Scope

Kawasaki Heavy Industries Quarterly Newsletter

April 2007
NO.71

Kawasaki

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in this issue...

About the Cover

The cover photo shows the LNG carrier, Surya Aki, *unloading LNG at the Hiroshima Gas Hatsukaichi LNG Terminal. This LNG Tank, situated across the shore from a popular tourist site, is painted in a subdued color and employs Japan's first underground in-pit system to blend in seamlessly with the local landscape.*

KAWASAKI HEAVY INDUSTRIES, LTD.

Scope

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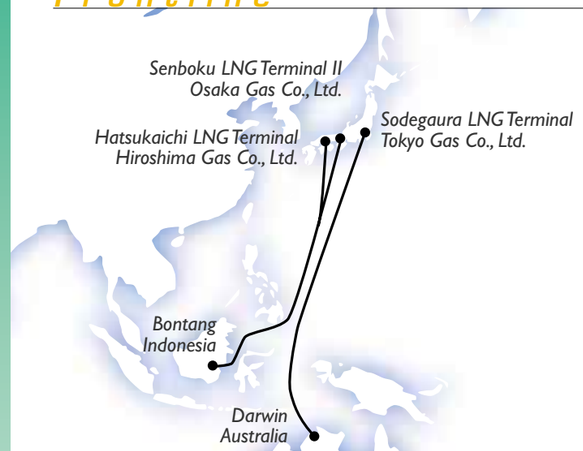


LNG Is Here!

The demand for natural gas, a clean abundant source of energy found around the world, is growing by leaps and bounds. Some estimate that natural gas will supply 25% of all our energy needs by the year 2030.

Once natural gas is processed into liquid natural gas (LNG) at a liquefaction plant in the country where it is produced, it makes its way to resource-strapped Japan via an LNG carrier. When cooled to the extremely low temperature of –162°C, natural gas transforms into liquid. This process of transformation reduces it to 1/600 of its former volume, making it easy to transport a large amount by sea. Approximately 26% of the world's natural gas exports are processed into LNG. Japan is a huge importer of LNG, buying 43.2% of the world's LNG. This issue's Frontline focuses on the transporting of LNG to Japan.

Eastward

Preparing to Unload the LNG

It's 2:00 p.m. and the LNG carrier, the *Energy Advance,* has just docked at pier two of Tokyo Gas' Sodegaura LNG Terminal in Chiba Prefecture. This vessel travels between the Darwin LNG Terminal in northwestern Australia and Tokyo Gas' LNG terminal, a one way journey of eight days.

Once the ship is safely docked at the pier, the ship's captain, chief engineer and terminal staff meet to discuss unloading procedures. Then the amount of LNG in the tank is measured. After the unloading arms, the LNG terminal's equipment, are connected to the tanker's manifold, a small amount of LNG is fed into the line to cool down the pipes. This process is necessary since a sudden surge of ultra-low-temperature LNG could result in a drastic change in temperature that would generate enough thermal stress to damage the arms and pipes. This takes about three and a half hours. It takes another hour to start up all of the eight cargo pumps, two for each of the four tanks. By 7:00 p.m. all safety precautions are completed and the LNG can be unloaded. Unloading takes about 13 hours. Afterwards, about three and a half hours are spent draining from the arms the remaining LNG, measuring the amount of unloaded LNG and completing documents. After refueling, the *Energy Advance* sets sail for Darwin at 2:30 p.m. the next day.

Four Giant Thermoses Full of LNG to Go

The approximately 290-meter-long, 49-meter-wide *Energy Advance* was built by Kawasaki Shipbuilding Corporation in March 2005. Equipped with four tanks, it is a large-scale state-of-the-art LNG carrier capable of transporting about 145,000 m^3 of LNG.

The vessel's cargo tanks, known as Moss spherical tanks, were built under a licensing agreement from Moss Maritime in Norway. The tanks are made of a corrosion-resistant aluminum alloy and are about 41 meters in diameter. Superior thermal insulation properties and safety are paramount for LNG tanks transporting ultra-low-temperature LNG at –162°C. Aluminum is highly resistant to extremely low temperatures and the spherical shape makes it mechanically stable. These two factors explain the material and shape used in the tank design. Since the more spherical the shape, the more sturdy the tank will be, ultra-precision processing combined with Kawasaki's unique high-current metal inert gas (MIG) welding are employed on the aluminum alloy material used to build each spherical shell.

Covered completely with Kawasaki Shipbuilding's proprietary high-performance thermal insulation panels (Kawasaki Panel System), each of these tanks acts like a giant thermos. It is impossible, however, to completely block off the external heat and a very small amount of LNG inevitably turns into gas. Yet this vessel's tanks keep vaporization down to a minimum of 0.1% per day. The boil-off gas is burned in a boiler that provides propulsion power to the vessel. The boiler, which was built by Kawasaki Plant Systems, Ltd., employs a cofiring system that can be used with heavy oil as well. This boiler allows some leeway in choosing the most cost-effective fueling option depending on the market prices for LNG and heavy oil during voyages. The vessel's turbine engine is also manufactured by Kawasaki .

Unloading arm. LNG is discharged through these pipes.

Loading of LNG began at 7:00 p.m. and was carried out throughout the night.

Sodegaura LNG Terminal seen from the bridge of the Energy Advance.

The Energy Advance *berthing at the pier. A thick pipe connected to onshore tanks is installed along the pier.*

LNG tanks.

The cargo control room on board the ship is equipped with an integrated monitoring and control system (IMCS) developed by Kawasaki. It enables monitoring and control of cargo handling operations as well as monitoring engine conditions.

Westward

Seven-day Voyage from Indonesia to Senboku

Arriving at Osaka Gas' Senboku LNG Terminal II pier located in Takaishi City, Osaka is the LNG carrier, the *LNG Flora.* Returning with its LNG cargo after a seven-day voyage from the Bontang LNG Terminal in Indonesia, the vessel goes through the exact same LNG unloading procedures as did the *Energy Advance.*

The *LNG Flora,* a large-scale, 125,000 m^3 carrier, was built by Kawasaki Shipbuilding (Kawasaki Heavy Industries at the time) in March 1993. At 272 meters long and 47 meters wide, it is equipped with four 40-meter Moss spherical tanks. It is the first carrier in the world to employ Kawasaki Shipbuilding's proprietary cargo operation support system. The system uses computer simulation for overall operations including cargo loading and unloading as well as navigation to provide optimal data to the operating crew. It significantly enhances both the efficiency and safety of carrier and cargo operations.

Secondary Transport of LNG to Shikoku Gas' Takamatsu Plant

Unloaded LNG is temporarily stored in LNG tanks at an LNG terminal. Some of the LNG is then transported to gas company secondary terminals around Japan by domestic LNG carriers. Here's how it works.

LNG is loaded onto the *Shinju Maru No. 1,* a domestic service LNG carrier, from an LNG tank at Osaka Gas' Himeji LNG Terminal located in Himeji City, Hyogo prefecture. The LNG is now off to Shikoku Gas Co. Ltd.'s Takamatsu Plant in Takamatsu City, Kagawa.

Shikoku Gas and Okayama Gas have shifted to using natural gas for city gas supplies. The LNG shipment will be used to meet their city gas needs. While it is possible to use trucks and pipelines to transport natural gas (in the form of gas) from a primary LNG terminal to city gas companies throughout Japan, they are not the best means in terms of transport efficiency. Domestic LNG carriers presented a viable alternative solution. Consolidating transport operations into the use of specialized carriers improved both efficiency and safety of transport.

The LNG Flora *docked at the Osaka Gas Senboku LNG Terminal II pier.*

Japan's First Domestic LNG Carrier, the *Shinju Maru No. 1*

The *Shinju Maru No. 1* is Japan's first domestic service LNG carrier built to serve as a link between the primary LNG terminals and local gas companies. Kawasaki Shipbuilding constructed the cargo tanks and handling sections that constitute the core part of the carrier while the hull was built by Higaki Shipbuilding Co., Ltd. The 2,500 m^3 carrier was completed in July 2003.

Designed to carry ultra-low-temperature LNG, the carrier is equipped with two independent pressure build-up type tanks that are laid horizontally in their respective cargo compartments. Each LNG tank can absorb contraction due to the cryogenic temperature. The pressure build-up tank system confines LNG that has been vaporized due to external heat in the high-pressure tank without any leakage of boil-off gas.

Loading LNG.

The loading arm is completely frosted over due to the cryogenic temperature.

The Shinju Maru No. 1 *approaching the public pier at Takamatsu Bay.*

Takamatsu Plant, Shikoku Gas.

Unloading LNG.

Vaporizing LNG

The Environmentally-Friendly Hatsukaichi LNG Terminal

You may be wondering how LNG is regasified and supplied to homes and factories after being transported and stored in an LNG tank. Let's take a look at operations at Hiroshima Gas' Hatsukaichi LNG Terminal located in Hatsukaichi City, Hiroshima prefecture.

One of Hatsukaichi LNG Terminal's unique features is a floor layout that effectively utilizes its limited space for the placement of equipment and facilities. Its two 85,000-kl LNG tanks built by Kawasaki employ Japan's first environmentally-friendly underground in-pit system. Storage tanks are installed in a concrete pit constructed underground. The tanks feature a double containment system with perlite and nitrogen gas between the outer and inner walls for insulation. Since only the roof section of the tanks is visible, the facility makes very little impact on the landscape. It is also safe since the liquid level is below the ground surface.

The Hatsukaichi LNG Terminal, Hiroshima Gas.

LNG Calorie Adjustment, Regassification, Odorization and Final Delivery

After being temporarily stored in a tank, LNG is then pumped out and fed to a vaporizer. There are several ways to regasify LNG such as warming the LNG feed line with seawater or warm water. The Hatsukaichi facility uses a natural gas cogeneration system to produce the warm water used to do the job. The system is powered by a natural gas-fueled engine. Its exhaust heat warms the water used to regasify the LNG. The generated power is used to supply electricity needed for facility operations and any surplus power is sold. It is a "kill-two-birds-with-one-stone system." Fueled by clean natural gas, it is also environmentally friendly.

LNG is combined with LPG (liquefied petroleum gas) to adjust calories to the specified level needed to produce city gas. Calorie adjustment can be done either before or after regasification. At the Hatsukaichi facility it is done before regasification. The final processing entails adding odor to the gas. Because natural gas has no odor, a strong smelling substance is added to it so people can tell if there is a leak.

Finally, city gas is supplied to end users through pipes of various sizes.

A vaporizer for regasifying LNG by heat exchange.

Manufactured city gas is stored in a gas holder.

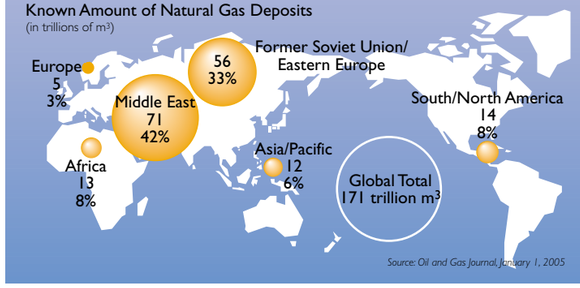
NATURAL GAS BASICS

Data Provided by The Center for Promotion of Natural Gas

(1) Found All around the World

Natural gas is found in abundance in many parts of the world. The known amount of deposits is approximately 171 trillion m^3 (as of January 1, 2005). The reserve-production ratio is about 64 years, which is higher than that of oil at 49 years. A number of new gas fields are still being discovered in many places.

Known Amount of Natural Gas Deposits
(in trillions of m^3)

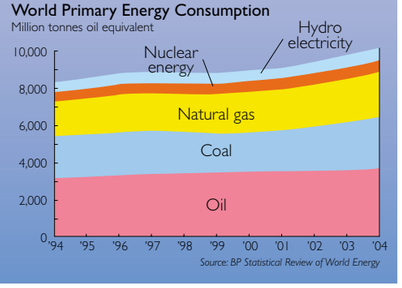


Source: Oil and Gas Journal, January 1, 2005

(2) Reasons behind Increasing Global Natural Gas Demand

Possible reasons for the increasing global demand for natural gas are: Natural gas is a clean, environmentally-friendly and abundant energy source that is found all over the globe. Its price is less susceptible to fluctuation than oil. Technological advancements have made it possible to construct natural gas liquefaction facilities and terminals at a relatively low cost. Demand for natural gas has risen significantly in countries that are making sweeping economic strides such as China and India.

World Primary Energy Consumption
Million tonnes oil equivalent



Source: BP Statistical Review of World Energy

The Unique ATV, the Ultimate Off-road Machine


KVF750 4x4

Some examples from Kawasaki's extensive ATV lineup


KFX450R


KFX700


KVF360 4x4

80,000 ATVs Produced at Kawasaki's Lincoln Plant Annually

ATVs (all terrain vehicles) are off-road four-wheel vehicles capable of driving on sandy or rugged terrain. Sport ATV riders enjoy ascending over mountain terrain and screeching down muddy trails. ATV racing events are regularly held in the U.S. On the more practical side they are used as means of transport in farming and sport hunting. North America is the major market for ATVs and accounts for approximately 80% of the global market share.

Kawasaki produces some 80,000 ATVs each year at its U.S. subsidiary, Kawasaki Motors Manufacturing Corp., U.S.A. (KMM) in Lincoln, Nebraska. Launching KMM's Lincoln facility in 1974, Kawasaki was the first manufacturer in the Japanese motorcycle and automobile industry to open a manufacturing plant in the U.S. In addition to motorcycles and ATVs, the facility produces Jet Ski® watercraft and Mule utility vehicles for the U.S., Japanese and European markets.

Built for Off-road Riding

Just like motorcycles, ATVs are designed for a single rider to straddle the vehicle's chassis and steer with the handlebars. Outfitted with wide, low-pressure tires, some are rear-wheel driven and others four-wheel driven.

ATVs are equipped with unique features that maintain steady brake performance after riding through mud or water, ensure stable riding performance in any terrain and prevent the vehicle from sparking fires while traveling through wooded areas.

The featured Kawasaki KVF750 4x4 was launched in the U.S. market in 2004. This 750 cc ATV is Kawasaki's first model to employ a fully independent rear suspension (IRS) system.


Selectable four-wheel button

Selectable four-wheel drive button
The rider can select two- or four-wheel-drive operation by pressing a button located on the right side of the handlebar depending on road conditions.


Differential lock lever

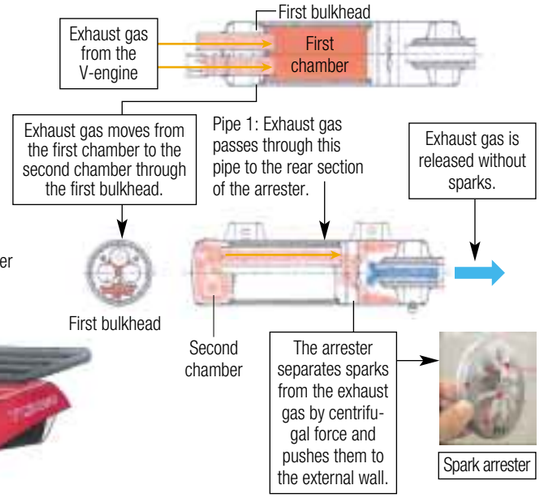
Differential lock control and lever
The variable front differential control allows the rider to adjust the amount of torque available to the front wheels by gripping the lever. Selectable four-wheel drive and differential lock control enhance the vehicle's performance when riding across rugged terrain.

Continuously variable transmission (CVT)
A CVT, which is also called a belt converter, is something often found on scooters. It provides automatic transmission with an infinite number of rotational speed ratios to meet continually changing load conditions. The KVF750 4x4 utilizes a compact, lightweight CVT that is specifically designed for use in ATVs.

Air cleaner
The air cleaner is located just in front of the seat for easy maintenance and cleaning.

Fender pockets
Convenient storage compartments are located on the front fender for storing maps and other articles, just one of Kawasaki's rider-friendly features.

750 cc V-twin engine
Kawasaki's unique, lightweight, compact V-twin engine is the strongest in its class. The V-engine dramatically reduces engine width, making it easier for the person in the saddle to operate the vehicle. Low vibration is another big feature of this engine.



Spark arrester
The muffler system comes with a spark arrester that stops sparks from escaping and prevents the ATV from causing fires when riding through wooded areas. When exhaust gas passes through the holes of the spark arrester, the sparks (high-temperature carbon particles) are separated from the exhaust gas due to the influence of centrifugal force.

Independent rear suspension (IRS)
The IRS allows left and right wheels to move up and down independently of each other, preventing the vehicle from tilting when driving through rough terrain. It provides smooth suspension action for high stability and superior riding comfort on uneven surfaces. The stabilizer bar (connecting the left and right sides of the suspension system) effectively reduces rolling during sharp turns.

Tires
Known as "balloon tires," these specially designed low pressure tires require 1/6 of the pressure needed to fully inflate automobile tires. The low pressure tires absorb incredible amounts of shock during off-road riding. The aggressive tread pattern employs large tread blocks for a maximum grip on the riding surface.

Wet-brake system in the rear gear case
The wet braking system sealed in the rear final gear case maintains stable brake performance after driving through mud or water. The encased brake design makes the brake system smaller and more compact.

Grand Touring Model 1400GTR Unveiled

Kawasaki has developed the 1400GTR as a new addition to sport tourer models that are gaining popularity in the European market. It combines supersport capabilities for winding roads with long-distance comfort.

The 1400GTR is a grand touring model with superior sport capabilities. With a Kawasaki proprietary aluminum monocoque frame, inverted front fork, and other structural design features most commonly found on supersport machines, it is also equipped with a newly designed shaft drive, large capacity panniers (side luggage cases) and electrically adjustable windscreen.

A liquid-cooled parallel four-cylinder DOHC four-valve engine (1,352cm^3) utilizing variable valve timing for optimized valve opening/closing duration at varied rpm, provides exceptional torque from initial acceleration and high rpm on demand befitting the sport tourer concept.

The 1400GTR was exhibited at Europe's largest motorcycle show, INTERMOT 2006, held last October in Cologne, Germany and it was a strong drawing-card for exhibition visitors. The 1400GTR is scheduled for release as a 2008 model. ::

First Forward Fuselage for 787 Dreamliner Shipped

In January, Kawasaki completed the development and production of the forward fuselage for Boeing's new midsize commercial airplane, the 787 Dreamliner.

The forward fuselage was transported from the dock located near the Nagoya Works 1 by barge to the Central Japan International Airport. It was then transported by Boeing 747 Dreamlifter Large Cargo Freighter (LCF), to Global Aeronautica, LLC in South Carolina, U.S.A. Once it is combined with the aft fuselage section, it will then be shipped by air to Boeing in Washington for final assembly.

The 787 is a 200- to 300-seat midsize commercial airplane utilizing a number of innovative designs as well as cutting-edge manufacturing technology aimed at realizing highly efficient operation. 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 involved in the development and production of the forward fuselage, the main landing gear wheel well, and the wing fixed trailing edge of the Dreamliner.

Kawasaki opened a new facility for production of key 787 Dreamliner components on July 10, 2006. Its new production line allows for an integrated manufacturing process from composite parts fabrication to assembly of the forward fuselage. The forward fuselage was produced with state-of-the-art equipment employed in the new facility such as an automatic fiber placement machine capable of simultaneously laying strips of prepreg tape and a six-meter cylindrical mandrel. The factory also boasts the world's largest autoclave in its class, with a diameter of approximately nine meters, for curing the laid-up composite at high temperature and high pressure.

Keeping to a tight product development schedule, Kawasaki successfully shipped the fuselage section ahead of other 787 Dreamliner joint development partners. Other key components of the 787 Dreamliner are now in the final stages of production. The airplane's first prototype is scheduled to take its maiden flight in the latter half of 2007. ::

Prototype of World's First Fully-Automated Robotic System that Simultaneously Cultures Multiple Cell Lines

Kawasaki has developed the first prototype of an automated cell culture system for the tissue engineering industry. Unlike conventional systems that culture a single cell line via partially automated processes, this complete system employs the world's first secure, fully-automated robotic operations to simultaneously culture mesenchymal stem cell lines for multiple patients. Mesenchymal stem cells derived from bone marrow can be used to regenerate bone, cartilage and muscle. Consequently, the growing of cell lines for multiple patients is an important part of research into cartilage regeneration that does not require the use of cartilage cells.

Tissue engineering is a state-of-the-art medical technology for cultivating a patient's own cells or tissues to restore tissues or organs that have lost the ability to function due to disease or injury. Currently, cells are produced in a cell processing center (CPC) where compliance with the World Health Organization's Good Maintenance Practice (GMP) standards governing the manufacture and quality control of pharmaceutical and medical products allows operators to handle only a single patient's cells per chamber in order to prevent contamination. Highly skilled technicians are needed to perform complex manual procedures. The lack of sufficient cell production capabilities due to these factors has been one of the stumbling blocks to realizing the full potential of regenerative medicine.

With this new automated cell culture system, multiple cell lines can be maintained in each individual chamber during incubation. Individual cells can be taken out and transported to an operating station where cell culture operations such as medium exchange and sub-culturing can be performed. Completely automated operations, including cell loading and removal, that are free of operator intervention, prevent the risk of cross-contamination. Know-how acquired in the manufacture of industrial robots has enabled the successful design of robotic movements that correspond with the intricate movements of a skilled operator to ensure high-quality and efficient cell culturing as well as superior versatility. The system is also equipped with functions that enable users to monitor cultured cell image data as well as remote monitoring functions. Backed by Kawasaki's long-fostered production control technologies, each system can be configured to meet specific requirements including production volume, scheduling and managing cell records.

This project was planned as a part of the technological development division's new market research activities that aim to widely apply core technologies in robotics, plant engineering, image processing and production. It is currently underway as a development project commissioned by the Japan Science and Technology Agency (JST). The first prototype has been installed in the CPC at Shinshu University Hospital's new Advanced Medical Center which opened in December last year and is currently undergoing a series of evaluation tests. Shinshu University is using the prototype to conduct research on potential applications in the field of cartilage regeneration. After testing, Kawasaki will continue further research and development efforts toward practical applications of robotic cell culture systems in the area of regenerative medicine. ::

Nippon Paper Chemicals Orders Coal-fired Boiler

Kawasaki Plant Systems, Ltd. (K Plant) has recently received an order for its coal-fired boiler from the Gotsu Works of Nippon Paper Chemicals Co., Ltd. (NPC). The construction of the boiler is scheduled for completion in August 2008.

With the installation of the coal-fired boiler, NPC's Gotsu Works plans to switch the fueling of its in-house power generation from an oil-fired to a coal-fired system. Amid skyrocketing crude oil prices, this will contribute to NPC's efforts to realize oil-free operations while reaping significant savings in energy costs.

The coal-fired boiler will be used to supply electric power and steam. It consists of a main boiler unit, an exhaust gas treatment system and a stack. The main boiler unit also employs the proprietary low NOx burner, which allows for effective furnace denitration through combined use with a dual firing system. Equipped with an electrostatic precipitator and a flue gas desulfurization system, the coal-fired boiler is built to environmentally friendly specifications. It also allows for mixed combustion of biomass fuels for the more effective use of resources and a reduction in the environmental burden. ::

New Aerospace Traction Drive T-IDG® Developed with Shinko Electric

Kawasaki and Shinko Electric Co., Ltd. have jointly developed the T-IDG, the world's first traction drive integrated drive generator (IDG) employing a TD-CVT for application in large-size aircraft.

An IDG is the main power supply unit used in an aircraft jet engine. It consists of an AC power generator combined with a constant-speed drive unit to drive the generator at a constant revolution speed. The constant-speed drive unit makes it possible to maintain a stable and constant frequency power supply for an aircraft regardless of engine revolutions.

A TD-CVT, or traction drive continuously variable transmission, is a power transmission mechanism that utilizes the viscous resistance of oil film and can transmit power between two objects with a smooth surface. Tilting the roller placed between two half-troidal-shaped discs allows for infinite variability in the input/output speed ratio with no discrete steps or shifts. This type of CVT is called a half-troidal CVT.

The newly developed T-IDG is the world's first IDG for aircraft applications employing a high-speed TD-CVT, instead of the conventional hydraulic CVT, as the constant-speed drive unit. It delivers significantly enhanced efficiency and durability compared with other models while ensuring superior power supply quality due to its high controllability as well as increased aircraft fuel economy and reliability. In developing the T-IDG, Kawasaki worked on the overall integration of the TD-CVT and IDG while Shinko Electric was responsible for the generator and its control unit.

A number of technological breakthroughs were achieved in developing the TD-CVT for practical aerospace applications. A lighter TD-CVT was designed by employing a lower-loss surface profile and a ceramic shaft bearing while establishing technology for controlling traction drive speed (15,000 rpm, or double the speed of an automotive traction drive) for high-speed low-torque operation. In addition, overall power transmission efficiency and reliability was significantly increased by employing a power split mechanism that distributes the engine's drive power to both the traction drive and the gear in addition to the sensor-free control that allows for virtual control of traction drive.

A negative-G capable oil system, traction oil with high mobility at low temperatures and a sealing technique for resisting pressure difference were also developed in order to meet strict environmental conditions required for

aircraft, as well as a highly-responsive electro-hydraulic servo system used to control traction drive speed, thereby ensuring superior power supply quality while allowing for uninterruptible switching of power supplies.

The new T-IDG is capable of controlling the variable engine speed (approximately 5,000 to 10,000 rpm) with the TD-CVT to maintain a constant traction drive speed and ensure a stable supply of AC power to an aircraft at a constant frequency of 400 Hz. The T-IDG can supply up to 90 kVA of power and will be upgraded to 250 kVA in the future. Plans are also underway to develop a line of products that will expand aerospace applications of the T-IDG on a global basis. ::

Malaysian Methanol Company Orders Gas Turbine Power Generation System

The Malaysian methanol company, Petronas Methanol (Labuan) Sdn Bhd (PML), has recently placed an order for Kawasaki's gas turbine power generation system. The system features proprietary 18 MW-class L20A gas turbines as its core components. This order brings the total number of orders for the L20A gas turbine power generation systems up to ten.

The system is a natural gas-fueled gas turbine power generation system employing the proprietary gas turbine L20A. It will be installed at PML's new methanol plant to be built in Labuan and supply 14 MW (at an inlet air temperature of 34ºC) of electricity to the facility.

Kawasaki will deliver the gas turbine power generation system while the German engineering company, Lurgi AG will perform local construction and overall engineering work on the methanol plant, which is scheduled for completion in December 2007.

PML is a subsidiary of Petroliam Nasional Bhd (PETRONAS), Malaysia's national petroleum corporation. PML's new natural gas-fueled methanol plant will be one of the largest facilities in Southeast Asia with a daily production capacity of 5,000 t of methanol.

Kawasaki has an impressive track record, having delivered seven gas turbines in Malaysia. The latest order is a testament to the superior environmental performance and lifecycle cost of the gas turbines as well as the company's outstanding technological capabilities and proven track record. ::

Kawasaki's First Supercharged Top-of-the-Line Jet Ski® Ultra 250X Launched

This March, Kawasaki launched its Jet Ski Ultra 250X in Japan. It's the ultimate personal watercraft and first model equipped with a Roots type supercharger, a belt-drive power boosting unit employing two counter-rotating lobed rotors that spin together to push out air.

The Jet Ski Ultra 250X's supercharged liquid-cooled 1,498 cm^3 in-line 4-cylinder engine ensures a stable supply of high-pressure intake air, even at low rpm, to significantly increase maximum power. This high-performance engine along with its newly designed hull ensures superior acceleration and handling under any wave conditions, making the Jet Ski Ultra 250X the ultimate super-sport model designed for one to three riders.

Jet Ski Ultra 250X

In addition to the Jet Ski Ultra 250X, the Jet Ski Ultra LX, an all-round sport cruiser fitted with the same hull as the Jet Ski Ultra 250X and the same engine found in the Jet Ski STX-15F has also been released.

Both models comply with not only the Japan Boating Industry Association's voluntary emissions control standards but also the emissions standards of the US EPA (Environmental Protection Agency) and CARB (California Air Resources Board), which has the strictest emissions standards in the world. ::

Subway Cars Delivered to New York City Transit

U.S. subsidiary Kawasaki Rail Car, Inc. (KRC), based in Yonkers, New York has recently delivered and received conditional acceptance of the first ten-car R160 subway trains to MTA New York City Transit (NYC Transit).

Kawasaki and France's Alstom Transportation Inc. formed a New York Limited Liability Company in October 2002 to supply a base order for 660 R160 subway cars to NYC Transit. Kawasaki will manufacture 260 cars out of the total of 660 cars, and is also serving as the engineering leader for the R160 contract, providing technical assistance that utilizes the experience gained with the R143 car, which has been in revenue service with NYC Transit since 2002. Bogies will be supplied for all of the R160 cars including Alstom's portion. The contract includes two options for additional orders of 620 cars and 380 - 420 cars.

The R160 subway cars are equipped with the latest heating, ventilation and air-conditioning/cooling (HVAC) technological controls, as well as door operating and public address systems to guarantee optimum safety and passenger comfort. The ten-car train delivered to NYC Transit was a prototype manufactured and tested at the Hyogo Works, however, the remaining car bodies will be manufactured at the rail car plant in Lincoln, Nebraska. Equipment installation, final assembly and testing is conducted at the plant in Yonkers, New York. Kawasaki is the only company in the U.S. capable of full-scale integrated product manufacturing from beginning to end. Production has already commenced and the last production car for the base contract is scheduled for delivery in 2008. The cars in the first optional agreement (620 cars) are scheduled for delivery between 2008 and 2009, and those in the second optional agreement (380 - 420 cars), between 2009 and 2010.

Since the initial delivery of 325 R62 subway cars in 1985, Kawasaki will have delivered 1,625 cars, including 260 R160 cars to NYC Transit. Once all of its R160 cars are delivered, including those under the options if exercised, over 2,000 cars in total will have been delivered, giving Kawasaki the largest share of NYC Transit's entire subway car fleet. ::

Carrying a Century of Dreams Forward


1907 Electric coach for Nankai Electric Railway


1911 Kawasaki's first steam locomotive


1934 Pashina-type steam locomotive


1957 Type 3000 electric train for Odakyu Electric Railway


1958 Electric express train, Series 151 Kodama


1964 Series 0 Shinkansen


1970 World's first rubber-tired guideway subway train for Sapporo City


1981 Kobe Portliner automated guideway transit system


1996 Series 500 Shinkansen for West Japan Railway Company


1997 Series 700 Shinkansen for Central Japan Railway Company/ West Japan Railway Company


1991 Bi-level passenger coach for Massachusetts Bay Transportation Authority


1999 C751B MRT car for Singapore Mass Rapid Transit


1997 Series E4 Shinkansen for East Japan Railway Company


2005 Series N700 Shinkansen Prototype Train for Central Japan Railway Company


1993 C301 MRT car for Department of Rapid Transit Systems of Taipei City


2005 R160 subway car for New York City Transit


2005 FASTECH 360 high speed experimental train for East Japan Railway Company


1989 Series 8000 electric train for Keihan Electric Railway


2004 700T electric train for Taiwan High Speed Rail Corporation

※Courtesy of Taiwan High Speed Rail Corporation


2006 200 kph EMU for China


2003 Series TX-1000 electric train for Metropolitan Intercity Railway Company


2005 Series 3000 electric train for Nishi-Nippon Railway


1994 Type DF200 diesel electric locomotive for Japan Freight Railway Company


1999 Towing locomotive for the Panama Canal

Kawasaki now moves into its next 100 years

Kawasaki's rolling stock business started in 1906 at its Hyogo Works in Japan, a decade after the Company was established. Since 1986, it has also been manufacturing rolling stock in the U.S. With a total of 87,000 train cars built during its first 100 years, Kawasaki will continue to apply its technological prowess to the evolution of transport arteries around the world for the next 100 years.

Kawasaki