Scope

Kawasaki Heavy Industries Quarterly Newsletter

October 2006

NO.69

Kawasaki

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About the Cover
Kawasaki supplies the specially designed electric locomotives that tow ships through the Panama Canal. Fifteen locomotives were delivered between 1981 and 1986, and 100 of the upgraded version were delivered between 1999 and 2006.

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Scope

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A Century of Leadership in Rolling Stock Technology

This year marks the centennial of Kawasaki's rolling stock business.

Since 1906, the company has always been at the forefront of technological developments in rolling stock in Japan, underpinning the country's modernization efforts and the growth of the railroad industry for the past century. Leveraging advanced technologies with proven productivity, the company has expanded its product offerings to include electric train cars, passenger cars, freight cars, electric and diesel locomotives, and new transit systems, as well as supporting systems and equipment. Kawasaki has also notched impressive milestones in the race to develop the world's fastest trains.

Kawasaki's overseas operations resumed after WWII, in the 1950s. Kawasaki rolling stock is now delivered to the U.S., U.K., China, East and Southeast Asia, Africa, and Central and South America, among other destinations. More than 87,000 railcars have now been delivered to Japanese and overseas clients. This issue of Frontline *focuses on the overseas expansion and innovative technologies of Kawasaki's rolling stock business.*

Hyogo Works, the production hub of Kawasaki's rolling stock

5,200 CARS DELIVERED OVERSEAS

Kawasaki is now the largest rolling stock manufacturer in Japan, and ranks among the top in the world. Not counting its prewar achievements, the company's first overseas delivery of 40 electric train cars was made to Argentina in 1956, followed by other South American orders from Argentina, Brazil and Chile.

In the 1980s, the U.S. quickly became a major client. Following an order for 141 streetcars in 1979 from the Southeastern Pennsylvania Transportation Authority, Kawasaki won orders for 125 cars for the Philadelphia subway in 1980, 325 R62 subway cars for New York City Transit (NYCT) in 1982, and 200 R68A subway cars for NYCT in 1987. Its track record also includes 75 double-decker cars for the Massachusetts Bay Transportation Authority in 1989. Including 1,600 subway cars for NYCT, U.S. orders total 2,650 cars. If orders received jointly with other companies are included, Kawasaki's overseas orders now total 5,200 cars.

PRODUCTION SITES IN YONKERS, NEW YORK AND LINCOLN, NEBRASKA

In 1985, Kawasaki established a subsidiary in New York, Kawasaki Rolling Stock (USA), Inc., which became Kawasaki Rail Car, Inc. (KRC) in 1989. The plant, in Yonkers, handles final assembly, repair, delivery and upgrading for NYCT subway cars and other vehicles, making good use of its location in an industrial complex bordering New York City.

In 2002, a new plant built on the premises of the Lincoln, Nebraska plant of Kawasaki Motors Manufacturing Corp., U.S.A. (KMM) began full-scale operations. It is one of the largest and most advanced railcar manufacturing facilities in the country. The plant building is 80 m wide and 500 m long, allowing very long production lines, and completes the production and assembly of one car each day.

KMM Lincoln plant manufactures double-decker passenger cars for Boston

KMM Lincoln also manufactures R160 subway cars for NYCT in cooperation with the KRC Yonkers plant and Hyogo Works in Japan

THREE PLANTS WORK CLOSELY TOGETHER DESPITE THE DISTANCE BETWEEN THEM

Kawasaki is currently working on a project to produce a large number of R160 next-generation subway cars. It is responsible for manufacturing 260 cars for the base order and 416 cars for the option, as well as all 3,400 bogies for the project, including those for optional orders.

Production is a collaboration of three plants. The Hyogo Works, the hub of Kawasaki's rolling stock business and home of one of the most advanced facilities in Japan, is designing, producing prototypes and manufacturing some parts, including end underframes and bogie frames. The carbodies are being manufactured and some assembly work is being done at the Lincoln plant, while final assembly and tests are being conducted at the Yonkers plant.

When all the deliveries are completed (final delivery for the options is scheduled in 2010), Kawasaki will be NYCT's largest subway car supplier. Takuma Harada, of Kawasaki's Rolling Stock Marketing Department, says the achievement can be attributed to Kawasaki's competence as the R160 engineering leader, its delivery track record with NYCT, its technological superiority and the reliability of its products and services.

Because of their eco-friendliness, trains are gaining renewed favor in the U.S. There are increasing numbers of projects to build large-scale new lines, replace old cars and expand overall transportation capacity. Also increasing are the production of subway cars, to cope with expansions of urban subway lines, and double-decker passenger cars to improve the comfort of suburban commuters.

CATERING TO LOCAL NEEDS IN OVERSEAS MARKETS

Each overseas order requires a different set of production and delivery arrangements.

For Taipei's Department of Rapid Transit Systems (DORTS), Kawasaki will be delivering 159 of 321 cars (final delivery in 2009) as finished products, with the remaining cars to be manufactured by a local company under the government's Industrial Cooperation Program (ICP). In China, where Kawasaki received an order for 300 linear motor-driven vehicles from Guangzhou Metro Corp. in Guangzhou Province, it is collaborating with CSR Sifang Locomotive and Rolling Stock Co., Ltd. (Sifang)

A railcar production site at the KMM Lincoln plant, Nebraska, U.S.A.

KRC Yonkers plant

Train cars at Yonkers waiting to be rehabilitated

of Qingdao, Shandong Province on the design and manufacture of the vehicles. Using Kawasaki's carbody shell design, technology transfer and production assistance, Sifang is further developing the design, and handling the manufacturing, testing and commissioning. The carbodies of the first 48 cars will be supplied by Kawasaki for Sifang to assemble, and the company will be responsible for start-to-finish production of the remainder of the trains, with final delivery in 2010.

Jointly with Sifang, Kawasaki received an order for 480 high-speed trains from China's Ministry of Railways to bolster speeds on the nation's existing railway lines. The trains will reach a maximum speed of 200 kph, with designs based on the Series E2-1000 Shinkansen bullet trains operated by the East Japan Railway Company. After adaptation, Kawasaki will supply the first three finished trains (24 cars) and knockdowns. Sifang will handle the local manufacturing and delivery of the remaining trains with technological assistance from Kawasaki. The final delivery is scheduled for 2007.

These orders are further proof that Kawasaki's exceptional expertise, innovative technology and pioneering spirit—backed by its ever-reliable products and services—will continue to keep the company on the leading edge in the rolling stock industry. Kawasaki is committed to bolstering its overseas operations by flexibly adapting to the requirements of diverse markets.

Cutting-Edge Technology for Faster, More Comfortable Trains

Kawasaki is an industry leader in rolling stock technology. Here are some examples of its efforts to improve the efficiency, safety and riding comfort of passengers:

● Proprietary technology to resolve tunnel shock waves

When a high-speed train enters a tunnel, a compression wave is generated and the blasts can be heard on the other end of the tunnel. These are called micropressure waves, which are known to grow stronger in proportion to the train's speed, and their vibrations and noise negatively impact the environment.

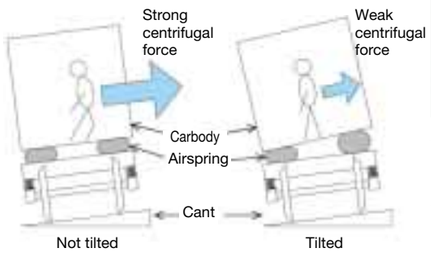
Two approaches are currently being taken: tunnel design improvements and train design enhancements. Entrance hoods (cylinder-shaped extensions to the tunnel entrance) can be installed to reduce the air taken in by the train. But to alter the design of high-speed trains so that they generate fewer micropressure waves requires much more: the train's nose cone must be extended, its cross-sectional area should be reduced and the cross-sectional change has to be evened out without reducing passenger space.

Kawasaki developed proprietary technology to identify the optimal cross-sectional area distribution through numerical simulations that combine computational fluid dynamics (CFD) and optimization simulation (genetic algorithm). This method is expected to lead to an optimized nose cone that generates fewer micropressure waves without compromising on passenger space.

● Making curves safer at high speeds through tilting control

Trains that take sharp curves generally operate at lower speeds around those curves because they exert an outward centrifugal force that can jeopardize safety and comfort.

Kawasaki developed an airspring tilting system that tilts the carbody inward by sending air to airsprings installed between the bogie and the carbody. Depending on the train's speed and the curve radius, the system reduces centrifugal force and ensures passenger comfort without having to reduce speed every time the train enters a curve.



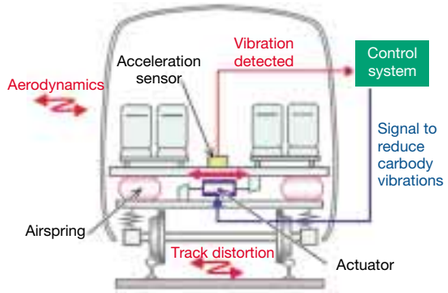
Excess centrifugal force with/without tilting of carbody

● Improving passenger comfort with an active suspension system

A train running at high speeds experiences simultaneous vibrations in different directions because of track distortion and aerodynamics. Lateral vibrations, in particular, affect rider comfort. To control these vibrations, an actuator that counteracts the vibration force can be installed between the bogie and the carbody. While pneumatic and hydraulic actuators have already been commercialized, Kawasaki has developed a new solenoid actuator.

An actuator for the active suspension system

This innovation offsets the lateral vibrations by making adjustments in an electric current fed to the actuator's electromagnetic coils, which laterally moves a component with a permanent magnet very rapidly. Acceleration sensors installed on the carbody detect vibrations and the computer instantly calculates how much force in what direction is needed. This solenoid actuator responds within 0.1 second and allows reduction of vibrations almost instantaneously.



Active suspension system

● Shortening of braking distance and noise reductions

In the event of an earthquake or other emergency, high-speed trains must come to a swift stop. To achieve this, Kawasaki has developed a device that increases air resistance. During emergency braking, in addition to the electrical and mechanical brakes, aluminum plates deploy from the carbody to increase air resistance and shorten the braking distance by about 500 m. The device is installed on a magnetic levitation (Maglev) train that is currently undergoing test runs. If commercialized, Kawasaki would be the first in the world to employ the system.

To reduce reflective noises from the train track subgrade and soundproof walls, Kawasaki has developed sound-absorbing panels to cover the lower section of the carbody.

Kawasaki's R&D efforts are also coming to fruition in the development of special bogies for high-speed trains, lighter structures, noise reduction devices for passenger cabins and many others that support faster, safer and more comfortable travel.

Panels to increase air resistance

Frontrunners of Evolving Shinkansen

Series N700

Series N700 is the new Shinkansen train developed jointly by Central Japan Railway and West Japan Railway. The goal was to create the newest, fastest, most comfortable train on the Tokaido and Sanyo Shinkansen lines. With maximum speeds of 270 kph (300 kph on the Sanyo segment), the vehicle features an optimized nose cone (aero double-wing model) that reduces the generation of micropressure waves when it enters tunnels, without compromising passenger space or riding comfort. It is scheduled to go into service in summer 2007.

FASTECH 360

East Japan Railway set technical service operation targets to achieve the world record speed of 360 kph with the FASTECH 360S for Shinkansen lines exclusively, and the FASTECH 360Z for Shinkansen and conventional lines. It is equipped with various cutting-edge technologies, including a new, proprietary nose cone that curbs the generation of micropressure waves when it enters a tunnel. Prototypes of both models are currently undergoing a variety of test runs, including trials at speeds close to 400 kph.

Technologies Behind LNG Carriers: Transferring LNG Safely at Ultralow Temperatures

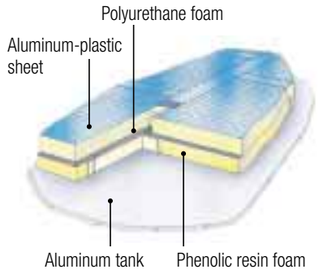
Liquefied natural gas, a clean fuel

LNG is produced by cryogenically liquefying natural gas at approximately –162ºC, after which it is regasified for use as fuel. Since LNG is refined during the liquefaction process, it is a very clean, earth-friendly energy source, producing lower quantities of CO_2 than coal or oil. It is also efficient to transport and store because liquefaction reduces its volume to about 1/600 of natural gas. However, because LNG storage tanks must withstand ultralow temperatures, they require high-performance thermal insulation and highly safe construction.

Megatanks made of aluminum alloy and high-performance thermal panels

Kawasaki Shipbuilding Corporation's LNG carriers are equipped with Moss spherical tanks that are 30 to 40 m in diameter and made of aluminum alloy that is 25 to 60 mm thick. Three to five Moss tanks are installed inside the double hull and supported by circular cylinders directly welded to the structure of the LNG carrier. Covered with high-performance thermal insulation panels using the Kawasaki panel system, the tanks allow 0.1 to 0.15% of LNG to be boiled off per day.

Kawasaki is a pioneer in LNG carrier building in Japan and a global leader in Moss tank technologies. In 1981, it built Japan's first LNG carrier, *Golar Spirit,* with an LNG storage capacity of 128,600 m^3.



Tank construction

Aluminum alloy panels are assembled to create a certain size of sphere shell first and built into a larger spherical tank. The accuracy of the panel size is controlled to the 0.1 mm for precise assembly.

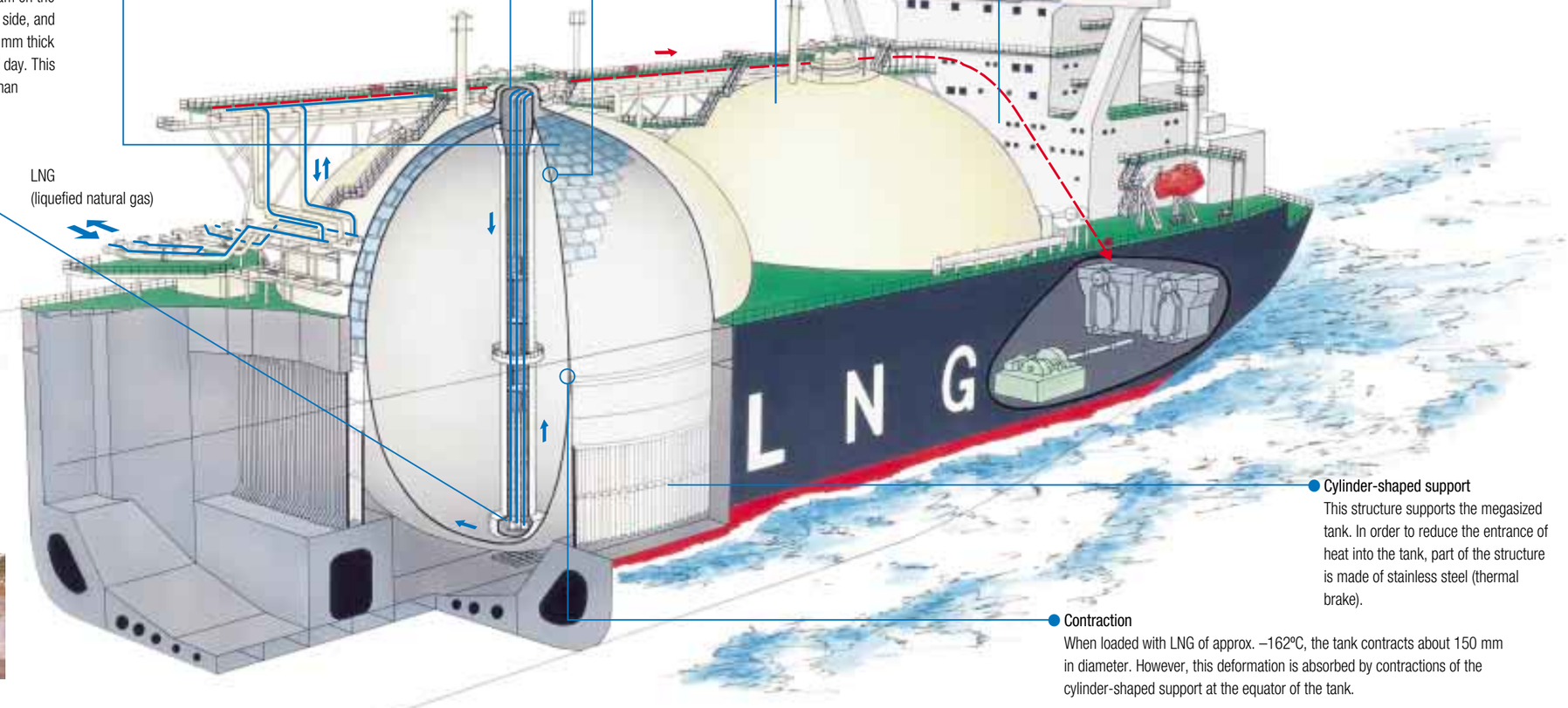
Tank dome
Located at the top of the tank, it contains the entrance for servicing, as well as for the various pipes that go inside the tank.

Moss spherical tanks
Developed by Norwegian firm Moss Rosenberg Verft AS (now Moss Maritime), these spherical tanks are extremely strong because of their self-supporting spherical structures, which free them from stress concentrations that are typically the cause of cracking.

Propulsion plant and use of boil-off gas
Methane, which comprises most of the boil-off gas (BOG) inside the tank, can be used safely as the carrier's boiler fuel for propulsion. The carrier is equipped with a propulsion plant that uses an environmentally friendly steam turbine that emits less NOx and SOx. To maintain optimum LNG tank pressure and to stabilize the supply of BOG to the propulsion plant, sophisticated techniques control the BOG level. Alternative propulsion systems, such as high-performance steam turbine plants and dual fuel diesel-electric engines with electric propulsion motors, have been developed and are ready for use.

Tank thickness
Between 25 and 60 mm (150 mm at the equatorial rings)

Tank material
Aluminum alloy



Thermal insulation features
Moss tanks are covered with thermal insulation panels based on Kawasaki's proprietary panel system technology. Each multilayer panel is comprised of phenolic resin foam on the low-temperature side (tank side), polyurethane foam on the ambient temperature side, and aluminum-plastic sheet on the exterior. The insulation panel is about 200 to 300 mm thick to achieve a boil-off rate (thermal insulation performance) of less than 0.15% per day. This proven performance superiority has been adopted by LNG carrier builders other than Kawasaki.

Pipe tower
Made with the same materials as the tanks, this shaft, about 3 m in diameter, is placed vertically in the middle of the tank to accommodate loading/unloading pipes, cargo pumps to discharge LNG to onshore facilities, stairs and instrumentation. The cargo pumps are located at the bottom of the pipe tower, in order to improve discharging performance.

Tank welding
Because the tanks must be highly durable and safe, sophisticated welding is required during their construction. To meet these demanding safety standards, Kawasaki's high-current metal inert gas (MIG) welding operations are conducted semi-automatically. All joints are welded using the most reliable butt-welding method, which can be thoroughly inspected by x-ray and ultrasonic testing, therefore assuring perfect welding.

Cylinder-shaped support
This structure supports the megasized tank. In order to reduce the entrance of heat into the tank, part of the structure is made of stainless steel (thermal brake).

Contraction
When loaded with LNG of approx. –162ºC, the tank contracts about 150 mm in diameter. However, this deformation is absorbed by contractions of the cylinder-shaped support at the equator of the tank.

Coal Moisture Control Plant Delivered

Kawasaki Plant Systems (K Plant) recently delivered a coal moisture control (CMC) plant to the Kita Kyushu Coking Works of Mitsui Mining Co., Ltd. The plant dries coking coal to target levels to assure coke quality, thus reducing energy consumption and enhancing productivity. It was codeveloped with Mitsui Mining for the 220 t/hour coking works in Kita Kyushu. K Plant supplied the equipment on a full turnkey basis.

The CMC plant is comprised of an automated coal-in-tube (CIT) drier, which dries coal inside the bundled tubes of a rotating drum, a conveyor, a steam supply, a hot water recovery system and an energy control system. The drier is corrosion- and abrasion-resistant and utilizes an indirect-heating method. The smaller tubes make it compact, allowing suitable processing time. The coal is not crushed and particle generation is thus reduced.

Kawasaki's CMC plant reduces the moisture content in coal from a conventional 9% – 12% to a stable 8%, thus greatly enhancing quality and operational stability, resulting in a production efficiency increase of 10%. It also reduces the fuel requirements of coke ovens. K Plant is a leading supplier of CMC plants, with six prior installations in steel and chemical company facilities.

Landmark Marine Diesel Engine Completed

Kawasaki recently completed the world's largest class marine diesel engine with electronic control, the Kawasaki-MAN B&W 12K98ME. It has been installed by IHI Marine United Inc. on an 8,000 teu container ship ordered by Kawasaki Kisen Kaisha (K-Line).

Equipping the ME engine with electronic control increases fuel efficiency and reduces cylinder lubricant requirements. It also allows stable operations under low engine speeds, thus providing higher maneuverability while entering and leaving port, and features lower NOx and soot emissions. Kawasaki is already at work on its next order for the environmentally friendly engine.

Kawasaki's manufacture of marine diesel engines began with a licensing agreement with Germany's MAN in 1911. Following the merger of MAN and Denmark's B&W in 1981, Kawasaki renewed the agreement and began producing Kawasaki-MAN B&W 2-stroke diesel engines. To date, it has delivered enough MAN B&W engines to output over 10 million horsepower.

In February 2005, Kawasaki unveiled its first electronically controlled model, the MAN B&W 7S60ME-C engine, which was installed in a K-Line car carrier. Two more have since been delivered.

The 12K98ME marks Kawasaki's fourth ME engine to be completed. The company is now fulfilling its second order for the model, with a backlog of four orders.

Biomass Power System Delivered

In March, Kawasaki Plant Systems (K Plant) delivered a biomass power generation system that features a proprietary, internally circulating fluidized-bed boiler to Tokai Pulp & Paper Co., Ltd.'s Shimada Mill.

The high-efficiency system comprises a boiler, a turbine generator, an exhaust gas treatment system and a silo for refuse paper and plastic fuel (RPF). The system generates steam by incinerating a mixture of eco-friendly biomass fuel (demolition and construction wood), RPF and waste plastics in the boiler.

This steam, combined with steam from another boiler installed earlier at the plant, feeds the power-generating turbine and is used for drying paper and other papermaking processes at the mill. The introduction of an axial exhaust turbine contributed to lowering the height of the turbine building.

The all-important boiler has an internally circulating fluidized-bed divided into combustion and heat recovery cells by double-partition walls. This enables internal temperatures to be lower than other methods, thus preventing corrosion attacks from chlorine on the superheaters and generating tubes within the heat recovery cell, and allowing the boiler to generate high-pressure, high-temperature steam.

Kawasaki's boiler also guarantees stable combustion even when fuels with different characteristics and calorific values are mixed. The operating load is easily adjustable between 60 and 100 percent. A combustion method that curbs the generation of environmentally harmful substances has been adopted, as well as bag filters, an activated carbon injector and flue gas desulphurization equipment for exhaust gas treatment. Noncombustibles in the fuels are also continuously removed from the bottom of the furnace.

Test Runs of Battery-Powered Light Rail Vehicle Begin

Kawasaki began test runs in August of a tram car powered by its proprietary nickel metal-hydride Gigacell battery, developed for a next-generation light rail vehicle (LRV).

Kawasaki plans to complete production of the test car for the super-low floor LRV, dubbed SWIMO (Smooth WIn MOver), in 2007.

The test car is 15 m long, with a capacity of 63 passengers and a top speed of 40 kph. The floor is only 33 cm from the ground at the entrance, making it easier for passengers to board. It has been kept flat to accommodate a variety of seat configurations. Kawasaki designed a new bogie that is the key technology in realizing the low floor height. The SWIMO generates power on reducing speed, which charges the Gigacell battery so that it can power the vehicle and utilities. This greatly increases the LRV's energy efficiency.

The Gigacell compensates for voltage reductions when the SWIMO is not near a substation, thus allowing greater distances between substations and a reduction in the overall number of substations. Consequently, maintenance requirements can also be reduced. Because the Gigacell enables operations without a constant supply of electricity from overhead lines, traffic systems can be designed with a reduced number of lines, thus helping to preserve the beauty of the cityscape.

Kawasaki's Gigacell battery is tailored to large-scale applications, with quick charge/discharge capabilities. It is safe, environmentally friendly and easily disassembled and recycled. It also contains no hazardous materials such as lead, sodium or lithium.

25 MW CCPP with L20A Gas Turbine Delivered

Kawasaki recently delivered a combined cycle power plant (CCPP) for an onsite heat and power supply project being implemented by Osaka Gas Co., Ltd. for automaker Daihatsu Co., Ltd. It completes the full turnkey order received in October 2004 for the plant, which has a total output of 25 MW.

The CCPP is driven by the high-efficiency 20 MW-class L20A gas turbine, a heat recovery steam generator and a steam turbine, all manufactured by Kawasaki. The plant's power and steam will be used at Daihatsu's Shiga (Ryuo) Plant, where dramatic improvements are expected in energy efficiency and CO_2 reduction.

Kawasaki began development of the L20A, driven by its proprietary technologies, in 1998, with the first unit completed in September 2000. This was installed in a cogeneration system at Kawasaki's Akashi Works in November 2001 and has since been providing power and steam to the plant. The L20A's first commercial installation was in 2004, when Kawasaki delivered two of the units to the Chiba Minato Power Plant, which supplies onsite heat and power for the Chiba Food Complex. With the latest delivery to Daihatsu, Kawasaki has now delivered six L20As, including three overseas. ::

Advanced Construction Machinery on Show at CONET2006

Kawasaki exhibited two models of construction machinery at CONET2006, the International Exhibition for Construction Equipment & Technology, held July 13 to 16 at Makuhari Messe, Chiba Prefecture.

Guided by the exhibition's theme—Construction Machinery, Meeting the Challenges of the Future!—Kawasaki showed the state-of-the-art 90ZV-2 wheel loader and the 55DV Snow Dozer, the world's fastest snowplow. These models demonstrate Kawasaki's commitment to satisfying a diversity of customer needs and to developing cutting-edge technologies that contribute to the environment, safety and efficiency.

Powered by an engine that complies with stringent off-road vehicle emissions regulations that came into effect in October in Japan, the export model of the 90ZV-2 on display features an Efficient Loading System (ELS) and various modifications with a large $4m^3$ bucket adapted specifically for industrial waste applications, thus meeting increased demand for environmental preservation.

The 9.2 ton-class, high-speed 55DV Snow Dozer, along with the 65DV and 70DV models, can reach snow-clearing destinations without causing traffic congestion en route. The 55DV boasts twice the acceleration speed of conventional snow dozers, with a traffic-friendly top speed of 49 km/h.

The dozers are equipped with comfort-controlled cabins, ride control to absorb vibrations, optional LSD (Limited Slip Differential) to control the vehicle on snowy roads, optional quick couplers that enable the operator to change plows from inside the cab, and such plow options as a multiwing plow and an angling plow to satisfy different conditions. ::

90ZV-2

New Boeing 787 Dreamliner Facility Completed

In July, Kawasaki completed a new facility to the east of its existing Nagoya Works 1 for production of key 787 Dreamliner components, as part of a codevelopment program with The Boeing Company of the United States.

Construction had been under way since November 2004. The new plant has about 20,000 m^2 total floor space. It is 160 m long, 95 m wide and 21 m high.

Kawasaki is taking part in the development and production of the forward fuselage, the main landing gear wheel well, and the wing fixed trailing edge for the Dreamliner. Those components will be manufactured and assembled using state-of-the-art equipment.

The 787 is a 200- to 300-seat midsize commercial airplane aiming for a high level of efficiency in operation, so a number of innovative designs—as well as cutting-edge manufacturing technology—are being applied in the airplane. The fuselage features a composite one-piece structure that is the world's first in a commercial aircraft, and requires a significantly different manufacturing process from that of existing airplanes.

Kawasaki is building an efficient production line that will enable it to realize an integrated manufacturing process, from composite parts fabrication to assembly of the forward fuselage. It is also introducing state-of-the-art equipment in the new facility, such as the world's largest class autoclave to cure the laid-up composite with high temperatures and pressures, an automatic fiber placement machine to co-cure the composite fuselage, and a panel-fastening machine to automatically rivet frames to the fuselage.

Development of the 787 Dreamliner is in its final stages, with entry into service planned for 2008. Kawasaki is scheduled to deliver the initial forward fuselage from its new facility in early 2007. The Company is committed to providing high-quality products from the new facility to the Boeing program, and to actively contributing to the development of the commercial aircraft business. ::

The world's largest class autoclave

185,000 DWT Cape Med Delivered

Kawasaki Shipbuilding recently delivered the large bulk carrier Cape Med, with a deadweight of 185,000 metric tons, to "K" Line Bulk Shipping (UK) Ltd. at its Sakaide Shipyard.

The carrier, Kawasaki hull No. 1569, complies with new safety regulations established by the International Maritime Organization. The 290 m long carrier features a body design that incurs less propulsion resistance, and is equipped with a fuel-efficient diesel engine, high-performance propellers and the Kawasaki rudder bulb system with fins (RBS-F).

In an effort to boost the ship's eco-friendliness, Kawasaki reduced the NOx content of exhaust emissions, replaced the engine room's firefighting extinguishers with foam rather than Co_2 gas, and adopted new refrigerants in the air conditioners and freezers. ::

Performance that never quits

Since introducing our first models in 1962, we've continued to diversify our pioneering wheel loader lineup. With a full range of models and options available, we can equip you to tackle even the most demanding applications and environments. Rely on Kawasaki wheel loaders for unmatched utility, power and efficiency.

Kawasaki

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