

# Feature Report

## Contributions to Environment

### A New Dawn for Future Energy Use

#### Promise in the Large-Scale Nickel-Metal Hydride Battery GIGACELL

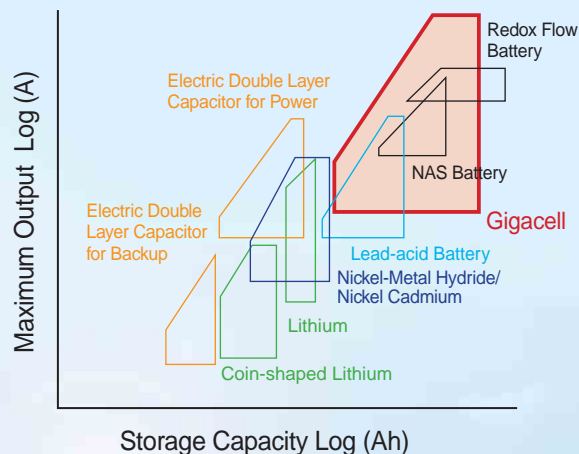
GIGACELL—This new kind of large-capacity, high-output battery is attracting attention as a system component that is free from hazardous metals, compensates for fluctuations in natural energy systems and is new source of electrical power for high energy efficiency transportation systems.

#### Large-Scale, Nickel-Metal Hydride Battery GIGACELL Backs Up Renewable Energy

As a result of the Kyoto Protocol coming into effect in February 2005, natural energy sources such as wind and solar power have come to receive increased attention as energy sources free of CO<sub>2</sub> emissions, but the generated power fluctuates greatly based on wind and sunlight conditions, so not only is it difficult to adjust the balance of supply and demand, these fluctuations can also affect voltage and frequencies adversely thereby limiting the scope of large-scale operations when connected to commercial electrical systems.

A way to settle this kind of problem is Kawasaki's nickel-metal hydride battery Gigacell. A Gigacell can always provide power in a stable state by storing electrical power generated by natural energy for subsequent use. Moreover, as you can understand by the comparison of various types of battery performance shown in the diagram below, the Gigacell has a remarkably large capacity and high output compared to conventional batteries, so there are high hopes for its use in a broad range of applications.

Comparison of Various Battery Performance



#### Various Applications for the Large-Capacity, High-Output GIGACELL

The large-capacity, high-output Gigacell not only adjusts the balance of supply and demand with wind and solar power systems but is also receiving notice as a component to produce new systems such as the currently much discussed Micro Grids and light rail vehicles (LRV) which can travel in area without trolley wire.

Speaking of Micro Grids, the application of a large-capacity, high-output Gigacell makes it possible to link various dispersed power generation systems such as wind power, solar power, biomass, fuel cells, and gas turbines into one network to perform functions that conduct stable and reliable supply and demand adjustments.

Another example that displays the functions of the Gigacell is their use in light rail vehicles (LRV) whose introduction has begun in various places around the world.

Some electric trains recover energy with the use of the motor as a power generator when braking (regenerating brakes) and can return electricity to trolley wire, but the electricity is not effectively used if another train to use that electricity is not nearby. With the installation of the Gigacell, this regenerated electricity can be stored by itself and securely used effectively to become a system high in energy efficiency. Moreover, if the train becomes able to travel using only this installed battery, it has the possibility to become a new, long dreamt of transportation system that won't even require trolley wire.



Large-Scale Nickel-Metal Hydride Battery GIGACELL



Image of Kawasaki LRV SWIMO which can travel in area without trolley wire

## Increasing Hopes toward a New Dawn for Future Energy Use with Environmentally Conscious Basic Technology

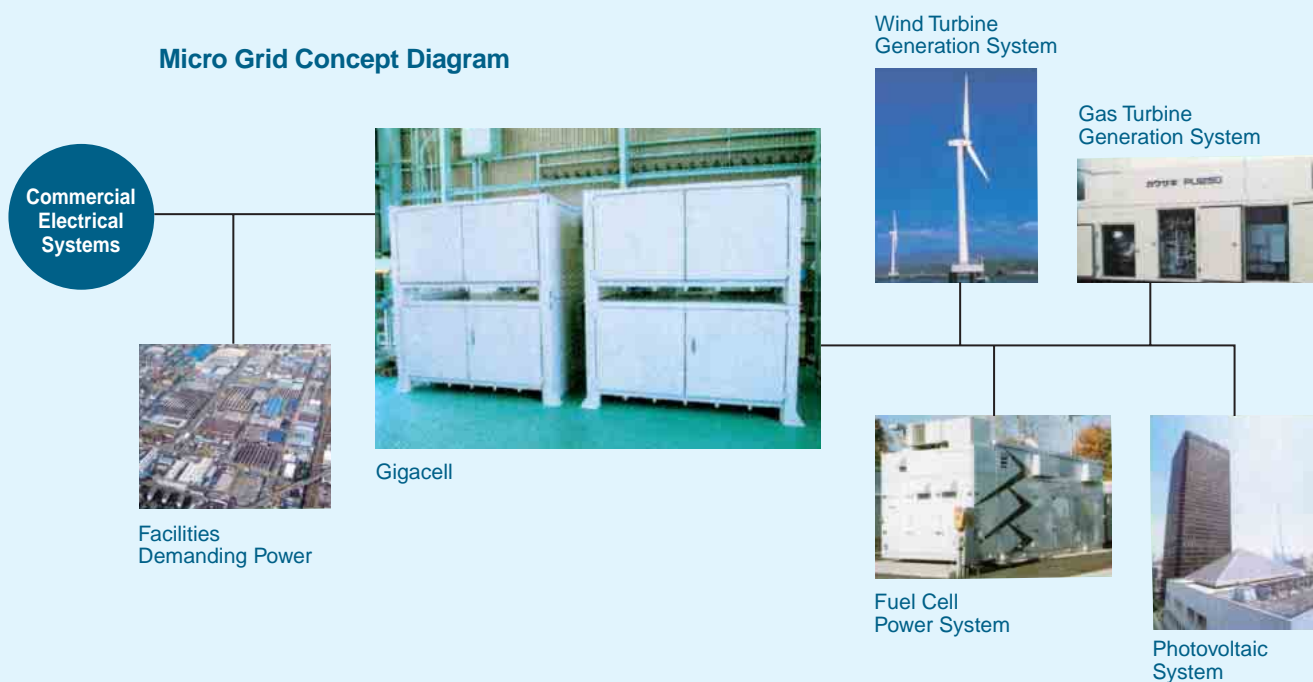
The Gigacell supports various environmentally conscious electrical power systems. Arising from the principle that a product that is useful to the environment must also itself be conscious of it, this battery employs specifications to accommodate environmental considerations. It is free of hazardous metals like lead, mercury, and cadmium and can be easily dismantled for recovery and recycling owing to its simple and weld-free construction.

The Gigacell has already gained attention from various business fields such as power companies, gas companies, and public transport.

From here on, the Gigacell holds promise as a basic technology that increases hopes toward a new dawn for future energy use and contributes greatly to people, society and the global environment.

In addition to all this, the Gigacell can be used as a back-up power source in intelligent buildings and industrial plants, so it holds promise in a variety of uses as a method to further increase the reliability of electricity.

### Micro Grid Concept Diagram



## Contributions to Society

# Trusted Kawasaki Technology Contributes to World Peace

## Steps toward the Practical Use for BULLDOG Humanitarian Demining System

Kawasaki has developed an anti-personal landmine removing system to clear landmines laid under grounds to promote the safety of people and restore their lives in such war-torn countries as Afghanistan. We've completed an improved version of this based on the results of a series of field tests in Afghanistan in FY2005.

### Landmines without Remorse

There are over 70 countries around the world in which landmines still lie under grounds, and it is said that the total sum of these landmines exceeds 110 million. The only current method of removal is carried out by hand and involves danger, and since a mere 100,000 landmines can be removed each year, at this pace it will take more than 1,100 years to clear all landmines.

Because a landmine remains active from 50 to 100 years once laid, it is estimated that casualties by landmines each year reach 15,000 to 20,000 people, half of whom are killed and the remaining half lose limbs. The majority of the victims are civilians, most of whom are children.

### Japan's Global Contributions and Kawasaki's Mission as a Comprehensive Heavy Industry Manufacturer

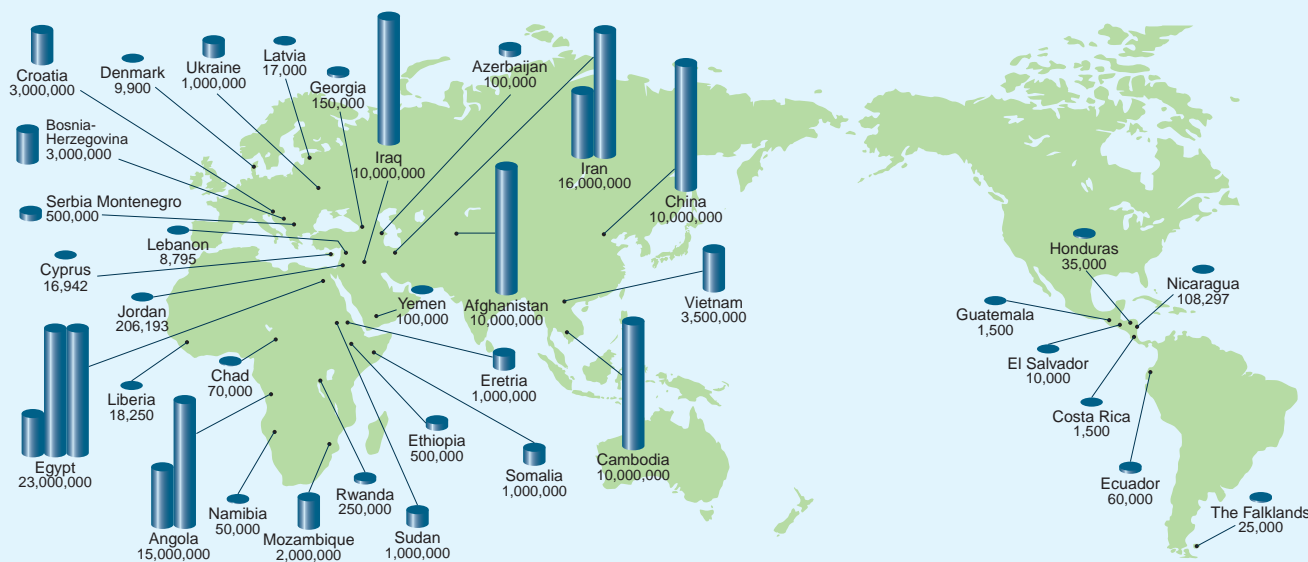
Japan became a member of the Ottawa Treaty to ban the use of anti-personnel landmines enacted in 1999 and has actively supported both the relief of victims and the research and development of safer and more effective anti-personnel landmine detectors and removal systems.

On the other hand, Kawasaki has engaged in the research and development of safe anti-personal landmine clearance systems since 1993, and has completed the first prototype in 2002 with the development of the Kawasaki BULLDOG System for practical use in 2003.

Our demining systems consist of the MINEDOG, a vehicle mounted landmine detection system which marks landmines and maps their locations with its detection sensor, and the MINEBULL, an anti-personnel mine clearance vehicle which excavates mines with its digging drum, detonates and crushes them, and collects iron fragments, and the Kawasaki BULLDOG System, which is equipped with the remote controllers to operate MINEDOG and MINEBULL from a remote and safer place.

## DISTRIBUTION OF ACTIVE LANDMINES THROUGHOUT THE WORLD

TOTAL : 111,738,337





## **MINEDOG Automatically Detects Landmines Using Ground Penetrating Radar**

The MINEDOG is about 7 meters long, 2 meters wide, and 3 meters tall. The MINEDOG's 8-channel sensors and proprietary software detect and identify AP landmines and unexploded ordnance. The sensor emits radio waves with its ground piercing radar that moves up and down following the terrain and measures the depth and size of the landmines or explosive devices based on the reflected waves when it encounters a target. It has the ability to automatically detect antipersonnel mines to a depth of 30 centimeters and anti-tank landmines to a depth of 50 centimeters.



## **MINEBULL Excavates and Detonates Landmines and Retrieves Their Shrapnel**

The MINEBULL vehicle is about 9 meters long, 3 meters wide, and 4 meters tall. It is equipped with digging depth control equipment, remote-control equipment, a GPS antenna and cameras to monitor the drum and the vehicle's path, a metal fragment collection bucket to simplify verification that all ordnance has been removed, and a digging drum with sturdy bits. The high-speed digging drum mechanism can be controlled to preset depths in order to remove landmines with precision up to a depth of 35 centimeters along with the dirt surrounding it. Further, it can automatically separate remaining.

## **Field Tests Earned High Praise from the Afghani Government, the UN, and Local NGOs.**

Kawasaki sent a team of 11 to Afghanistan to carry out a series of tests on landmine detection capabilities, anti-personnel landmine clearing capabilities, actual field tests for the detection and clearance of landmines, and comprehensive tests on durability, anti-explosive capabilities, and detection and removal systems at a test area on the outskirts of Kabul and we could get various great successful results.

In the flat terrain detection test prepared by the United Nations, MINEDOG detected 100% of the actual landmines. In the clearance test carried out subsequently in an actual minefield on the periphery of the Kabul International Airport, MINEBULL detonated 32 antipersonnel landmines, achieving a removal rate of 100%. Even in explosion-resistance tests, we proved our products' durability against explosive blasts, protection for the operator, and easy maintenance.

Achieving many impressive results, the Kawasaki BULLDOG System received high praise from the Afghani government, the UN, and local NGOs concerning its performance in tests and capabilities.

## **Hopes Toward the Practical Use of the Kawasaki BULLDOG System**

Consequent to the field tests in the Afghanistan minefield Kawasaki has improved the prototype and produced the modified BULLDOG System in 2005. These improvements include counter measures to prevent minute sand granules smaller than 1micro-meter in diameter entering machine components, which often cause machine failure and increase maintenance work.

Thanks to MINEDOG, sensitivity in landmine detection and identification in instances of high temperatures and low humidity have been improved. MINEBULL also incorporates countermeasures for reducing blast wave pressure in the cabin and for escaping from minefields in the event of breakdowns.



The Banshu (left) and Harima Works(right) which carried out modifications accordant to field tests in Afghanistan mine fields