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Scope
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No. 120 Summer 2019
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Special Feature

Life-Saving Wings:

Factors that Make the BK117 a Great Fit for Emergency Medical Services

カワる、
サキへ。
Changing forward

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An emergency medical service helicopter preparing to depart from Kawasaki Medical School Hospital. See *Special Feature* for details (page 2).

The BK117 D-2 model

Life-Saving Wings:

Factors that Make the BK117 a Great Fit for Emergency Medical Services

A helicopter dedicated to emergency medical services (EMS) can transport a physician swiftly to a patient in peril and provides on-board medical care. Kawasaki's BK117 Series helicopters account for about 50% of the rotorcraft engaged in life-saving missions in Japan. What are the factors that make the BK117 a preferred choice? This issue of SCOPE focuses on Kawasaki's superior technologies that ensure reliable and safe operation of these EMS helicopters.

EMS Helicopters Reduce Patient Deaths by 40% Compared to Ambulance Transport

The history of EMS helicopters in Japan goes back to an encounter of two parties: a group of physicians who were distressed over the deaths of many patients during long-distance emergency transport, and public administrators troubled by a growing number of patients seriously injured in traffic accidents. The groups met for the first time through Dr. Sukenobu Kawasaki, the founder of Kawasaki Medical School in Kurashiki City, Okayama Prefecture, and out of this meeting came a project to establish a system for providing helicopter-assisted emergency medicine — the materialization of the EMS helicopter.

Next to the heliport at Kawasaki Medical School Hospital is a monument with a small plate with the inscription, "Birthplace of the EMS Helicopter." Here in April 2001, full-scale operation of Japan's first EMS helicopter was launched. In 2007, the Japanese government enacted the "Act on Special Measures Concerning Securing of Helicopter Emergency Medical Services," which stated the country's view on utilization of EMS helicopters and paved the way for them to be adopted nationwide.

An EMS helicopter is defined by the government's Act as a "system whereby a helicopter equipped with medical devices and pharmaceuticals transports physicians and nurses to an emergency site and then transports physicians and nurses to an appropriate medical institution after providing medical care on the spot." Flying 50-70 km or 15-25 minutes (one way) is considered a standard range for missions.

Emergency care is a race against time. According to a study by a group under the Japanese Ministry of Health, Labour, and Welfare, the average time between a dispatch request and a physician on an EMS helicopter reaching the emergency site and starting treatment is 14 minutes — an average of 27 minutes less than that of ambulance

An EMS helicopter (the BK117 C-2) standing by at Kawasaki Medical School Hospital.

transport. It is estimated that, compared to ambulance transport, the EMS helicopter can reduce patient deaths by 39% and severe injuries/sequelae by 13%.

As of March 31, 2019, such helicopters were operating at 53 sites in 43 out of 47 prefectures. They were engaged in about 25,000 dispatches in fiscal 2016, or 7.5 times the number in 2004.

Currently, of all EMS helicopters used in Japan, 25, including reserve helicopters, are BK117s. SCOPE's editorial team visited a hospital where one of these "life-saving wings" is in use, to find out how the BK117 is meeting the expectations of helicopter operators and medical professionals.

Dr. Ryukoh Ogino
Head of the Emergency Department and
Advanced Emergency Medical Center
Kawasaki Medical School Hospital

Physician-Patient Contact 68 Min. Faster in One Case

Kawasaki Medical School Hospital's Advanced Emergency Medical Care Center is home to Okayama Prefecture's EMS helicopter. The model used is the BK117 C-2, which can seat a pilot, a mechanic, and four other people, including a patient on a stretcher in the rear of the cabin. The cabin houses various devices, including monitors, a syringe pump for high-accuracy intravenous infusions, an artificial respirator, and a suction pump, in addition to pharmaceuticals. The team departs within five minutes after a call for dispatch and reaches the site within 30 minutes if the destination is located in Okayama Prefecture. In fiscal 2017, they handled 362 dispatch requests.

Dr. (Professor) Ryukoh Ogino, the head of the Emergency Department and Advanced Emergency Medical Center at the hospital, explains, "In terms of the type of disease that EMS helicopter service was requested for, traumatic injuries accounted for 55%, followed by cerebrovascular disorders at 15%, and cardiovascular diseases at 10%. To better accommodate these needs, we established a system to facilitate the coordination between the EMS helicopter service and medical facilities at the hospital, including a stroke care unit (SCU) run by the Stroke Department."

Some impressive cases of shortened travel time have been reported: In one, the medical team arrived 68 minutes faster than by other means to make contact with a patient who had an acute myocardial infarction while driving on the freeway. In another case, a patient who stabbed himself in the neck with a knife was transported to the hospital in 57 minutes, achieving a 37-minute reduction in accessing a physician.

The hospital's EMS helicopter is operated by Central Helicopter Service, Ltd., on a contract basis, which provides the helicopter and three staff: a pilot, a mechanic, and a communication specialist (CS). After receiving a dispatch call, the pilot and mechanic get in the cockpit, while the CS in the flight control room judges the feasibility of the flight, based on weather conditions and other factors, and selects a suitable landing site to retrieve the patient.

Manabu Yamasaki, team leader and mechanic, comments, "Everyone on board the EMS helicopter, including the pilot, the physician, and the nurse, works together as a team. I'm a mechanic, but I check the electrocardiogram monitor, and make sure that the IV tube doesn't get tangled, obstructing treatment. I also collect patient information needed by the physician before we reach the landing site, such as overall conditions, blood pressure, and respiratory status. It is also our responsibility as crew members to inform the destination hospital of the patient's name and condition."

United as a Team for Absolute Safety

"Absolute safety" is what the members of an EMS helicopter are called to strive for.

Manabu Yamasaki
Maintenance Enginer
Flight Operation Department
Central Helicopter Service, Ltd.

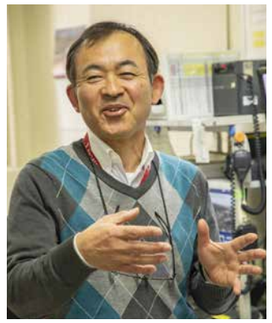
Needless to say, this takes meticulous maintenance of the helicopter by the mechanics. In addition, if the patient is stabilized during the flight, even the physician and the nurse are asked to pay attention to any changes in the surrounding environment.

Pilot Naoto Okabe comments, "I fly expeditiously, but never in a rush. We all have a strong desire to save the patient, but deliberately suppressing that sense of haste is a must in order to fly safely."

Throughout the mission, the CS plays a behind-the-scenes role of supporting safe operations and providing an optimal care environment for the patient. It is for this reason they are called "communication specialists" and not "flight controllers."

The CS receives the call for dispatch. Then, using the hospital's internal radio system, the CS shares the information with the Emergency Medical Center physician and the staff at the heliport (where the EMS helicopter is standing by). The CS then judges whether the flight is feasible, and if so, recommends to both pilot and physician a rendezvous point (with an ambulance that will take the patient to the nearest medical facility).

CS Hideaki Harayama explains, "The ultimate mission of an EMS helicopter is to safely bring a physician and nurse to a patient as quickly as possible. Valuable time is lost if the CS is unable to make a quick decision on whether or not a flight is possible. Even while standing by, the



Hideaki Harayama
Dispatcher
Flight Operation Department
Central Helicopter Service, Ltd.

The flight control room for the EMS helicopters. When a dispatch request is made via the hotline, the CS immediately contacts related parties through the hospital's internal radio system and selects a route and rendezvous point.

The EMS helicopter lifting off after receiving a dispatch call. On this occasion, the helicopter transported a patient to a different hospital, returning shortly before sunset.

CS is constantly monitoring the weather, simulating all possible scenarios to see which landing point would result in the least amount of time in reaching the patient, or whether it would actually be faster to request an EMS helicopter from a neighboring prefecture."

The CS is also responsible for ensuring that 1,100 rendezvous points, including ones in neighboring prefectures, are safe to be used in the event of emergency, and for mitigating any complaints from local residents in conjunction with the administrative departments of local hospitals.

"We inspect about 40 to 50 rendezvous points annually. If any changes occur, such as a newly-installed communications antenna in the nearby area or trees that have grown too tall, we must deal with them," comments Harayama.

These examples show how CSs are equipped with specialized communication skills to assist EMS helicopter operations. It has been five years since Hayarama, previously a pilot, began his CS career. His extensive knowledge of flying and air safety are fully utilized in his role as a CS.

Capability of the BK117 to Meet Diverse Needs

Why are so many units of the BK117 Series adopted as EMS helicopters? The answers are in the voices of professionals who are involved in EMS missions.

One of the features signature to the BK117 is its spacious cabin. Professor Ogino elaborates, "The cabin can accommodate five people, or four people aside from the patient, so two physicians and two nurses can be on board or a physician-in-training can take one of these seats. If the condition of the patient so requires, we have enough space to bring in optional equipment. This means that the BK117 allows for better medical intervention than other models."

Mechanic Yamasaki cites the functionality of the rear clamshell doors as another reason that the BK117 is preferred. "The clamshell doors provide enough room for loading and unloading a stretcher, and because of the slightly elevated position of the floor, the stretcher's legs can be stretched out securely. These may be small things, but they are some of the factors that ensure absolute safety."

Pilot Okabe stresses the fact that the BK117 is the only Category A, twin-engine EMS helicopter. Category A helicopters are multi-engine helicopters capable of safe flight even if one engine becomes inoperative. Okabe adds, "Even in such an emergency, it can keep flying safely. In addition, because the C-2 model has great engine output and offers highly-responsive maneuverability, it is capable of smoothly avoiding dangers. The BK117's instruments warm up quickly, which significantly reduces the time between the call for dispatch and the liftoff."

Kawasaki partnered with Europe-based Airbus Helicopters in developing the BK117, with Kawasaki in charge of developing and manufacturing the transmission and gearbox, which transmit engine power to the rotor, as well as the fuselage. Development of the spacious cabin and rear clamshell doors would not have been possible without Kawasaki's seasoned manufacturing expertise. The clamshell doors were made possible because the high-performance gearbox was compact enough to be installed on the ceiling, also resulting in a roomier cabin and the tail boom being in a higher position than in other helicopters.

EMS helicopters are "life-saving wings" and Kawasaki's technologies are behind their effectiveness.

Naoto Okabe
Pilot
Flight Operation Department
Central Helicopter Service, Ltd.

The cabin houses various medical devices. On the right side of the photo on the right is a stretcher for carrying patients. The photo on the left shows an avionics suite that greatly reduces the pilot's workload.

Rear clamshell doors secure enough space for loading/unloading the patient. The height of the cabin floor is configured to make it easy to stretch out the stretcher's legs.

A Leader's Voice

Katsumi Tamura

Deputy General Manager, Helicopter Project Division, Aerospace Systems Company

Ensuring the Continuity of Life-Saving Missions with Development/Manufacturing Technologies and After-Sales Support for EMS Helicopters

The BK117 is a multi-purpose helicopter with a spacious cabin and rear clamshell doors, which are unique features that have encouraged many operators to adopt the BK117 for EMS work. In addition to its usability, the helicopter offers high maneuverability, durability, and flight safety. Coupled with ease of maintenance, the BK117 has won overwhelming support from customers involved in EMS operations.

Supporting these excellent features are Kawasaki's development and manufacturing capabilities. The spacious cabin and clamshell doors were made possible because our design and manufacturing prowess resulted in a compact, high-performance transmission. The latest D-3 model adopts a system with five main rotor blades, which achieves less vibration and thus greater comfort when boarding. An increase in useful load was also achieved. These features translate to improved functionality of the BK117 as an EMS helicopter, allowing for safer and more reliable operations.

When it comes to EMS helicopters, I consider that it is the responsibility of the manufacturer to provide ongoing after-sales support, as our job doesn't end when the deal is closed. In addition to existing services, we began offering a Parts-By-the-Hour (PBH) program in April 2019, through which we ship spare parts immediately should a failure occur. This new program will reduce maintenance and flight downtime, and thus raise the helicopter's operation ratio.

Moreover, in May 2019, we launched a training center dedicated to training pilots and mechanics of the BK117 Series, and for advanced training of those who already have basic skills. The center is equipped with training equipment for the maintenance of the Fenestron tail rotor, which was adopted for the first time by the BK117 D Series, and for mastering the use of the cutting-edge avionics suite.

Kawasaki is committed to ensuring the continuity of EMS operations in Japan by contributing to the safe flying and operational stability of the operator which provides the EMS helicopters and staff — as well as operational services — to its clients, through technical support and development of human resources. We believe such an approach best reciprocates the confidence that those who are involved in EMS helicopter missions have in us.

Looking Forward to Tomorrow

BK117 D-3 Evolving to Achieve Even Higher Performance

Since delivery of the first unit in 1983, 178 BK117 helicopters have been delivered in Japan as of May 10, 2019. When deliveries by Airbus Helicopters are included, the number exceeds 1,500 units worldwide, making it a global best-seller. The latest model, the BK117 D-3, which made its debut in March 2019, inherits the features of the D-2 but adopts a cutting-edge system with five main rotor blades. As a result, compared to the D-2, its useful load increased by 150 kg to 3,800 kg, and the maintenance time for the main rotor system was shortened.

Please also see the feature story on the BK117 on Kawasaki's Brand Site "THE STORIES."

The site contains articles and videos introducing an array of Kawasaki products and how they are utilized, as well as the social contributions the company makes through manufacturing. **https://global.kawasaki.com/en/stories/articles/vol77/**

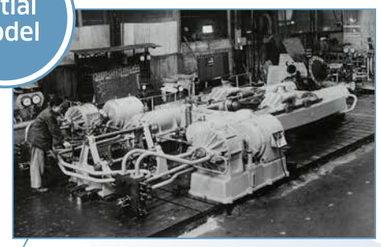
Epoch Maker

Kawasaki's Electro-hydraulic Steering Gear:

A Behind-the-Scenes, Cutting-Edge Product Boasting the Largest Global Share

An electro-hydraulic steering gear controls a ship's rudder, which is the ship's turning mechanism. Kawasaki boasts the world's largest market share in this sector, with their products installed on a cumulative total of 20,000 vessels, reflecting the deep confidence customers have placed in its product. Such a large number of deliveries is the result of Kawasaki's commitment to resolving the challenges presented by each successive era, resulting in superior steering gears being adopted by vessels of the largest class built during that period.

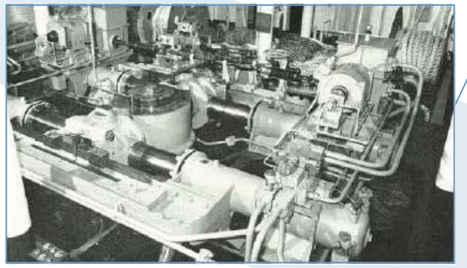
Initial Model



1925

Hele-Shaw Type

The first domestically-produced electro-hydraulic steering gear using technology obtained through partnerships was installed on the merchant ship *Florida Maru*, followed by the cruiser *Kinugasa* in 1926, and the aircraft carrier *Hiyo* in 1942. After WWII, Kawasaki also developed a compact Hele-Shaw steering gear for fishing boats, contributing to the modernization of fisheries in Japan.



1964

BV Type

The FD-85P, with its BV axial piston pump developed by the German firm Bruninghaus, was installed on the tanker *Tenryugawa Maru* in 1964, closing out the era in which large Hele-Shaw pumps had typically been used. This innovation achieved a significant cost reduction through increased hydraulic pressure and rotational speed not possible with the Hele-Shaw pumps. Many mega tankers broke capacity records by adopting the BV Type, and these development efforts helped Kawasaki strengthen its technological foundation.

1987

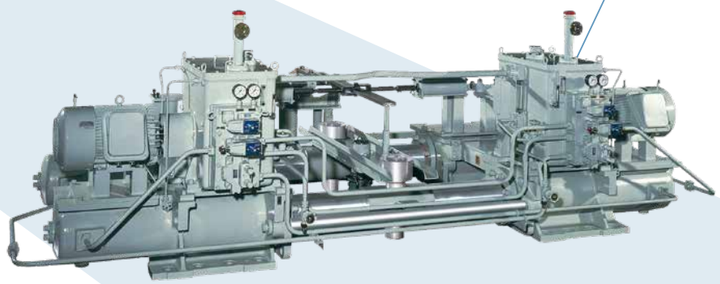
LV Type

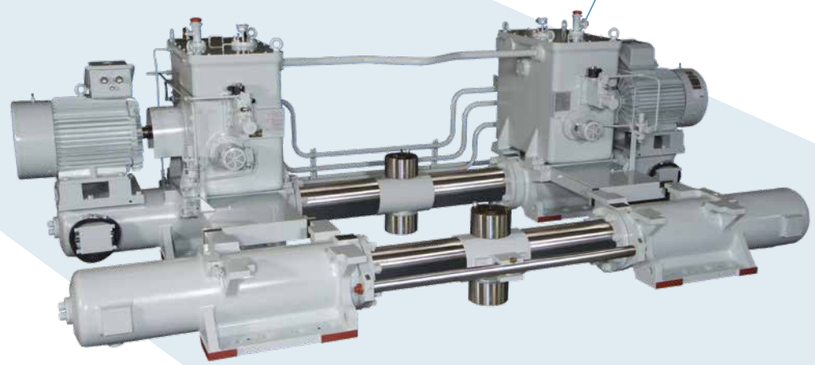
Kawasaki developed the "LV Type" large steering gear using its L Series bent-axis-type axial piston pump and other proprietary technologies. Adoption of the high-pressure, long-lasting L Series pump dramatically increased the steering gear's hydraulic pressure and durability, as well as its response capability and steering angle accuracy achieved via the development of a continuous control system. These features worked together to maximize the energy-saving autopilot's performance.

2016

LV Type 20 Series

This series, with its redesigned steering gear actuator which realized higher hydraulic pressure, reduced weight, and a more compact size than the LV Type, provides enhanced competitiveness while maintaining the Type's reliability. Compared to the initial model of the Hele-Shaw pump developed nearly a century ago, power density per unit weight has increased six-fold.





Development of the electro-hydraulic steering gear was a technological revolution that changed the landscape of the sector, which had previously been dominated by steam-pressure-driven gears. To capitalize on this innovative technology, Kawasaki decided to partner with the U.K.'s John Hastie & Co. Ltd. and the Hele-Shaw Company in 1916, to utilize the Hele-Shaw type electro-hydraulic steering gear in its products.

The first vessel equipped with this steering gear was the merchant ship *Florida Maru*, completed in 1925, followed by the cruiser *Kinugasa* in 1926. (Kawasaki also began manufacturing Hele-Shaw pumps in 1924.) At that time, the most popular hydraulic power source for steering gears was the electric-motor-driven pump, and it remained so for a long time as it was possible to change the discharge rate as well as the direction of the oil flow.

In 1964, Kawasaki started to manufacture large "BV Type" electro-hydraulic steering gears, using the B Series axial piston pumps of the German firm Bruninghaus, with whom Kawasaki entered into a technological tie-up. This steering gear was adopted by successive mega tankers, with each one breaking the world record for capacity. In the process, Kawasaki continued upgrading the product in terms of reliability, durability, accuracy, and torque characteristic suitable for actual rudder load — the mandatory features of steering gear.

Because pumps are key to operating electro-hydraulic steering gears, Kawasaki developed the "LV Type" steering gear in 1987, for which their proprietary L Series bent-axis-type axial piston pump was adopted. This was another technological innovation in the marine equipment sector.

The company's journey of innovation continued: in 2016, it launched the "LV Type 20 Series" which achieved higher hydraulic pressure and lighter weight compared to the LV Series, while ensuring equivalent reliability. Furthermore, in 2018, in conjunction with Mitsui O.S.K. Lines, Kawasaki launched a project to develop steering gear technologies which would provide energy-saving operations and failure prediction resulting from new sensing capabilities and big data analysis. Kawasaki is sure to lead the industry in the coming era, too, when steering gears will be equipped with intelligent features.

Techno Box 20

Cutting-edge technology that results in easy-to-use, failure-resistant machines for heavy-duty use.

FX850V-EFI: General Purpose Engine for Lawn Mowers

Commentary by

Masahiro Nonaka (left)
Assistant Manager, Section 1, R&D Department
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Yuichiro Imai (right)
Manager, Sales Administration Section
Planning & Business Operation Department
General Purpose Engine Division
Motorcycle & Engine Company
Kawasaki Heavy Industries, Ltd.

The Engine which Earned Unrivaled Support from Lawn Mowing Professionals

The FX850V-EFI is a general purpose engine used for commercial riding mowers marketed mainly in the U.S. In 1957, Kawasaki began manufacturing and selling general purpose engines in Japan, and since then, in order to strengthen its business foundation in this segment, has been expanding the engines' applications into areas such as agriculture, light industry, golf, leisure, and lawn care. Sixty years after the launch of the business, the engines are now manufactured at factories in the U.S. and China*, 90% of which are sold to mower manufacturers in the U.S. through Kawasaki Motors Corp., U.S.A. (KMC).

The market size of riding mowers in the U.S. is huge, with the number of sales reaching almost two million units annually. Kawasaki's general purpose engines enjoy about a 60% market share in engines for the professional segment (customers in the landscape industry mainly offering mowing services), and boasts top-selling status among general users. Such a high level of support for Kawasaki engines is attributable to strong confidence in their quality, performance, and durability, and our vast support network of over 7,200 Kawasaki dealers.

Professional users seek equipment with the least likelihood of downtime, as well as a powerful engine which can maintain optimal blade tip speed regardless of lawn conditions. A malfunctioning mower increases downtime, thereby reducing income. If an engine gets overloaded and blade tip rotation slows when trimming overgrown grass or working on a slope, the mower will fail to produce a sharp cut. If the blade edge is dull, the tip of the grass discolors quickly and is unattractive. However, if a mower's speed and blade rotation are unaffected by changes in load — that is, if the engine's rpm remains stable — the grass will be cut cleanly.

"Trust" is what Kawasaki considers to be the brand's core value for its general purpose engine, because a trustworthy engine is what customers desire.

* General purpose engines are manufactured in the U.S. by Kawasaki Motors Manufacturing Corp. U.S.A. (KMM), and in China by Changzhou Kawasaki and Kwang Yang Engine Co., Ltd. (CK&K).

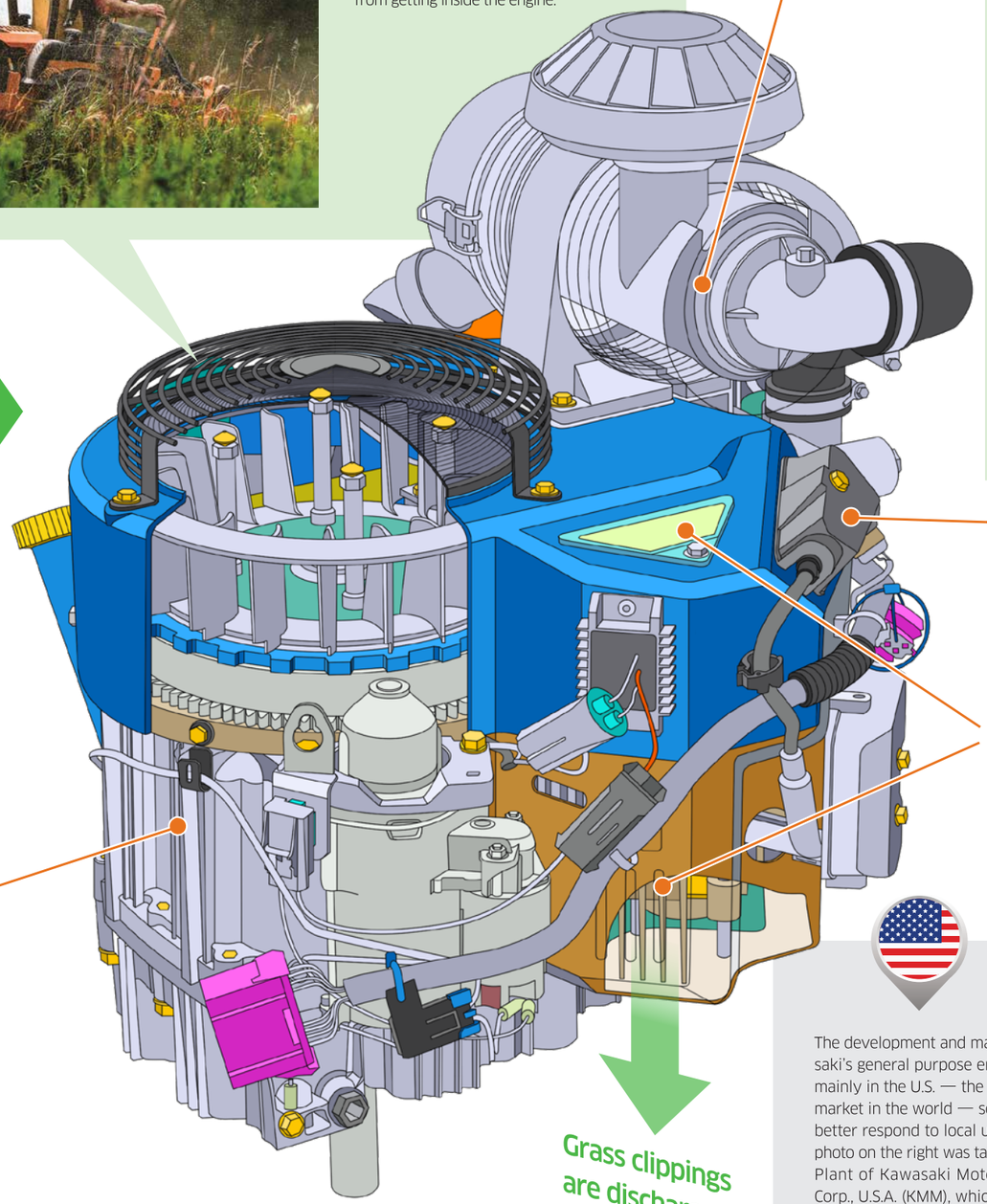
Kawasaki's Superior Technology

Rotary Chopper Screen Fights the "Enemy"

Grass clippings are actually the general-purpose engine's worst enemy, because they fly up into the space between the engine and cover and accumulate there. Because of this accumulation, an air-cooled engine can overheat and therefore malfunction. To prevent this, the FX Series is equipped with a "rotary chopper screen," which is a disc with small holes that rotates above the engine, inside the cover, preventing grass clippings from getting inside the engine.

Cylindrical Air Filter Supports Demanding Engine Drive System

Clean air is a must for an engine to operate without failures, and to that end, this system adopts a heavy-duty cylindrical air filter. An umbrella-like device at the top prevents rain from getting into the filtering system.

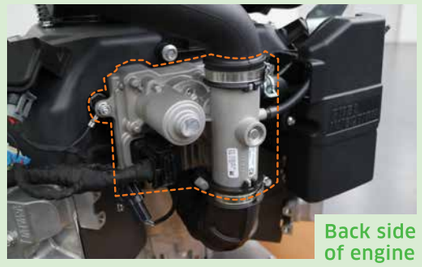


V-Twin Engine with Impressive Power

The 852 cc engine is V-shaped with a vertical output shaft. Only 516 mm long, 503 mm wide, and 620 mm high, this engine produces up to 29.5 horsepower (gross @ 3600 rpm) despite its compact size. Thanks to this outstanding performance, coupled with an integrated electronic throttle and electronic fuel injection (EFI) technology, a reduction in fuel consumption has been achieved compared to carbureted engines. Because the rpm of the engine is fixed and unaffected by load changes, commercial mower productivity has also improved.

Kawasaki's Superior Technology

e-Gov and EFI Achieve Clean-Cut Mowing



Back side of engine

An electronic throttle which has been integrated into the engine control unit (ECU) and an electronic fuel injection (EFI) system are both key to achieving clean-cut mowing. The ECU uses sensors to collect information on temperature, intake pressure, throttle position, etc., enabling the integrated electronic throttle to automatically open/close the throttle-plate according to the engine's rpm and load. In addition, the EFI works with the control system of the electronic throttle to inject fuel in a highly precise manner to maximize output and fuel efficiency. As a result, the engine's rpm remains unchanged and good operational efficiency is maintained even if the load fluctuates. The ECU-integrated electronic throttle is a proprietary design by Kawasaki that provides robust failure resistance and an outstanding competitive edge in the market in terms of response speed and reliability.

External Ignition Achieves Greater Engine Cooling Efficiency

An ignition-coil is an electronic device that produces a spark to start in-cylinder combustion. In the case of the FX850V-EFI, however, it is placed outside the engine cover, because such a configuration creates the least obstruction to the air flow, resulting in increased cooling efficiency of the engine. This improved structure also contributes to preventing accumulation of grass clippings around the engine.

Marketing with Emphases on Ease of Maintenance and Kawasaki's Brand Power

Grass clippings can pass through the space between the engine and the cover and be discharged from below. For ease of maintenance, the mower has two triangular inspection plates bearing the Kawasaki logo, one on either side of the cover, which can be easily removed to inspect for any grass clippings which may get stuck around the engine. For mower manufacturers, the Kawasaki logo indicates to customers the superiority of their products.

A "Made in America" Product

The development and manufacture of Kawasaki's general purpose engines is conducted mainly in the U.S. — the largest lawn mower market in the world — so that Kawasaki can better respond to local users' feedback. The photo on the right was taken at the Maryville Plant of Kawasaki Motors Manufacturing Corp., U.S.A. (KMM), which manufactures the engines. Keeping a lawn beautiful is every user's dream, and the Kawasaki brand ensures that the dream will come true.

Aspiring to Broaden Bonsai's Potential While Preserving Its Tradition

Masashi Hirao

Bonsai master Masashi Hirao has visited 30 countries with the mission of creating opportunities for people to "meet" bonsai in a new way. To demonstrate his techniques, he has chosen unconventional venues such as bars, clubs, and streets. The editorial team of SCOPE interviewed this unorthodox master at his bonsai garden, "Seisho-en," to find out his present aspirations.

Visiting Other Countries Made Me Realize What a Craftsman Should Aspire To

To start his demonstrations, Hirao raises his scissors high in the air and then adopts an attitude of prayer. After that, accompanied by music provided by a DJ or a band, he does improvisational styling and shaping of a tree reminiscent of a dinosaur's spine, housed in a huge pot, completing his "performance" within a given limit of 30 minutes. His unique world of bonsai has been enthusiastically welcomed by the art scene around the world, resulting in highly-rated events in 30 countries.

Regarding his unconventional style of bonsai demonstrations, Hirao comments, "During my apprenticeship under the late Master, Saburo Kato, I already felt uncomfortable about the bonsai industry's fixed notion that bonsai is a unique realm that exists completely outside the ordinary world, and desired to bring the bonsai I love to a status on par with fashion, design, and art. So, although I was only a trainee, I was giving presentations on the beauty and joy of bonsai in places that belonged to completely unrelated industries."

After completing his apprenticeship in 2009, Hirao embarked on a "boot camp tour" abroad, visiting Spain, Argentina, Italy, the Philippines, the Netherlands, and France. Hirao recalls, "It was during my trips that I got the idea of doing a live bonsai performance. But because I consider myself a simple craftsman and not an artist or a creator, I always strive to live up to a high standard of behavior as a person who represents Japanese culture. Even if 100 people say I'm great, if a single person thinks I'm 'not authentic,' I'm ruining the good reputation of all Japanese bonsai masters."

His commitment paid off; news about his unique activities spread fast and in 2013, he was chosen as one of Japan's Cultural Envoys designated by the Japanese Agency for Cultural Affairs. Under this program, he visited 11 countries in four and a half months, engaging in international cultural exchange using bonsai.

Commenting on his experiences, Hirao says, "Each country I visited had a completely different way of enjoying bonsai. One day, I was approached by an Italian who demanded of me, 'Why don't Japanese people know much about bonsai?' It's true that bonsai still has the image of being a hobby for retired people. That comment significantly changed my thinking; I decided to teach the essence of bonsai to Japanese people first, instead of teaching it outside the country."

The Bottom Line: Bonsai Is a Way of Loving Living Things

At Hirao's bonsai garden, "Seisho-en," which he opened in Saitama Prefecture in 2016, there is a bar counter and a lounge — his attempt at helping younger generations and families with children to enjoy bonsai in a more relaxed setting.

In regard to teaching bonsai, Hirao says, "After I launched workshops in Japan, I felt that people had a tendency to think 'bonsai is too hard,' or 'what if I fail?' and overthink things, worrying about potential negative outcomes. Maybe it's because people see bonsai as objects and not as living things. If you approach bonsai as a living thing, you realize that it's very simple: it dies if you don't feed it, and it responds if you pour your love into it. It's difficult just because it's so simple. What's important is having a heart of love for living things."

"Bonsai" is now a universal term. The total value of Japan's export of garden trees and bonsai plants in 2017 amounted to more than 12.6 billion yen, supported by an increasing number of bonsai growers in China, Vietnam, and other countries.

"My eye-catching performance is what people talk about, but it's a means of passing on the tradition. Bonsai will evolve only if people respect their predecessors' wisdom and skill and pass them on to the next generation. To realize that in a true sense, we must cultivate people who will carry on the mission. Presently, I have four apprentices, but I want bonsai to see more than just a temporary boom, and hope that Japan will become a country where many unexpected applications of bonsai can be found."

Hirao giving a bonsai demonstration in Mexico

Masashi Hirao

Born in Tokushima Prefecture, Japan, in 1981. Bonsai master and owner of bonsai garden "Seisho-en." He was apprenticed to the late Master Saburo Kato at "Omiya Kato Mansei-en." In 2013, he was appointed a Cultural Envoy by the Japanese Agency of Cultural Affairs. Based in Japan, he is now collaborating on projects with different industries and providing bonsai workshops.

Masashi Hirao website: **http://bonsaihirao.net/**

World's First Loading Arm for Ship-to-Shore Transfer of Liquefied Hydrogen

Tokyo Boeki Engineering, Ltd. (TEN), Kawasaki Heavy Industries, Ltd. (Kawasaki), Japan Aerospace Exploration Agency (JAXA), and Japan Ship Technology Research Association (JSTRA) developed the world's first loading arm for transferring liquefied hydrogen (LH_2) from a carrier to an on-shore storage facility, as part of the Cross-ministerial Strategic Innovation Promotion Program (SIP)* led by the Cabinet Office of Japan.

Hydrogen has been attracting global attention as an energy source that releases no CO_2 when used, just as solar, wind, and other renewable energies do not. Various initiatives are underway to broaden its applications, such as fuel cell cars and hydrogen power generation. Against such a backdrop, Japan has committed itself to achieving low-cost utilization of hydrogen. One such initiative has been construction of an ocean-going LH_2 carrier and a handling terminal needed in order to build a global hydrogen supply chain by which mass procurement and distribution of hydrogen will be possible. When completed, the supply chain will provide hydrogen produced from renewable energies, as well as from unused energy resources available outside Japan which integrate CCS (carbon dioxide capture and storage) into the hydrogen production process.

Because marine transport of LH_2 by a dedicated carrier is unprecedented, the four organizations have developed one of the key components for connecting carriers and on-shore terminals — a loading arm for LH_2 transfer. Since the temperature of LH_2 is lower than the liquefaction temperature of oxygen, using loading arms which were designed for liquefied natural gas (LNG) and developed based on earlier technology would run the risk of fire, because during LH_2 transfer, liquid oxygen (LO_2) may be generated on piping surfaces. To prevent such generation, a structural design has been developed that provides high thermal insulation performance and ensures safety.

*The Cross-ministerial Strategic Innovation Promotion Program (SIP) is a national project led by the Cabinet Office for achieving scientific and technological innovations. This development project was conducted between October 2014 and March 2019 as one of the themed projects under the "Energy Carrier" program of SIP, entitled "Development of Cargo Loading/unloading System for Liquefied Hydrogen and the Relevant Rules for Operation."

World's Largest GTG Plant Launched in Turkmenistan

In June Kawasaki launched the world's largest gas-to-gasoline (GTG) plant for State Concern Turkmengas, Turkmenistan's state-owned gas company headquartered in Ashgabat. The engineering, procurement and construction (EPC) contract was signed in August 2014, and Kawasaki fulfilled the main role as the consortium leader, with the support of its partner Renaissance Heavy Industries, a Turkish construction company registered in Ankara. This GTG plant is located in the Ovadan-Depe area, on the north side of Turkmenistan's capital Ashgabat. As the consortium leader, Kawasaki assumed responsibility for overall project supervision and control, plant engineering, and equipment supply. Kawasaki also cooperated with Sojitz Corporation on project implementation.

The plant is based on an advanced technology developed by Haldor Topsoe, a Danish company providing chemical process technologies and catalysts, the GTG plant is the only one of its kind worldwide that produces 600,000 tons annually of high-quality gasoline from natural gas. In this plant, gasoline is produced from methanol synthesized from natural gas. Gasoline produced at the new plant contains no heavy metals, so no toxic substances are emitted during its combustion. Moreover, because the gasoline is 100% chemically synthesized from natural gas, it contains only small amounts of sulfur and other impurities and thus meets strict environmental standards in countries around the world.

Turkmenistan boasts the world's fourth largest reserves of natural gas, and in addition to exporting this gas, in recent years the nation has focused its efforts on producing improved, value-added natural gas products as well. This recently completed GTG plant, along with a fertilizer plant completed by Kawasaki in 2014 in the eastern Turkmen city of Mary (annual urea output: 640,000 tons), has been highly praised throughout Turkmenistan for its contributions toward achieving high value-added products using natural gas resources.

Kawasaki LNG Floating Power Plant Obtains AiP from DNV GL

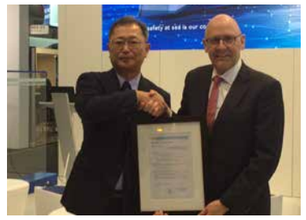
Kawasaki has developed an LNG floating power plant equipped with its own high-efficiency power generation equipment. Its gas engine model has obtained Approval in Principle (AiP)* from DNV GL** based on its "Gas Power Plant" rules which were introduced in 2018.

An LNG floating power plant is an integrated system in which LNG fuel tanks, LNG regasification unit, power generation equipment and switchyard are all outfitted on the hull. It is towed on the sea or river and then moored at the installation site, where it generates power on the hull that is then supplied to the onshore power grid.

Demand for this type of power plant is expected to be strong in countries where demand for electricity is rapidly increasing, such as in Southeast Asia, especially on islands or in locations where it is difficult to secure stable power sources, and also in areas with geographical problems such as lack of land for constructing onshore power plants.

LNG, which is the fuel used for power generation, has a cost advantage over heavy oil and emits less greenhouse gases than coal and heavy oil. As an environmentally friendly fuel, the scale of supply and demand as well as applications of LNG are expected to expand.

* AiP: To obtain confirmation by the classification society as a third party by a risk assessment and verification of compliance with classification rules for the conceptual design of new products and technologies.
** DNVGL: DNV GL is the world's leading classification society and a recognized advisor for the maritime industry. DNV GL enhances the safety, quality, energy efficiency and environmental performance of the global shipping industry, across all vessel types and offshore structures. DNV GL is also a world-leading service provider offering technical consulting services in the oil and gas fields, and other such services.



Yoshinori Mochida, Kawasaki (left)
Mr. Johan Petter Tutturen, DNV GL (right), at the recent Nor-Shipping trade fair in Oslo.

Image of Kawasaki LNG Floating Power Plant.

Cutting-edge Training Center Opened for H145/BK117 Helicopter

On May 10, Kawasaki held an opening ceremony for a facility that uses its most advanced equipment, dedicated to training pilots and mechanics for the H145/BK117. The "H145/BK117 Training Center" is located at Kawasaki's Gifu Works.

In Japan, despite an increase in the use of helicopters for emergency medical services, firefighting, disaster relief, and other public duties, there is a shortage of pilots due to aging and retirement, and a shortage of mechanics is also being seen. The recruiting and training of these pilots and mechanics has therefore been a serious challenge in recent years. In response, Kawasaki launched the Training Center to ensure that the skills of pilots who fly Kawasaki-produced helicopters and the maintenance skills of mechanics are kept high, and to contribute to furthering flight safety in helicopter operations.

This Center is the third training facility in the world dedicated to the H145/BK117 helicopter, in addition to Germany and the U.S., and the only one in Japan. Training at the Center is based on the design concept, and is offered by the engineers, pilots, and mechanics at Kawasaki who actually designed and initially operated it. The cutting-edge equipment at the Training Center used for conducting indoor, weather-independent training simulating harsh conditions, which is not possible using actual helicopters.

The Training Center plans to offer training to trainees from outside Japan. It will also provide training for customers of the H145/BK117 who purchased the helicopter from Airbus Helicopters, Kawasaki's development partner for the rotorcraft.

Training Center reception desk.

Inside the Training Center.

* The H145//BK117 is a mid-size, twin-engine helicopter designed for emergency medical services, firefighting, disaster relief, law enforcement, news coverage, and passenger/goods transport. Since the first one was delivered in 1983, the helicopter has undergone a series of improvements. Backed by Kawasaki's technological prowess and high product reliability, its delivery record has reached 179 units (as of May 10, 2019). When deliveries by Airbus Helicopters are included, the volume is more than 1,500 units worldwide, making it a global best-seller.

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