

Scope

Kawasaki Heavy Industries Quarterly Newsletter

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Quarterly Newsletter

No. 121 Autumn 2019

Kawasaki Heavy Industries, Ltd. Editor-in-Chief: Takashi Torii. Corporate Communication Department. 1-14-5, Kaigan, Minato-ku, Tokyo 105-8315, Japan
Phone: 81-3-3435-2133 / Fax: 81-3-3432-4759 <https://global.kawasaki.com/en/corp/profile/contact/index.html>



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Special Feature
**Crushing Technology
that Revitalizes
the Earth**

EARTHTECHNICA's Crushing/Swelling
System that Enables the Utilization
of Plant Biomass

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Changing forward

Autumn 2019
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Crushing Technology that Revitalizes the Earth

EARTHTECHNICA's Crushing/Swelling System that Enables the Utilization of Plant Biomass

Crushing and pulverizing technologies that are used in many industries are now being applied to the utilization of plant biomass. These technologies are behind the activation of microbes that are reviving the power of the good earth.

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Compost that Revitalizes Soil and Supports Organic Farming

The Notsu District of Usuki City in Oita Prefecture is known as "a village of *Kicchom Minwa* (folktales about a witty man named Kicchom) and *Kakure Kirishitan* (underground Christians)." Here, Hiromi Fujishima, whom we interviewed in mid-June, owns a farm where we observed many cabbage butterflies hovering around his early summer vegetables.

"Because we don't use agrochemicals, they flock to the crops. In organic farming, insects are part of the cultivation cycle, but we limit crop damage by using agricultural nets and other means of control that do not require agrochemicals. It's labor-intensive work, but the resulting crops are tasty and full of nature's blessings," comments Fujishima.

His organic farming is supported by a matured compost called *Usuki Yume Taihi* ("Usuki Dream Compost"), produced by the Usuki Soil Manufacturing Center

which is run by the Usuki City Ecological Agriculture and Forestry Promotion Public Corporation. He annually uses about two tons of this compost per 1,000 m² for his 7,500 m² farm.

Most compost is made of livestock manure, but 80% of the Dream Compost derives from pruned trees and other plant biomass. In the compost-making process, the plants' main element, carbon, is turned into humus via microbial decomposition, greatly enhancing the soil's ability to nourish crops. This process restores the soil to

its natural, original state, or what Usuki farmers call "real soil."

The texture of the soil mixed with this compost is free-flowing, without the stickiness typical of soil amended with compost made from livestock manure. "You can tell that the compost's aggregate structure is changing the property of the soil. In this soil, vegetables grow stress-free," Fujishima says laughingly.

The manufacturer of the crushing/swelling system used for producing this compost is EARTHTECHNICA, a member of the



Hiromi Fujishima
Farmer, Representative of the
Hommamon Agricultural Crops
Promotion Network

About the Cover

A Shokusenki used at the Usuki Soil Manufacturing Center for manufacturing compost for soil conditioning. For details, see *Special Feature* (this page).



The Usuki Soil Manufacturing Center, located in the Notsu District, Usuki City, is a central facility for achieving an eco-system through organic farming.

Kawasaki Group. For the swelling treatment, the company offers a proprietary machine, the "Shokusenki," which is capable of applying pressure, mixing, crushing, heating, and expressing the moisture contained in plant biomass. In the final stage, this machine releases the pressure and fluffs up the material so that it will be an optimal environment for microorganisms.

Although plant biomass has long been recognized as a nature-friendly, useful resource, many unresolved challenges in treatment methods remained. By using its proprietary swelling treatment technology to resolve them, EARTHTECHNICA became a game changer, turning plant biomass into a multi-purpose resource. At the same time, crushing technology, originally developed for crushing and pulverizing rocks, is now being used by

many sectors as people- and eco-friendly applied technology.

What It Took to Make Hommamon ("Real") Products

As to why Usuki City is committed to producing compost, even to the point of establishing a dedicated facility — Usuki Soil Manufacturing Center — Yasuhiro Nakao, assistant manager of the Ecological Agriculture and Forestry Promotion Public Corporation, explains that it was because they realized that supporting the production of good soil was a prerequisite to promoting organic farming.

Asked why Usuki City decided to launch organic farming initiatives in the first place, he said that the city had two reasons. One was to source healthy vegetables for school

lunches. The other was to provide the local community with vegetables full of flavor and "vitality," and free of agrochemicals.

Shinsuke Hirose, Deputy Director of the Organic Farming Promotion Office of the Agriculture and Forestry Promotion Section of Usuki City, comments, "We have been working for more than 10 years to produce organically-grown *hommamon* farm products in order to revitalize farming in the city." Currently, about 60 households are practicing organic farming to produce *hommamon* products. Participating farmers use the Dream Compost and the city conducts annual analyses of their soil. Once certified, producers are allowed to put on their farm products stickers with the character "HO" (for HOmmamon) in white on a gold background as proof that they have met the city's criteria.

Hirose explains that sweet potato is among the highest value-added products, in regard to which the growers were able to launch a brand they call *Kanta-kun* ("Mr. Sweet"). Another star product is bell pepper, with some farmers shipping an amount worth 30 million yen (USD 285,000) annually.

Every year, Usuki City accepts four to five people who wish to begin farming for the first time. Two types of trainees are solicited for this program: *Chiiki Okoshi Kyoryoku-tai* (City revitalization

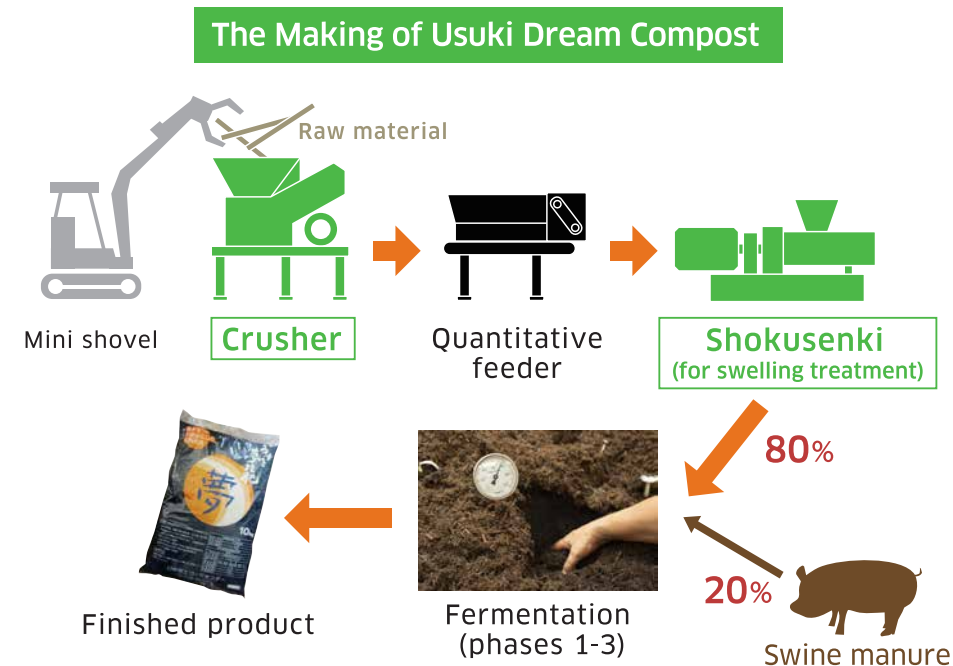
team members) who undertake a three-year course to become independent professional farmers and *Agri Kigyo Gakko Kenshusei* (agricultural startup trainees) who take a one-year bell pepper cultivation course to become professional growers. The number of trainees is unusually high compared to other cities with similar programs, proving that the trainees' vision of farming and the city's organic farming strategy "resonate" beautifully.

While the city offers the Dream Compost at 5,000 yen (USD 46.00) per ton, it purchases a ton of raw material (pruned tree branches) at only 300 yen (USD 2.80) per ton. During our interview, a local welfare organization brought in a truckload of pruned tree branches. They said that selling the raw material has been helping fund their activities. The city's organic farming efforts are therefore creating an eco-system through which various entities are connected.

The Method of Crushing and Cutting Determines the Quality of Soil Made

It takes six months for the Dream Compost to be ready for distribution, as the raw material needs to undergo crushing, swelling, and three-phase fermentation processes. Annually, Usuki Soil Manufacturing Center manufactures 1,600 tons of the compost. In more detail, the compost-making has four stages: 1) Crushing, 2) Air Separation, 3) Quantitative Feeding into the Shokusenki, and 4) Swelling. EARTHTECHNICA's system is used for the entire cycle.

Pruned tree branches delivered to the Center by forestry associations and other groups are fed into a crusher with rotating double-sided blades to become



(From left) Shinsuke Hirose, Deputy Director, Agriculture and Forestry Promotion Section, Usuki City; Koki Takeo, Head of the Usuki Soil Manufacturing Center; and Yasuhiro Nakao, assistant manager, Usuki City Ecological Agriculture and Forestry Promotion Public Corporation.



A scene from compost-making at the Usuki Soil Manufacturing Center. By slowly mixing swelled plant biomass with livestock manure (top), Usuki Dream Compost is produced (bottom).



EARTHTECHNICA's crushing and swelling system. Pruned branches are fed into the crusher (right side of this photo) and the resulting wood chips go through the air separator and the quantitative feeder (back side) and are sent to the Shokusenki (front) which discharges the swelled product from the left side (top photo).

5-cm-long wood chips. Koki Takeo of the Center comments, "The raw material — pruned tree branches — comes with different vegetative properties unique to that locale. We've spent about a year testing, trying to figure out an optimal method of crushing for each location, as the composition of the raw material varies from place to place. Some biomass has a high percentage of bamboo; others may contain a large amount of trees with soft fibers."

After crushing, wood chips go through the air separator where foreign objects such as stones and materials with a heavy specific gravity are removed. The chips are then transported to a quantitative feeder before entering the Shokusenki, which determines the quality of the compost. The model used at the Center is the SM30-110 — a motorized, 0.5-m-wide, 4-m-long, cylindrical apparatus which processes 2 tons of raw material per hour.

Inside the cylinder, a large feeding screw is rotating to crush the wood chips, applying high pressure as the chips move from the entry point to the discharge point. Because of the pressure, heat is generated and the moisture in the wood chips evaporates as steam.

Then, the compressed wood chips enter the cylinder end — the highlight of the process in the Shokusenki. The 50-cm-long section has three 15-cm-long resistance pins, which are 5 cm in diameter and are attached to three different points around the circumference, and which



The swelled product is fluffy like cotton.

further compress and break raw materials into fibers. The chips are then sheared into even smaller fragments by a shear knife rotating near the discharge point and ejected from the discharge holes.

To facilitate fermentation, the Center mixes livestock manure with the discharged material at a ratio of 2:8 before the mixture goes through a three-phase fermentation process. In the first month, the mixture is constantly agitated to promote fermentation. Then, after two more fermentation phases, it is ready for distribution. The entire process takes about six months.

From Technology that Fights Nature to Technology that Revitalizes It

Tokio Kayaba, Manager, Environmental Machinery Sales Section, Sales Department at EARTHTECHNICA, who has been in



Tokio Kayaba
Manager, Environmental Machinery Sales Section
Sales Department
EARTHTECHNICA CO., LTD.

charge of developing and marketing the Shokusenki, comments, "In the compact space of the cylinder end, all actions required for swelling the material take place successively and seamlessly. The quality of the resulting humus is determined by how well these activities go, especially the crushing of the resistance pins, the effectiveness of the shear knife, the way in which the release of pressure affects the swelling, and how the swelled product is broken down into fibers. We have a comprehensive knowledge of all these processes."

The shear knife is an ultra-hard tool, thermally-sprayed with tungsten carbide. Along with the resistance pins, the performance of the shear knife significantly affects the Shokusenki's overall effectiveness, as the knife is used immediately before discharge.

A certified Compost Manufacturing Manager, Kayaba has long been on a mission to identify the relationship between composts and soil. The process of making plant-derived compost is, in effect, reproducing what a mountain does in creating

a mass of leaves over a very long period of time by artificially creating an optimal environment for microbes — the main players in compost-making — to work.

EARTHTECHNICA has been expanding the application of crushing, pulverizing, sorting, and other fundamental technologies to many different fields — from things as large as rocks to ultra-fine products such as copy machine toner. Today, these technologies are indispensable for crushing and pulverizing plant-derived biomass, the material previously deemed difficult to recycle.

Kayaba adds, "A heavy-duty technology developed for crushing and pulverizing rocks and other hard materials — which could be described as "nature-fighting technology" — has been found to be useful for handling vegetation. This technology is now being used to make high-quality compost, creating people- and eco-friendly soil, and supporting organic farming. The real thrill of applying Shokusenki technology is knowing that it can bring about a new eco-cycle."



Verifying the Usability of Bamboo Powder: Turning a Huge Challenge into an Asset

Because bamboo is one of the hardest plant species that grows in the fields and mountains of Japan, its removal has been a challenge. In cooperation with Leave a Nest Co., Ltd., a science education company in possession of extensive knowledge in agriculture, EARTHTECHNICA launched a project in May 2019 to pulverize bamboo using Shokusenkis, and to verify its effects on soil and on crop growth/harvest. (The test site is located in Masuda City, Shimane Prefecture.) It is expected that the test will reveal — physically, chemically, and biologically — the efficacy of powdered bamboo as a soil conditioner. If proven effective, the powder will facilitate the recycling of bamboo and significantly reduce the damage it causes.



The SM-18-30CR Shokusenki



A Leader's Voice

Tsuyoshi Shibazaki General Manager, Sales Department, EARTHTECHNICA CO., LTD.

Crushing/Pulverizing Serving as a Vital Technology for Environmental Conservation

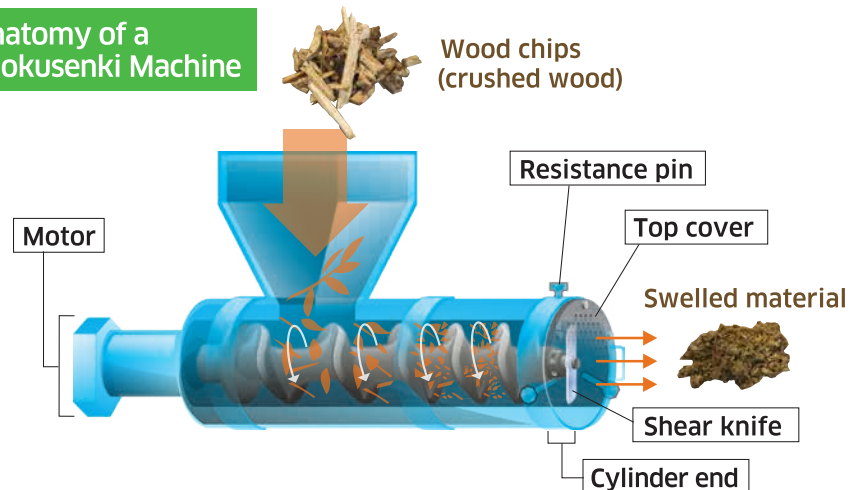
EARTHTECHNICA develops, manufactures, and markets machines that crush or pulverize various materials. We have delivered our products to operators of mines and quarries where many crushers and pulverizers are used. In recent years, however, technologies for these machines have become recognized as valuable contributors to environmental conservation. For example, crushing/pulverizing scrapped cars, plastics, concrete, and other industrial waste has resulted in the reuse of resources. Currently, our environment-related business is focused on three sectors — scrap steel, plastic packaging, and industrial/construction waste — and it has become one of our pillar businesses.

Against such a backdrop, our company acquired the Shokusenki Machine business of Shinkozoki Corporation in 2017 to reinforce our eco business. Our Shokusenkis, which use swelling technology to convert pruned branches and

other biomass into useful resources, have been delivered mainly to local governments in Japan. We are exploring new applications for the Shokusenkis, and bamboo is now on the top of our list. Bamboo does not biodegrade easily, is hard to reuse, and its encroachment into woodlands near populated areas has been a problem. We are exploring the possibility of using our Shokusenki to turn bamboo into powder for use as a soil conditioner and livestock feed.

Some existing customers of our crushers are considering expanding into the farming sector. We would like to market our Shokusenki widely to these customers. Crushers and Shokusenkis have the potential of expanding our existing customers' new businesses more than ever. We will continue to improve our products so that the biomass resources they produce will contribute to expanding our customers' business horizons.

Anatomy of a Shokusenki Machine



Wood chips fed into the Shokusenki are compressed as they go through the feeding screw. They are compressed further and broken down into fibers by the resistance pins and sheared by the shear knife, and their fineness is adjusted by the top cover before the swelled material is discharged.



The Shaping of the Japanese Locomotive

A shift from road transport to other means – a so-called modal shift – has been as beneficiaries of this shift. A pioneer of domestically-produced locomotives, the Japanese locomotive itself, which began in the early 20th century with the

gaining momentum in recent years, and locomotives are top of the list. Kawasaki's journey in locomotive manufacturing is the history of introduction of steam locomotives.



1913

Type 9600

A standard steam locomotive used for freight in the first half of the Taisho Era (1912-1926). Nicknamed "Kyu-Roku" (Nine-Six), it was mass-produced and used across the country until the use of steam locomotives terminated in the Showa Era. By 1925, Kawasaki had manufactured 686 of the 784 domestically-produced Kyu-Rokus.



1965

Type EF65

A direct-current electric locomotive which became the standard for electric locomotives in Japan. The high-speed 500 series which was added to this family of industry-leading locomotives had a maximum speed of 110 km/h and was equipped with an electromagnetic brake command device.

1966

Type DE10

A mass-produced switcher locomotive equipped with a 1,250 hp engine and a set of switchable low/high hydraulic transmissions (an improved version of its predecessor, the DD51). Compared to preceding switchers, the DE10 has a smaller axial load, making it possible for it to haul cars on branch lines, yet the weight was increased so that it achieves higher switching performance.



1992

Type DF200

A new type of diesel-electric locomotive which operates on non-electrified sections of rail in Hokkaido Prefecture. Its power output is 1.5 times that of conventional types, enabling it to operate at high speed. In addition to cold and snow resistance features, the DF200 employs a GPS-based acceleration detection device – the first ever for locomotives in Japan.



1996

Type EF210

Developed to replace the Type EF65, which was the most mass-produced locomotive for Japanese National Railways (predecessor of the Japan Railway companies), the EF210 is used mainly for hauling container cars that can withstand high-speed operation on the Tokaido and Sanyo Lines. With a power output of 3,390 kW and maximum speed of 110 km/h, this locomotive is capable of hauling 1,300 t of goods.



When government-run factories began producing locomotives in the early 20th century, they had no choice but to source many of the parts from other countries. An ever-increasing amount of import expenses was a headache for the government, which was curbing imports at the time, so a 100% domestically-produced locomotive was an imperative. In response, Kawasaki and Kisha Seizo Co., Ltd. committed themselves to tackling the challenge. However, with the merger of the two companies in 1972, the main role of manufacturing locomotives domestically was entrusted to Kawasaki. With Hyogo Works as its manufacturing site, by December 2018, Kawasaki had reached a milestone of 5,000 Japan-made units.

Various types of locomotives, both large and small, have been designed in order to haul cargo and passenger cars of different weights. These efforts at accommodating individual needs helped Kawasaki advance in the production of more sophisticated, high-performing locomotives.

With respect to commercial steam locomotives, their production in Japan ended in 1953 with the "25tC for Kawasaki Seitetsu" as the last type to be produced, heralding the era of electric locomotives. Because Japan is a country with many steep mountains, electric locomotives are expected to have the power to climb steep slopes and the capability of operating at high speed, on par with passenger trains, so that they do not disrupt passenger train schedules. A number of challenging situations compelled Kawasaki to develop many advanced features.

These progressive steps culminated in the EF210, an advanced locomotive, one of which was crowned with the honor of being the 5,000th unit, and which serves as the main freighter for Japan Freight Railway Company which has received over 100 of the Kawasaki-made units. The EF210 is capable of hauling goods weighing more than 1,000 t at 100 km/h. Watching this locomotive zooming by, spectators undoubtedly realize that the technologies behind it are extremely sophisticated.



Kawasaki Racing Team Wins Back Title at Suzuka 8 Hours Endurance Race After 26 Years!

Team Manager Guim Roda Discusses Factors Behind Kawasaki's Victory

On July 28, 2019, for the first time in 18 years, Kawasaki Racing Team (KRT), a factory team of Kawasaki, returned to the Suzuka 8 Hours Endurance Race. Through the last moment of the event, all eyes were riveted on the fierce battle that resulted in Kawasaki's first victory in 26 years. We interviewed Guim Roda regarding the factors that made Kawasaki a victor.



Under a blue sky, the Suzuka 8 Hours Endurance Race began at 11:30 a.m., July 28, 2019.

A Team that Unlocked the Potential of Human-Machine Synergy

With only two minutes left in the event, KRT's last rider and race leader Jonathan Rea was expected to finish first and receive the checkered flag, but he slid and crashed because of light rain and an oil spill on the course. The race was red-flagged and ended without Rea crossing the finish line. Provisional results named KRT's closest competitor the winner. However, after deliberations, the results were amended, making KRT the victor.

Team Manager Guim Roda comments, "When a race is red-flagged, rule has it that the ranking in the lap previous to the incident counts, and as a result of this rule being applied, KRT won back the title 26 years after its first victory in 1993. International race rules differ slightly from race to race, and in this case there was some confusion

on the part of FIM's jury. In any case, we achieved a dramatic victory."

Roda adds laughingly, "When the final result was announced, not everybody knew what had happened and those in the paddock who didn't yet know about it were wondering why we were so happy when we'd lost the race."

Motorcycle magazines featured titles such as "A Battle for the Ages" and "Birth of a New Legend." For the first time in 18 years, Kawasaki's factory team, KRT, had joined a race in which Yamaha was vying to achieve its fifth consecutive win and Honda was determined to stop Yamaha. The race indeed turned out to be a very exciting one, exhilarating both fans and race officials.

Speaking of the race, Roda says, "KRT's participation in the race was officially decided in the spring of 2019. It was extremely tough to prepare for because it was my first Suzuka 8 Hours and we were traveling around the world for World Superbike (WSBK) races. However, I was getting more and more convinced that KRT would live up to expectations, because we had Leon Haslam and Toprak Razgatlioglu in addition to our ace rider Jonathan Rea, and the motorcycle was the Ninja ZX-10RR, the most powerful machine made by Kawasaki. On top of that, our factory team had the best crew there is."

"As expected, Rea was the fastest among all participating riders. In 70 (67%) of the 104 laps he rode around the approximately 6-km circuit, he finished in an amazing 2 minutes 9 seconds or less. Haslam actually wasn't 100%, physically, but as the starting rider, he performed with great fuel efficiency, covering many laps before his first pit stop. The pit crew also performed wonderfully. The total in-pit time was an impressive 24 seconds shorter than Yamaha's, and other precise strategies and tactics, such as fuel efficiency calculations and race development control, brought out the best in the riders."

Regarding the Ninja ZX-10RR, Roda said that it "exhibited flexibility and power that accommodated any changes in conditions." The riders alternate, using the same machine for the entire race, so strategy and decisions as to which rider the machine should be tailored to are important. The Ninja ZX-10RR used for this race was not tailored specifically to Jonathan Rea. However, two critical factors — Rea's ability to attain the fastest speed and the capability of

the machine to deliver whatever riders demand of it — contributed to the victory.

Roda explains, "Everything was coming together to achieve a synergistic effect. I thought, 'We really could seize this race.' As team manager, I fully implemented our strategies and tactics without any hesitation."

A Passion for Manufacturing Is the Source of Kawasaki's Exceptional Strength

Guim Roda has been involved in the management of Kawasaki's racing teams since 2009. After assuming the post of team manager for KRT in 2012, he had contributed to Kawasaki earning five riders' titles and four manufacturers' titles at WSBK by 2018. From a team manager's perspective, we asked, what exactly is a "Kawasaki motorcycle"?

"I am constantly impressed by the deep and robust passion that people at Kawasaki have for motorcycles. They don't simply like motorcycles, they love producing themselves the ultimate in machinery and being involved in motorcycle-related businesses. Because of such fervor, fans, too, become fervent and come to love Kawasaki. This means that Kawasaki and fans together are improving the brand's power. Such a high level of passion isn't found in any other manufacturer. That's why impressive control is possible even in a race as tough as the Suzuka 8 Hours, which requires intricate strategy and tactics."



A pit work time amounting to only 310 seconds was also vital to winning the victory.



Provisional results were listed as "incomplete," but KRT was named winner after re-deliberations. Jonathan Rea commented, "Hearing that we won after being dejected, the emotional roller coaster is unreal." Because the dejection had been shared by all KRT staff, the joy of the victory increased exponentially.

Motorcycle development at Kawasaki finds its roots in the company's aircraft engine manufacturing, or — going further back — in the passion for making aircraft of Kawasaki's first president, Kojiro Matsukata, who contributed greatly to the modernization of Japanese industry with his indomitable spirit. Still very much alive at Kawasaki is a corporate culture of tackling challenges and persisting in perfecting the manufacturing process — the "DNA" it inherited from its predecessors.

Roda concludes, "Kawasaki's strong passion for motorcycles boosts everyone's morale for tackling complex challenges. That spirit permeates KRT and we will be working hard and with unswerving dedication toward winning another WSBK championship."



Guim Roda

Born in 1977 in Spain. While studying industrial design at university, he himself raced motorcycles. In 2009, he got involved in Kawasaki's racing team management and became the KRT team manager in 2012. Under his leadership, by 2018, KRT had earned five riders' titles and four manufacturers' titles at WSBK.

In September 2019, Jonathan Rea became the first-ever five-time WSBK Champion. KRT aims to win the remaining races for this season to secure the manufacturers' title. (They're currently first in the standings.)



Please visit the subsite dedicated to KRT's victory at the Suzuka 8 Hours Endurance Race on our brand site, "STORIES."

<http://global.kawasaki.com/en/stories/articles/vol90/>



Amon Miyamoto

Believing in People's Potential in Order to Fully Unleash Their Appeal

Amon Miyamoto is a director/artistic director whose activities transcend both national borders and theatrical genres, directing musicals, straight plays, operas, kabuki, and other forms of drama in many different countries. SCOPE's editorial team asked him his secret for managing cast members and staff when they all exhibit strong individuality and when each production has a unique set of cast members and staff.

Enjoy Chemical Reactions Between People

In 1987, at age 29, Miyamoto made his debut as a director with an original musical "I Got Merman" (a portrayal of Broadway star Ethel Merman's life), for which he received the following year the Grand Prize of the National Arts Festival hosted by the Japan Agency for Cultural Affairs. In 2004, he became the first Asian to direct a Broadway musical, "Pacific Overtures," which garnered four Tony Award nominations, one of the most prestigious awards in theater.

Miyamoto, now 61, has directed more than 120 productions with his unique take on traditional arts. When the number of cast and crew in a single production can reach nearly 100, how does he lead such a big team whose skill levels and professional experiences are so different? We asked Miyamoto this question, and he responded with clear words that beat a comfortable rhythm.

"My style is to fully unleash the appeal unique to that person and assign to him or her the most suitable role, rather than building a team. As we get older, many of us are inclined to impose boundaries on our capabilities, but life experiences gained from striving to achieve great results are applicable in many different fields. I dare to cast in a manner

which results in a production resembling a mixed martial arts competition. I could say that, objectively speaking, we then enjoy watching the new "chemical" reactions born of people's encounters with each other as well as with the works themselves."

Miyamoto doesn't maintain a designated theatrical company; he renews the cast for each production because it keeps him energized. Commenting on this, Miyamoto says, "If I get to a point of feeling secure, then that's where my future ends. Such complacency would show explicitly in my work. Even if we have been working together for a long time, we should not be overly dependent on each other. Each of us grows by gaining experience through work, and we should provide each other a platform where we, as friendly rivals, work together in pursuit of 'something yet more interesting.'"

Prior to any overseas performance, Miyamoto conducts extensive research on the location, as traits of local people vary, and favorite works and responses differ country to country. He believes that thorough research makes for well-received productions. Another factor that he takes into account is the difference in ways people communicate. For example, Japanese people may be able to drive a project forward with unspoken agreements, but such an approach doesn't work elsewhere.



Amon Miyamoto

Director/artistic director. Born in Ginza, Tokyo, in 1958. He made his debut as a director with the original musical, "I Got Merman," for which he received the Grand Prize of the National Arts Festival hosted by the Japan Agency for Cultural Affairs. In 2004, he became the first Asian to direct a Broadway musical, "Pacific Overtures," which earned four Tony nominations. His productions of straight plays, operas, Noh dramas, etc., span the world and a broad spectrum of genres.

Amon Miyamoto Facebook page:
<https://www.facebook.com/AmonMiyamotoOfficial/>

Miyamoto explains, "Because we all live in different cultures and environments, we must respect each others' identities, choose our words carefully, and communicate mindfully even if it is time-consuming. Working together requires the building of relationships through close interaction."

We Only Live Once. Enjoy It – Make the Most of It.

The smile never seems to leave Miyamoto's face. He says he values the inspiration he gets from conversations with others. This is because what sounds "off the wall" may reveal a speaker's unique thoughts, and gems can be found in nonstandard opinions. From his clever words and gentle demeanor, it is hard to imagine that, in the past, Miyamoto struggled with human relationships, and experienced truancy and social withdrawal during his high school years. We asked him for some words of advice for people having difficulty communicating with others.

"I fully understand how people feel when they are struggling with relationships. I still am not confident about how I relate to people. But when I observe people's faces carefully, I find that many of them are also lacking in confidence. Since we both are struggling with confidence issues, we should start by greeting each other casually, like saying 'Good morning,' or showing appreciation verbally, such as 'Thanks for everything today,' rather than thinking too hard about how to build a good relationship. Such casual interactions may reveal an unexpected side to the person and bring about surprising changes in the relationship. I try to talk in the gentlest way possible to the people I feel are the hardest to deal with."

For the last few years, Miyamoto has been focusing on fusing all types of Japanese traditional arts and culture to achieve cutting-edge entertainment. He devotes himself to generating novel theatrical expressions and to thrilling audiences. His passionate words and twinkling eyes are brimming with curiosity and creativity.

Miyamoto summarizes, "You only live once. It's a waste if thinking about the past and worrying about the future is pulling you down and keeping you from enjoying 'now.' Just be yourself and enjoy life. Whatever happens, hope is around the next corner. Life is short. I'm determined to live life to the fullest, and to enjoy it."

Delivery of LNG Transport Vessel *SOHSHU MARU*

Recently, Kawasaki delivered the *SOHSHU MARU* (Kawasaki hull No. 1735), a 177,000 m³ capacity liquefied natural gas (LNG) transport vessel for use by Trans Pacific Shipping 8 Ltd., a joint venture between JERA Co., Inc. and Mitsui O.S.K. Lines, Ltd.

The third in Kawasaki's line of 177,000 m³ capacity LNG carriers to be commissioned, this ship is designed to enable passage through the newly expanded Panama Canal, which opened for full operation in 2016. The *SOHSHU MARU* will be used by JERA to transport LNG procured

via the Freeport LNG Project in the U.S. The vessel features standard LNG carrier hull dimensions in order to enable docking at major LNG terminals around the world while offering larger cargo tanks for increased transport capacity, thus cutting LNG transport costs and facilitating more flexible LNG trade operations by shipowners.

Kawasaki has optimized the hull structure to decrease overall ship weight, enhanced the hull-shape design, and adopted a two-motor, twin-screw propulsion system to achieve the best propulsive performance possible, while also integrating a DFD electric propulsion system* which increases fuel efficiency at all speeds.

*The dual fuel diesel (DFD) engine is capable of burning both oil and gas, whereas a conventional generator engine can only burn oil for fuel. The propulsion system comprises multiple generator diesel engines and variable-speed propulsion motors. Either gas or oil is supplied to the engines to generate electricity, which drives the propulsion motors that power the propeller.



Kawasaki selected on Dow Jones Sustainability Asia Pacific Index, ESG investment index, for seventh consecutive year

Kawasaki has been selected for the seventh consecutive year for the Dow Jones Sustainability Asia Pacific Index (DJSI Asia Pacific), the Asia Pacific version of the Dow Jones Sustainability Indices (DJSI), which is one of the leading indices of ESG (environmental, social and governance) investment.

Jointly compiled by S&P Dow Jones Indices and RobecoSAM AG*, DJSI is a leading ESG index which assesses and selects leading sustainability-driven companies in terms of economic, environmental, and social criteria, and serves as one of the most important indices for investors who take the corporate social responsibility (CSR) initiatives of each company into consideration.

Specifically designed for companies in the developed Asia Pacific markets, including Japan, the DJSI Asia Pacific has captured 148 companies, including 76 Japanese companies, that are leading the way in terms of

sustainability, from among the 612 invited companies in the region.

For inclusion in the DJSI Asia Pacific, RobecoSAM AG assesses companies based on questionnaire responses, public annual and sustainability reports, other publications, and media information from each company. Kawasaki has been included in the DJSI Asia Pacific for the seventh consecutive year for its outstanding performance based on the three criteria above.

In addition to the DJSI Asia Pacific, Kawasaki has also been included in the FTSE4Good Index and MSCI ESG Leaders Indexes, which are also benchmark ESG indices. Furthermore, Kawasaki has been selected as a constituent of the FTSE Blossom Japan Index, MSCI Japan ESG Select Leaders Index, and

the S&P/JPX Carbon Efficient Index. These indices were selected by Japan's Government Pension Investment Fund (GPIF), the world's largest pension fund.

*RobecoSAM AG: Is an investment specialist focused exclusively on Sustainability Investing. Its offerings comprise asset management, indices, private equity, engagement, impact analysis and sustainability assessments, as well as benchmarking services. Together with S&P Dow Jones Indices, RobecoSAM publishes the globally recognized Dow Jones Sustainability Indices (DJSI). In 1995, RobecoSAM was founded on the conviction that integrating ESG factors into traditional financial analysis leads to more informed investment decisions.

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Construction started on Australian Hydrogen Terminal

Kawasaki and Hydrogen Engineering Australia Pty Ltd (HEA), Kawasaki's subsidiary company based in Melbourne, has started construction work on a hydrogen liquefaction and loading terminal for the Hydrogen Energy Supply Chain pilot project (Project).

This facility will convert hydrogen gas into liquefied hydrogen, which will be stored and then loaded onto the world's first specialized marine carrier for transport to Japan. The Project will involve the production of hydrogen from brown coal at Latrobe Valley in Victoria, Australia, and will create a new innovative technical foundation for the development of an exciting hydrogen export industry for Australia.

"Delivering clean hydrogen to the world for the benefit of our environment is a goal we share deeply and we look forward to achieving", said Chairman of the Board of Kawasaki, Mr Shigeru Murayama. "The hydrogen economy is already materializing in Japan, and it is wonderful to now be breaking ground here in Australia. We are excited to be translating our joint hydrogen vision into reality", he said.

The construction work includes building and mechanical installation, including a liquefaction facility and a storage container to be completed by June 2020, to be followed by commissioning, with operation targeted to begin in 2020-2021. Kawasaki will use its know-how and experience gained from past liquefied hydrogen and industrial plants to deliver the Project safely on time. Kawasaki and HEA will continue to work with the local community to share information about the Project and respond to community feedback.

The Project is being delivered by a consortium of Japan's and Australia's top energy and infrastructure related companies, with the full support of the Victoria, Australian and Japanese Governments. Together with Kawasaki and HEA, the consortium partners include Electric Power Development Co., Ltd. (J-Power), J-Power Latrobe Valley Pty Ltd (JPLV), Iwatani Corporation, Marubeni Corporation and AGL Loy Yang Pty Ltd.



Kawasaki Local Subsidiary in Vietnam Begins Motorcycle Sales

Kawasaki established Kawasaki Motors Vietnam Co., Ltd. (KMV), a locally based motorcycle import and sales company in Vietnam. KMV started operation on August 22nd.

In October 2014, Kawasaki entered a cooperative agreement with a Malaysian-owned company, TC Motorcycles (Vietnam) Co., Ltd. (TCMVCV), in which Kawasaki played a role in production and international logistics of motorcycles and TCMVCV handled domestic sales in Vietnam. However, in response to forecasted growth in the motorcycle market of Vietnam, Kawasaki has decided to establish KMV. KMV has taken over TCMVCV's

network of dealerships and will use them to carry out sales activities while also establishing new dealer locations in response to market growth, with the aim of expanding Kawasaki's motorcycle business in Vietnam.

The current market in Vietnam saw more than 3.3 million motorcycles sold in 2018, making it the 4th largest motorcycle market in Asia after those of China, India and Indonesia. As Vietnam's economy continues to grow, sales are projected to reach approximately 3.6 million units in 2019.* Furthermore, because income levels are on the rise in Vietnam, rapid growth is expected in the mid-size

and large motorcycle categories (250 cc and higher), increasing from approximately 4,400 units in 2018 to roughly 6,600 units in 2019.**

Kawasaki sells 175-1,000 cc class motorcycles of Supersport, sport and naked types (among others) in Vietnam, with plans to sell about 2,500 units in FY 2019.

* Statistics published by the Vietnam Association of Motorcycle Manufacturers (VAMM) for 2018 and 2019
** Kawasaki estimates for 2018 and 2019

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