Kawasaki

Kawasaki Gallery

Heizo Kanayama's World

Chrysanthemum, 1935-45, 37.4 x 45.4 cm, oil on panel, from the collection of Kawasaki Heavy Industries, Ltd.

Masterly Rendition of Chrysanthemums in a Vase, Painted with Characteristic Style

Shusaku Sagara, Associate Curator, Hyogo Prefectural Museum of Art

Heizo Kanayama seems to have had a flair for still lifes. Aside from landscape paintings, still lifes comprise one of the largest bodies of his work. His subjects range from the typical fare of plates laden with fruit and vegetables to a single fish depicted in a distinctive way. Flowers, are among his best-known works of still life. Kanayama took pride in his prominent position in modern art circles, and applied himself for a period of time to producing paintings for the Imperial Fine Arts Academy Exhibitions. For a total of 15 exhibitions, he painted six flower paintings, two of which were bought by the Ministry of the Imperial Household. His flower still lifes were admired by both fans and critics alike, which is evident from the generally favorable reviews they received in magazines at the time.

In the piece shown here, masterfully painted with delicate brushstrokes that are a characteristic of the artist's work, a careful viewer will notice that the flowers on the left are withering. In contrast, the vase holding the flowers is given a vivid luster, suggesting that perhaps Kanayama was more attracted to the vessel than the flowers. Here we can catch a glimpse of the realism and uniqueness of Kanayama's vision, reminiscent of the "vanitas" motif of the Dutch and Flemish paintings, which depicted fresh and faded flowers side by side to remind viewers of the transience of life.

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.

Scope

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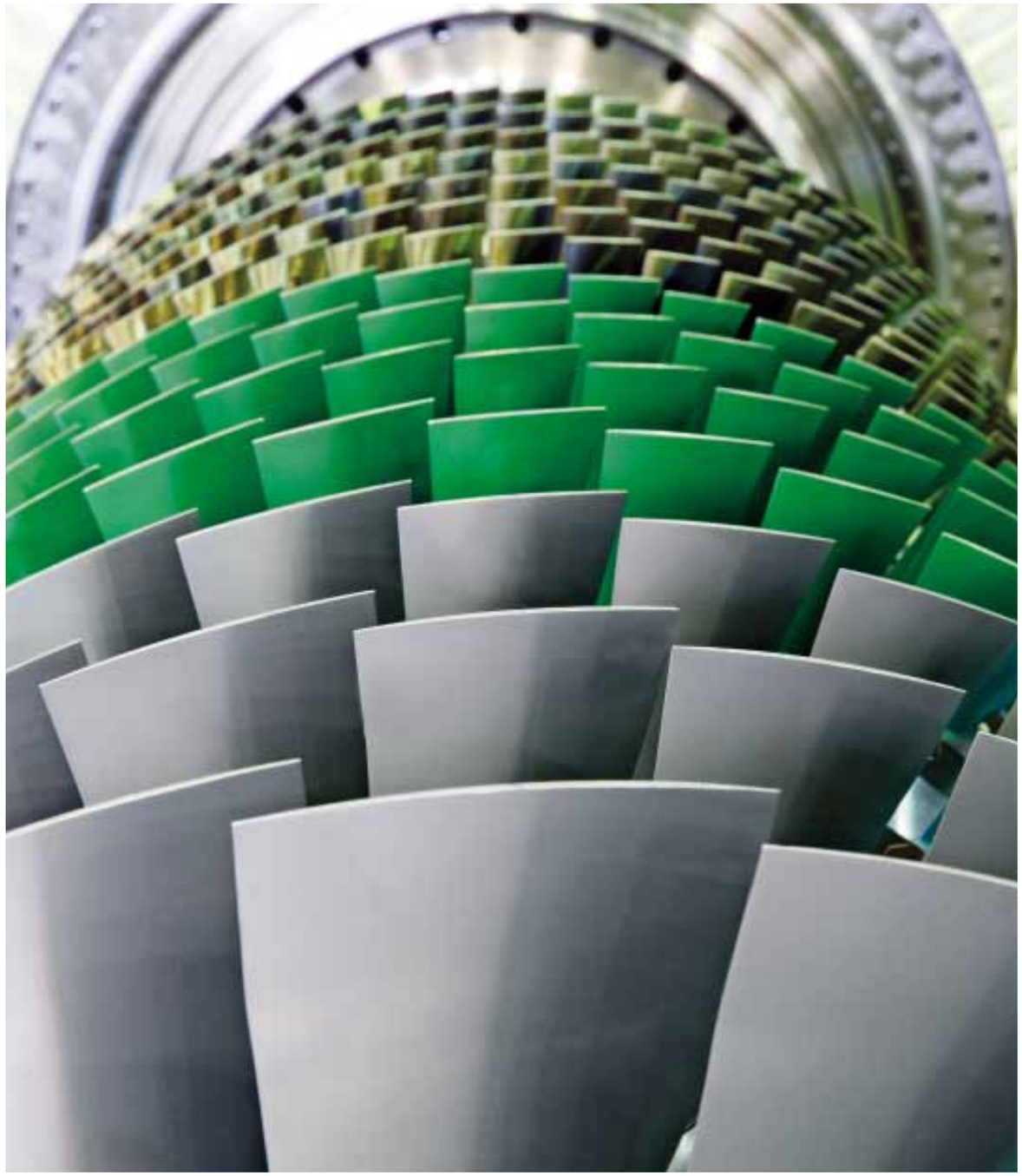

Kawasaki Heavy Industries
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About the Cover
A closeup of the compressor vane of the latest L30A Kawasaki Green Gas Turbine. Large and small vanes attached to the rotors compress the air taken in by the rotation of the rotors.

KAWASAKI HEAVY INDUSTRIES, LTD.

Scope

Editor-in-Chief: Kosei Nishino
Public Relations Department
World Trade Center Bldg., 4-1
Hamamatsu-cho 2-chome, Minato-ku
Tokyo 105-6116, Japan
Phone: 81-3-3435-2132
Fax: 81-3-3432-4759
URL: http://www.khi.co.jp

Dawn of a New Era in Electrical Energy Part 2

Kawasaki Green Gas Turbine and Cogeneration Systems

Leaders of 21 countries and regions gathered in Vladivostok, Russia this past September for the 2012 APEC Summit. A related energy plant constructed at the site was using a cogeneration system driven by a total of seven Kawasaki Green Gas Turbine units.

Cogeneration systems use boilers to recover exhaust heat from gas turbine generators (GTGs), producing steam and hot water. Along with the capability to generate electric power while also producing heat needed for production and heating, cogeneration systems boast an overall efficiency of nearly 80%. This impressive efficiency level has made cogeneration a popular energy solution both at home and abroad.

This issue's *Frontline* takes a look inside the energy plant at the APEC Summit site and examines the appeal of cogeneration systems and Kawasaki Green Gas Turbines—including the new 30 MW-class L30A, which achieves a world-leading energy efficiency of over 40%.

Vladivostok is a city situated in the Far East region of Russia. The Port of Vladivostok, known as a fine natural harbor, is also a famous military port.

A photo of the APEC Summit Main (Central) Site district heating power plant in September. The plant, powered by five Kawasaki Green Gas Turbine generators, is located on Russky Island, Vladivostok (see map above).

Seven Units Delivered for Energy Plants at APEC Russia Summit Site

2012 APEC Summit Held on Russky Island

Vladivostok is situated at the southern tip of the Muravyov-Amursky Peninsula, which juts out into the Sea of Japan at the south end of Russia's coastal region. Russky Island, where the 2012 APEC Summit was held, is a five-minute drive from here by way of a newly constructed bridge that crosses over to the island.

The facilities used for the summit are scheduled to be refitted as a new campus of the Far Eastern Federal University, which was formed through the merger of three universities in the coastal region. Construction of campus-related facilities is currently underway at the site.

Far Eastern Energy Corp. Orders 7 GTGs

Kawasaki received orders for a total of seven GPB70D GTGs from Russia's Far Eastern Energy Corporation (FEEC) via prime contractor Sojitz Corporation. Of these, five were used for the district heating power plant at the APEC summit's Main (Central) Site on Russky Island, and two at the Marine Center Site. All seven units are driven by a 7,000 kW class M7A-02D Kawasaki Green Gas Turbine. The GTGs were delivered by Kawasaki while the hot water boilers and other auxiliary equipment were separately provided by Sojitz.

The GTGs are normally fueled by natural gas, but should the supply of natural gas be disrupted, they can also run on diesel fuel, thanks to their dual-fuel capability.

"We Chose Kawasaki for Its Reliability and Cost Performance"

During an interview at the site in June, Mr. Sergey Paramonik, vice president of FEEC, was asked about choosing the Green Gas Turbine. He said: "We chose it for its exceptionally high reliability and cost performance, as well as excellent efficiency and environmental friendliness, which keep CO_2 emissions to a minimum level. It is also compact and produces minimal noise and low vibration. It can even be installed on the roof of a building as a standby generator. The relatively long interval of four years between periodic overhauls also helps improve the operating efficiency. We are also very pleased with the on-site support we get from Kawasaki's engineers. The current project was part of the preparations for the APEC summit, and as such, it was a very high-profile project in which Kawasaki showed that it could provide an established solution for distributed power generation projects. We believe that this project provided a good opportunity for Kawasaki to establish a bridgehead in Russia."

Comments on the Project from Various Sectors

High Hopes for Kawasaki's Energy Technology Support at the Summit

Starting about three years ago, a huge amount of money has been invested in this region to construct ports, bridges and other infrastructure in preparation for the APEC summit, contributing to the growth of the region.

As the local representative of Japan, nothing was more pleasing for us than the success of the energy plant undertaken by Kawasaki, which went on line as planned, supporting the underpinning of the summit.

Since this project was an excellent opportunity to put Japan's superior technology on display for the Russian people to see firsthand, we hope this will further strengthen the economic partnership between our two countries.

There are plans for various natural gas projects in Russia, and if Japan can collaborate on these projects with its leading technology, this can also lead to the diversification of energy suppliers for Japan.

Nobuaki Ito
Consul General
Consulate General of Japan in Vladivostok

Inside the Main (Central) Site of the APEC summit. Five Kawasaki Green Gas Turbine generators are lined up, offering an impressive view.

The five generators come equipped with Kawasaki's M7A-02D Green Gas Turbine.

The Main venue of the APEC summit, where the summit was held, under construction.

A rendering of the completed oceanarium.

Powering One of the Largest Aquariums in the East

The Marine Center Site supplies electricity and hot water to an oceanarium, which Mr. Paramonik notes is one of the largest in the East, holding a total of more than 25,000 tons of water. To keep a facility of this size running, a highly reliable supply of electricity and hot water is essential. For the Marine Center Site, two GTGs were delivered.

Mr. Paramonik concluded the interview with the following remarks: "It is a great honor to host the APEC summit at Vladivostok, and we feel very proud. The summit provided an opportunity for building new roads as well as energy and other facilities. And we now have a bridge that connects the island to the mainland. These infrastructure developments are expected to lead to huge growth for the region, and we are very excited."

Mr. Paramonik, vice president of FEEC

Cogeneration Project in the Russian Far East

In his remarks (please see column on the facing page), Sergey Egorov, Trade Representative of the Russian Federation in Japan, says, "A shift to gas will begin in the Khabarovsk and Primorskii Provinces." What does this mean?

Although it depends on the region, local governments in Russia have an obligation to provide hot water to residents for heating their homes through approximately eight months each year. In the Russian Far East, most of the facilities for providing hot water are coal-fired boilers that are aging and have an energy efficiency of less than 40%. With this new class of gas turbine cogeneration system, however, energy efficiency doubles to about 80%, with 30% of fuel converted to electricity and 50% recovered as heat. By installing a gas turbine cogeneration system of a suitable size close to where the demand is, transmission losses of electricity and heat can be minimized, saving a considerable amount of energy.

Signing of a memorandum at the 5th Japan-Russia Investment Forum.

In the Russian Far East, pipelines were constructed for transporting natural gas produced in Sakhalin to Vladivostok via Khabarovsk, enabling the gasification of the region. The cogeneration project in the region is an effort to replace existing coal-fired boilers with gas turbine cogeneration systems.

After a series of consultations with its Russian partner RAO Energy System Vostok and with Sojitz, Kawasaki confirmed its intention to collaborate on the cogeneration project in the Russian Far East, and in June, a memorandum was signed at the 5th Japan-Russia Investment Forum held in Kazan, Russia.

Exterior of the district heating power plant (Marine Center Site) in September.

This story was written following a tour of the cogeneration facilities in early June. Photos that do not mention a different month were also taken at that time, and thus do not reflect the completed state of the facilities.

Inside the building. Two Kawasaki Green Gas Turbine generators (GPB70D) are installed, waiting to begin trial operation.

Comments on the Project from Various Sectors

Kawasaki's Expertise Is Vital for Energy Reform in the Russian Far East

Sergey Egorov
Chief Representative
Trade Representative of the
Russian Federation in Japan

Being a resource-rich nation, Russia has only recently begun working on energy conservation, which is considered to be one of the five pillars of economic modernization.

The construction of gas pipelines connecting Sakhalin to Khabarovsk and on to Vladivostok is a major project that could impact the economic exchange between Russia and Japan. With this as a turning point, a shift to gas will begin in the Khabarovsk and Primorskii Provinces. And if cogeneration systems using Kawasaki's high-efficiency gas turbine generators take root in these regions, energy efficiency there will be greatly improved.

Cogeneration systems based on Kawasaki's GTGs were discussed at the 5th Russian-Japanese Investment Forum held in Kazan this past June, and Kawasaki's name is highly regarded by relevant authorities in Russia. We are convinced that Kawasaki's efforts in Russia will benefit both Russia and Japan, and we hope for the growth and success of the company's business.

Energy-Saving Technology as a Key to Greater Economic Exchange

Takayoshi Tsuda
Director, Russia,
Central Asia and Caucasus Office
Trade Policy Bureau, METI

Russia's energy efficiency is less than one-tenth that of Japan's, and the Russian government has made the promotion of efficient energy usage part of its growth strategy. This precisely matches the Japanese government's new growth strategy, in which it declares an intent to leverage Japan's world-leading technology in energy conservation, acquired in its efforts to overcome, through technological innovation, the environmental pollution that resulted from pursuing rapid economic growth after World War II, and the two oil crises that befell the country.

Russia has high expectations for moves into Russia by Japanese companies, which, like Kawasaki, possess cutting-edge technology that will enable improved energy efficiency. Kawasaki's recent delivery of a cogeneration system for facilities at the APEC summit venue, where the leaders of the member economies came together, was very meaningful in that it demonstrated the usefulness of Japan's advanced technology.

In the future, large-scale cogeneration projects aimed at improving energy efficiency are expected to be launched in the Russian Far East and elsewhere. It is hoped that these projects will lead to further economic exchange between the two countries.

L30A Brings Top-Class Efficiency of Over 40% to the Market

Output Range from 200 kW to 30 MW

The Kawasaki Green Gas Turbine is an industrial gas turbine developed using Kawasaki's proprietary technology, which it has cultivated through international collaboration efforts to develop and manufacture engines for large aircraft.

The lineup currently covers an output range from 200 kW to 30 MW. Standby generators driven by these gas turbines, as well as cogeneration systems built around Kawasaki's gas turbine generators, have earned high marks around the world.

Heated, Compressed Gas Drives the Turbine

A gas turbine engine is a type of internal combustion engine, similar to a diesel or gasoline engine. The basic principle behind their operation is the same—the operating cycle comprises air intake, compression, fuel combustion and exhaust. However, while diesel and gasoline engines are driven through the reciprocal motion of pistons, gas turbines rely on rotational motion.

The turbine compresses air and sends it to a combustion system, where the air is mixed with fuel. The resulting air-fuel mixture is burned to create high-temperature, high-pressure gas, which is used to drive the turbine (consisting of rotors with numerous vanes attached). A gas turbine generator produces electricity using a generator connected to a turbine. Natural gas and liquid fuel such as kerosene and diesel oil can be used for fuel.

Large Output, Small Body, No Cooling Water Required

One of the most distinctive features of a gas turbine is that it is self-cooling, eliminating the need for cooling water. This means that no installation of cooling water equipment and piping is necessary, helping to reduce installation costs and making maintenance easier. The installation location can also be chosen more flexibly.

The L30A was shipped to Daicel Corporation's Aboshi Plant in Himeji.

With a rotation speed of 3,000 to 100,000 RPM, gas turbines are intrinsically capable of producing large amounts of power despite their compact and lightweight structures.

Unlike the reciprocating motion of a piston engine, the rotational motion of a gas turbine produces almost no vibration. Therefore, they can be installed anywhere, regardless of the foundation structure.

Gas turbines also have excellent seismic performance. This is because gas turbines, unlike diesel engines, do not require such support as anti-vibration rubbers and springs, which cause low-frequency vibrations like seismic waves to induce vibration resonance.

Kawasaki's 30 MW class L30A Green Gas Turbine undergoing trial runs at the Akashi Works. A cogeneration system built around the L30A has a combined thermal efficiency of over 83% and NOx emissions are cut to the world's lowest level.

Cogeneration System Using L30A Has a Combined Thermal Efficiency of Over 83%

Kawasaki's recently launched L30A boasts an output on the order of 30 MW, the largest in the Green Gas Turbine lineup.

It maintains the basic structure of the M7A, which has seen sales of over 100 units around the world, and leverages the technology of the L20A, while incorporating a number of innovative new features such as a compressor with a higher pressure ratio, the use of advanced heat-resistant materials, and improved turbine cooling technology.

As a result, the L30A has achieved the world's top-level efficiency rating of over 40%. When employed in a cogeneration system, the combined thermal efficiency exceeds 83%. In a combined cycle power plant, the L30A achieves a generating efficiency of more than 50%, in combination with a steam turbine.

The environmental performance is also top-notch, with NOx emissions kept below 15 ppm (O_2=15%)—the world's lowest level—by utilizing Kawasaki's proprietary Dry Low Emission combustion system, which curbs NOx emissions without using water or steam.

1st Demo Test Begins at a Chemical Company—Expanding into the Global Market

The first unit of the L30A was installed at Daicel Corporation's Aboshi Plant in Himeji, with a demonstration test scheduled to begin in October.

At the same time, there have been numerous inquiries about the L30A. Other than the domestic market, the three largest projects that are the most promising involve installations in Russia to meet the demand for heat in the colder regions, installations in European factories—especially Germany, where demand has been strong—and installations in the factories of Southeast Asia.

Our Goal Is to Become a Global Leader

Joji Iki
President, Gas Turbine & Machinery Company

The U.S. has succeeded in drilling shale gas, and natural gas has been increasingly attracting global attention. Being a clean fuel, natural gas can help reduce environmental impact, and efforts to eliminate its cost disadvantage against oil are making headway. Given these circumstances, it is safe to say that the Green Gas Turbine and the Green Gas Engine, which primarily run on natural gas, are the ideal engines for the times.

Of these two, the Green Gas Turbine, which is a rotary machine that continuously burns fuel inside a combustion system, is suited for continuous operation over an extended period of time. On the other hand, the Green Gas Engine, which converts the reciprocating motion of pistons into rotational energy, can maintain high generating efficiency even with a partial load. In other words, its high partial load performance enables an appropriate response to daily or seasonal load fluctuations.

In practice, the two types of engines are used selectively in a way that maximizes their respective advantages, but I believe the gas turbine and the gas engine can also be used in combination. The idea is to handle the base load with the gas turbine, and the variations with the gas engine.

We will work to improve the performance and quality of the Green Gas Engine (we are aiming for an efficiency of over 50%), as well as the cost and delivery time. We also have plans to develop marine gas engines and put them on the market within FY 2013. With the development of the L30A, our Green Gas Turbines can now serve a wide spectrum of needs. As we move forward, we will further strengthen our footholds in the five regions of the U.S., Europe, Southeast Asia, the Middle East and East Asia, including Japan. We will also leverage our gas turbine network to expand the sales of gas engines, with an eye to fulfilling our goal of more than doubling the business by 2020.

We plan to broaden the application of gas turbines beyond power generation to include such uses as driving machinery. In addition, we will introduce a wide range of products to users around the world, so that we can lead the world in the field of gas turbines and gas engines.

The Technology Behind the Boeing 787 Dreamliner—A Revolution in the Skies

Kawasaki is a partner of the Boeing Company.

Partnered in the joint development and manufacturing of 777 from the initial stages.

Manufactured components of 767 as a partner.

Taking Passenger Comfort to New Heights

The Boeing 787 Dreamliner, a revolutionary midsize aircraft that the U.S. manufacturer has developed through a global collaborative effort, has been generating considerable interest around the world.

Although the 787 comes with numerous innovative features, the most pleasing of all to passengers is its greatly enhanced cabin environment. The cabin, which holds 210 to 250 passengers, is brightly lit with LED lighting, while its high ceiling gives a spacious feel and large windows provide unparalleled views. The 787 uses carbon fiber composite materials for a large portion of its structure, providing sufficient strength and anti-corrosive properties to enable adjustments of the cabin's humidity to comfortable levels. And since the cabin pressure is now maintained close to that at ground level regardless of the flight altitude, any unpleasant ringing in the ears has been minimized.

A Midsize Aircraft Capable of Long-Range Flights

The lighter and stronger airframe of the 787, made possible with the use of composite materials, has helped improve fuel consumption by approximately 20% and operating costs by approximately 30%, compared with existing aircraft of the same class. These improvements have enabled the 787 to fly long-haul routes, previously only possible with larger aircraft. Despite being a midsize airliner, the 787 is capable of nonstop flights from Japan to as far as the East Coast of the U.S. or Europe.

Kawasaki has been a partner in the creation of the 787, undertaking the development and manufacturing of key components such as the forward fuselage, main landing gear wheel well, and fixed trailing edge. Kawasaki has also partnered with Rolls-Royce, one of the two engine suppliers for the 787, and undertook the design and manufacturing of the intermediate pressure compressor (IPC) module, a core engine component.

Indicates the sections undertaken by Kawasaki.

Airframe design
The airframe has a streamlined form that has been designed using a supercomputer and based on computational fluid dynamics, giving a sleek impression overall.

Lighter airframe
The 787 uses composite materials for about 50% (in weight ratio) of its airframe structure, and its interior components have also been made lighter. No other aircraft in the world has ever used so much composite material in the airframe as the 787.

Comfortable humidity level
The increased use of composites, with their high anti-corrosive properties, has enabled the installation of a humidifier, freeing passengers from the discomfort of dry air conditions in the cabin.

Less ear-ringing
The superior strength of composite materials has enabled the cabin pressure to be maintained at levels close to those on the ground, regardless of the flight altitude. This reduces the unpleasant ringing in the ears caused by differences in air pressure.

Soothing interior lighting
The LED lighting creates a cabin ambience that is more relaxing than ever.

High ceiling, spacious cabin
The high ceiling lends a spacious feel to the interior, which is further enhanced by the wide seats and aisles.

Large windows
The increased use of composite materials enhanced the strength of the fuselage, enabling the installation of larger windows for a broader view. The windows employ an electronic dimming function instead of the traditional window shades to block external light.

Wing design
The wings feature a unique shape designed to minimize drag and improve fuel efficiency.

Fixed trailing edge

Main landing gear wheel well

A Trent 1000 engine.

Forward fuselage
The fuselage is produced with an automated fiber placement (AFP) machine that lays fiber in a uniform width around a mold with a diameter of approximately 6 m.

The state-of-the-art AFP machine used by Kawasaki, which undertakes the design and manufacturing of the forward fuselage, boasts the world's top-class fiber tow width and is capable of partially increasing laminate thickness, such as in the window frame. Once the fiber placement is complete, the fuselage undergoes drying, curing, machining and nondestructive testing processes. The completed forward fuselage is transported to the U.S. from Central Japan International Airport onboard a special transport aircraft named the "Dreamlifter."

IPC module for the Trent 1000
Airlines purchasing the 787 will be offered a choice of two engine options supplied by two different manufacturers. Kawasaki participated in the development of Rolls-Royce's Trent 1000, undertaking the design and manufacturing of the IPC module for the engine. The IPC module is one of the engine's primary components. It increases the pressure of compressed air drawn into the engine fan from approximately 1.5 atm to approximately 10 atm before sending it on to the high-pressure compressor.

The IPC module designed and manufactured by Kawasaki.

Supporting H-IIA Launch Vehicle No. 21

Kawasaki supplied the payload fairing (PLF*1) for the H-IIA Launch Vehicle No. 21, which successfully blasted off from the Tanegashima Space Center earlier this year. After design and parts manufacturing at Kawasaki's Gifu Works, the PLF was assembled and shipped from the Harima Works. The PLF was delivered to Mitsubishi Heavy Industries, Ltd. and then incorporated into the launch vehicle.

Measuring 16 m in length and 4.1 m in diameter, the dual-type 4/4D PLF carried two satellites: the Global Change Observation Mission 1st - Water (SHIZUKU)*2 of the Japan Aerospace Exploration Agency (JAXA) and the Korean Multipurpose Satellite-3 (KOMPSAT-3)*3 of the Korea Aerospace Research Institute (KARI).

Since delivering the first PLF for the H-II launch vehicle in 1993, Kawasaki has supplied PLFs for a total of seven H-II launch vehicles. Kawasaki has also developed and manufactured a variety of PLFs for a total of 20 H-IIA launch vehicles, including 4 m single (4S), 4 m dual (4/4D), and 5 m single (5S) fairings.

The PLFs for the H-IIA launch vehicle are designed to meet a broad range of payload specifications, such as the launch of large satellites and the simultaneous launch of two satellites. Kawasaki is playing a vital role in today's satellite launch industry via the development and production of cutting-edge PLFs.

*1. A payload fairing is an enclosure installed at the tip of a launch vehicle that protects the satellite from aerodynamic heating, acoustic noise and vibration during liftoff. After the launch vehicle leaves the earth's atmosphere, the fairing splits in two and is jettisoned, allowing the satellite to separate from the launch vehicle.
*2. SHIZUKU (GCOM-W1) was launched as part of a project to observe the long-term changes in the global environment from outer space. It will observe precipitation, water vapor, sea surface wind speed and sea surface temperature.
*3. KOMPSAT-3, a successor to KOMPSAT-1 and -2, features an optical instrument with enhanced resolution capability. Following the sun-synchronous orbit, it is performing various environmental observations and providing high-resolution image data needed for geographical analyses.

New Shipbuilding Venture in China

Earlier this year, Kawasaki acquired a 34% stake in Dalian COSCO Shipbuilding Industry Co., Ltd. (DACOS), a shipbuilding company based in Dalian, China. The new venture is called Dalian COSCO KHI Ship Engineering Co., Ltd. (DACKS).

DACOS was cofounded in 2007 by COSCO Shipbuilding Industry Company (COSIC)—a wholly-owned subsidiary of the COSCO Group, which is one of the largest shipping companies worldwide—and Nantong COSCO KHI Ship Engineering Co., Ltd. (NACKS), a 50-50 joint venture operated by Kawasaki and COSIC. DACOS was 70% owned by COSIC and 30% by NACKS. At its 1.8 million m² shipyard, which features two building docks, DACOS built two 205,000 ton class bulk carriers, earning high marks from the shipowners for both timely delivery and quality.

Kawasaki acquired the stake in DACOS from COSIC, which had been searching for a new partner with more advanced shipbuilding technology. After the share transfer, DACKS is 36% owned by COSIC, 34% by Kawasaki and 30% by NACKS.

As a direct investor in DACKS, Kawasaki aims to build a stronger cooperative relationship based on the successes of NACKS. Kawasaki will also work toward enhancing DACKS's capacity to develop, design and build ships, while improving its production and management system, to lay a firm foundation for its long-term growth.

With a view to expanding operations in China and boosting profitability, Kawasaki will further deepen cooperation between its bases at home and in China, and actively pursue shipbuilding activities.

Dalian COSCO KHI Ship Engineering Co., Ltd. (DACKS) (After investment by Kawasaki)
Location: No.1 Shunda Street, Lushun Economic Development Zone, Dalian, Liaoning, China
Representative: Xu Kai (Chairman and COSIC General Manager)
Founding date: July 18, 2007 **Capital:** 2,620 million yuan (as of December 31, 2011)
Ownership: COSCO Shipbuilding Industry Company (COSIC) 36% Kawasaki Heavy Industries, Ltd. 34% Nantong COSCO KHI Ship Engineering Co., Ltd. (NACKS) 30%
(NACKS is a 50-50 joint venture co-founded by COSIC and Kawasaki.)
Operations: Design, manufacture, sales and maintenance of ships
Employees: 1,150 (as of December 31, 2011)

Cryogenic Tanks for Australian LNG Project

A consortium comprised of Kawasaki and Laing O'Rourke was recently awarded the Engineer-Procure-Construct (EPC) contract to deliver a network of four massive cryogenic tanks for the Ichthys LNG project at Darwin, Northern Territory, Australia. The order was placed by the JKC Joint Venture, consisting of JGC Corporation, KBR and Chiyoda Corporation. The tanks are scheduled for completion in mid-2016.

The Cryogenic Tanks Package includes two full containment LNG tanks with 9% nickel-steel inner tanks and prestressed concrete outer tanks, each with a capacity of 165,000 m³, an 85,000 m³ full containment propane tank and a 60,000 m³ full containment butane tank.

The Ichthys LNG Project is a joint venture between INPEX and Total. Gas from the Ichthys Field, in the Browse Basin approximately 200 km offshore of Western Australia, will undergo preliminary processing offshore to remove water and extract condensate. The gas will then be exported to onshore processing facilities in Darwin via an 889 km subsea pipeline. The Ichthys Project is expected to produce 8.4 million tonnes of LNG and 1.6 million tonnes of LPG per annum, along with approximately 100,000 barrels of condensate per day at peak.

In the LNG storage tank business, Kawasaki maintains a share of more than 50% in the Japanese domestic market, in addition to the overseas market, where more than five tanks are currently under construction using its design/engineering and construction technology.

As leader of the Kawasaki-Laing O'Rourke Consortium, Kawasaki is fully committed to the successful execution and completion of this project, utilizing the know-how and experience accumulated through its long history in this industry.

Three Shield Machines Delivered to Abu Dhabi

Kawasaki recently completed the delivery of three shield machines to be used in a sewerage tunnel project in Abu Dhabi, the United Arab Emirates (UAE). The order, placed by Samsung C&T Corporation of South Korea in March 2011, was the first for Kawasaki shield machines to be delivered to the Middle East. The machines are being reassembled locally and are expected to begin excavating during the summer.

These cutting-edge earth-pressure balanced shield machines have a diameter of 5.22 m and will be used for the 42 km long Strategic Tunnel Enhancement Program Project being undertaken by the Abu Dhabi Sewerage Service Company (ADSSC). They will excavate the 16.2 km leg linking the industrial satellite town of Mussafah with central Abu Dhabi. The project is scheduled to be completed by the end of 2014.

Engineered to tunnel through soft ground as well as hard rock and gravel layers, the shield machines can dig through virtually any geological composition. Equipped with an articulation mechanism for excavating curved sections, they are also designed to provide the durability and high speed needed to construct long tunnel distances stretching approximately 5 km.

Kawasaki's long list of achievements includes the delivery of around 1,400 shield machines and tunnel boring machines (TBMs) to customers around the world. This latest order is a testament to Kawasaki's outstanding technological capability as well as the proven track record and reliability of its shield machines.

Kawasaki expects to see additional orders for shield machines coming from the Middle East, where plans for more underground construction work are on the drawing board, including ongoing subway projects in Abu Dhabi, Dubai and Cairo. The outlook for the medium- to long-term looks bright throughout the Middle East as well as Asia, with subway construction projects scheduled to break ground in the major Indian cities of Mumbai, Delhi, Calcutta, Chennai and Bangalore, as well as in China, Singapore, Thailand, Malaysia and Indonesia. Kawasaki is moving steadily ahead to expand shield machine and TBM sales across the globe.

Smart Grid Demonstration Test with GIGACELL

Kawasaki recently installed and started operation of a demonstration test system equipped with its high-capacity nickel-metal hydride battery GIGACELL* at a test facility of Mitsubishi Electric Corporation, which is currently undertaking a demonstration project for smart-grid and smart-community technologies. Kawasaki has joined forces with Mitsubishi Electric to develop the necessary technology to apply the GIGACELL system to the area of system stabilization.

The GIGACELL system comprises 18 GIGACELL modules totaling 38 kW and a power conditioner. It is installed at Mitsubishi Electric's Amagasaki test site and linked with a 4,000 kW photovoltaic power generation system and a test facility that simulates thermal power generation, pumped-storage hydroelectric power generation, and grid load. The demonstration test will be conducted with a significant portion of the grid power coming from renewable energy sources, which are highly susceptible to weather conditions, and will evaluate the GIGACELL system's ability to maintain power quality such as by suppressing fluctuations in system frequencies.

The demonstration will cover three areas: maintenance of power quality (GIGACELL to suppress fluctuations in photovoltaic power output), autonomous operation in times of disaster (using GIGACELL on an off-grid autonomous power system and combined with other distributed power sources), and system stabilization under large-scale integration of renewable energy (efficient utilization of GIGACELL in controlling distribution voltage and frequency).

Capable of rapid charging/discharging, the GIGACELL effectively responds to sharp fluctuations in renewable energy supplies. It has numerous applications in a wide range of fields, including output stabilization in renewable power generation, autonomous operation systems in times of disaster, electrical storage devices for ships, and wayside energy storage systems for railways (Battery Power System). Kawasaki will continue to develop new technologies that contribute to more effective energy use.

*GIGACELL is a registered trademark of Kawasaki Heavy Industries, Ltd.

The system stored in a 40 ft. container

10-180 type GIGACELL

Inside the container

New Brazilian Shipbuilding Venture

Kawasaki recently signed on to a joint venture project to build shipyards and drill ships in Brazil.

Kawasaki invested in Estaleiro Enseada do Paraguaç S.A. (EEP), located in Bahia State, Brazil, as a 30% shareholder and will transfer shipyard and drillship technology to EEP. EEP is a joint venture founded by leading Brazilian general contractors Odebrecht, OAS and UTC (Brazilian Partners) for the construction and integration of offshore units, such as platforms, support vessels and drilling units.

In Brazil, considerable offshore oil reserves were found in the ultradeep layer, leading to a spike in demand for various ships, including drillships and FPSO (floating production storage and offloading). EEP is quite active in this sector, obtaining a letter of intent from investment firm Sete Brazil for the construction of six drillships to be chartered by Petrobras, Brazil's state-owned oil company.

Kawasaki has a track record of successful technology transfers to two joint venture shipyards in China, Nantong COSCO KHI Ship Engineering Co., Ltd. (NACKS) and Dalian COSCO KHI Ship Engineering Co., Ltd. (DACKS). These past successes led the Brazilian Partners to recognize Kawasaki as their preferred technical partner.

EEP will be the third overseas shipyard for Kawasaki, following NACKS and DACKS. Kawasaki will be actively involved in the construction of various ships at EEP, with an eye to assisting in the growth of the company and increasing its profitability.

Outline of the Joint Venture
Company name: Estaleiro Enseada do Paraguaç S.A.
Foundation date: June 11, 2010
Location: Maragojipe City, Bahia, Brazil
Capital: R$253 million (after investment)
Capital Composition: Kawasaki 30%, Brazilian Partners (Odebrecht, OAS and UTC) 70%
Operations: Construction and sale of various offshore structures and ships
Outline of the shipyard:
Site area: Approx. 1.6 million m²
Steel processing capacity: 36,000 t/year

Partnering On Motorcycle Business in China

Kawasaki has signed a letter of intent for a business partnership deal with Loncin Motor Co., Ltd. regarding the manufacture and sale of motorcycles in China.

Kawasaki and Loncin entered into the LOI with the aim of establishing joint venture companies for sales and manufacturing, to bring Kawasaki motorcycles to the Chinese market.

Headquartered in the city of Chongqing, the capital of the Chinese motorcycle industry, Loncin is one of the leading motorcycle manufacturers in China in terms of production size.

The recent economic growth in the country, the largest motorcycle market in the world, has resulted in a diversification of personal tastes and interests among its consumers. It is expected that this trend will lead to a growing number of Chinese customers who purchase motorcycles for recreational purposes—the segment mainly targeted by Kawasaki. In this market environment, Kawasaki will leverage Loncin's domestic sales network and cost competitiveness to reach a wide customer base in China with its high-quality, high-value-added motorcycles.

Kawasaki will strive to further enhance its brand and reach new levels of customer satisfaction by bringing outstanding products and services to its Chinese customers.

About Loncin Motor Co., Ltd.
Location: Chongqing, China
Year of Foundation: 1993
Representative: Gao Yong
Capital: 720 million yuan (Approx. 9 billion yen)
Operations: Manufacture and sale of motorcycles, three-wheeled vehicles and engines
Number of Employees:
6,700 (as of June 2012)
*Exchange rate: 1 yuan = approx. 12.5 yen

Development of Tier III-Compliant Marine Gas Engines

Kawasaki has launched a project to develop a marine gas engine that is compliant with the International Maritime Organization (IMO)'s Tier III regulations, to meet rising demand. It will be the first marine main engine developed in Japan that is fueled solely by gas and has an output capacity over 2 MW.

The Tier III regulations, due to take effect in January 2016, require marine vessels sailing international waters to reduce NOx emissions in the emission control areas by 80% from Tier I levels. Controls on CO_2 and SOx emissions will also be tightened in stages.

Prior to the latest project launch, Kawasaki developed a line of gas engines for the distributed power generation market, with application in such areas as small- and midsized power plants and private power generation.

These gas engine generators boast the world's highest power-generating efficiency, 49.0%, and NOx emissions below 200 ppm (at 0% O_2), which is only about 10% of the amount contained in diesel engine emissions. The low NOx level enables them to meet Tier III regulations without relying on a DeNOx system. In addition, since gas engines run on natural gas, they release less CO_2 than diesel engines, which use Bunker C fuel oil, and only negligible amounts of SOx.

In developing the new marine gas engine, Kawasaki will leverage the technology it has cultivated through the development of its highly efficient gas engine generators. The new engine will feature technology that minimizes knocking due to load fluctuations and also supports two types of propulsion systems: a direct propulsion system in which the engine is coupled directly with the propeller and an indirect, electrical propulsion system which uses propulsion motors to drive the propeller.

Kawasaki will develop a 2.5 MW (6 cylinders) demonstrator engine within fiscal year 2013, and after obtaining a classification certificate, it will launch a product line in the output range of 2 to 8 MW (5 to 18 cylinders).

To answer calls for more environmentally friendly marine vessels, Kawasaki will continue to develop new technologies in the field of marine engineering.

Trains Ordered for Taiwan High Speed Rail

Kawasaki and Toshiba Corporation have jointly received an order for four 12-car trainsets from Taiwan High Speed Rail Corporation (THSRC). The contract was signed in May by a consortium of Kawasaki and Toshiba Digital Media Network Taiwan Corporation (TDMT), Toshiba's local subsidiary.

Kawasaki will undertake the design and manufacture of the car body and the bogie, as well as supervision of the entire project; while Toshiba will design and supply the electrical equipment, air conditioning and onboard PA system. Delivery of the first train is scheduled for December 2012, with remaining orders to be fulfilled successively by November 2015. The contract comes with an option for up to four additional trains (48 cars).

THSRC has been stepping up its train services to serve a passenger base that has continued to grow since it launched services in January 2007. In addition, the company is slated to open an extension line in 2015 covering a 5.7 km section between Taipei Station and Nangang Station. The latest order of additional trainsets has been placed to provide THSRC with a large enough fleet to keep up with its expanding operations.

Kawasaki and Toshiba collaborated on an earlier project for TSHRC as members of the Japanese consortium Taiwan Shinkansen Corporation (TSC). TSC was awarded a contract in December 2000 for the E&M system, including the 700T train—the first high-speed rail system exported by Japan—with the order amounting to a total of 360 cars. The 700T is based on the Series 700 Shinkansen train, which is operated on the Tokaido-Sanyo Shinkansen line, and modified to meet the requirements of THSRC. The latest order is for the same model, which is a testament to the solid operation record and high reliability that the 700T has maintained since the launch.

Kawasaki and Toshiba will work together to further build on their delivery record with THSRC, with an eye to expanding their global operations in the high-speed rail business.

Trainset overview
Car type: 9 motor cars, 2 control trailer cars, 1 trailer car, 11 regular class cars, 1 business class car, 989 seats/train
Dimensions:
Lead car: 27 m (L) x 3.38 m (W) x 3.65 m (H)
Middle car: 25 m (L) x 3.38 m (W) x 3.65 m (H)
Car body material: Aluminum alloy
Power source: Overhead wire (single phase, 25,000 VAC, 60 Hz)
Maximum operating speed: 300km/h

Electrical Installation Wins Award

Kawasaki recently received a technical award conferred by the Institute of Electrical Installation Engineers of Japan for the electrical installation of the K Computer facility at the RIKEN Advanced Institute for Computational Science (AICS) in Kobe. The installation uses a cogeneration system consisting of two 6 MW class gas turbines developed by Kawasaki.

The award is given in recognition of outstanding achievements in academic study, workmanship or technological development with the aim of encouraging advances in the field of electrical installation. The installation of the next-generation K Computer received high recognition for a facility plan that provides for diversified and stable power supply, maintainability, energy efficiency and security.

The supercomputer is powered by an electrical installation featuring Kawasaki's gas turbine cogeneration system, which was adopted for cooling the supercomputer as well as the entire AICS facility that houses it. The system harnesses steam to produce electricity and drive a vapor absorption chiller machine, achieving a generating efficiency of approximately 30% and heat recovery efficiency of approximately 45% for a combined efficiency of nearly 75%. The electricity produced by the system is interconnected at 6.6 kV and is capable of supplying up to 12,000 kW of power. The cogeneration system is also used to provide uninterrupted power for critical load systems, thus protecting the supercomputer from unexpected events.

This award will provide further impetus for Kawasaki's continued gas turbine development efforts.