

FOR IMMEDIATE RELEASE

**Development of magneto-cardiograph 3-D visualization of heart current distribution
-- Enabling simultaneous inspection of the back of the heart --**

Tokyo, September 9, 2004 ---Hitachi, Ltd. (NYSE:HIT / TSE:6501), has developed magneto-cardiograph visualization technology enabling 3D imaging of the electrical current distribution associated with cardiac activity for the first time in the world. The technology uses magneto-cardiographs taken from the front and back of the heart, and reconstructs the current distribution on a 3D model of the heart. As the entire heart can be observed at once, it is possible to visually catch electrophysiological phenomena. This technology is expected to find clinical applications such as the clarification of the mechanisms of heart failure, development of new diagnostic methods, etc.

Heart disease is the number two cause of death in Japan today. The electro-cardiograph is widely used as a simple method to screen for heart disease, however, as it is not capable of providing detailed data with high sensitivity, echocardiography or methods using radio isotopes are employed. Further, the electro-cardiograph is used to record data from the front of the heart, but it was difficult to measure the back of the heart.

As a new technology for heart disease screening, Hitachi developed a magneto-cardiograph system^{*1)} capable of detecting the very weak magnetic field^{*2)} formed on the surface of the body as a result of cardiac activity, using a special magnetic sensor called SQUID^{*3)}. The magneto-cardiograph was commercialized by Hitachi High-Technologies Corporation in March 2003, and is capable of measuring cardiac activity while clothed and in a short time. The non-invasively obtained magneto-cardiograms present a two-dimensional electrical distribution map, and provide a method for early detection of heart diseases such as arrhythmia and angina pectoris. Development of 3D imaging technology for current distribution maps was, however, also desired for multi-faceted analysis of the mechanisms of heart disease.

Given this need, Hitachi developed new technology for position-matching on a model of a standard heart and technology to reconstruct current distribution, to achieve the world's first three-dimensional imaging of the heart's current distribution.

Features of the technology are as follows:

(1) Technology for position-matching on a standard heart model

A computational method was developed to match the position of magneto-cardiograms on to a model of an average heart, using the sino-atrial node^{*4)} as a reference point. As a result, it is now possible to reconstruct the electrical distribution on the standard heart model without an MRI or X-ray image of the heart.

(2) Technology for reconstructing current distribution

The three-dimensional electrical distribution map is reconstructed from magneto-cardiograms taken from the front and the back of the heart. As the strength of the magnetic field depends on the distance from the heart, the strength of the reconstructed electrical distribution is also different. A computational method to easily match strength-levels and interpolate for the difference in frontal and dorsal electrical distribution strengths was developed, giving a smooth three-dimensional electrical current distribution.

When the heart of a healthy subject was observed using the three-dimensional electrical distribution imaging technology developed, it was able to confirm a time difference in electrical activity between the frontal (right atrium) and the dorsal (left atrium) side. Further, as it is possible to observe the electrical activity of the entire heart at once, the relationship between the section of the heart and electrical signals can be studied. The next step will be to adapt this technology to clinical data so that it can be used in the clarification of the mechanisms of heart disease, etc. This technology was developed with guidance from the National Cardiovascular Center, Suita-shi, Japan and the University of Tsukuba Hospital, Tsukuba-shi, Japan.

These results will be presented at the 21st Annual Meeting of the Japanese Society of Electrocardiology, 13th – 14th September 2004, at the Kyoto International Conference Hall, Kyoto, Japan.

Notes

- *1) Magneto-cardiograph (Model Name: MC-6400):
The magneto-cardiograph has been commercialized as a magneto-cardiograph system, and in December 2003, the Japanese Ministry of Health, Labour and Welfare approved its coverage (1,500 points) in clinical use for heart disorders, under national health insurance.

- *2) Strength of the heart's magnetic field:
A magnetic field of 100fT (femto-tesla: 10^{-15} tesla) to several tens of pT (pico-tesla: 10^{-12} tesla) is emitted from the heart. The earth's magnetic field is approximately $50\mu\text{T}$ (10^{-6} tesla), thus the heart's magnetic field is approx. $1/1,000,000$ that of the earth's field.

- *3) SQUID: Superconducting Quantum Interference Device
A magnetic device formed from one or two Josephson junctions arranged in a superconducting ring. The maximum (superconducting) current which can be applied to the loop changes with the magnetic flux confined in the ring. This change becomes a periodic change in each quantum flux ($\Phi_0=2.07\times 10^{-15}\text{Wb}$). This highly sensitive response to minute changes in the magnetic field is employed to create an extremely sensitive magnetic sensor.

- *4) Sino-atrial Node:
The sino-atrial node discharges an electrical signal which acts as the trigger signal to initiate a heart beat. It is located in the wall of the right atrium, near the entry of the superior vena cava. The sino-atrial node is located in a fixed position in the heart, and is in an optimal location for position cross-referencing and alignment.

About Hitachi, Ltd.

Hitachi, Ltd., (NYSE:HIT/TSE:6501) headquartered in Tokyo, Japan, is a leading global electronics company, with approximately 326,000 employees worldwide. Fiscal 2003 (ended March 31, 2004) consolidated sales totaled 8,632.4 billion yen (\$81.4 billion). The company offers a wide range of systems, products and services in market sectors, including information systems, electronic devices, power and industrial systems, consumer products, materials and financial services. For more information on Hitachi, please visit the company's Web site at <http://www.hitachi.com>.

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