Scope

Kawasaki Heavy Industries Quarterly Newsletter

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Kawasaki

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in this issue...

About the Cover
The Kawasaki BK117-C2 medevac flies across a clear blue sky.

KAWASAKI HEAVY INDUSTRIES, LTD.

Scope

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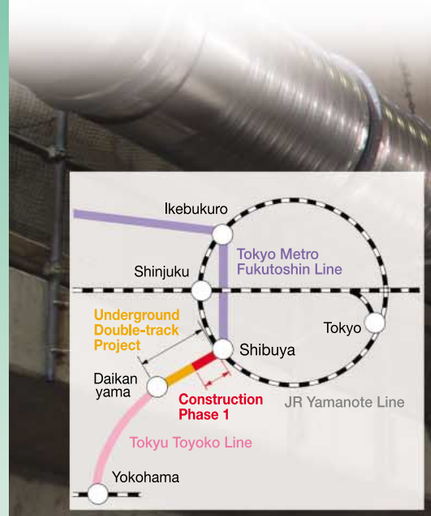
Tokyo Underground

Innovation Shapes the Future of Railway Tunneling

When it comes to creating subway and road tunnels beneath the modern city streetscape, safety comes first. Urban tunnel excavators have to be able to burrow through a tightly knit web of existing tunnels without ever breaking the road surface and disrupting traffic. Tunnelers today are continually searching for ways to boost efficiency by reducing the cross-sectional area to be excavated. The APORO-Cutter (All Potential Rotary Cutter) developed jointly by Kawasaki and Kajima Corporation meets that challenge. This innovative machine can be used to construct tunnels of many cross-sectional designs, including circular, oval or horseshoe shapes. It can also be used for tunneling through hard soil as well as various underground obstacles.

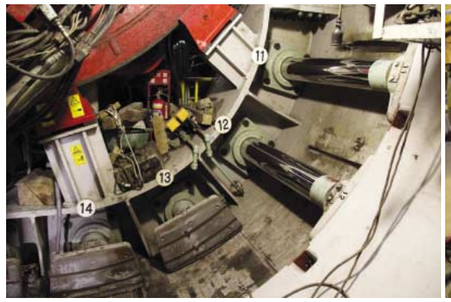
This issue's *Frontline* takes an in-depth look at this amazing machine at work below the streets of Tokyo.



Street-level noise enclosure. The tunnel is being built toward the background.

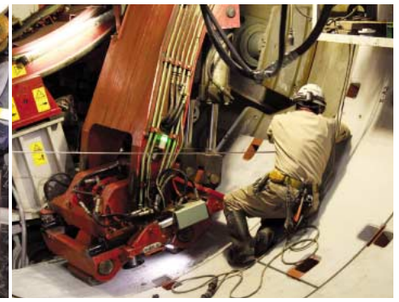
The central control room 20 m below ground is the project's nerve center.

The underground shaft area where construction work began. Soil is carried out via conveyor belt while segment blocks are loaded on a tram.



Whenever 1.1 m of soil is excavated, the shield jacks are retracted and segment blocks laid in.

An erector lifts a segment block and moves it into place for installation. Workers must stay on their toes in the cramped environment.



The unique cross-section demands precision accuracy when laying segment blocks.

● Cutting a Perfect Figure Eight

Tokyo's Shibuya area is one of the most densely developed commercial hubs in Japan. At the heart of this bustling metropolitan center is Shibuya Station, where workers have been digging a tunnel with a very unusual cross-sectional design.

The new tunnel will link an underground double-railway track section of the Tokyu Toyoko rail line with Tokyo Metro's Fukutoshin subway line. Being built to replace a 1.4 km section of elevated track between the Toyoko Line's Shibuya and Daikanyama Stations, it will provide passengers with a seamless underground connection between the two lines when it officially opens for business in 2012.

At the center of the construction project is a steel tunnel-boring machine encased in a sturdy shield-like frame, aptly known as a shield machine. It has a large rotary cutter head that spins as the entire machine moves forward to excavate the tunnel. While these machines have conventionally been used to dig tunnels with a circular cross-section, the one at work below the streets of Shibuya is anything but conventional. Dubbed the APORO-Cutter, this innovative rotary cutter has been employed to carve out a complex figure-eight cross-sectional shape that looks something like a pair of square-framed eyeglasses.

The first phase of Tokyu's underground double-track section construction project was implemented by a consortium consisting of Kajima, Nishimatsu Construction, and Tekken Corporation acting together as the primary contractor. The civil engineering project, encompassing an expansive 577 m stretch, included the excavation of a 508 m long tunnel with a shield machine.

● On the Cutting Edge

Our journey to the face of the tunnel to see the shield machine in action begins as we pass through a noise enclosure (a sealed-off area where materials and equipment are loaded/unloaded) that sits in the middle of a busy street near Shibuya Station. Work on the tunnel began with the drilling of a vertical shaft, and it's down that same shaft we descend via a lift that takes us about 20 m below the surface. Here, we finally spy the tunnel entrance.

Today there is a growing demand for tunnels with unconventionally shaped cross-sections that make construction work more efficient. Railway tunnels with a non-circular cross-section have less dead space than their circular-shaped counterparts. Less tunnel space also means more distance between important architectural structures and private buildings, as well as sewage pipes and other underground conduits.

Since a large section of the excavated area for the underground double-track section consisted mainly of a hard soil called consolidated silt, it required a shield machine with superior cutting performance. The short distance between the end of the tunnel and the ground surface also posed a major challenge. Working together to meet these challenges head on, Kawasaki and Kajima developed a revolutionary new cutting mechanism.

● Cutter Heads Rotating on a Revolving Drum

Heading toward the face of the tunnel, we make our way through the finished section. Our eyes are immediately drawn to the amazing geometric patterns formed by the joints connecting the precast ferroconcrete segment blocks that line the tunnel and the supporting steel columns sprouting up at equal intervals along its center. As we continue forward, a tram loaded with segment blocks passes us by from time to time as it travels along the tracks. All the while excavated soil is constantly being carried away by conveyor belt to the shaft and then out of the tunnel to a soil pit via a vertical conveyor.

Although we finally arrive at the tunnel face, we can't see the soil that lies just ahead of the shield machine. Also unable to view the front end of the machine, we can't see the mechanical force carving out this unique cross-section. You can get a perfect view of this amazing machine just by looking at the diagram at the bottom of the next column. The rotary cutter head (painted red) that excavates the soil is attached to a swing frame (yellow), which is mounted to the main rotary drum (the gray revolving drum). Rotating as it turns on the revolving drum, the cutter head chews up the soil. The machine's revolving drum and swing frame can be angled to excavate the exact cross-sectional shape desired. This unique design also makes easy work of tunneling through curved sections.

It's really the innovative cutter mechanism that makes this shield machine so revolutionary. The double-head shield machine was specifically designed to bore through this double-track railway tunnel's large cross-sectional diameter (measuring 7.44 m high and 10.64 m wide) in one fell swoop. Since the cutter head spins at 4.7 rpm, the machine can optimally excavate approximately 3 cm of soil per minute. Boasting a cutter head speed that's about three times faster than any other on the market today, this shield machine can make relatively quick work of tunneling through even the hardest soil.

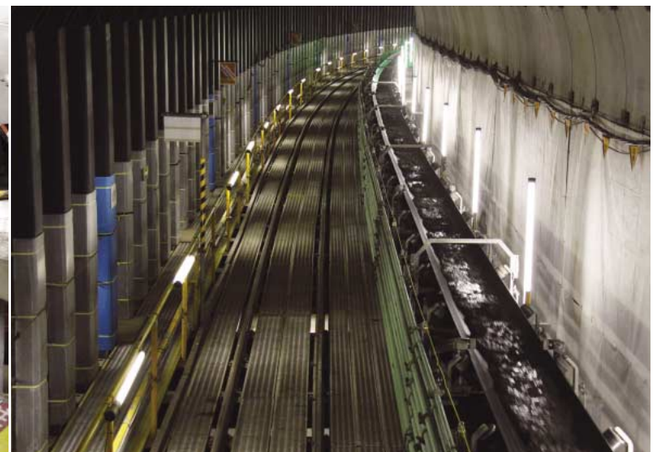
● Right on Track at 3 cm per Minute

Once Kawasaki and and Kajima completed the machine, it was put through its paces in repeated tests that verified it could steadily perform at a digging rate of up to 3 cm per minute. Now each time the machine bored through a 1.1 m section of soil (the width of a precast reinforced concrete segment), 10 segment blocks were installed to line the excavated surface. While this operation could be done automatically in the construction of a tunnel with a circular cross-section, the atypical design of this tunnel required workers inside the machine to lay each block by hand with the aid of an erector (lift). Operating within the tight quarters of the shield machine, the workers assigned to the task told us that they "gradually got the hang of it as they went along and eventually picked up speed."

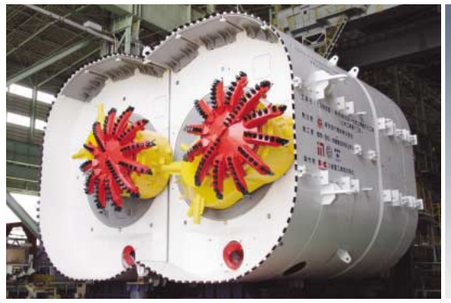
Our report on the building of this unusual tunnel just scratches the surface of a journey that began back in April 2009. Work continued to move right on track throughout the year and by the end of 2009 the rate of excavation had reached 7.7 m or seven segments per day (two 8-hour shifts). Then in early 2010, the shield machine finally reached the light at the end of the tunnel, well ahead of schedule.

The shield machine excavates the tunnel face. The soil is hidden from view behind the machine.

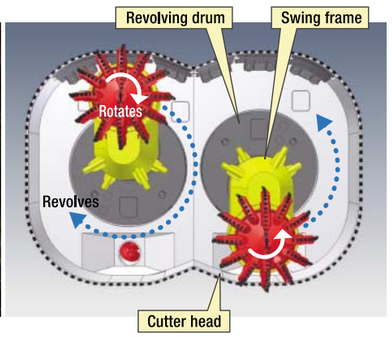
A completed section of tunnel. The other (identical) half of the tunnel lies to the left of the supporting columns.



The APORO-Cutter, a revolutionary shield machine developed jointly by Kawasaki and Kajima Corp.

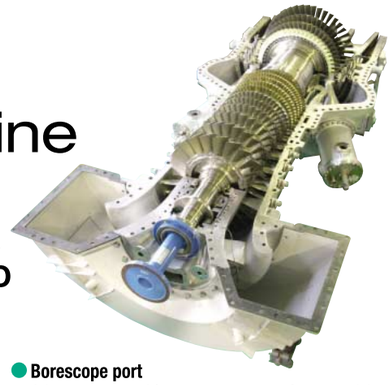


How the APORO-Cutter Works



A breakthrough ceremony on February 1, 2010 celebrates the end of excavation work.

Inside the M7A-03: The Latest M7A Gas Turbine Boasts a Record-High Thermal Efficiency of 34%



Kawasaki Turbines Help Power the Future

Balancing environmental conservation with a growing appetite for energy is a major problem today, but energy-efficient cogeneration systems*1 and combined cycle power plants*2 may be just the answer to the world's needs. Gas turbine-driven systems have received especially high marks for environmental performance since they create relatively low amounts of toxic gases, like NOx. They can also recover high-temperature waste heat for even better overall thermal efficiency.

Since developing its first industrial gas turbine in 1974, Kawasaki has supplied more than 9,000 units. Today it enjoys the lion's share of Japan's small and medium-sized gas turbine market. The M7A series is Kawasaki's line of 7,000 kW-class gas turbines. The first M7A model, the M7A-01, was developed in 1993, followed by its successor, the M7A-02, in 1999. The M7A-03, the latest model in the series, takes a tradition of excellence one step further. Kawasaki has delivered nearly 100 M7A gas turbines across the globe. So far they have logged a combined total of about 2 million service hours and are still hard at work helping power the future.

*1. A cogeneration system supplies electricity and heat (as steam and/or hot water) via a heat recovery boiler that captures the waste heat from a gas turbine power generation system and uses it to generate steam.
*2. A combined cycle power plant uses both gas and steam turbines to generate power. A heat recovery boiler turns waste heat into steam, which it then uses to drive a steam turbine.

Super Efficient and Reliable

Continuing to feature the best of the M7A series, the state-of-the-art M7A-03 realizes more output with less input. The M7A-03 boasts:

- a thermal efficiency of 34%, the highest level for a gas turbine in its class;
- the same specifications and components as other M7A series models to ensure superior reliability; and
- a dry low emission (DLE) combustion system to realize cleaner exhaust, making it the first gas turbine to achieve record low NOx emissions of 15 ppm (when used with natural gas).

Kawasaki launched the M7A-03 in 2007 and has to date received ten orders, four of which are already in full-steam operation. Inquiries about this top-performing gas turbine have been pouring in from all over the world.

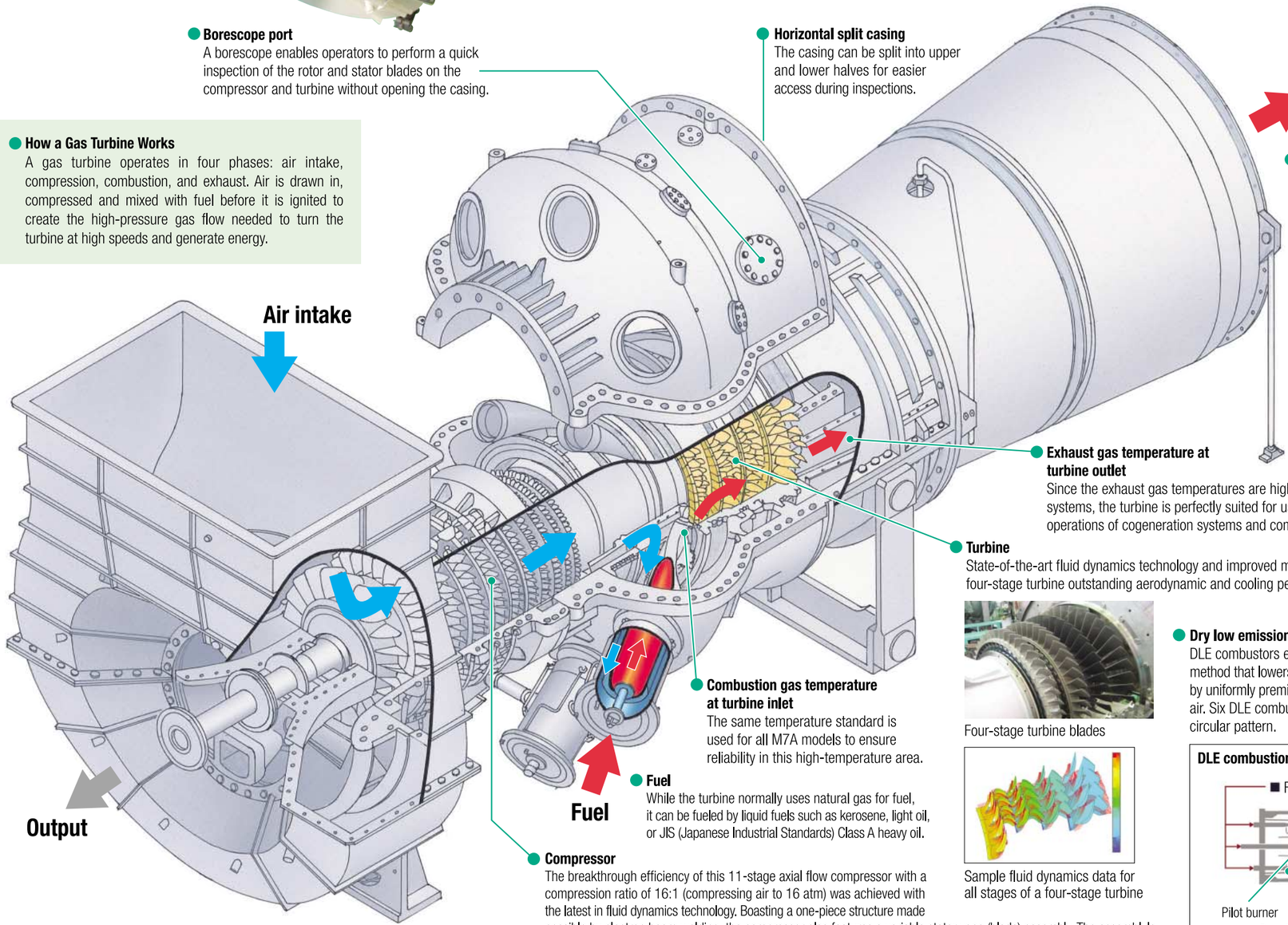
• Recent M7A-03 deliveries

Munksj Paper Unterkochen Plant (Germany)
Output: Approx. 7,000 kW (10˚C)
CO_2 emissions cut by 30,000 t/year

Bridgestone Thailand Nong Khae Plant (Thailand)
Output: Approx. 7,000 kW (20˚C)
CO_2 emissions cut by 11,000 t/year

Fripa Papierfabrik Miltenberg Plant (Germany)
Output: Approx. 7,500 kW (10˚C)
CO_2 emissions cut by 17,000 t/year

How a Gas Turbine Works
A gas turbine operates in four phases: air intake, compression, combustion, and exhaust. Air is drawn in, compressed and mixed with fuel before it is ignited to create the high-pressure gas flow needed to turn the turbine at high speeds and generate energy.



Borescope port
A borescope enables operators to perform a quick inspection of the rotor and stator blades on the compressor and turbine without opening the casing.

Horizontal split casing
The casing can be split into upper and lower halves for easier access during inspections.

Exhaust gas
The turbine meets the world's toughest NOx emissions standard, which limits the acceptable emissions level to 15 ppm or less.

Advanced operating control system
The turbine can be monitored remotely via a communications network.

Exhaust gas temperature at turbine outlet
Since the exhaust gas temperatures are higher than other thermal engine systems, the turbine is perfectly suited for use in the waste heat recovery operations of cogeneration systems and combined cycle power plants.

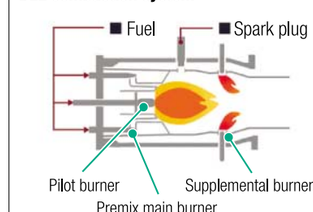
Turbine
State-of-the-art fluid dynamics technology and improved materials give the four-stage turbine outstanding aerodynamic and cooling performance.

Four-stage turbine blades

Sample fluid dynamics data for all stages of a four-stage turbine

Dry low emissions (DLE) combustion system
DLE combustors employ a premix combustion method that lowers the combustion temperature by uniformly premixing the fuel with compressed air. Six DLE combustors are arranged in a circular pattern.

DLE combustion system



Combustion gas temperature at turbine inlet
The same temperature standard is used for all M7A models to ensure reliability in this high-temperature area.

Fuel
While the turbine normally uses natural gas for fuel, it can be fueled by liquid fuels such as kerosene, light oil, or JIS (Japanese Industrial Standards) Class A heavy oil.

Compressor
The breakthrough efficiency of this 11-stage axial flow compressor with a compression ratio of 16:1 (compressing air to 16 atm) was achieved with the latest in fluid dynamics technology. Boasting a one-piece structure made possible by electron beam welding, the compressor also features a variable stator vane (blade) assembly. The assembly's adjustable mounting angle for the four-front stator vanes significantly enhances startup and part-load performance.

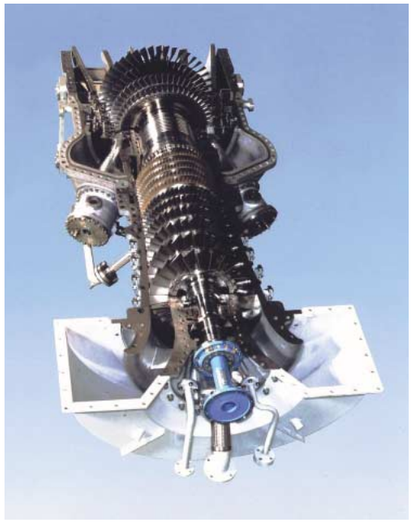
Gas Turbine Systems Ordered for 2012 APEC Summit Site

Kawasaki recently received four orders for its GPB70 gas turbine power generation systems from Russia's Far East Power Generation Co. via Sojitz Corporation, a general contractor. The systems, driven by Kawasaki's proprietary M7A-02 gas turbines, will be used at the site of the 2012 APEC Summit to be held on Russky Island in Vladivostok. These are the first Kawasaki gas turbine power generation systems to go to Russia.

The orders came as part of a project to construct a cogeneration system consisting of gas turbine power generation systems and hot water boilers that will supply electricity and heat for the APEC Summit venue. The system uses exhaust gas from the gas turbine to supply hot water for an overall efficiency rate of approximately 80%, resulting in contributions to curb global warming. The power generation systems are equipped with dual-fuel gas turbines that will be powered by light fuel oil until a switchover to natural gas is made with the scheduled completion of a natural gas pipeline in the fall of 2011.

The GPB70 systems are each equipped with an M7A gas turbine, a 6 to 8 MW-class industrial gas turbine developed using Kawasaki's proprietary technology. In early 2009 Kawasaki produced its one-hundredth M7A gas turbine, ahead of other Japanese makers. Since shipping its first unit in 1994, Kawasaki has delivered M7A turbines throughout Japan as well as to Europe, the U.S. and other markets around the world.

The GPB70 has been proven to outperform all competitors over a wide range of areas. This latest order is a testament to the GPB70's overall superior performance, compact size and ease of maintenance, in addition to Kawasaki's excellent customer support services in the Russian Far East.



Large Bulk Carrier *Cape Canary* Delivered

Kawasaki Shipbuilding Corporation recently delivered the *Cape Canary* bulk carrier to "K" Line Bulk Shipping (UK) Limited at its Sakaide Shipyard. The carrier, identified as Kawasaki hull No. 1634, is the first state-of-the-art bulk carrier with 180,000 DWT to be developed by Kawasaki Shipbuilding. The *Cape Canary* boasts one of the largest cargo capacities among vessels that can enter France's Port of Dunkirk.

The 292 m long carrier is fully compliant with the new hull strength rules (IACS Common Structural Rules) for enhanced safety. It employs the latest in technology to achieve maximum fuel economy, including an energy-saving main diesel engine, highly efficient propellers and the Kawasaki semiduct system with contra fins (SDS-F) and rudder bulb with fins (RBS-F), which all contribute to the vessel's enhanced propulsion performance. The *Cape Canary* also employs double-hull fuel oil tanks and electrical deck machinery to prevent marine pollution. Another feature of the bulk carrier is its anti-corrosion coatings, which comply with the new performance standards regarding protective coatings (PSPC) for ballast tanks to ensure paint quality that is better than ever.

Green Gas Engine Drives In-house Power Generation Plant

Kawasaki recently started up the Kobe Power Center, an in-house power generation system driven by the KG-12, a 12-cylinder, 5,000 kW Kawasaki Green Gas Engine, at its Kobe Works. All electricity generated by the system is used by the Kobe Works. Boasting a world record-breaking fuel-to-electricity efficiency rate, the Green Gas Engine is sure to cut energy costs.

Implementing the system, which will serve as a model of superior performance, enables Kawasaki to build on its operational know-how and enhance its ability to offer related solutions covering everything from installation to operation and support services. Kawasaki can use the system to simulate its customers' power plant operations and provide them with optimal energy solutions.

The cutting-edge Green Gas Engine has a proven track record of cost efficiency and environmental performance underscored by a record-breaking electric generation efficiency of 48.5% and the world's lowest NOx emissions level: less than 200 ppm at 0% O_2. The engine beats conventional gas engines in its class by cutting fuel costs by more than 5%. Thanks to its low-NOx emissions, it also eliminates the need for de-NOx equipment in most areas of Japan. Lightweight and compact, the Kawasaki Green Gas Engine also features an electric spark ignition system that does away with the need for liquid fuel. Once test runs are complete, Kawasaki will connect the in-house power generation system to the grid and enhance the gas engine's power generation efficiency via networked operations.

While mounting problems related to global warming pose a serious risk to our environment, Kawasaki is meeting the challenge head on with new energy and environment-related technologies that minimize our carbon footprint.

Order for Japan's Largest Aboveground Full Containment LNG Tank

Kawasaki has broken ground on two liquefied natural gas (LNG) tanks, which are now being constructed for Chubu Electric Power Co., Inc. at its Kawagoe Thermal Power Station. When completed, the prestressed concrete (PC) LNG storage tanks, each with a capacity of 180,000 kl, will be among the largest aboveground full containment LNG tanks in Japan. The tanks are slated to go into service in 2013.

Located in the town of Kawagoe, in northern Mie Prefecture, the Kawagoe Thermal Power Station is one of the world's largest LNG thermal power plants, boasting a total output of 4,802,000 kW. The power station currently operates four 120,000 kl LNG tanks. The two new LNG tanks will add greater stability and flexibility to Chubu Electric's LNG procurement operations.

Since the delivery of its first underground LNG tank in 1982 and aboveground tank in 1983, Kawasaki has outfitted Japan with every type of LNG tank on the market, including single/double/full containment tanks, in-pit tanks, as well as inground and underground membrane tanks. Kawasaki has also been involved in international LNG tank construction projects in Korea and elsewhere. To date, there are 26 Kawasaki-built LNG tanks in successful operation around the world.

MX700N Robot Launched

Kawasaki recently launched the MX700N general-purpose large-size robot. The MX700N is a top-of-the-line M Series robot with a maximum payload of 700 kg. The new model features the largest wrist torque (fifth axis) in its class on the market today, creating more possibilities for gripper designs and robot postures to provide better handling of heavy workpieces. The new robot significantly boosts productivity with an increased payload that enables it to move multiple workpieces in a single cycle and handle pallet layers.

This newest addition brings the total number of M Series models to seven, including the MX350L, MX420L, MX500N and MX700N floor-mounting robots, the MT400N shelf-mounting robots, and MD400N and MD500N palletizing robots. The M Series is built to meet today's growing need for heavy-duty assembling and material-handling operations.

The robots feature compact profiles, via an innovative design of the advanced link mechanism on the third axis without the use of a counterbalance. This cutting-edge design reduces interference and increases the work envelope for easier application. Kawasaki developed a high wrist torque of 5,488 Nm by utilizing the same high-power motors used in the major axes. Equipped with vibration suppression controls on its highly rigid arm as well as collision detection software, the robot can manipulate large payloads smoothly and safely.

Gigacell™ Awarded

Kawasaki received the 2009 Japanese Minister of the Environment Award for Outstanding Achievement in the Fight against Global Warming. The award for technological development and commercialization went to Kawasaki for the superior energy efficiency of its large-scale, fully sealed high-capacity nickel-metal hydride battery, the Gigacell.

The Ministry of Environment established the annual awards back in 1998 as part of its initiative to mitigate global warming. The annual awards are given to individuals and groups to honor their outstanding achievements in saving the environment.

Nickel-metal hydride batteries, a safe and reliable power source, are used in hybrid vehicles. Kawasaki was able to overcome past obstacles to develop the large-scale Gigacell. It features a fully sealed structure that enables efficient charge/discharge of a large amount of electricity. Safe and easy to handle, the Gigacell contains no toxic substances. It also features a weld-free structure that makes it easy to recycle and is environmentally friendly. The Gigacell is an energy-saving, low-carbon solution that holds enormous potential for application in a wide range of areas.

When installed on a rail car, the Gigacell stores regenerative power generated during breaking and reuses that energy to power the train's motors when accelerating, providing huge electricity savings. Kawasaki's proprietary next-generation light rail vehicle, SWIMO™, has achieved a 30% to 50% reduction in energy consumption thanks to the Gigacell. Kawasaki is looking into employing the Gigacell on various large-scale transportation systems with an eye to saving energy and cutting carbon dioxide emissions.

The Gigacell can also be used as a battery power system for rail substations. Subway line verification testing has already proven that the Gigacell can significantly reduce power consumption at substations as well as contracted power supply volume (by 20%). The outlook for the future is bright as Kawasaki harnesses the power of the Gigacell to drive renewable energy forward with applications for power grid stabilization technologies (e.g. smart grid, microgrid, etc.) and more that will reduce our carbon footprint. Kawasaki is moving forward to develop and promote energy-saving products designed to conserve the earth's environment.

* "Gigacell" and "SWIMO" are registered trademarks or trademarks of Kawasaki Heavy Industries, Ltd. in Japan, the U.S.A. and other countries.

Order for Turkmenistan's Largest Fertilizer Facility

Sojitz Corporation and Kawasaki Plant Systems, Ltd. (K Plant) recently received a 60 billion yen order for a fertilizer complex from Turkmenhimiya State Concern, Turkmenistan's state-owned petrochemical company, located in Ashgabat.

Once completed, the entire fertilizer complex —consisting of ammonia and urea plants, power generation, water treatment, nitrogen production as well as other offsite and utility facilities—will be the largest in Turkmenistan. K Plant and Sojitz will deliver the unit, equipment and materials to a construction site in eastern Turkmenistan's Mary City where the fertilizer plant will be built by Turkmenhimiya. The complex will use Turkmenistan's natural gas resources as feedstock to produce 1,200 metric tons of ammonia and 1,925 metric tons of urea per day.

Sojitz will be responsible for coordinating the project, including making the financial arrangements, while K Plant will be responsible for the engineering of the fertilizer complex as well as supplying the equipment. The complex is slated to go on line in 2013.

Turkmenistan possesses an abundance of natural resources such as natural gas and oil and is one of the fastest growing countries in Central Asia, boasting a GDP growth rate of approximately 10%. In addition to natural gas and oil, cotton is also one of the country's major exports and demand is rising for the urea fertilizers needed to grow cotton. The government of Turkmenistan is currently focusing on investments designed to boost the agricultural sector as well as the heavy and chemical industries and infrastructure. It plans to build additional fertilizer plants in the inland city of Tejen as well as the Caspian Coast city of Turkmenbasy, with an eye to meeting the country's own increasing demand for urea fertilizers as well as to exporting fertilizers to neighboring breadbasket countries as well.

This latest order brings the total number of orders K Plant has received for fertilizer production facilities to seven. That figure includes two orders received from Turkmenistan's neighbor, Iran, in addition to an order from Pakistan received jointly with Sojitz. This most recent order is a testament to Kawasaki's proven track record, which gives it a clear advantage over the European engineering companies that have historically dominated the Central Asian market.

Sojitz and K Plant will leverage the know-how and expertise they have gained via their overseas operations as they continue to move forward together to win future contracts for plant construction. Both companies will step up their efforts with a focus on making further market inroads into Turkmenistan and surrounding countries in Central Asia.

Medical Care in the Air

Taking Emergency Medical Services to New Heights

A medevac (dubbed "Doctor-Heli" in Japan) is an emergency medical helicopter equipped with respirators, patient monitoring systems, medicine, stretchers and a host of other equipment. It carries medical personnel rapidly to the scene, no matter how remote, and allows them to provide emergency medical services (EMS) on the ground as well as en route to the nearest medical facility. Medevacs significantly boost a victim's chances for survival, as well as a full recovery.

Japan's first medevac fleet took off on a trial basis back in 1981. A special law was then enacted in 2007* to make medevac services available throughout the country, and the government has implemented an initiative to promote widespread use of helicopters for emergency medical services. In March 2009, it earmarked funding from taxes to cover 50% of the expenses incurred by prefectural governments for medevac operations. As of March 31, 2009, medevac helicopters were in use by 18 hospitals in 16 prefectures. Eight of those hospitals use the Kawasaki BK117 helicopter.

*Act on Special Measures Concerning Securing of Emergency Medical Care Using Helicopters for Emergency Medical Care

The moment the emergency call comes in, a doctor and nurse rush to board the medevac heli standing ready at the Kawasaki Medical School Hospital's Advanced Emergency Medical Center heliport.

Spacious Cabin with Wide Clamshell Door for EMS

The Kawasaki BK117C-2 helicopter used for emergency medical services is a medium-sized twin-engine multipurpose helicopter. The latest in Kawasaki's BK117 lineup, the BK117C-2 inherits all the excellent features of its C-1 predecessor with an upgraded maximum cruise speed of 260 km/h and a cruise range of up to 700 km. A spacious cabin makes a big difference for medical teams to save lives inside a medevac copter. The BK117C-2 boasts the largest cabin (floor area of 5.1 m^2) of any EMS helicopter in Japan. It's large enough for an onboard medical team to easily move around all sides of a patient (which is crucial, especially when dealing with pregnant women).

The cabin can accommodate a maximum of five people. Normally four people board the helicopter, including the patient, a doctor, a nurse, as well as a friend or a family member of the patient. The extra seat can be used by a pediatrician, when transporting a newborn baby, medical personnel in training and others.

The C-2's wide clamshell door at the rear facilitate the swift transfer of patients in and out of the helicopter. The cabin is even spacious enough to load a large incubator sitting on top of a stretcher. The C-2's roomy cabin eases medevac services and makes the helicopter a favorite among healthcare professionals working at the scene of an emergency.

Use of medevac helicopters is steadily rising thanks to the considerable efforts of personnel at the forefront of emergency medical services. EMS helicopters will be in operation at 25 hospitals in 24 prefectures of Japan by the end of March 2011—and the momentum will continue to accelerate. Use of the BK117 as medevacs throughout Japan is expected to increase along with the demand for EMS.

Large rear hatch with clamshell door.

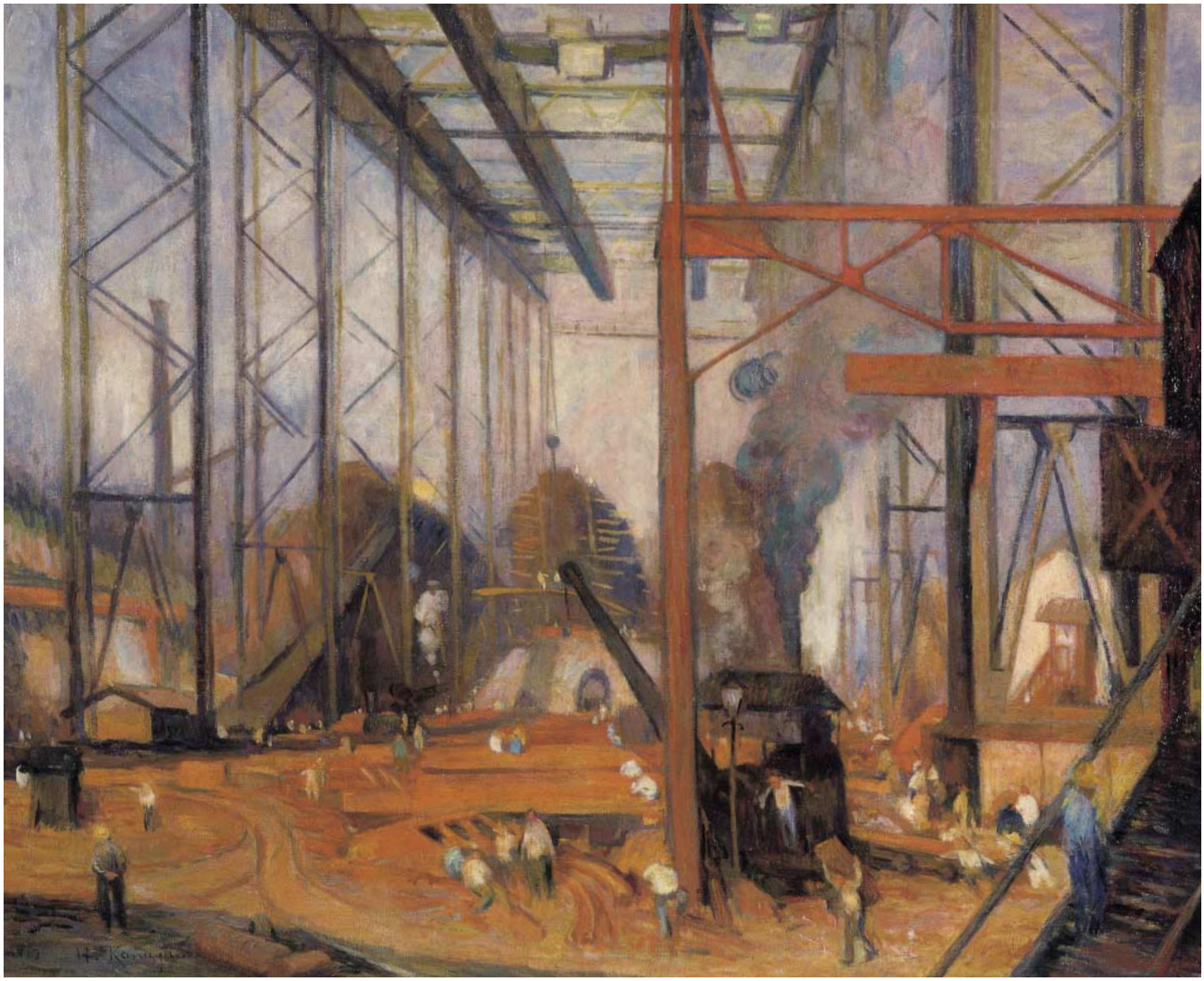
Cabin space for up to five people.

Inside a medevac as it transports an injured person (photo courtesy of the Kawasaki Medical School Hospital).

Kawasaki

Kawasaki Gallery

Heizo Kanayama's World



The Shipyard, 1917, 97.3 x 121.8 cm, oil on canvas. From the collection of Kawasaki Heavy Industries, Ltd.

Blending Art and Industry

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

Heizo Kanayama painted this Kobe shipyard gantry crane, built by Kawasaki Dockyard Co., Ltd. (currently Kawasaki Shipbuilding Corporation), in November 1912. These majestic towers dominated the skyline of the port city, the hub of Japan's shipbuilding industry, until 1962. The unique cityscape has been an ongoing inspiration for numerous artists and photographers.

Kanayama was greatly influenced by the Impressionists during a four-year sojourn in Europe. Renowned painter Tokusaburo Masamune drew comparisons between this painting and Monet's *Saint-Lazare Station* for the depth of its perspective and its depiction of smoke. Upon his return to Japan, however, Kanayama soon abandoned his experimentation with pointillism in favor of the more distinct brush strokes and colors we see here in *The Shipyard*.

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.

Exhibited at the Ministry of Education Art Exhibition in 1917, *The Shipyard* 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.