

ACCELERATING INNOVATIONS IN HEALTHCARE – MOVING TOWARDS SOCIETY 5.0

A conversation with **MASAYA WATANABE**, CEO of Healthcare Business Unit, Hitachi Ltd.



To meet the growing need for patient-oriented, tailored and sustainable solutions for human health and social infrastructure in the 21st century, Hitachi has made healthcare a key pillar of its social innovation business. After 68 years of developing healthcare technologies such as ultrasound systems, radiological diagnosis systems and particle beam therapy, the company is building on its strengths in advancing medical innovations. Masaya Watanabe explains how Hitachi's Healthcare Business Unit is expanding its capabilities by integrating artificial intelligence and other emerging technologies.

Many people associate Hitachi with electronics and transport. Why focus now on healthcare?

Hitachi is renowned as a highly diversified company with a portfolio that includes electronics, information and telecommunication systems, automotives, industrial machinery, power systems, materials and components, among others. As the incidence of incurable diseases increases and medical expenditure rises, along with regional disparities in the provision of healthcare, we are keenly aware of new societal needs.

We are uniquely positioned to face these challenges by drawing on our extensive experience in providing innovative solutions and technologies. The Hitachi Healthcare Business Unit was launched in April 2016 as part of the company's vision to play a leading role in the medical innovation field. Our motto 'Innovating healthcare, embracing the future' captures our commitment to developing products and services that will improve quality of life. Our defining strength is our ability to combine technologies — across fields such as diagnostics, therapies and digital — to drive healthcare innovations. We believe this is essential to expand the possibilities of healthcare. Our goal is a society in which

everyone can enjoy a healthy and secure way of life.

Can you tell us more about your activities in those fields: diagnostics, informatics and robotics?

In the diagnostics and clinical field, Hitachi is leading the way with equipment such as our Diagnostic Ultrasound System with CMUT (Capacitive Micro-Machined Ultrasound Transducer), which provides unparalleled image resolution. Our particle beam therapy (PBT) system, now used for cancer therapy in Japan, the United States, and now spreading to other countries, has been highlighted explicitly in the Sustainable Development Goals (SDGs) Industry Matrix as an exemplary healthcare innovation.

It's a very exciting time for digital healthcare solutions. We're focusing on combining artificial intelligence (AI) with medical equipment and services. With our ability to bridge operational technology (OT) and information technology (IT), Hitachi is at the forefront of Internet of Things (IoT) solutions. Smart Cyber Operating Theater, which is developed by Tokyo Women's Medical University, makes use of IoT for integrating Hitachi intraoperative MRI. The intraoperative MRI enables superb visualisation of brain tumours, for example, in real time so that neurosurgeons can operate more precisely

and safely.

In 2016, Hitachi launched a humanoid service robot called EMIEW3 along with its 'remote brain' cloud-based system to provide customer assistance in public places, such as airports. EMIEW3's mobility allows it to guide and keep up with people at a brisk walking pace. We're exploring the possibilities of using EMIEW3 in healthcare solutions.

How will these new AI and IoT technologies help Japan's wider goal of achieving Society 5.0?

The Japanese government in its Fifth Science and Technology Basic Plan outlined a plan for a 'super smart society' or Society 5.0 to tackle various socioeconomic challenges. Promoting healthy longevity and reducing total medical expenditure have become part of a major national agenda. These are essentially the same goals that Hitachi is striving to realise in its healthcare innovations.

Society 5.0 was a symbolic term which shows Japan is focusing on social level innovations. The idea is to face broad social challenges by making the best use of emerging fields, such as AI and IoT with an emphasis on connecting systems, equipment, services, people and data. In doing so, we can develop smarter solutions and services more tailored to individual needs. Open

innovation is one of the ways in which we're developing new technologies fit for Society 5.0, and such efforts are helping to raise Japan's competitiveness.

Are collaborations important in developing these innovations?

We highly value our collaborations with governmental bodies, companies and research institutes. Within the Hitachi Group as well, we can draw on a wide range of expertise and deep networks. Hitachi Chemical is now focusing on regenerative medicine in the life science business and Hitachi High-Technologies is developing genetic testing systems in the biomedical business.

Medicine-engineering collaborations are essential for accelerating healthcare innovation. We have partnered with doctors in universities to speed the development of AI technologies. We have joint activities with doctors to innovate medical modalities. In genomic research we are also collaborating with universities and institutes to innovate healthcare through precision medicine — the next frontier in patient-centered care.

HITACHI
Inspire the Next

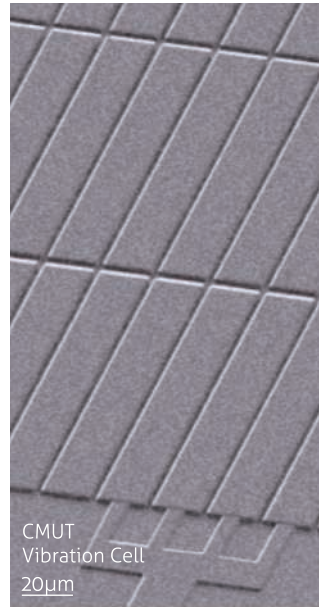
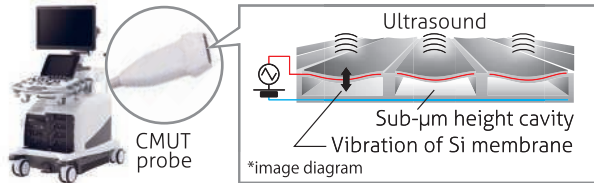
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Innovating Healthcare, Embracing the Future

Through its work on the construction of social infrastructure, Hitachi has long been engaged in creating a society that is convenient and comfortable. Recognising that the healthcare sector is an important part of the infrastructure that supports smarter society, Hitachi has made healthcare one of the cores of its Social Innovation Business and accelerates innovation in healthcare.

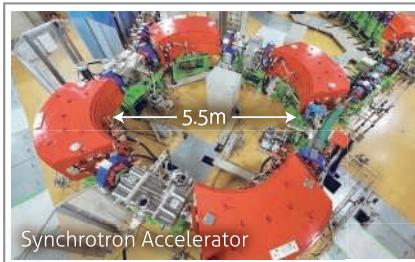
Capacitive Micro-machined Ultrasound Transducer (CMUT)

In the ultrasound medical imaging, higher image resolution and wider frequency bandwidth are keys to innovation. CMUT is a novel ultrasound probe manufactured by state-of-the-art semiconductor process technology. CMUT has innumerable tiny vibration cells with sub- μm height. The vibration of silicon membranes generates ultrasound. CMUT can propagate broadband ultrasound waves into human body smoothly, because the stiffness of the silicon membrane is designed to be close to the human body. Therefore, CMUT can provide very high resolution (0.1 mm) images which cannot be realised by conventional probes. CMUT also covers a frequency bandwidth that is three times wider than conventional probes. These features provide a one-probe solution that several conventional probes can be replaced by one CMUT probe, and improve the workflow of ultrasound examinations.



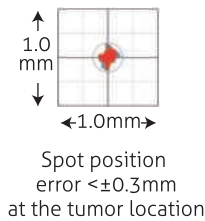
CMUT
Vibration Cell
20 μm

Particle Beam Therapy (PBT) System



Synchrotron Accelerator

Accurate Irradiation



PBT is an advanced type of cancer radiotherapy. Protons from a hydrogen atom are extracted and accelerated up to 70% of the speed of light. Its energy is concentrated directly on the tumor while avoiding radiation dose to the surrounding healthy tissues. Spot scanning irradiation technology does not scatter proton beams as with conventional PBT. Rather, it repeatedly turns a narrow proton beam on and off at high speed as it progressively changes location to irradiate entire tumor volumes.

Protons can be aimed with high precision according to the targeted tumors, even those with complex shapes, while minimising the impact on nearby healthy tissue. PBT improves the quality of life for cancer patients since the patient experiences no pain during treatment and the procedure has very few side effects compared to that of traditional radiotherapy. Hitachi has developed PBT solution based on the experience of the high energy accelerator technologies for physics research. These technologies contribute the spot position accuracy as shown in the figure, which is essential to realise spot scanning irradiation.



PBT (Treatment Room)

Healthcare Informatics Technologies

In the field of healthcare informatics, Hitachi possesses sophisticated analytics technologies, such as AI and machine learning, which will support medical doctors' efforts to improve patients' quality of life.

Hitachi is collaborating with universities and institutes with the goal of innovating healthcare through a data-driven approach. For example, Hitachi is currently working on investigations into deep learning-based imaging diagnosis technology that will help radiologists detect early-stage cancers. Hitachi is also working on the creation of novel services for patients in hospitals using the humanoid robot EMIEW3 and AI. These technologies offer the potential for hospitals to realise higher level patient-care, with lower medical costs.

Smart Cyber Operating Theater (SCOT)

The SCOT realises security therapy and high precision decision support and is consisting of state-of-the-art medical equipment.



*image diagram



EMIEW3