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**Hokkaido University and Hitachi to Begin Joint Development  
of a World-First Novel Proton Beam Therapy System  
for Cancer Treatment under Japan's FIRST Program**

**Hitachi to Deliver System to Hokkaido University for Treatment Starting From 2014**

Tokyo, September 21, 2010 --- Hokkaido University and Hitachi, Ltd. (NYSE:HIT / TSE:6501) today announced that they have concluded an agreement to jointly develop a new type of proton beam therapy(PBT) system for cancer treatment by combining with the world-leading Japanese advanced medical technology. The proposed system was awarded for a grant under the Funding Program for World-Leading Innovative R&D on Science and Technology (FIRST Program), a national project sponsored by the Japanese government. In line with the agreement, Hitachi will deliver this therapy system to Hokkaido University.

The FIRST Program is a major Japanese government initiative to incubate the world leading science and technology to establish future Japanese technical backbone. Only 30 "Core Researchers and Projects" were awarded for the grants out of 565 applications throughout Japan in March 2010 by the Council for Science and Technology Policy. Hokkaido University's "Sustainable Development of Molecular-Tracking Radiotherapy System" project, applied by Professor Hiroki Shirato, Department of Radiation Medicine, Graduate School of Medicine was awarded for this FIRST grant\*, as the only application accepted in the field of radiation therapy. The proposed system is expected to advance radiation cancer therapy in Japan. Hokkaido University and Hitachi will combine real-time moving tumor tracking technology and spot scanning irradiation technology for the first time in the world to develop a compact and high-performance PBT system that can precisely target the respiratory moving tumors. The new facility will be constructed adjacent to the Hokkaido University Hospital with ground breaking in the fiscal year 2011 and completion in March 2014. After the completion, this new facility will start patient treatment as a part of, Hokkaido University Hospital.

PBT is an advanced type of cancer radiotherapy. Protons, the atomic nucleus of hydrogen, are accelerated to high speed and its energy is concentrated on tumors. PBT allows patients to continue the normal life during the treatment by its superb characteristics that almost no pain

is associated with treatment and damage to the body's functions or form is limited to the minimal level. It has thus attracted attention as a cutting-edge therapy for treating cancer whilst maintaining patients' quality of life (QOL). Because of its superb characteristics of dose concentration to a small spot, PBT can focus easily to the cancers that do not move like brain tumors, but the treatment to the tumors in the body trunk such as lung and liver which moves in accordance with the respiration needs special care, and the combination of PBT with real time tracking to target the tumor location is desired.

Hokkaido University has focused on the development of technologies to concentrate irradiation dose to tumor locations, which is one of the most important technologies for the radiation therapy for more than half a century. Professor Shirato has successfully developed real-time moving tumor tracking technology that automatically identifies the location of a gold marker inserted in the proximity of a moving tumor with X-ray fluoroscopic images and irradiates only when the tumor comes to the anticipated marker position. He has also developed the world's first 4D(four-dimensional) X-ray radiation therapy system employing this technology. These breakthroughs enabled the accurately targeted X-ray radiation therapy to the respiratory moving tumors by the real time images.

Through its power systems business, Hitachi has developed PBT system based on its vast technologies and know-how related to accelerators, irradiation and control system. In May 2008, Hitachi's first spot scanning irradiation technology that can concentrate irradiation dose to the tumor shape has started patient treatment at the University of Texas M. D. Anderson Proton Therapy Center in the U. S., one of the world's largest hospitals specializing in cancer treatment. This marked the first clinical application of spot scanning irradiation technology in a general hospital.

Hokkaido University and Hitachi entered into a comprehensive academia-industry collaboration agreement in April 2003 and since then have been conducting various joint researches. In the medical field, in particular, they have been jointly developing new molecular imaging technology for assessing and diagnosing the radioresistance of cells that are critical in radiation therapy. This research trajectory followed selection of the technology in fiscal 2006 as a Future Drug Discovery and Medical Care Innovation Program as part of a major national project funded by the Special Coordination Fund for Promoting Science and Technology of the Ministry of Education, Culture, Sports, Science and Technology, which is expected to last for 10 years.

Under the FIRST Program, Hokkaido University and Hitachi will develop a PBT system that can accurately irradiate respiratory moving tumors by combining for the first time in the

world the real-time moving tumor tracking technology accumulated by Hokkaido University in X-ray treatment and the spot scanning irradiation technology Hitachi was first to deliver to a general hospital. Because protons boast superior dose distribution to X-rays, the combination of real-time moving tumor tracking technology and spot scanning irradiation technology should yield more precise irradiation by drawing on the advantages of both technologies. It is highly demanded that this system will enable outstanding cancer treatment in terms of QOL with greatly enhanced safety. Development work also aims to popularize PBT worldwide by reducing the size of and simplifying accelerators and irradiation systems, to create a system that is internationally competitive.

Hokkaido University and Hitachi will combine their respective outstanding technologies, knowledge and experience in the medical and engineering fields, to contribute to cutting-edge radiation cancer therapy that maintains excellent QOL for patients through the development of this PBT system.

Note\*: In parallel with development of a PBT system to create "Sustainable Development of Molecular-Tracking Radiotherapy System", Kyoto University Professor Masahiro Hiraoka, who was a joint proposer of the project, plans to develop a\_tracking-image X-ray therapy system that tracks and irradiates tumors in the X-ray therapy field.

### **Overview of the PBT Facility**

Planned construction site: Hokkaido University Campus, Kita 13, Nishi 6, Kita-ku, Sapporo

Site area: Approx. 2,000 m<sup>2</sup>

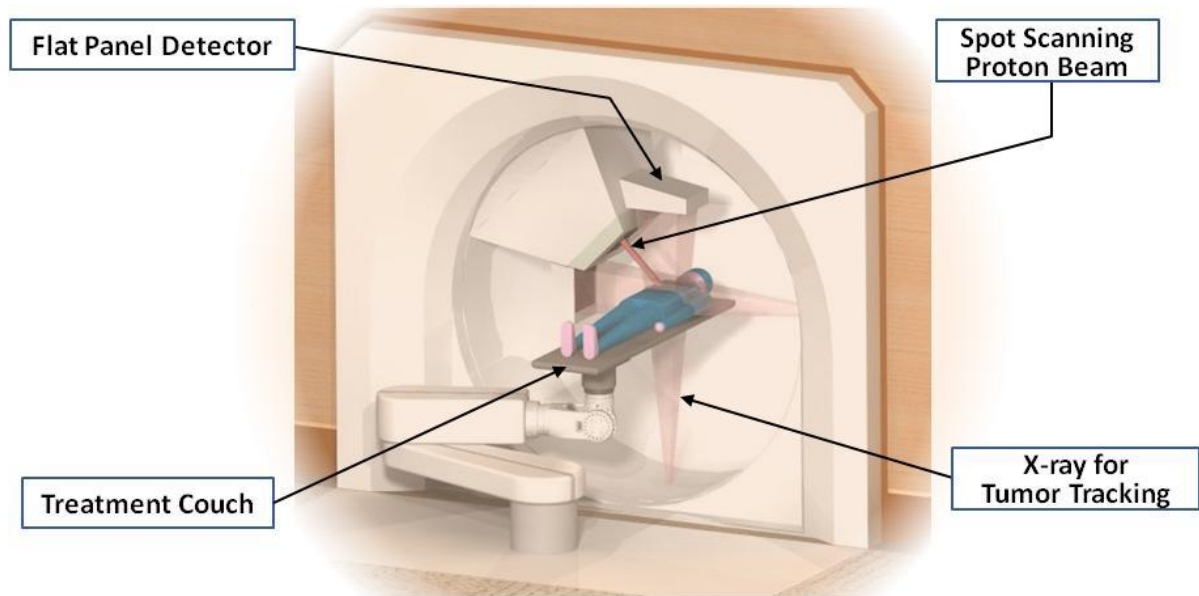
Planned Building floor area: 946.94 m<sup>2</sup>

Planned Total area: 2,850.48 m<sup>2</sup>

Structure and size: Four-floor, steel-reinforced concrete structure

Irradiation chamber: 1 rotating gantry treatment room

### Computer graphic of the proposed Molecular-Tracking Radiotherapy System



#### Overview of Real-time Moving Tumor Tracking Technology

Real-time moving tumor tracking technology inserts a 2 mm diameter gold marker in the proximity of the tumor and uses a computed tomography (CT) system to identify the marker position in relation to the tumor core. Using an X-ray fluoroscopic system from two directions, the technology automatically pinpoints the gold marker position on a fluoroscopic image with pattern recognition technology and repeatedly calculates at intervals the spatial position. The targeted tumor will be irradiated only when the gold marker is located within several millimeters from the planned position. As this operation is performed at high speed, it is possible for the first time in the world to irradiate the moving cancer cells with high accuracy. Compared with a conventional method to irradiate the whole area over which the tumor might migrate, this system reduces the irradiation volume to the level of one-half to one-quarter, thereby enabling a dramatic reduction of the irradiation to of normal tissue.

#### Overview of Spot Scanning Irradiation Technology

Spot scanning irradiation technology does not scatter proton beams like conventional PBT method. Rather, it repeatedly turns the narrow beam on and off at high speed as it progressively changes location to irradiate the whole tumor volume and the protons can be targeted with high precision according to the shape of tumors, even those with complex shapes eventually minimizing the impact on normal tissue.

### **About Hokkaido University**

Hokkaido University was founded in 1876 as Sapporo Agricultural College. It was Japan's first institute of higher education to award bachelor's degrees. The basic philosophies that guide education and research at Hokkaido University are: "Frontier Spirit", "Global Perspectives", "All-round Education", and "Practical Learning". To this end, Hokkaido University strives to become a university open to the world as well as a global center for education and research by supplementing its approximately 18,000 undergraduate and graduate students, and 4,000 faculty members with a diverse international student body. For more information on Hokkaido University, please visit the university's website at <http://www.hokudai.ac.jp/en/>.

### **About Hitachi, Ltd.**

Hitachi, Ltd., (NYSE: HIT / TSE: 6501), headquartered in Tokyo, Japan, is a leading global electronics company with approximately 360,000 employees worldwide. Fiscal 2009 (ended March 31, 2010) consolidated revenues totaled 8,968 billion yen (\$96.4 billion). Hitachi will focus more than ever on the Social Innovation Business, which includes information and telecommunication systems, power systems, environmental, industrial and transportation systems, and social and urban systems, as well as the sophisticated materials and key devices that support them. For more information on Hitachi, please visit the company's website at <http://www.hitachi.com>.

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