breaking new technological ground.

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The Driving Company for the Regional Future Award

— ULVAC KIKO, Inc.



In December 2017, ULVAC KIKO, Inc. was selected as 1 of 2,148 companies in Japan and 1 of 38 companies in Miyazaki Prefecture to receive the Future of the Earth Award from the Ministry of Economy, Trade and Industry. This award was established to promote the use of methods that encourage investment in the future of the Earth.

Companies that receive the Future of the Earth Award are very influential in their regional economies based on their business, employment, and sales, both regionally and beyond. They are expected to grow, and they play or have the potential to play a central role in the value chain of their regional economies. This award makes it easier for recipients to get support in the form of consulting on business strategy and sales development, relief for capital investments and tax burdens, and easing of regulations.

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Ceremony to Open New Factory in Shenyang, China

— ULVAC (Shenyang), Co., Ltd.



Laser show on large-screen display (beginning of ceremony)

ULVAC (Shenyang), Co., Ltd. held an opening ceremony for its new factory on November 22, 2017.

The new factory was built with the aim of enhancing development of ULVAC Shenyang, which was previously a joint venture and

became a wholly owned ULVAC subsidiary in October 2016.

Over 100 people came to the ceremony, including customers from across China, government officials, and representatives from ULVAC Group companies.

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Received LG Display Partner Growth Award

— **ULVAC KOREA, Ltd.**

On December 6, 2017 ULVAC KOREA, Ltd. received the LG Display Partner Growth Award from Korean FPD maker

● **New Products**

ULVAC, Inc.

Two Models of SOPHI Ion Implanter for Power Devices Developed



SOPHI-30

SOPHI-400

In July 2017, ULVAC, Inc. developed the SOPHI-30 low-acceleration ion implanter and SOPHI-400 high-acceleration ion implanter, both of which are compatible with ultra-thin wafers and can be used for power device manufacturing. The company is developing technology for power devices, including Insulated Gate Bipolar Transistors (IGBT), Silicon Carbide (SiC), and Gallium Nitride (GaN).

The SOPHI-30 low-acceleration, high-density ion implanter eliminates the disadvantages of previous implanters, makes low-acceleration, high-density processing possible in one-sixtieth of the previous time, and solves problems such as breakage of ultra-thin wafers in single-wafer processing.

The SOPHI-400 high-acceleration ion implanter makes improvements on many levels. It can process ultra-thin wafers with up to 2.4 MeV of energy using single-wafer processing, and can even form a field stop layer using hydrogen as a next generation process.

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To the left is Vice President and CPO of LG Display, Shin Sang-Moon. On the right is Chairman of ULVAC KOREA and Director and Managing Executive Officer of ULVAC, Dr. Choong Ryul Paik

LG Display for its outstanding contribution to FPD manufacturing. The award went to two material companies and three equipment companies. ULVAC KOREA received it in recognition of its quick delivery and process setup for generation 8.5 IGZO sputtering.

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ULVAC, Inc.

LS Series Dry Vacuum Pumps High Speed Pumping and Low Power Consumption



LS120A

In April 2018, ULVAC, Inc. launched sales of the LS Series dry vacuum pump. Ordinary low power consumption dry vacuum pumps tend to have low pumping speed at near atmospheric pressure, meaning that pumping takes a long time. In order to solve this issue, ULVAC developed the LS Series of dry vacuum pumps, which are designed for high pumping speed at low power consumption. ULVAC achieved a shorter pumping time by increasing pumping speed at near atmospheric pressure, and reduced power consumption by applying newly-developed proprietary technology.

There are four models in the LS Series with pumping speeds ranging from 120 to 1200 m³/h. The optimal pump model can be selected for the size of the customer's device and the conditions of use.

- Pumping speed: High pumping speed at near atmospheric pressure makes it possible to shorten pumping times.
- Lower power consumption: Power consumption at high pumping speed and ultimate pressure is an industry-leading 0.6 kW or less.
- Low noise: A built-in silencer keeps the noise level at 61 dB(A) or less.

● **Contact Information**

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■ **Japan**

- ULVAC, Inc.
- ULVAC TECHNO, Ltd.
- ULVAC KYUSHU CORPORATION
- ULVAC TOHOKU, Inc.
- ULVAC KIKO, Inc.
- ULVAC EQUIPMENT SALES, Inc.
- ULVAC CRYOGENICS INCORPORATED
- ULVAC-PHI, Inc.
- TIGOLD CORPORATION
- ULVAC COATING CORPORATION
- Nisshin Seigyo Co., LTD
- ULVAC Human Relations, Ltd.
- SHINKU CERAMICS CO., LTD.
- FINE SURFACE TECHNOLOGY CO., LTD.
- REJ Co., Ltd.
- SHOWA SHINKU CO., LTD.

■ **China**

- ULVAC (China) Holding Co., Ltd.
- ULVAC (NINGBO) Co., Ltd.
- ULVAC (SUZHOU) CO. LTD.
- ULVAC Orient (Chengdu) Co., Ltd.
- ULVAC Automation Technology (Shanghai) Corporation
- ULVAC Tianma Electric (Jingjiang) Co., Ltd.
- ULVAC (Shenyang) Co., Ltd.
- ULVAC (Shanghai) Trading Co., Ltd.
- ULVAC Materials (Suzhou) CO., LTD
- ULVAC Opto-electronics Thin Film Technology (Shenzhen) Co., Ltd.
- ULVAC CRYOGENICS (NINGBO) INCORPORATED
- ULVAC NONFERROUS METALS (NINGBO) CO., LTD.
- ULVAC Research Center SUZHOU Co., Ltd.
- Hong Kong ULVAC Co., Ltd.
- ULVAC VACUUM EQUIPMENT (SHANGHAI) CO.,LTD.

■ **Taiwan**

- ULVAC TAIWAN INC.
- ULTRA CLEAN PRECISION TECHNOLOGIES CORP.
- ULCOAT TAIWAN, Inc.
- ULVAC AUTOMATION TAIWAN Inc.
- ULVAC SOFTWARE CREATIVE TECHNOLOGY, CO.,LTD.
- ULVAC Materials Taiwan, Inc.

■ **South Korea**

- ULVAC KOREA, Ltd.
- Ulvac Korea Precision, Ltd.
- Pure Surface Technology, Ltd.
- ULVAC CRYOGENICS KOREA INCORPORATED
- ULVAC Materials Korea, Ltd.
- UF TECH, Ltd.

■ **Southeast Asia**

- ULVAC SINGAPORE PTE LTD
- ULVAC MALAYSIA SDN. BHD.
- ULVAC (THAILAND) LTD.

■ **North America**

- ULVAC Technologies, Inc.
- Physical Electronics USA, Inc.

■ **Europe**

- ULVAC GmbH

ULVAC WEBSITE:
<https://www.ulvac.co.jp/en/>
VACUUM MAGAZINE:
<https://www.ulvac.co.jp/wiki/en/>

Innovation Begins in a Vacuum

ULVAC's Vacuum Technology

We take for granted the tablet displays that we use everyday, but they would not work without the vacuum technologies supplied by ULVAC. The vacuum technologies that we have developed over the past 60 years are used in a wide range of areas, including semiconductors, electronic devices, flat-screen TVs, solar cells, automobiles, pharmaceuticals, and food products.

"The Ultimate in Vacuum Technology"

We will continue to push the envelope of vacuum technologies in step with innovations in related technologies.