

# Scope

Kawasaki Heavy Industries Quarterly Newsletter



Special Feature

## Joint-Growth 25

Kawasaki's Collaborative  
Hydraulic Equipment Business  
with the U.K. Spans a Quarter Century

カワる、  
サキへ。  
Changing forward

Spring 2019

No. 119



# Joint-Growth 25

## Kawasaki's Collaborative Hydraulic Equipment Business with the U.K. Spans a Quarter Century

*In 1994, Kawasaki established its first development and manufacturing subsidiary in which develops, manufactures, and supplies hydraulic equipment and devices. Twenty-five years later, KPM (UK) is now a prominent international supplier of hydraulic motors and pumps. In this issue of SCOPE, we bring you a story featuring how Kawasaki and the U.K. have cooperated with each other as "Joint-Growth" partners, and what the leaders' visions are for the future of the business.*

*Europe, Kawasaki Precision Machinery (UK) Ltd. (KPM [UK]), twenty-five years have passed, this issue of SCOPE, we bring you a story featuring how Kawasaki and the U.K. visions are for the future of the business.*

### Contents

2 Special Feature  
**Joint-Growth 25**  
Kawasaki's Collaborative Hydraulic Equipment Business with the U.K. Spans a Quarter Century

10 Techno Box  
**High-Precision High-Speed Hydraulic Press for Carbon Fiber Reinforced Plastics (CFRP)**

12 Interviews with Today's Pioneers  
**Kaori Sasaki**

14 **HOT TOPICS**

#### About the Cover

Production processes for Staffa motors  
See *Special Feature* for details.



#### Kawasaki Precision Machinery (UK) Ltd.

An aerial view of the headquarters and plant. The two-story building on the right was added in 2013, and its second floor is used as an office. The campus has a lake and a river on its north and west ends, and their water levels change according to the tidal ebb and flow of the nearby sea. The river flows for about 10 km before reaching the English Channel, which faces Brittany in France and the Atlantic Ocean on the west side. Plymouth, known as the "gateway to the sea," is where the campus is located.

## Kawasaki's First Development and Manufacturing Base in Europe: Supplying Hydraulic Equipment to the World from the U.K.

The U.K. has long played an instrumental part in Kawasaki's businesses. When Kawasaki was first founded as Kawasaki Tsukiji Shipyard in 1878, and also when the company embarked on the manufacture of rolling stock in 1906, it was technologies imported from the U.K. — the world's leader in manufacturing — which supported those endeavors.

Even today, the British influence is evident in Kawasaki businesses. Hydraulic equipment and devices supplied by the Precision Machinery & Robot Company is one such example. KPM (UK) has been manufacturing and marketing these hydraulic motors and pumps at the Plymouth site in the U.K., as well as providing services in Europe and elsewhere, since 1994.

The company, which celebrates its 25th year of operations in 2019, was originally a hydraulic motor plant owned by an American company, Vickers, Inc., which Kawasaki acquired at the end of 1993. Long before the acquisition, a relationship

existed between Kawasaki and Vickers. It began in 1963, when Kawasaki decided to apply to their domestic products hydraulic motor technology used in Staffa hydraulic radial piston motors for marine vessels, which the Vickers plant had been manufacturing. Subsequently, KPM (UK) was established, with operations commencing in January 1994.

The decision to acquire the plant, establishing Kawasaki's first manufacturing base in the U.K., as well as in Europe, was based on the corporate motto "Joint-Growth" (growing together), proposed by Hiroshi Oba, the then president of Kawasaki.

The Japanese portion of the production of Staffa motors was later transferred to KPM (UK), making the subsidiary Kawasaki's sole manufacturer of Staffa motors. Today, Staffa motor is one of two pillar businesses of KPM (UK). The other is the manufacture, assembly, customization, sales, and marketing of axial piston motors and pumps, which are developed in Japan and exported to Europe and elsewhere.

The scope of applications of these products is wide—ships, construction equipment, agricultural equipment, manufacturing machinery, and many more. Today, they are used worldwide, proving that the collaborative business between Japan and the U.K. is seeing great outcomes a quarter century later. What are the types of progress has "Joint-Growth" achieved, and where is the collaboration going?

### Staffa Motors: Originated in the U.K., Evolved via the Kawasaki Method

Plymouth is a port city on the southern coast of Devon County in England, located 300 km south-west of London, with a population of 264,200. It is known as the port from which the Pilgrim Fathers departed for the United States aboard the Mayflower in 1620. It is also known as a port which served as a base for Sir Francis Drake, an English admiral, and it continues to be a major base for the British Navy. After the industrial revolution and up to the 1950s, the city flourished as a shipbuilding center.

The 280-member headquarters and plant are situated 10 km north-west of



A scene from the production of Staffa motors.

Plymouth's center, along the River Tamar which flows into Plymouth Sound, a bay on the English Channel.

The plant was first built in the latter half of the 1950s by a British machine tool manufacturing firm. The firm was later sold to another company, which decided in 1982 to produce hydraulic radial piston motors — the Staffa motor.

Development of the Staffa motor dates back to 1955. It became especially popular in the shipbuilding sector because of its remarkable features: low speed, high-torque design; low occurrence of failures; low maintenance; and robust durability. Deck machinery, offshore winches, plastic injection molding machines, and drill rigs are among the main applications of the motor.

The company which had owned the plant was renamed twice during merger and acquisition, and the present owner, KPM (UK), is the world's exclusive developer and manufacturer of Staffa motors. It is a top-selling brand in hydraulic motors for marine and industrial applications. KPM (UK) boasts a production output of 7,500 units per year, which is achieved through a two-shift production system. This product accounts for 35% of its total sales.

Steve Clarke, Product Development Manager, who leads research and development of Staffa motors at KPM (UK), comments, "Our biggest mission is to maintain our No.1 status in the marine machinery market, both today and in the future. The Staffa motor is often considered to be a product built on an obsolete technology,

United Kingdom of Great Britain and Northern Ireland



(Top) Smeaton's Tower on Plymouth Hoe is a symbol of the port city, as well as a monument commemorating a civil engineer who designed many lighthouses. (Below) The Barbican, a historic scenic complex facing the Port of Plymouth. Plymouth was bombed during WWII, it was a base for the Royal Navy, resulting in the loss of many historic buildings.



Steve Clarke  
Product Development Manager  
Kawasaki Precision Machinery (UK) Ltd.



Staffa motor undergoing a finishing process.

so investments in new research and development are imperative if we are to maintain superior market competitiveness.”

The “Joint-Growth” collaborative approach underpins the never-ending improvements and launch of new motors. Clarke states, “Staffa motor parts that were developed in the 60s and 70s can be replaced with new parts redesigned by Kawasaki, and new mechanical motion detection and control systems can be integrated. This will show that the Staffa motor’s superior reliability ensures operation for years to come, and that combined with Kawasaki’s quality, efficiency, and usability, it is a motor with remarkable benefits rolled into one.”

At the plant’s testing section for new products, operational tests are being conducted for a high-speed Staffa motor, which will be a dramatic improvement of one of its main features. KPM (UK) also is

positioning the new Staffa motor to accommodate needs in industrial machinery markets other than marine applications, such as injection molding machinery for synthetic resins.

### Localizing and Optimizing Japan-Made Pumps/Motors in the U.K.

KPM (UK) takes a different marketing approach to hydraulic axial piston pumps and motors than it does to Staffa motors. While Staffa motors are developed and manufactured by KPM (UK) and exported from the U.K. worldwide, axial piston pumps are developed by Kawasaki in Japan, and core parts (rotary group) are exported to KPM (UK) under the Kawasaki brand. The main role of KPM (UK) in this business, which accounts for more than 50% of its total sales, is therefore manufacture and assembly for its customers.

Because axial piston pumps and motors are compact and come in a variety of types, they are applied to a wide range of equipment — from excavators (their main application) to mobile construction machinery (other than excavators), mobile agricultural machinery, and other industrial machinery. KPM (UK) is therefore tasked with meeting diverse

customization and localization needs. The number of sales is about 5,000 pumps and 3,000 motors per year for excavators, and about 18,000 pumps for non-excavator machinery.

John Glover, Application Engineering Manager at KPM (UK), who is in charge of mobile product application engineering, comments, “It is very important to ascertain the specific requirements of our customers, and to meet those needs as much as possible by communicating closely with the design division in Japan. Currently, we are increasing our product portfolio by introducing new products.”

Glover adds that the key to expansion is the sharing of knowledge in a highly transparent manner among three parties (the design divisions in both countries

and the sales force in the U.K.) and working as a team. This is another factor that contributes to achieving “Joint-Growth.”

Regarding the collaborative relationship, John Boote, Senior Manager for Sales & Marketing at KPM (UK), comments, “Our prominent customers in the construction and agricultural machinery sectors are Volvo of Sweden, JCB of the U.K., John Deere

and New Holland of the United States, and other multinationals. Their diverse requirements are accommodated not only through cooperation among engineers at KPM (UK) but also by involving the development divisions in Japan, so as to collaboratively resolve challenges. This cooperative relationship is a significant advantage in our growth.”

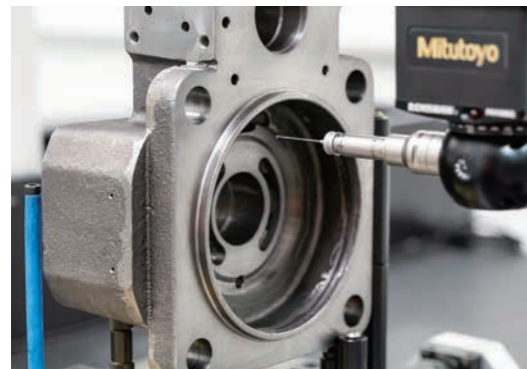
KPM(UK) made a leap forward in its hydraulic pump and motor business by securing a major contract for Volvo’s construction machinery in the year 2000. Boote explains that the collaboration between the design divisions in Japan and the U.K. played a vital role in such sales activities.

For the last several years, KPM (UK) has been promoting its products through



Finished products waiting to be shipped to global markets.

advertisements featuring the Kawasaki brand image, which have proven effective. Kawasaki is well-recognized as a cutting-edge global leader in two-wheelers and high-speed trains in the EU and nearby markets, and this high-profile image serves to assure potential customers that Kawasaki will supply hydraulic products that best meet their requirements, just as it does in the motorcycle and rolling stock sectors.



Bracket of hydraulic motor being inspected for final accuracy. Inspections at KPM (UK) are performed in a dedicated facility.



**John Glover**  
Application Engineering Manager  
Kawasaki Precision Machinery (UK) Ltd.



**John Boote**  
Senior Manager, Sales & Marketing  
Kawasaki Precision Machinery (UK) Ltd.



### Staffa Motors

A radial piston motor developed in the U.K. in 1955, characterized by low-speed, high-torque operation, and robust durability. Although the main applications for the motor include winches and the steering gear of ships, it is now being applied to injection molding machinery for synthetic resins, metal press machines, and tunnel boring machines as well.

## The Three Main Products of KPM (UK)

### Hydraulic Pumps

Kawasaki’s axial piston pumps are developed based on its proprietary technologies. Outfitted with hydraulic motors, the pumps are applied to a wide variety of machinery, including construction, agricultural, and manufacturing equipment.



### Hydraulic Motors

Axial piston motors of the same type as the pumps, in which the hydraulic cylinders are configured parallel to the rotation shaft. These are high-speed, high-torque, variable-pressure motors that accommodate downsizing, and are used for the same purposes as hydraulic pumps.



(Photo above) A hydraulic pump being assembled at the Plymouth plant. Most key components are imported from Japan or sourced within the EU, but KPM (UK) also manufactures some of the parts. (Upper right) Casing for hydraulic pump awaiting assembly at the Plymouth plant after being imported from Japan. (Lower right) In the testing room for new products, a Staffa motor on the right and a hydraulic pump on the left undergo operational tests.





Instructions for assembly are displayed on the LCD monitor, making it a paperless procedure. This method was first utilized for hydraulic pumps, but it is now applied to Staffa motors.

### Optimal Solution Achieved by Dividing Responsibilities and Coordinating Japan and the U.K.

Although KPM (UK) seems to operate two separate businesses (U.K.-made Staffa motors and Japan-made hydraulic pumps and motors), Glover, who is in charge of design in the hydraulic pump and motor division, says, "I communicate with my counterpart in the Staffa motor division, Steve (Clarke), on a daily basis. That's because although we are in charge of different projects, we have the same procedure for coordinating the sales and the manufacturing divisions."

Martin Cunniff, Operations Director, who oversees all business operations at KPM (UK) comments, "In the manufacturing of hydraulic pumps and motors, assembly can now be accomplished by following the

instructions on the LCD monitor in front of you. We are currently introducing the same systems for manufacturing Staffa motors."

Such advancement in the manufacturing process cannot be achieved merely by applying Japanese production systems to those in the U.K. KPM (UK) is now gearing up for the fourth industrial revolution, known as "Industry 4.0," whereby high-mix, low-volume production of high-value-added products can be done in a timely and highly-efficient manner by utilizing the Internet of Things (IoT) and artificial intelligence (AI). This "smart manufacturing" is being explored particularly by German and other European companies.

Cunniff elaborates, "European manufacturers — our customers — are working on reforms to achieve Industry 4.0. We, too, are upgrading not only our production systems but also the entire operational system."

These initiatives at KPM (UK) are communicated to Japan. Masaki Onishi, who assumed the post of Managing Director at KPM (UK) in April 2018, explains, "We do have an agreement that in terms of product development, the U.K. team leads the Staffa motor projects, and the Japanese team, hydraulic pumps and motors. However, the people in charge of developing these products in Japan and the U.K. are communicating closely. Looking back over the last 25 years, we pursued 'Joint-Growth' by taking approaches that were suitable for each country individually and, at the same time, made efforts to coordinate with each other. We would like to apply this procedure to Information and Communication Technology (ICT) initiatives and human resources development, as well as to management, in order to achieve effective collaboration."



**Martin Cunniff**  
Operations Director  
Kawasaki Precision Machinery (UK) Ltd.

Looking Forward to Tomorrow



## 140 Years of Kawasaki's Tie with the U.K.



Since its founding 140 years ago, Kawasaki has had a connection to the U.K. It was British technologies which supported the launching of several of our new businesses in the initial years. In conjunction with Rolls-Royce, we have been developing turbofan engines for passenger aircraft and gas turbines for ships, as well as supplying tunnel boring machines for the Channel Tunnel which opened in 1991, to name a few. And for a 1996 ceremony in Japan marking Kawasaki's centennial of incorporation, then prime minister Margaret Thatcher gave a special lecture.

Such history makes the establishment of KPM (UK) as Kawasaki's first development and manufacturing base in the U.K. and Europe 25 years ago the natural outcome of such a long-time relationship.

## A Leader's Voice

## Japan-U.K. Collaboration to Continue, to Keep Achieving "Joint-Growth"



### Lee Crocker

Executive Director, General Manager  
Kawasaki Precision Machinery (UK) Ltd.

KPM (UK) marked its 25th year of operations in 2019. We have undergone significant changes in the last quarter century. For example, our current product portfolio is very different from that of 25 years ago. Initially, we only had Staffa motors, but Kawasaki's hydraulic pumps and motors were later added, and we now have many variants of Staffa motors as well.

Over the years, sales have increased with fluctuations; we experienced a major dip in 2009 resulting from the global financial crisis, and a subsequent sharp recovery in 2010/2011. This experience has driven us to diversify our product offering, by increasing customer value and growing our industrial and agricultural market share.

Our primary clients, namely European and American manufacturers, are focused on transitioning to Industry 4.0, compelling us to accommodate the ensuing changes. Although some analysts view Brexit as being a potential business opportunity, as opposed to being merely a risk, it is still a factor which necessitates changes on our part.

At such times, we must focus on employee engagement and development, because unless employees are equipped to transform with these changes, we will not be able to keep up. This is aligned with Kawasaki's "Changing forward" cultural reform. I have a slogan, "develop people first, products next." We are offering training programs geared to all levels of employees and for all types of work. We have been awarded accreditation against the Investors in People Standard, the international standard for personnel management, given to companies which make significant investments in personnel development.

Kawasaki's Japanese management culture has supported KPM (UK)'s engaging working environment. This has contributed to creating an attractive workplace and providing a high retention rate of employees. Other companies tend to be less focused on long-term personnel development.

Looking back, we can say that our favorable relationship with major clients like JCB and Volvo is attributable to Kawasaki's superior brand power, technology, and products. Kawasaki, in turn, respected the superiority of Staffa motors' brand power, technology, and products.

Current MD, Masaki Onishi, is someone who experienced an interesting turn of fate, as he began working for KPM (UK) as an engineer 20 years ago, just when KPM (UK) decided to supply Kawasaki's hydraulic products. We hope to continue achieving "Joint-Growth" in the upcoming period of change by working closely together.



GM Lee Crocker with MD Masaki Onishi.

# High-Precision High-Speed Hydraulic Press for Carbon Fiber Reinforced Plastics (CFRP)



**Commentary by**  
**Masafumi Fukuda** (left)  
 Manager, Customer Service Development Division  
 Engineering Service Department  
 Kawasaki Hydromechanics Corporation  
**Ayumi Murakami** (right)  
 Export Division, Sales Department  
 Kawasaki Hydromechanics Corporation

## A Hydraulic Press Packed with the Industry Leader's Expertise

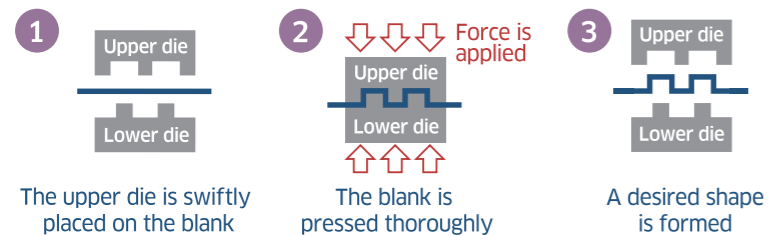
Press machines mold metal or resin material into desired shapes by applying high pressure. They come in two types, with different mechanisms for applying pressure — mechanical or hydraulic.

Kawasaki Hydromechanics Corporation (hereafter, "KHM"), one of Kawasaki's Group companies, is a press manufacturer with the largest market share in the Japanese hydraulic press market. To date, KHM has delivered 3,000 units, including 500 for customers outside Japan. The presses are used at various manufacturing sites, improving the quality of parts molding and achieving higher work efficiency.

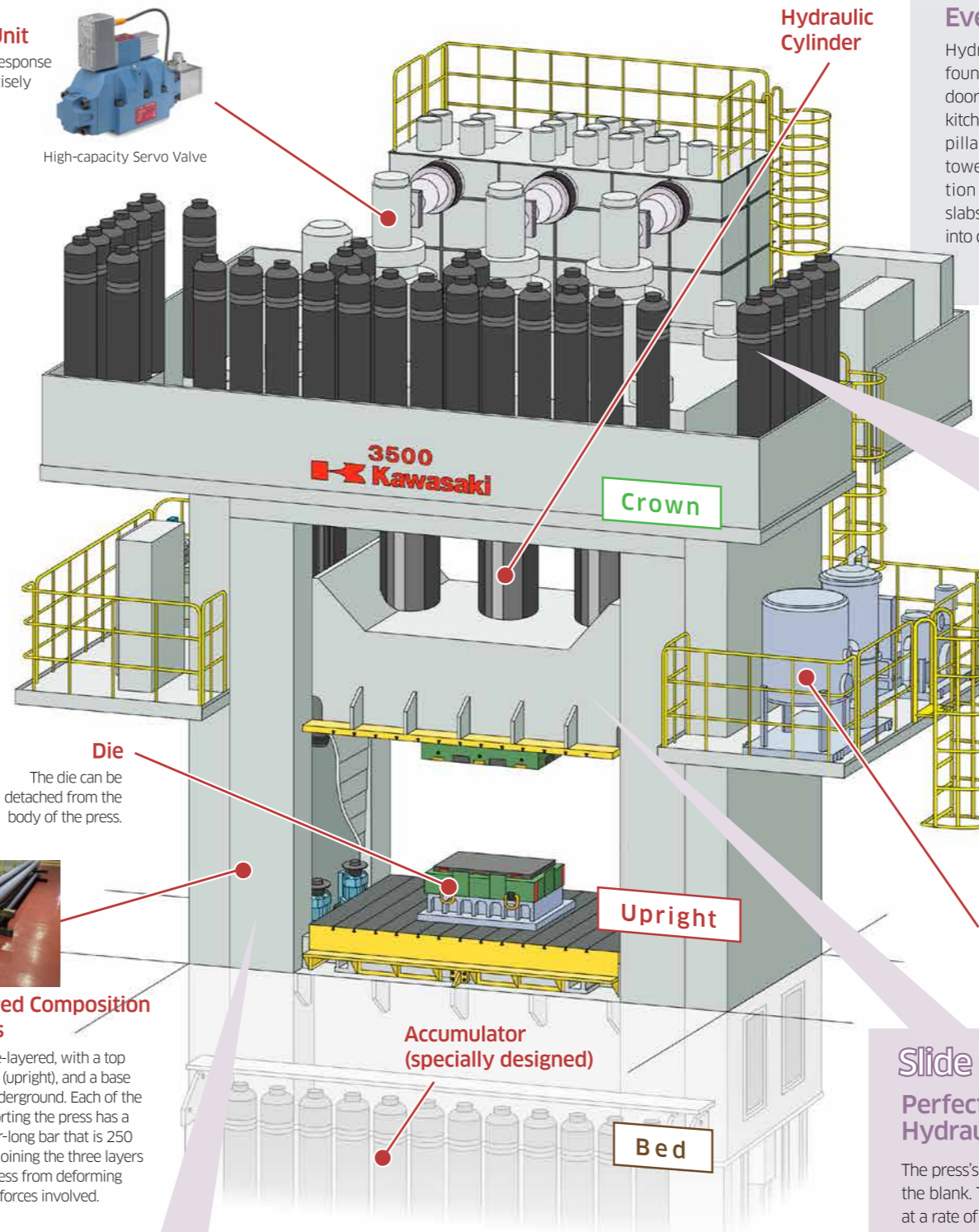
KHM has been leading the industry with notable achievements, such as commercialization of Japan's first numerical control system and a high-precision leveling system for hydraulic presses (see Kawasaki's Superior Technology on the right page). It has also developed a press with an output of 150,000 kilonewtons (kN), which is the highest in the world.

Recently, a high-precision, high-speed hydraulic press for molding carbon fiber reinforced plastic (CFRP) was delivered to Nagoya University's National Composite Center, which specializes in research for new-generation composite materials. Packed with the seasoned expertise of KHM, the machine is a "dual-purpose" press, capable of molding two different types of CFRP — thermoset (cured into a solid form when heat is applied) and thermoplastic (cured into a solid form when cooled) — by applying 35,000 kN of force.

### How a Press Machine Works:



**Hydraulic Unit**  
 The unit's high-response servo valve precisely controls the oil.



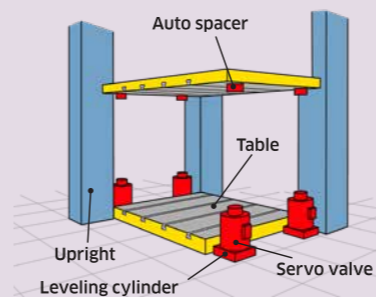
**Triple-layered Composition of the Press**  
 The press is triple-layered, with a top (crown), a middle (upright), and a base (bed) which is underground. Each of the four pillars supporting the press has a gigantic 11-meter-long bar that is 250 mm in diameter, joining the three layers to prevent the press from deforming under the strong forces involved.

## 4-point High-Precision Leveling System

Achieves Precision Level of 5/100 mm

When molding resins, pressure must be applied uniformly across the surface or the thickness of the product will be uneven. To prevent this, the upper and lower dies must be leveled and the movement of the press controlled according to the resin's expansion and contraction. A four-point high-precision leveling system makes this possible, achieving horizontal leveling accuracy of 5 mm per 100 mm. The system controls the hydraulic valve's movement according to various data sent from the sensors installed close to the four pillars that support the press.

Kawasaki's Superior Technology



## Molded Products Are Used Everywhere

Hydraulic presses produce products that are found in our everyday lives, such as the rear doors, chassis, and bodies of eco-friendly cars; kitchen sinks; and modular bathrooms. The main pillars of the Tokyo Skytree (a broadcasting tower with an observation deck) are made of slabs molded by a press into cylindrical shapes.

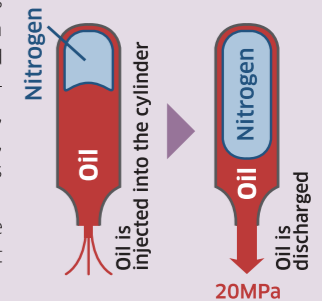


Kawasaki's Superior Technology

## Accumulator

Balloon-like Components of the Accumulators Control the Press Velocity

When molding CFRP, the two dies must be brought together and pressure quickly applied to the heated blank before it cools down. To achieve this, accumulators (which resemble gas cylinders) installed at the upper section of the press are used to move the press's cylinders speedily to close the upper die and keep pressing. Inside the accumulator is a rubber balloon filled with nitrogen, which is compressed as oil is injected into the cylinder. When the oil is released, the balloon rapidly expands, resulting in 20 megapascals (MPa) of pressure and discharging a massive volume of oil into the hydraulic circuit to move the cylinders.



## Vacuum Degasser

To improve the texture and prevent burning, any air or gas remaining in the dies is removed through holes in the dies by a vacuum degasser.

## Slide

Perfecting Tasks That Only Hydraulic Presses Can Do

The press's three cylinders press the die against the blank. These cylinders descend and ascend at a rate of 800 mm/sec, and upon deceleration, exert 35,000 kN of force on the blank in a variety of movements. These various movements and pressure retention features are what distinguish hydraulic from mechanical presses.

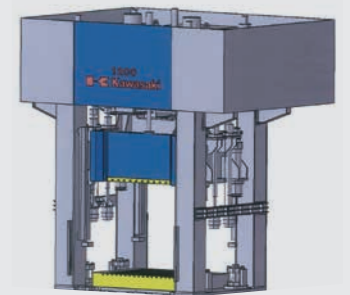
Kawasaki's Superior Technology



## Next Generation Model

### A Hybrid Press

At KHM, development of a "next-generation hybrid hydraulic press," which offers the benefits of both hydraulic and mechanical presses, is nearing its final phase. When complete, it is expected to lighten the load of oil changes and other maintenance. The company already has an established technology for an electro-hydraulic hybrid system which utilizes both electric motors and hydraulic systems. A prototype is scheduled to be installed at KHM to be used in customer trials.



Artist's rendition of the hybrid system



# Kaori Sasaki

*Creating a Place  
Where Women with  
High Aspirations Can  
Connect Comfortably  
with Each Other*

*Well deserving of the title, “a forerunner of diversity building,” Kaori Sasaki has long pioneered the development of innovative products and services focused on promoting diversity in Japan. Since the summer of 1996, she has annually produced the International Conference for Women in Business (ICWB), through which she has built a platform for women with high aspirations to connect with each other.*

## Gaining Diversified Perspectives Is Key to Change

In 1987, even before the term “start-up venture” was coined, Sasaki had formed Unicul International Inc., an international communications consultancy, while she was in her 20s and working as a freelance interpreter. In 1996, she opened the first-in-Japan bilingual (Japanese/English) portal for working women, with the mission of serving as an online platform where women with great ambitions could interact candidly.

In the same year, she launched one of the first international conferences for working women – the International Conference for Women in Business (ICWB). In addition, in the year 2000, she formed ewoman Inc., and later introduced her proprietary schedule-organizing method – the “Action Planner” – a product that became a time management trendsetter and best seller in the years that followed.

As someone who is always ahead of the pack, Sasaki has also been promoting diversity for the last 30 years. She comments, “Increasing diversity isn’t about having more women in your organization – it’s about gaining diversified perspectives. Ultimately, how diversified your organization becomes depends on how diversified your perspectives are during discussions, just as a new scene unfolds as you change your angle of observation. Increased diversity brings about innovation, but that doesn’t happen unless the organization makes an effort to transform the awareness and behavior of each individual.”

As a first move toward a more diversified workplace, many Japanese companies are hiring more women, but how will they incorporate workplace diversity in their management strategies?

In November 2018, Sasaki formulated the “Diversity Index,” which quantifies each employee’s understanding of what diversity means to their organization. She adds, “Just like annual

health check-ups, I would like companies to utilize the index to promote diversity.”

Part of her extremely busy life is spending time with her two children, but her powerful, energetic smile shows how much she enjoys both work and family. She explains, “As I have many responsibilities, staying energized is as important as working effectively. Even if I get stressed about something, I can’t afford downtime, so I’m pretty particular when it comes to choosing what to eat and how my time should be spent, in order to keep my energy level high.”

## It’s Important to Think “You Can Do It,” as Passion Opens Any Door for Anyone

Every year, nearly 1,000 motivated women gather at the one-day ICWB for 10 hours of intense interaction from 10 a.m. to 8 p.m. Many women participate on their own, without company sponsorship, but after being exposed to the positive energy of other participants and realizing how much they have in common, they become close. By the end of the conference, they feel like old friends.

“By the evening party, their appearances have completely changed from when they first arrive in the morning. The more positive-thinking women they get to know, the more their faces glow. They all exude energy in the evening, and I look younger in the evening than in the morning,” comments Sasaki laughingly.

The previous year, a 14-year-old junior high student had come with a handmade business card, paying the participation fee with money she had saved from her allowance. Some students share future resolutions to return as speakers, once they become working adults. These positive people spur one another on.

As these examples show, Sasaki is an innovator who keeps on creating “incubators” for other innovators. Her efforts exemplify a genuine desire to create a space where high-minded, positive women can connect.



ICWB is where people of any age, nationality, gender, or income can experience what diversity is all about. It offers an inspirational experience that is unique to ICWB.

Such efforts are an encouragement and inspiration to younger generations.

Sasaki comments, “I don’t want young people to think ‘I can’t do it.’ Not particularly ambition-driven and without a supportive background, I have always learned things the hard way, just like any young person. It’s important to want to try. If you have a passion to complete what you’ve set your mind on, you can achieve it. Discover that it’s fun to live outside the boundaries of ‘fixed ideas.’ The women at ICWB have an aura about them that is truly inspiring. They marry, have children, and work as executives. Yet despite their busy lives, they are happy and fulfilled. That’s probably a very different image from what one would normally have of a female executive, but I hope to show young women that anyone can become one.”



### Kaori Sasaki

Born in Yokohama, Kanagawa Prefecture, Japan. Currently CEO of ewoman, Inc. and Unicul International, Inc. Also serves as the Chairperson of the International Conference for Women in Business, which is now in its 24th year. Serves as an outside board member for several public companies and is a former member of the Regulatory Reform Council of the Cabinet Office of the Japanese Government, to which she was appointed by Prime Minister Shinzo Abe. Author of several books.

ewoman website:

[http://www.ewoman.co.jp/2005\\_about/english/](http://www.ewoman.co.jp/2005_about/english/)

International Conference for Women in Business website:

<http://www.women.co.jp/conf/about/index-e.html>

Unicul International, communication consultancy:

<http://www.unicul.com/english/index.html>

## Kawasaki Produces Five-Thousandth Locomotive

Kawasaki completed its 5,000th locomotive, and commemorated this achievement with a celebratory ceremony at the Hyogo Works on December 20. This unit was an EF210 electric locomotive built for the Japan Freight Railway Company (JR Freight). The EF210 is JR Freight's primary

locomotive for major railway lines such as the Tokaido and Sanyo Lines, and Kawasaki has worked in cooperation with the Mitsubishi Electric Corporation to manufacture more than 100 EF210s to date.

Over 110 years have passed since Hyogo Works' establishment in 1906, and the facility

has produced more than 90,000 railway vehicles since then. Its first locomotive, delivered in 1911 to the Ministry of Railways, was a Type 6700 steam locomotive. Hyogo Works also produced Japan's first diesel-electric locomotive, the DD10, and has provided AC electric towing locomotives for use by the Panama Canal Authority, JR Freight DF200 diesel-electric locomotives used primarily for freight services in Hokkaido, and other locomotives to numerous customers in Japan and abroad.

In recent years, various social challenges, including environmental concerns and a shortage of truck drivers, have been accelerating a modal shift in freight transport. Based on advanced technological capabilities and highly reliable products and services, Kawasaki will continue to provide trains, an environmentally friendly mode of transportation, to customers around the world.



## New UK Subsidiary Established to Produce Autonomous Underwater Vehicles (AUVs)

In Aberdeen, Scotland, UK, Kawasaki recently launched a new subsidiary of Kawasaki Subsea (UK) Limited, to specialize in the production, sale, and post-sale servicing of AUVs.

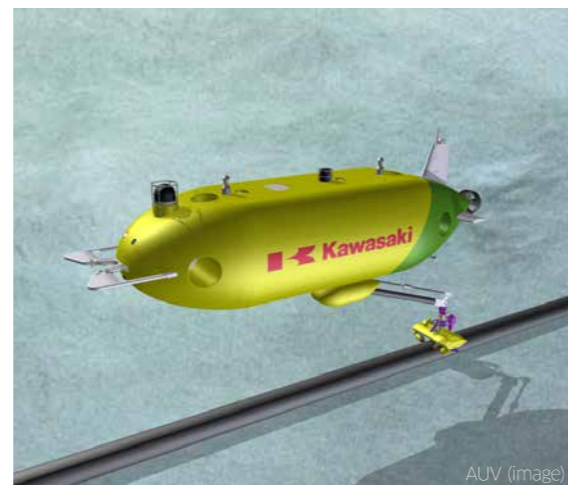
With a focus on the growing demand for pipeline maintenance in offshore oil and gas fields, Kawasaki has been developing the world's first AUV equipped with a robot arm for subsea pipeline inspection, based on a fusion of submarine technologies and industrial robot technologies fostered in-house over many years.

Kawasaki plans to launch the AUV in fiscal 2020. Prior to that, the company intends to increase its market presence and construct a business network through the new subsidiary, which is strategically

located in Aberdeen — a hub city for North Sea oil and gas business.

Scotland is a global leader in offshore development, innovating subsea technologies for offshore oil and gas development. Following the establishment of this local subsidiary, Scottish Economy Secretary Mr. Derek Mackay stated, "I am delighted to welcome Kawasaki Heavy Industries who set up an office in Aberdeen." Expressing his strong expectations for Kawasaki's AUVs, he continued: "There have been a number of joint subsea projects between Scotland and Japan, and I am

confident that Kawasaki Heavy Industries will play a leading role in this two-nation relationship in the subsea industry."



AUV (image)

## Kawasaki Starts Sales of New H145//BK117 D-3 Helicopters

On March 6, Kawasaki released the new H145//BK117 D-3 helicopter (BK117 D-3), which was jointly developed with Airbus Helicopters Deutschland GmbH.

Central Helicopter Service Ltd., which operates 10 BK117 helicopters for EMS, disaster prevention operations, and VIP transportation in Japan, will be the first customer to use the BK117 D-3 in Asia.

The BK117 D-3 features a 150 kg increase in useful load with a five main rotor blade system and shortened maintenance downtime, while inheriting features of preceding BK117 D-2 that has earned high acclaim, such as versatility, wide clamshell doors at the rear, outstanding hovering performance, and low noise level.

The BK117 is a medium-sized, twin-engine helicopter used for various purposes, including emergency medical services, firefighting, disaster relief, law enforcement, broadcasting, and personnel and cargo transport. Following delivery of the first model in 1983, the BK117 has been continually improved over the years, and thanks to the aircraft's outstanding technological strengths and high reliability, Kawasaki has successfully

delivered 178 units as of March 5, 2019. Including those delivered by Airbus, the total exceeds 1,500 worldwide, making it a global bestseller.



## RPF and Biomass-fired Boiler Delivered to Korea's Jeonju Paper Corporation

Kawasaki delivered an RPF\*1 and biomass-fired boiler ordered by Samchully ES Co., Ltd., a Korean engineering firm based in Seoul, which then supplied the boiler to Jeonju Paper Corporation, a leading paper manufacturer in Jeonju City, Korea.

The delivered unit is an internal circulation fluidized bed boiler (ICFB) that burns RPF and wood chips as fuel. It supplies 131 tons of high-temperature, high-pressure steam per hour, the largest capacity in its class ever manufactured by Kawasaki. Jeonju Paper has introduced the new ICFB as part of upgrades to the power generation system within its plant. Steam generated by the boiler and electricity created by the steam turbine power generation system will be used to operate the company's paper mill, with surplus power being sold to a local power supplier. Samchully ES, which was contracted to carry out the facility upgrade, has completed the necessary installation work and commissioning, and the boiler continues to

operate steadily. Including this latest delivery, Kawasaki has delivered a total of three boilers of this type to Korean customers.

Kawasaki's ICFBs can use numerous types of fuel and are capable of providing the high-temperature, high-pressure steam needed for high-efficiency power generation operations. Compatible fuel types include fuels made from solid waste such as RDF\*2 and RPF, waste plastic, biomass fuels such as PKS\*3, gumwood, waste wood, and wood chips. This boiler features combustion and heat recovering cells that divide the fluidized bed portion into separate partitions, and its internal structure allows the fuel and bed materials to circulate from the combustion cell to the heat recovering cells by varying the velocity of airflow. By separating combustion gas and bed material flows, this design enables stable and sustained burning of fuels containing chlorine, a substance that

creates the risk of problems such as corrosion and efficiency decreases within boiler heat exchanger tubes, and of alkaline fuels containing constituents such as potassium and sodium. As a result, it is possible to use refuse-derived fuels with high chlorine content and high-alkalinity biomass fuels, which have seen very little use until now.



\*1 RPF: Refuse paper and plastic fuel. Solid fuel consisting primarily of waste paper and waste plastic, industrial waste materials that are difficult to recycle.

\*2 RDF: Refuse-derived fuel. Solid fuel consisting primarily of combustible municipal solid waste.

\*3 PKS: Palm kernel shells. Fuel consisting primarily of palm kernel shells collected from palm fruit.

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