Kawasaki

Kawasaki Gallery

Heizo Kanayama's World

Glow of the Setting Sun, 1945-56, 50.0 x 60.0 cm, oil on canvas. From the collection of Kawasaki Heavy Industries, Ltd.

Life Echoing Nature's Rhythm

Shusaku Sagara, **Associate Curator, Hyogo Prefectural Museum of Art**

Between mounds of snow that have been shoveled off steep roofs and piled high along the sides of the street, we see children, bundled up from head to toe, plodding toward the setting sun. The titles of Heizo Kanayama's paintings often indicate the geographical location where the work was painted, and, like this one, provide a poetic description fitting the scene depicted in the painting. While we cannot say with absolute certainty where it was painted, we can assume that this is Oishida, Yamagata Prefecture, since the artist left us a number of similar themed works. We can also guess from the amount of snow accumulated along the street that it's late winter.

One of the reasons Kanayama found inspiration in Oishida was the charm of its unique rows of houses, which he said "had the air of a foreign country." Another was his fascination with the locals of this then-thriving town, steeped in art and culture. They welcomed him with open arms and when Kanayama made Oishida his home, it seemed he had embraced them in return. The relationship he cultivated with the community continued to blossom over time in the form of dance lessons for children and more. In this work, we can see that this scene of children returning home against the backdrop of the setting sun's glow strikes a chord with the artist, who sees our lives as but an echo of nature's rhythm.

Heizo Kanayama and Kawasaki

Heizo Kanayama (1883 -1964) went to Europe in 1912, after graduating at the top of his class from the Tokyo University of the Arts. He won the second prize at the Ministry of Education Art Exhibition in 1916, and went on to create many masterpieces in which nature is a recurring theme. Kanayama left an indelible imprint on the history of modern art in Japan.

The Shipyard, exhibited at the Ministry of Education Art Exhibition in 1917 (and featured in *Scope 83*), is the work that first brought Kawasaki and Kanayama together. Toward the end of Kanayama's life, Kawasaki agreed to the artist's request to permanently house 138 pieces of his artwork. Kawasaki has since donated a major portion of this collection to the Hyogo Prefectural Museum of Art.

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About the Cover
This futuristic design is actually a close-up image of the new PA-5 rail car's headlights. Please see Frontline for more details.

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Scope

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U.S. Rolling Stock Business On Track

KRC, KMM and Kawasaki Hyogo Works: Putting Kawasaki On Top in Passenger Rail Cars

Kawasaki's rolling stock operations in the U.S. are right on track, with business booming thanks to a succession of contracts awarded in recent years for a number of large-scale projects. The orders include 660 R160B subway cars that have already been delivered to the MTA New York City Transit (NYCT). Another 350 PA-5 rail cars are currently being built and shipped to the Port Authority Trans-Hudson Corporation (PATH), a subsidiary of the Port Authority of New York and New Jersey. Four hundred and five M-8 AC/DC electric passenger cars are now also being produced for the MTA Metro-North Railroad (MNR). Added to this long list is another order for 428 7000 Series subway cars from the Washington Metropolitan Area Transit Authority (WMATA). The WMATA contract includes an option for up to 320 additional cars. If exercised, the option would bring the total number of rail cars to be manufactured to a colossal 748, making it a super-scale project.

Kawasaki's outstanding track record has earned an approximate 32%* share of the U.S. passenger rail car market between 2005 and 2011,* making it America's No. 1 rolling stock supplier.

*Per KRC data.

The new NYCT R160B train at the Queensboro Plaza station.

An A-5 rail car arriving at the 33rd Street PATH station.

To the Power of Three

Kawasaki's U.S. rolling stock operations consist of Kawasaki Rail Car, Inc. (KRC) and Kawasaki Motors Manufacturing Corp., U.S.A. (KMM). It all began in Yonkers, just north of New York City, New York, where Kawasaki set down roots with a production facility in 1986 that evolved into KRC in 1989. Since then the company has made major inroads into the North American rail car market and today employs over 350 people.

Kawasaki built its KMM rail car plant in Lincoln, Nebraska to provide U.S. customers with a nearby production base that could immediately respond to market needs. KMM went on line in 2002 and is today operating at full capacity. Situated in the Midwest, Lincoln is a central location that enables Kawasaki to meet customer demand on the East Coast as well as the West Coast, where rail travel is expected to soar in the coming years.

In May 2010, KRC delivered the last of the 660 R160B subway cars ordered by NYCT. Accounting for more than 30% of NYCT's entire subway car fleet, the order earned Kawasaki the distinction of being New York's top subway car supplier. There are currently about 20,000 subway and commuter rail cars as well as light rail vehicles in operation across the U.S. Over 70% of these rail cars travel the tracks of America's Northeast Corridor. It's the busiest passenger rail line in the U.S., and New York is at the center of it — and so is Kawasaki.

While KRC manages all Kawasaki's rolling stock operations in the U.S., including everything from bid, contract administration and project management to procurement, commissioning and warranty, Kawasaki's formula for success entails a winning combination with three companies working together. It all starts with Kawasaki Heavy Industries' Japan-based Rolling Stock Company, which does all the design and engineering work for its U.S. rolling stock operations. The Rolling Stock Company harnesses the latest in technology to manufacture working prototypes that are then put to the test at its Hyogo Works. That's when the KMM rail car plant in Lincoln, Nebraska comes into play, procuring materials, assembling carbody shells, as well as outfitting and performing the final assembly of the rail cars. Completing the whole picture is KRC's Yonkers Plant, which delivers the completed rail cars along with the product warranties to the customer. For some customers along the Northeaster Corridor, KRC also installs underfloor equipment and bogies as part of the final assembly work in addition to conducting performance tests of rail cars. Kawasaki's Rolling Stock Company, KRC and KMM all work closely together to keep rolling stock operations on track in the U.S.

Going the Distance

This innovative production strategy, fueled by a division of roles, is not the only driving force behind Kawasaki's growing market share in the U.S. The outstanding reliability and safety of Kawasaki rolling stock products have won the hearts and minds of customers across America. "Reliability" here means that Kawasaki rolling stock products hardly ever break down.

The U.S. rail car industry measures how well rolling stock performs by calculating the average distance it travels between breakdowns. Dubbed "mean distance between failures," or MDBF, it is the industry's gold standard for reliability. The Kawasaki R62 subway cars, which the NYCT has been using since they were first delivered in 1985, significantly reduced the failure rate over their predecessors. NYCT officials were overwhelmed when they saw that the rail cars had racked up an MDBF record that was ten times better than the required MDBF spelled out in the contract. Orders from NYCT have been on the rise ever since.

While the order for the R160 subway cars, which were all delivered by May 2010, was jointly awarded to Kawasaki and Alstom Transportation Inc., NYCT's confidence in Kawasaki is underscored by the fact that it was assigned the all-important task of designing the rail car as well as manufacturing all the bogies.

The KMM Lincoln plant, the newest and largest rail car facility in the U.S. and the only one designed for integrated mass production of subway, commuter and high-speed rail cars.

The Lincoln plant now has functional and operational test facilities with 600 m of test track.

One by one, air ducts, door pockets, seats and various other components are installed inside the car. The rail car is put to the test at every step.

This time around the Kawasaki-built R160B subway cars delivered a repeat performance of outstanding reliability. While the contract called for an MDBF of 100,000 miles (approx. 161,000 km), the R160B delivered an impressive MDBF of 1.6 million miles for the month of December 2009, thus earning Kawasaki even higher marks from NYCT.

Reliability is far from being Kawasaki's only forte. The U.S. rail car industry maintains strict safety standards as well. All rolling stock used in the U.S. must be designed to safely withstand head-on collisions. Rail cars in the U.S. have to be built tough to meet stringent Federal Railroad Administration (FRA) regulations and other requirements. When the NYCT tapped Kawasaki for a new fleet of subway cars in 1997, design engineers performed extensive tests on the new R142A subway car structure to make sure it could stand up to even the worst collision. Kawasaki has taken the lessons learned from R&D on the R142A and incorporated them into the development of all its new rail and subway cars for NYCT to ensure maximum safety. America's high safety standards require individual fireproof tests to be performed on all materials used for rolling stock floors and interiors for each and every new contract.

Engineering Excellence

Kawasaki's keen focus on cutting-edge technology has not only yielded rail cars that meet the extremely strict U.S. collision-resistance, safety and reliability standards, but have exceeded the expectations of the U.S. rail industry. On top of that, the rail cars incorporate a host of anti-vandalism features, including surface coatings and materials that make removing graffiti easier than ever, as well as reinforced glass windows glazed with a special film. Kawasaki counts the ability to leverage these kinds of technological advancements as one of its greatest achievements and the key to fulfilling a wide spectrum of customer needs.

Since rolling stock in the U.S. is most commonly produced for taxpayer-funded public works projects, manufacturers must comply with the federal government's "Buy America" requirements. The requirements essentially mandate that whenever federal funding is used to purchase rolling stock, it "must be assembled in the United States and 60 percent of its components, by cost, must be of U.S. origin." Many U.S. states also impose their own "local content" requirements where manufacturers must purchase a certain percentage of locally-made components when producing rolling stock for a public project. Although full compliance may be challenging, it is an absolute in the standard operating procedure at Kawasaki.

After adding two sides and the roof, it's beginning to look more like a train.

M-8 train cars at the end of the new rail car body production line, built to meet growing demand.

KMM Lincoln Plant Operating Full Swing

The Lincoln rail car production facility is a massive structure stretching about 500 m in length. To the trained eye, the KMM Lincoln plant seems to be missing something. While conventional rail manufacturing facilities have a network of installed floor rails, the Lincoln facility has none. All rail cars produced here, including semifinished products, are transported via air pallets. The level floor surface actually makes transporting parts and components easier and the lack of permanently laid tracks opens a world of production line layout possibilities. Stepping into this state-of-the-art plant is like exploring the frontier of rail car production technology. At the heart of this expansive facility are about 600 dedicated professionals who turn out an average 25 rail cars a month. In addition to being the largest manufacturing

Assembling the very large bogies of the M-8, one of the largest commuter trains by width and length.

facility in the State of Nebraska, it's the largest rail car production plant of its kind in the U.S. and the only one in the country designed for integration of subway, commuter and high-speed rail car production, encompassing everything from carbody manufacturing to outfitting and functional testing.

Currently the Lincoln plant is running at full capacity to keep pace with the constant flow of orders. Booming business necessitated the recent addition of another production line that is now pumping out a new fleet of 405 state-of-the-art M-8 AC/DC electric passenger cars for MNR.

Excluding the pilot cars, the M-8 is the first electric rail car to be manufactured entirely at the Lincoln plant. The whole process from carbody production to final assembly and testing will be done here. The plant is now equipped with functional and operational test facilities, including a new 600 m long test track that was recently installed on site. The new test facilities are designed to check every aspect of a rail car's functions, including the air conditioning, communication and lighting systems, and track operation.

As work moves forward on the M-8 fleet, the Lincoln plant's other production line is producing 23 R188 NYCT subway cars and 350 PA-5 PATH rail cars.

A PA-5 rail car gets final outfitting and bogies at KRC's Yonkers plant, marking the train's completion.

Where the Line Begins and Ends

The whole production process begins at KRC with an order for rail cars. Then the KMM Lincoln plant usually takes it from there, with rail car body production and outfitting before the cars are transported via trailer to the KRC Yonkers plant some 2,000 km away. Upon arrival at Yonkers, they are outfitted with all the equipment they will need and given the finishing touches. Once completed, the rail cars must pass a series of operational and functional tests before being shipped to the customer. KRC is the beginning and end of the line when it comes to Kawasaki's U.S. rolling stock operations.

Expanding U.S. Business Horizons

The outlook for the U.S. rail market is bright. The American Recovery and Reinvestment Act of 2009 (ARRA) as well as President Obama's high-speed rail initiative is helping transit authorities across the country build or upgrade rail systems. This commitment to improving rail travel bodes well for the industry, with orders for transit cars expected to soar in the foreseeable future.

During the three decades since its U.S. market debut, Kawasaki has established itself as the country's leading rolling stock manufacturer, supplying quality products on time. The time Kawasaki has spent building up its operations here have paid off in ways that are immeasurable. The wealth of expertise it has gained in U.S. regulations and requirements alone is something to envy. Kawasaki is leveraging these advantages to the fullest as it develops its efSET™, a new train designed for the U.S. high-speed rail market that will travel at speeds of up to 350 km/h.

Kawasaki already markets models that currently run at speeds up to 200 km/h. These models have demonstrated excellent performance in various operational tests conducted by both railroad companies and the FRA. Kawasaki rail cars have been running since 1999 on the Maryland Department of Transportation's commuter rail line between Washington D.C. and Baltimore at a top speed of 200 km/h. These achievements will no doubt serve as a firm foundation upon which Kawasaki will lay tracks to further success in the U.S. market via pinpoint marketing and ongoing development of its new K-Star Express family of commuter and intercity passenger trains.

Lean, Green efSET Setting the Pace in the Global Market

The world will soon be moving at a faster pace than ever and Kawasaki's in-development efSET, designed to meet the new global standard with a top speed of 350 km/h, will be the driving force behind it.

With the exception of Japan, whose high-speed Shinkansen trains run on dedicated lines, high-speed trains across the world operate on both dedicated as well as conventional rail lines. This means that Kawasaki must make these high-speed rail cars even more impact-resistant than it makes the Shinkansen. Although the efSET has a lean, lightweight structure designed to save energy, its body is built to withstand one-and-a-half times more compressive force than its Japanese counterpart. The efSET also incorporates redesigned bogies fitted with enhanced motors for high-speed operation.

This R&D project follows on the heels of the 700T train, designed and manufactured for Taiwan High Speed Rail. Building the 700T, whose technical requirements complied with European standards, gained Kawasaki a world of experience.

Kawasaki launched the R&D project for the efSET in 2008 and has already completed the basic design and development work. Meeting specifications required for high-speed passenger train services currently in the works for countries around the world, including the U.S., Vietnam and India, the efSET may be rolling into a station near you sometime soon.

The BK117 Goes EMS

HEMS in Japan

Today emergency medical service (EMS) helicopters are taking to the skies across Japan. As of the end of November 2011, helicopter emergency medical services (HEMS) are provided at 28 medical facilities in 25 prefectures across Japan.

Equipped with respirators, patient monitoring systems, medicine, stretchers and other equipment, these airborne ambulances swiftly transport medical personnel to the scene of an emergency. No matter how remote the destination may be, these helicopters get EMS responders to wherever they are needed, significantly boosting a patient's chances for survival as well as a full recovery.

Kawasaki's BK117 Is No. 1 in HEMS

EMS helicopters must be equipped with outstanding safety features and a spacious cabin where an onboard medical team can effectively move around to provide the patient with necessary treatment. The BK117 helicopter, developed jointly by Kawasaki and German helicopter manufacturer Messerschmitt-Bolkow-Blohm GmbH (MBB), now Eurocopter Deutschland GmbH (ECD), is a twin-engine model. The BK117's flight control system employs dual electrical and hydraulic systems to ensure uninterrupted operation in case of a failure in one of the systems. The spacious cabin can accommodate up to five people including the patient. The helicopter also boasts other outstanding features like wide clamshell doors at its rear to facilitate the swift transfer of patients in and out. The latest in Kawasaki's BK117 lineup, the BK117C-2, features 35% more floor space than previous models and a lot more comfort. It also provides impact-resistant seats and a crash-resistant fuel system for greater flight safety than ever.

Kawasaki has delivered 153 BK117s, and together with those delivered by ECD, there are over 850 in use around the globe.

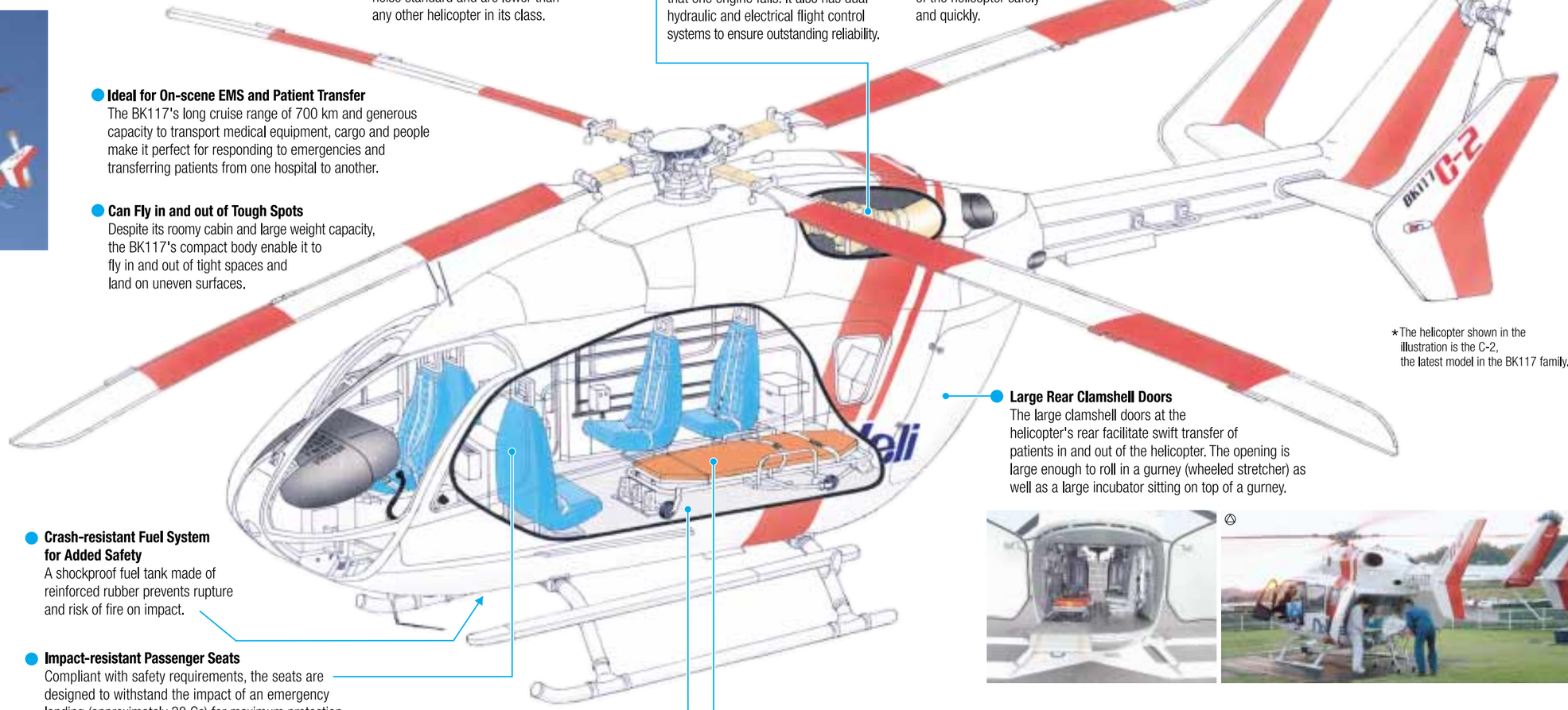
Low Noise
The BK117's external noise emissions fall far below the International Civil Aviation Organization (ICAO) aircraft noise standard and are lower than any other helicopter in its class.

Twin Engine and Dual Electrical and Hydraulic Systems
Equipped with two engines, the BK117 can keep flying safely in the event that one engine fails. It also has dual hydraulic and electrical flight control systems to ensure outstanding reliability.

Main and Tail Rotors Designed for Safety
Since the helicopter's main rotor is located 3.5 m from the ground and its tail rotor 2 m from the ground, patients can be transferred in and out of the helicopter safely and quickly.

Ideal for On-scene EMS and Patient Transfer
The BK117's long cruise range of 700 km and generous capacity to transport medical equipment, cargo and people make it perfect for responding to emergencies and transferring patients from one hospital to another.

Can Fly in and out of Tough Spots
Despite its roomy cabin and large weight capacity, the BK117's compact body enable it to fly in and out of tight spaces and land on uneven surfaces.



*The helicopter shown in the illustration is the C-2, the latest model in the BK117 family.

Large Rear Clamshell Doors
The large clamshell doors at the helicopter's rear facilitate swift transfer of patients in and out of the helicopter. The opening is large enough to roll in a gurney (wheeled stretcher) as well as a large incubator sitting on top of a gurney.

△

Crash-resistant Fuel System for Added Safety
A shockproof fuel tank made of reinforced rubber prevents rupture and risk of fire on impact.

Impact-resistant Passenger Seats
Compliant with safety requirements, the seats are designed to withstand the impact of an emergency landing (approximately 30 Gs) for maximum protection.

Optimal Cabin Space

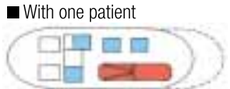
The cabin can accommodate a maximum of five occupants (four cabin seats and a gurney). Normally four people board the helicopter, including a doctor, nurse, patient and a friend or family member of the patient. The extra seat can be used by a specialist physician or medical professional in training.

The spacious cabin makes it easy for onboard health care providers to maneuver around the patient for unimpeded medical treatment.

Accommodating Two Patients
Equipped with an auxiliary gurney, the helicopter can accommodate up to two patients. When transporting two patients, two of the seats cannot be used.

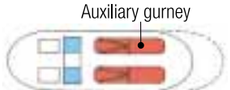
Cabin floor plan

■ With one patient



■ With two patients

Auxiliary gurney



Seat Gurney

△ Photos marked with a star courtesy of Central Helicopter Service., Ltd.

Fully Equipped for Highly Efficient EMS
BK117s employed as EMS helicopters are outfitted with the medical equipment they need thanks to input from health care professionals and helicopter operators involved in HEMS pilot programs in Japan, as well as lessons learned from countries around the world where HEMS is employed.

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BK117C-2 Medevacs Ordered

Kawasaki started delivery in December of two BK117C-2 helicopters, ordered by Nishi Nippon Airlines Co., Ltd., to be used as medevacs in Kumamoto and Miyazaki prefectures.

The BK117 was developed jointly by Kawasaki and helicopter manufacturer Eurocopter Deutschland (ECD), formerly Messerschmitt-Bolkow-Blohm (MBB). The BK117 is a medium-sized twin-engine multipurpose helicopter that's used for everything from broadcasting to transporting cargo and passengers, fighting fires, police work, emergency medical services and more. Its many outstanding features as well as its compact body and superior mobility have earned the BK117 high marks around the world for emergency medical services. (Please see *Technology* on page 8 for more.)

The BK117 has been continually upgraded since its market debut in 1983. Cutting-edge technology and outstanding reliability have proven to be a winning combination: the BK117 is the bestselling model in the world today. Kawasaki has delivered 153 BK117s, and combined with those delivered by ECD, there are over 850 in use around the globe.

Kawasaki continues to outpace the competition with its proven superior technological capabilities and outstanding customer services as it actively markets its BK117C-2 helicopter. ::

Newly Developed LNG Carrier Delivered

Kawasaki delivered the *Energy Horizon* (Kawasaki hull No.1664), its newest LNG carrier, to Tokyo LNG Tanker Co., Ltd. and Nippon Yusen Kabushiki Kaisha (NYK Line) in September. The 300 m-long vessel is the world's first 177,000 m³ LNG carrier with the largest Moss spherical tanks. In completing this newest vessel, Kawasaki has succeeded in increasing cargo capacity over its most popular 147,000 m³ LNG carrier by enlarging the cargo tanks while maintaining all the great features of the 147,000 m³ vessel, like a broad utility hull size that is able to enter the world's major LNG terminals and a high propulsive performance hull form.

The *Energy Horizon* is equipped with the newly developed Kawasaki URA plant, which is the world's first re-heat steam turbine propulsion plant. In this plant, the steam, which is generated in the boiler, first works on the high pressure turbine, then is returned to and re-heated in the boiler, and finally works on the intermediate pressure turbine and low pressure turbine. Adopting this re-heat plant and Kawasaki's newly developed boiler, which is able to generate a higher-temperature and higher-pressurized steam than conventional boilers, has dramatically increased the thermal efficiency of the plant. As a result, the fuel consumption has been improved by about 15% compared to conventional steam turbine propulsion plants. ::

RD80N Palletizing Robot Released

Kawasaki recently released a new midsize palletizing robot, the RD80N, designed for loading cardboard boxes and bags onto palettes for logistics work. The RD80N is a vertical articulated robot with a maximum payload capacity of 80 kg, developed by improving upon the excellent performance of the conventional FD50N, particularly in terms of speed and repeatability.

The RD80N's lightweight arm and small high power/high speed motor give it higher speed and acceleration than conventional models, allowing the payload capacity to be increased by 30 kg. This increases throughput by about 25% to 900 cycles* per hour, making it the best in its class.

For applications from high-speed packing of food products on conveyor belts and packing into cardboard boxes to palletizing, the RD80N provides a compact, high-productivity automated system in combination with the YF03N high-speed picking robot and small-to-medium size R series general-purpose robots.

By extending the operating stroke of each axis, the range has also been extended by about 50 mm for vertical operations as compared to the conventional FD50N, resulting in increased freedom of layout and optimum coverage of 1,100 mm x 1,100 mm palettes. Increasing the load capacity while achieving a compact body results in improved work accessibility and closer spacing between robots, allowing high-density systems to be constructed.

Optional palletizing software, K-SPARC allows layout planning and operations to be simulated on a PC. Compared to conventional software, K-SPARC has an increased number of stacking patterns with improved usability and allows for easier teaching. ::

*Based on a load of 80 kg, and a horizontal movement of 2000 mm per cycle with a vertical movement of 400 mm.

First Gas Turbine Cogeneration System Delivered to Switzerland

Kawasaki Gas Turbine Europe GmbH (KGE), Kawasaki's Frankfurt-based gas turbine sales and service subsidiary for Europe, recently delivered a 1.7 MW class GPB17D gas turbine cogeneration system to Industrielle Werke Basel (IWB), a Swiss energy service company* based in Basel. This was the first order for the GPB17D and the first Kawasaki gas turbine generator to be delivered to Switzerland.

The system consists of a natural gas-fueled turbine power generation system employing Kawasaki's newly developed M1A-17D gas turbine as well as a waste-heat recovery boiler. Boasting an overall efficiency rate of 27%, the system will be used for IWB's regional thermal energy project to be implemented in Basel. It will supply both electricity as well as heat recovered from the gas turbine exhaust system, cutting CO_2 emissions while providing a steady supply of power.

Kawasaki supplied the M1A-17D gas turbine generator while KGE was responsible for procurement of the exhaust recovery boiler and auxiliary equipment as well as assembly, onsite installation and test runs of the gas turbine power generator system. The cogeneration system is scheduled to go on line in March 2012.

The GPB17D system builds on the technological foundation of Kawasaki's GPB15D gas turbine generator, which has earned an outstanding reputation in the market. The GPB17D outperforms the GPB15D with 13% more output and 10% higher thermal efficiency. Kawasaki's dry low emissions (DLE) technology cuts NOx emissions to 15 ppm, the lowest in this turbine class.

Kawasaki is working with KGE to make further inroads into the cogeneration system market in Switzerland and the rest of Europe as it leverages its global sales network, encompassing North America, Southeast and Southwest Asia, as well as the Middle and Far East, to expand its reach around the world. ::

*An energy service company (ESCO) is a provider of comprehensive energy-saving solutions, energy infrastructure and maintenance services.

Green Gas Engine Goes to Automotive Manufacturer

An order for Kawasaki's Green Gas Engine was recently received from engineering firm Ene-Vision Co., Ltd. The engine will be installed by Ene-Vision at Central Motor Co., Ltd., a wholly owned subsidiary of Toyota Motor Corporation, for use at its Miyagi plant.

The Green Gas Engine boasts an output of 7,800 kW of electricity and the world's highest power-generating efficiency at 49.0%. Kawasaki will supply Ene-Vision with a gas engine power generator, electrical and control systems, as well as auxiliary equipment.

Central Motor's Miyagi plant is the Toyota Group's newest facility. Built to serve as a key production base in northeastern Japan, the plant will employ a gas engine cogeneration system to fulfill its power needs and enhance its energy efficiency. Awarded a grant from the Toshi-gas Shinko Center for the promotion of gas cogeneration systems, Central Motor will use the Green Gas Engine to supply electricity and steam exclusively to its Miyagi plant. The cogeneration plant is scheduled to go on line in January.

Kawasaki's energy and environmental business is moving forward to deliver clean and efficient energy solutions like gas engine-driven power generation systems, which are leaving behind a smaller environmental footprint than ever. ::