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04

NEW EYES, NEW SKIES

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In search of new applications for radiography

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- Growing with China
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NEW EYES, NEW SKIES

The next 40 years will see telescopes that far outstrip any ever seen before. **Jeff Kanipe** profiles four* of them; illustrations by **Lynette Cook.**

* In the original article four telescope were profiled. Here two of the profiles are reproduced.

This is part of a News Feature originally published in *Nature* Vol.457 (18-25) / 1 January 2009

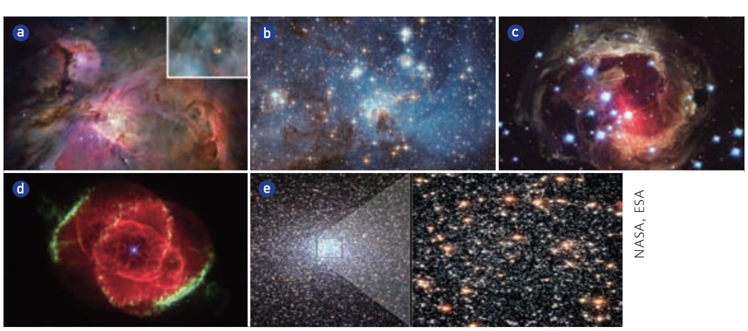
The armillary and astrolabe are now seldom seen outside museums and antique shops; but the telescope, which joined them in the observatories of early modern Europe 400 years ago, is still at the centre of the astronomical world. In optical precision, in the wavelengths that are used and in their sheer size, they have changed almost beyond recognition. After two centuries in which they left no records other than the users' sketches, and a century in which their visions were recorded on photographic plates, they have in the past decades become entirely electronic. And they are now stationed everywhere — oceans, deserts, mountain tops and all kinds of orbit. But the job is still the same: collecting and focusing whatever information the Universe sends our way.

Yet for all its glorious 400-year history, the astronomical telescope's best days may still be to come. Telescopes currently in development show an unprecedented degree of technical ambition as they seek to provide near-definitive answers to questions that, a generation or two ago, it was hard to even imagine investigating.

To answer these questions, the telescopes profiled here will often work in complementary ways. The infrared capabilities of the James Webb Space Telescope and the radio acuity of the Square Kilometre Array will both be used to probe the Universe at the time of its own 'first light' — the birth of the first stars and galaxies. The radio array will map the large-scale structure of the Universe, elucidating the role in that structure of 'dark matter' and 'dark energy', as will studies of the faintest galaxies by the Large Synoptic Survey Telescope and European Extremely Large Telescope. That behemoth and the orbiting Webb will, in turn, complement each other in their attempts to characterize planets around other stars with unprecedented detail.

This quartet, for all its ambition and expense, does not exhaust the possibilities being explored and wished for. The Atacama Large Millimeter/ Submillimeter Array will soon revolutionize astronomy at its chosen wavelengths. Other projects are planned throughout the electromagnetic spectrum and beyond into the new realms of gravitational waves and neutrinos. These instruments are all being designed with specific scientific challenges in mind. But at the same time, all concerned hope devoutly to discover something as strange and unlooked for as Galileo's mountains on the Moon — or spots on the face of the Sun.

Jeff Kanipe is a science writer based in Maryland. Lynette Cook is an artist and illustrator based in California.



From Figure 3 of "18 years of science with the Hubble Space Telescope"
Nature Vol. 457 (41 - 50) / 1 January 2009

A montage showing the life cycle of stars.

a, The Orion nebula is a dense cloud of gas within which new stars are forming. The inset shows a close-up of a young star surrounded by a dusty disk that may eventually form planets. **b**, Young blue stars surrounded by leftover natal gas in the Large Magellanic Cloud, a nearby dwarf galaxy. **c**, The evolving star V838 Monocerotis, whose past flashes have illuminated material that was ejected in an early stellar wind. **d**, A planetary nebula forms as a dying star sheds its outer layers, leaving behind a fading white dwarf at its centre. **e**, A globular cluster containing many old stars. The faintest stars in the cluster are white dwarfs. Images courtesy of NASA.

ALL ILLUSTRATIONS BY LYNETTE COOK

The James Webb Space Telescope

Like the Hubble Space Telescope, to which it is in some ways the successor, the James Webb Space Telescope (JWST) will be the orbital flagship of its generation. But whereas the Hubble sees mainly in the visible and ultraviolet, JWST is optimized for the infrared. That means it can see things hidden from the Hubble and its like by dust, and peer into the high-redshift epoch just after the Big Bang at objects indiscernible at visible wavelengths — such as the first stars.

Astronomers at the Space Telescope Science Institute in Baltimore, Maryland, started their first plans for a follow-on instrument in 1989 — a year before the Hubble itself was launched. It should finally make it to the launch pad 24 years later. Although its design and cost have changed a few times over the past two decades (see *Nature* 440, 140–143; 2006), its main mission remains simple and visionary — to study unseen aspects of every phase of the history of the Universe. To do so, the telescope will make use of several innovative technologies, such as ultra-lightweight optical systems made from beryllium, extremely sensitive infrared detectors and a cryocooler that can maintain the mid-infrared detectors at a frosty 7 kelvin indefinitely.

The most striking of the new technologies, though, affects the very heart of the telescope. JWST's designers wanted a mirror that would have been too large to fit into the payload fairing of any rocket available. So they designed one in segments, a mirror that could be launched folded up and then deployed to its full 6.5-metre diameter once the telescope settles into its final orbit, 1.5 million kilometres from Earth. That distance gives the telescope much more sky to look at than the Hubble gets, and keeps it cooler, too. But it has its downside: as yet there is no way to get there to fix any problems so, unlike, the Hubble, JWST has to work perfectly from the start.

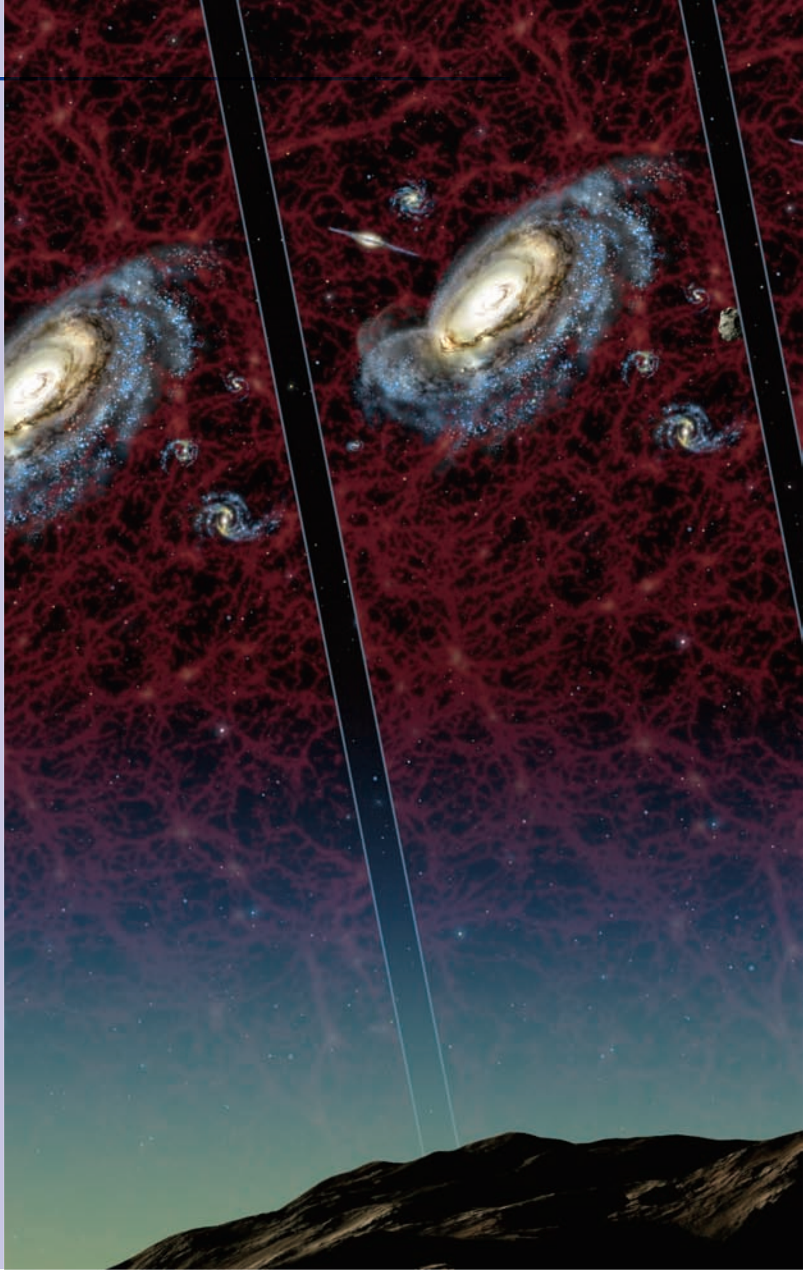
At the moment, says John Mather, Nobel laureate and senior project scientist for JWST, the telescope is designed to last for at least five years, but longer may be possible. It will carry ten years' worth of fuel, and the presence of the cryocooler means that, unlike earlier infrared missions, its lifetime is not limited by a fixed supply of coolant. "If we are lucky and clever we hope to conserve fuel and perhaps run much longer," says Mather. "But we can't promise that." What Mather thinks he can promise is discovery. "We do not know which came first, black holes or galaxies, and we do not know how it happens that there is a massive black hole at the centre of almost every massive galaxy. If there are any surprises about the early Universe, I am guessing that they will be in these areas."

JWST is not just about deep space and distant epochs, though; it will also scrutinize the shrouded origins of objects closer to home — such as nascent solar systems, coalescing stars and star clusters amassing within dusty nebulae, says Matt Mountain, director of the Space Telescope Science Institute.

But where the telescope will really stand out will be its ability to probe the very early Universe. "JWST is so sensitive," says Mountain, "that we can take actual spectra of the very earliest objects you can just barely detect with Hubble."

Follow up around the world

LSST will be able to send out alerts on the Internet within a minute of seeing something untoward in the sky. The Las Cumbres Observatory Global Telescope will be eager to hear them. When completed, this will be a network of robotic telescopes distributed in two rings, one circling each hemisphere. Currently the network — a privately funded, non-profit organization — has just two telescopes up and running, one on Haleakala, Hawaii, and another in the Siding Spring Observatory in New South Wales, Australia. More are planned for sites in Mexico, the Canary Islands, Chile, South Africa and Australia. The final goal is to have two dozen or so 0.4-metre telescopes and a similar number of 1-metre telescopes. The smaller ones will be skewed towards educational use, the larger ones towards science, but there will be a lot of overlap. Once fully operational, the network will be able to keep a constant eye on new-found objects, such as supernovae and new asteroids, for days or weeks.



A DEEP, MOVING IMAGE

The Large Synoptic Survey Telescope

Sometimes telescopes see double not because of any aberration, but because that is the way the Universe works. The bending of light by intervening masses — called gravitational lensing — means that some galaxies are seen by Earthly observers in more than one place. By adding together survey image after survey image, and so measuring things that no individual image would show, the designers of the Large Synoptic Survey Telescope (LSST) hope to find a significant fraction of the 10,000 or so such images in every square degree of sky. They also hope to open up a neglected dimension in astronomy: time. As well as adding together images of the same part of space taken again and again to reveal new depth, they will compare those images to spot any differences, turning up a wealth of supernovae, asteroids and Kuiper belt objects on the fringe of the Solar System that would otherwise be missed. The telescope's proponents call it celestial cinematography.

The telescope will suck in celestial data by the terabyte every night, surveying almost all of the sky visible from Cerro Pachón, Chile, every week. Such coverage is made possible by an 8.4-metre primary mirror, which will be ground so as to provide a field of view of 10 square degrees. That's 49 times the size of the full Moon, and more than 300 times the field of view of the Gemini telescopes, which have mirrors of similar size optimized for staring in a single spot. Over ten years, says Željko Ivezič, of the University of Washington in Seattle, the LSST system will look at everything in its field of view about 1,000 times. A massive amount of computing power will be used to correlate, compare and catalogue the torrent of data — and to make

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ALL ILLUSTRATIONS BY LYNETTE COOK

LSST

Collection area: 35 square metres
First light: 2015
Cost: $390 million to first light
Unique selling point: All of space, in real time

them all available on the Internet. Anyone with a computer — students, and amateur and professional astronomers — will be able to participate in the process of scientific discovery.

Studies of objects that have been gravitationally lensed should reveal huge amounts about the structure of the Universe in general, and the distribution of dark matter and the effects of dark energy in particular. At the same time, though, LSST will mount a virtual space patrol, looking for potentially hazardous near-Earth asteroids. Astronomers already know where most of the big, killing-off-species-wholesale asteroids are. LSST will be one of the tools that catalogues the vast majority of lesser asteroids still capable of smashing a city. But with a sensitivity to faint, transient events 1,000 times greater than ever previously achieved, the telescope will not restrict itself to the 'vermin of the skies' in Earth's backyard. It will observe vast distant cataclysms, such as collisions between neutron stars, and is all but sure of discovering whole new categories of transient events.

The project is overseen by the LSST Corporation, comprising more than 100 scientists and two dozen laboratories, universities and institutes based mainly in the United States. Although the project's design is still being worked out, the main mirror has already been cast. Astronomers with the corporation are hopeful that construction will begin as planned in 2011 and that first light will occur in 2015. In the subsequent ten-year survey, LSST will take stock of every object in the Universe, known, unknown and newly discovered. "For the first time in history," says Ivezič, "we will catalogue and study more celestial objects than there are people on Earth."

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In search of new applications for radiography

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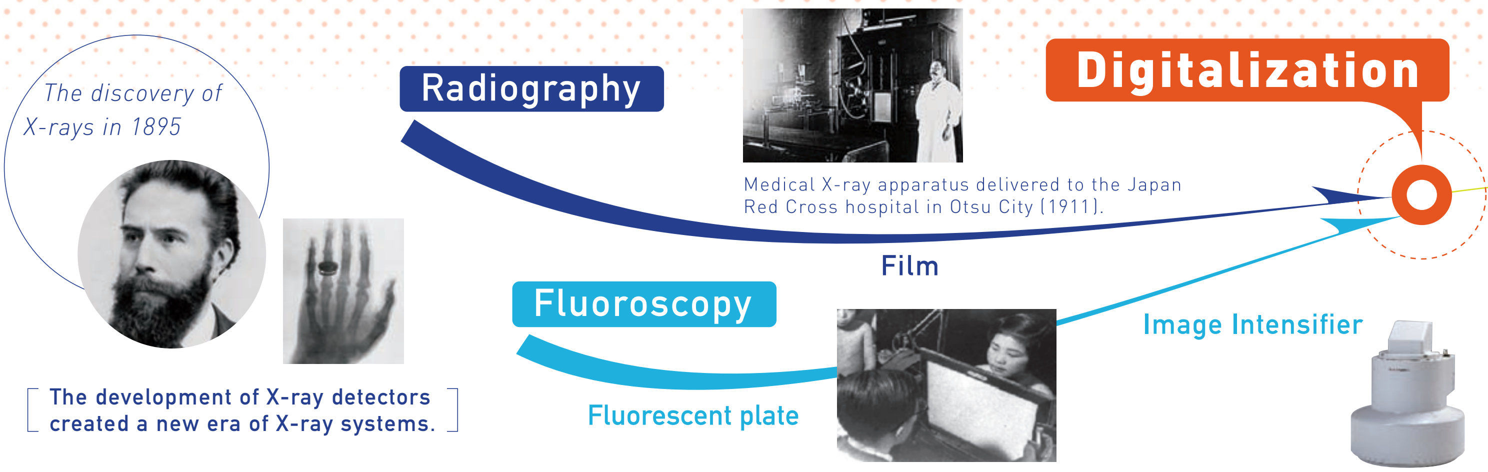


It was the spring of 1896 when news of the discovery of X-rays by German physicist Wilhelm Röntgen reached Japan. Japanese researchers promptly followed with their own experiments, and in October of the same year, brothers Genzo Jr and Genkichi Shimadzu — sons of the founder of Shimadzu Corporation — successfully radiographed a one-yen coin in a wooden box in collaboration with physicists at the institute later to become Kyoto University.

In 1909, Shimadzu became the first company in Japan to manufacture medical X-ray instruments, and in 1961 the Kyoto-based precision instruments manufacturer became the world's first to commercialize a remotely controlled X-ray television system.

Today, Shimadzu continues to lead the world in medical X-ray system development thanks to its spirit of innovation, pursuing safer, easier-to-use devices providing the highest imaging quality. At the turn of the twenty-first century, these endeavors have led to the invention of era-defining technologies such as the direct-conversion flat panel detector (FPD) and digital tomosynthesis. And despite the testing business conditions surrounding medical X-ray devices, "Shimadzu is undaunted in its commitment to researching new radiographic applications, creating new possibilities of much-needed diagnoses and medical treatments," says Hidefumi Suzuki, General Manager of Shimadzu's Research and Development Department, Medical Systems Division.

New era of imaging

Shimadzu's medical X-ray system business has grown in parallel with the evolution of the X-ray detector, which has undergone a number of major technical revisions since its discovery. X-ray images were originally only taken as still frames using photographic film. Following the development of the image intensifier in the 1950s, however, it became possible to capture moving images, which proved to be useful in a wide range of studies, from gastrointestinal diagnoses to angiography.

The advent of digital imaging in the 1970s made it possible to develop new medical devices beyond radiography, including positron-emission tomography (PET), computed tomography (CT) and diagnostic ultrasonography. Shimadzu also developed these new technologies, but the importance of X-ray imaging remained undiminished.

A major tipping point for Shimadzu came in the 1990s when radiological imaging started to shift toward full digitalization. Manufacturers began competing to develop FPDs, which maximize the benefits of digital imaging: high-resolution images and instant viewing for quick diagnosis. Many of them focused on the development of indirect-conversion FPDs, in which X-rays are first converted by a scintillator screen (cesium iodide) into detectable light, which is then converted to an electrical signal by a photodiode array. This system is similar to the existing image intensifier system, and is subject to light diffusion resulting in degraded image quality.

From the start, Shimadzu was more ambitious, pursuing the development of a direct-conversion FPD technology in which X-rays are converted into electrical signals directly using an amorphous selenium (a-Se) screen. This method captures X-rays in fewer steps and affords much clearer images compared to those obtained using indirect FPDs. In 2003, following a decade of research and development in collaboration with two other Japanese manufacturers, Shimadzu marketed the world's first cardiovascular imaging system with direct FPD.

Other manufacturers also attempted to develop direct FPDs, but only Shimadzu persevered in the face of technical difficulties in reliably fabricating a large-scale a-Se screen. "While all other companies abandoned their efforts,

FPD Angiography System BRANSIST safire

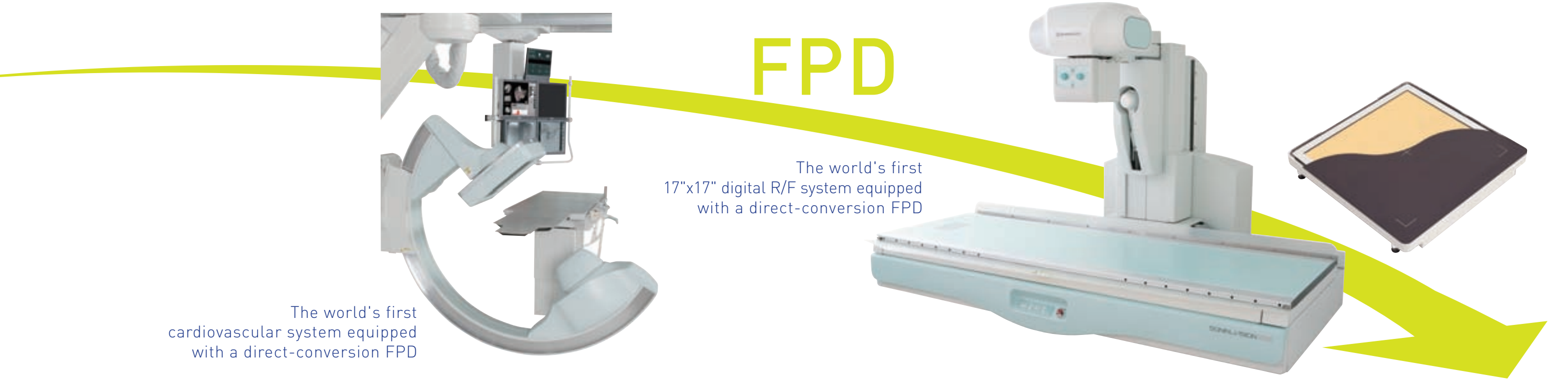
FPD Digital Radiographic Mobile X-ray System MobileDaRt Evolution

Direct-conversion FPD

FPD General Radiographic System RADspeed safire

FPD Multi-purpose Digital R/F System SONIALVISION safire 17

SHIMADZU FPD SYSTEM LINEUP



we hung in there despite numerous challenges, and our company supported our perseverance," Suzuki says.

'safire' opens immense possibilities

The direct FPD technology, named the Shimadzu Advanced Flat Imaging Receptor, or 'safire', was first released in the Shimadzu DIGITEX safire instrument, which was designed for cardiac and vascular diagnosis.

Following this first 9-square-inch FPD model, an upgraded 17-square-inch model was released a year later, expanding the spatial field of imaging beyond that possible with film-based imaging. The Shimadzu SONIALVISION safire digital table system even allowed observation of the entire esophagus without moving the viewing area. The Shimadzu RADspeed safire series now provides high-quality image processing for general radiography.

To support expanded applications of direct FPDs, a goal considered critical by Shimadzu, the flagship digital tomosynthesis software suite continues to be actively developed. Digital tomosynthesis has promising applications, for example, as a replacement for CT scanning, which requires a complete tomographic scan to be performed for each slice of the reconstructed three-dimensional image. In contrast, digital tomosynthesis can produce a series of consecutive, longitudinal cross-sectional image slices from just a single scan. Tomosynthesis can also be performed with the patient in almost any position, including upright positions in examination of knees and other joints. Importantly, the use of tomosynthesis can reduce the radiation dose to a tenth of that incurred in CT scanning, easing health concerns associated with medical radiography. Shimadzu is currently working with doctors in applying digital tomosynthesis to the examination of early lung cancers.

Other cutting-edge applications include 'slot radiography', a technique for taking elongated images in examinations of scoliosis and the lower limbs, and 'dual-energy subtraction', which allows images of soft tissue and bone structures to be taken simultaneously using different X-ray energies to support doctors in observing the difference in these physical properties.

Looking to the future

In an era of rapidly ageing populations in Japan and other developed countries, demand is shifting from diagnosis to more effective medical treatment and disease prevention. Challenges lie ahead for Shimadzu in competing with alternative medical systems such as endoscopes, necessitating improvements in X-ray systems in terms of cost and device safety.

Shimadzu nevertheless sees opportunities. The company is already working on new applications for X-ray technologies, including the 'bone mineral reference', which will calculate and display mineral levels in bone and possibly gallstones. Research has also begun on '4D' digital tomosynthesis, which will enable doctors to examine and treat a patient using a single device, and on next-generation flat panels, which Suzuki claims will dramatically improve the sensitivity of X-ray imaging.

"While the market for medical X-ray systems is already mature, we are going to keep exploring new values to contribute to health and longevity," says Suzuki.

Hidefumi Suzuki
General Manager
Research & Development Department
Medical Systems Division
Shimadzu Corporation

Tomosynthesis opens up new opportunities in lung cancer screening

Shimadzu's SONIALVISION safire II is a new instrument for tomosynthesis that is contributing to the fight against lung cancer by providing high-definition imaging at lower exposure doses.

The SONIALVISION safire II at the National Cancer Center

Cancer is the most common cause of death in Japan, and the number of deaths from the disease continues to increase every year. According to the Ministry of Health, Labour and Welfare, lung cancer was the No. 1 cause of cancer death among men in 2008, and the No. 2 cause of cancer death among women. Lung cancer screening for early detection is normally performed by chest X-ray, which is effective for advanced cancers but has limited diagnostic ability for stage-one early cancers. Realizing the limitations of plain film for chest imaging in 1993, Noriyuki Moriyama, currently Director of Research Center for Cancer Prevention and Screening, the National Cancer Center of Japan, conducted the world's first lung cancer screening by computed tomography (CT), and increased the five-year survival rate from 49% by conventional screening to 84% by CT.

However, as the medical radiation exposure associated with CT becomes a global concern, Moriyama sees a major opportunity for digital tomosynthesis as a next-generation cancer-screening tool. He is presently working on clinical applications of this technology using Shimadzu's SONIALVISION safire II X-ray R/F (radiography and fluoroscopy) system, which is equipped with the 'safire' direct-conversion flat panel detector (FPD).

Technological revival of tomosynthesis

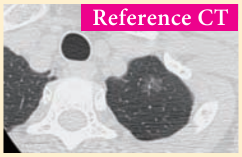
Tomosynthesis is a technology that enables a lab technician to easily obtain an image of any chosen section from a single tomography scan. In a scan, the target area is irradiated with X-rays from various angles, and the captured images are reconstructed using a computer. The technician can generate as many images of each slice as necessary in a single operation.

The theory of tomosynthesis was proposed before the advent of CT, and numerous attempts were made without success in acquiring clear images by conventional analogue tomography. With the widespread use of CT, analog tomography was becoming a technology of the past.

In 2003, Shimadzu developed a direct-conversion FPD technology that has led to the resurrection of tomosynthesis in the field of tomography. The development of the image intensifier, or X-ray imaging tube, saw a dramatic evolution of the X-ray detector, replacing the original photograph film technology. However, several challenges, including a narrower field of view and image distortion, remained unsolved until the introduction of FPDs, which also allow dynamic imaging. However, due to the diffusion of light converted from X-rays, the widely used indirect-conversion type of FPDs were still unable to achieve satisfactory resolution. Shimadzu overcame this drawback, and also made high-resolution video imaging possible, by developing a method of converting X-rays to electrical signals directly. This direct-conversion FPD technology has broadened the possibilities of image processing, and dramatically advanced the development of new applications, including tomosynthesis.

The SONIALVISION safire II can be equipped with a 17-inch wide-field FPD with features such as high-definition and high-density resolution, and is suitable for multiple purposes in a variety of examination areas, from the gastrointestinal tract to abdominal areas and orthopedics. Multiple slice images and an image of any chosen cross-section can be generated in just a few seconds by tomosynthesis. Active clinical applications are primarily in the orthopedics field, where tomosynthesis allows imaging to be performed while the patient is standing or bending the elbow or knee, or even wearing a cast. It also allows broken bones to be imaged when the patient has an artificial joint or other metal orthopedic implant. These are just some of the benefits of tomosynthesis that are not possible with CT. Another advantage

Comparison of Plain Chest X-ray Images and Tomosynthesis Images



H.U. of GGO
12 x 8 (mm) CT
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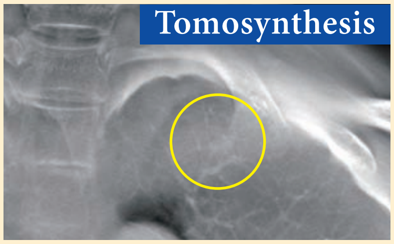

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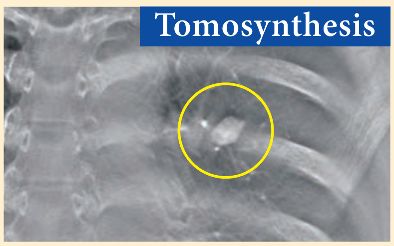
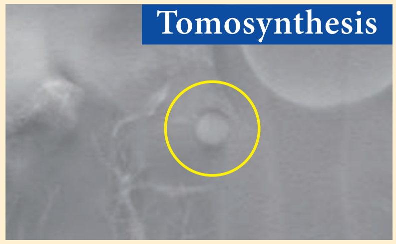
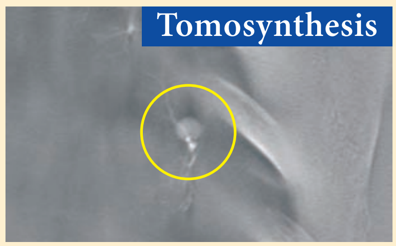
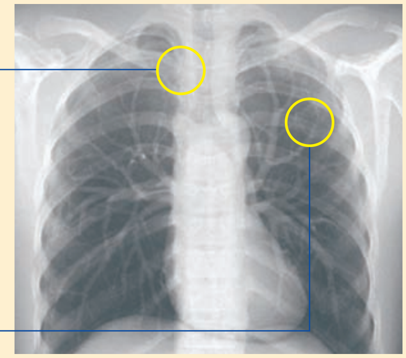


Test Results on Detectability of Simulated Tumor Using Chest Phantom

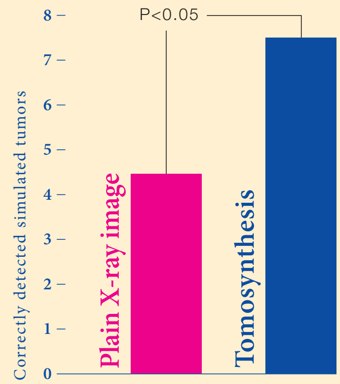






Simulated Tumors (two 6 mm spherical bodies) no one could spot in plain X-ray images.

Tomosynthesis Achieved Higher Detectability



The National Cancer Center

emphasized by Moriyama is the radically reduced exposure dose compare to CT.

Application to lung cancer screening

After graduating from Chiba University's School of Medicine in 1973, Moriyama aspired to become a surgeon. However, he came to realize the limitations in diagnostic techniques, and moved to the radiology department of the National Cancer Center in 1976. "I was going to return to the study of surgery after learning diagnostics, but I had so much to learn in this field," says Moriyama. Although he began using more reliable CT instead of plain film chest imaging in lung cancer screening, CT had some problems to be introduced to cancer screening because of the high exposure doses. Just as he was beginning to think that "we need something else, in addition to CT, to increase the rate of cancer screening," he heard about Shimadzu's tomosynthesis technology. "What surprised me was the capability to reduce exposure doses to this low level. It was really wonderful," recalls Moriyama.

According to Moriyama, tomosynthetic imaging produces images with far higher definition than plain film, enabling technicians to clearly observe the bronchus and the relationship between cancers and blood vessels. If the examination area of the lung is obscured, a different slice of image may be chosen for observation, allowing the area to be checked using an image that distinguishes cancer from surrounding tissue.

In lung cancer diagnosis, 'ground-glass opacity' is an indication of early stage cancer. Detection of regions of such opacity with a length of about 10 mm is generally sufficient for cancer screening because no medical procedures will be performed for tumors smaller than 5 mm. In the clinical application of tomosynthesis using a phantom (dummy), most 6 mm simulated tumors with ground-glass opacity were detected, and 4 mm tumors were also detected to a certain extent. With regard to solid nodules, even smaller ones were confirmed due to its high density. The acquisition of such high-definition images, equivalent to CT, at low exposure doses highlights the potential of tomosynthesis in contributing to elevated cancer screening rates.

CT is expensive and not easy to use, and the introduction of CT into small clinics would be difficult. In large hospitals, patients scheduled for CT scans are already on waiting lists of up to several months, and it is impossible to make the CT equipment additionally available for cancer screening. Tomosynthesis-based SONIALVISION is flexibly applicable for a range of examinations in addition to lung cancer screening. If the manufacture of tomosynthesis-based equipment increases and the price falls, "I would recommend tomosynthesis for a town clinic who can't afford to buy CT but needs to buy a piece of equipment for clinical examination," says Moriyama.

Today, physicians are busier than ever before, and they are having difficulty securing enough time to analyze images from examinations as they used to. "I hope that a peripheral device like a computer-aided detection (CAD) system will be added to the tomosynthesis processing so that we will be able to stop the video image or draw a marker in an area with suspicious conditions," says Moriyama. "What I'd really like to see is a unique product made only in Japan."

Noriyuki Moriyama

Director of Research Center for Cancer Prevention and Screening
National Cancer Center

Growing with China

Over the last half century, Shimadzu has grasped the opportunities presented by China's ever-changing market to step ahead of rivals in the competitive precision instruments industry.

Long before Japanese manufacturers rushed to China to explore business opportunities in the late 20th century, Shimadzu Corporation had firmed its foothold in this rapidly growing country. As early as 1956, the Kyoto-based precision instruments manufacturer started trading with China, and 23 years later it opened its first service center for analytical instruments in Beijing.

Since then, the presence of Shimadzu in China has grown steadily, with focus in the core areas of analytical and measuring instruments, medical devices and industrial equipment. Shimadzu now operates nine production and sales/service subsidiaries on the Chinese coast as well as 12 branches covering the rest of China. Among the 1,200 employees of Shimadzu in China, only 30 are Japanese, and many of the top positions in key divisions are headed by Chinese executives.

China is now the largest overseas market for Shimadzu, generating more than US$280 million in 2008, or 25% of the group's total international sales. In addition to sales and production, China is also becoming increasingly important for the Shimadzu Group's research and development strategy. Cementing this relationship, the group established the Shimadzu Research Laboratory (Shanghai) Company in 2007 to carry out basic research on mass spectrometry instrumentation.

"As China transforms itself from the world's factory to the world's R&D center, we have braced ourselves to provide comprehensive support for our Chinese customers," says Koji Furusawa, CEO of the Shimadzu International Trading (Shanghai) Company, which operates the inland branches.

The key to success in China, Furusawa says, is Shimadzu's strong commitment to developing and selling products specifically dedicated to the diversifying Chinese market. The company also provides a 'total solutions service' — a hands-on consulting service to assist customers in the use of their new Shimadzu instruments to best meet their objectives.

Analytical and measuring instruments generate about 70% of the total sales for Shimadzu in China. In the past, Shimadzu sold predominantly high-end, high-performance liquid chromatography instrumentation. New demand for middle- and low-end models, however, has continued to grow as the Chinese population becomes increasingly aware of health and safety issues such as pesticide residues in agricultural products and impurities in drugs, says Liu Wen Yu, General Manager of the Analytical Instruments Division. The mainstay products include the Shimadzu Prominence UFLCXR, an ultra-fast liquid chromatograph, and the Shimadzu LCMS-IT-TOF, a hybrid mass spectrometer.

Demand is particularly strong for industrial equipment such as the Shimadzu Turbo Molecular Pumps, and Shimadzu's Inline Plasma Chemical Vapor Deposition (CVD) System, which is widely used to deposit anti-reflective films on solar cells.

Although the rapid pace of economic growth in China has contributed to wealth, it has also cast a shadow over the health of the nation's people. "The rate of lung cancer is rising, and the only way to prevent it is early detection," says Akinori Yamaguchi, General Manager of the Medical System Department. He says the Shimadzu SONIALVISION safire, a new digital radiography system mainly developed for the diagnosis of stomach, is now being applied to the diagnosis of lung cancer using the digital tomosynthesis application. The machine's 'slot radiography' function is also particularly effective for orthopedic diagnosis.

The applications of Shimadzu's medical expertise are not limited to hospitals — following the devastating earthquake in Sichuan Province in 2008, a mobile Shimadzu X-ray system called MobileDaRt was used to provide efficient and speedy diagnosis of casualties in the worst-affected districts.

Shimadzu has an ample production lineup and benefits from many years of accumulated data and network development. To keep ahead of fierce competition from Chinese and Europe and the U.S. precision instrument manufacturers, Shimadzu continues to strengthen its total solution service and offers management training for employees, among other endeavors. "We would like to grasp precisely China's needs and provide optimal products tailored to Chinese customers. By doing so, we expect to contribute to Shimadzu Group's overall growth," says Furusawa.

Koji Furusawa, CEO

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The Faster, More Accurate AXIMA Resonance Mass Spectrometer Enables Comprehensive Research of Proteins Related to Cancer and Other Diseases, and to Drug Side Effects

The AXIMA Resonance system identifies and analyzes the structures of proteins related to diseases and to drug side effects. It offers up to 20 times higher sensitivity than previous instruments. Furthermore, since Shimadzu's proprietary MS^n function enables accurate large scale and large volume structural analysis, this system is particularly useful for comprehensive research of protein structures and functions. It also features new software enabling more intuitive operation, thereby improving research productivity.

Joint Development of BMI Technology by Honda, ATR*1, and Shimadzu to Enable the Control of Robots Simply by Thought

Shimadzu, Honda, and ATR have jointly developed the world's first*2 brain machine interface (BMI) technology, which allows operators to manipulate the hands and feet of a humanoid robot without physically pressing any buttons or other controls. Instead, sensors on the operator's head capture the changes in brainwaves and cerebral blood flow activity as the operator imagines moving their hands or feet. The development team hopes to combine this approach with intelligence technology and robot technology to develop products that enhance quality of life.

*1 Advanced Telecommunications Research Institute International
*2 Based on an investigation by Honda

BRANSIST safire VB9 Slender Bi-Plane Package Angiography System Offers Improved Features to Support Neuroendovascular Therapy

This system is designed to create and display three-dimensional images of the complicated vascular blood flow patterns in the brain. Since 3D cerebrovasular images of the patient are synchronized with real-time imaging during clinical study, the pathway for inserting catheters into blood vessels can quickly be confirmed. This makes for smoother examinations and treatment, and puts less stress on the patient by reducing the total X-ray dose and injection volume of contrast media.

Release of AGS-X Series Autograph Tabletop Precision Universal Tester, which Offers High-End Precision, Functionality, and User-Friendliness

This system performs tensile, bending, compression, and other strength tests for a variety of materials (including plastics, rubbers, and films) used in many industries, such as automotives and electronics. This model is designed for quality control departments, and offers the precision and functionality of high-end models at a more affordable price. The Trapezium Lite X software includes macro functions that make it easy to perform even complicated processes, and dramatically improves testing productivity.

GC-2010 Plus Capillary Gas Chromatograph Detects Ultra Trace Contaminants and Impurities in Foods and Pharmaceuticals With Up To 4 Times Higher Sensitivity

The improved detectors in this system detect ultra trace quantities of hazardous substances in food products, pharmaceuticals, and the environment, achieving four times the sensitivity of previous models for the detection of residual pesticides and odor-causing substances such as organic phosphorous and sulfur-based compounds. The reliability of repeat analyses has also been improved to provide stable analytical results.

Mobile X-ray "Mobile Zoo" Designed for Pediatric Hospitals to Allay Children's Anxiety and to Facilitate Diagnostic Tests

A "Mobile Zoo" has been designed for pediatric health care, based on the concept "Big Smiles for Children." Decorating MobileDaRt Evolution and MobileArt Evolution with animal decals helps to reduce children's fear and anxiety, leading to smoother positioning. It is also expected to alleviate the blurred images during examinations caused when children are crying. With a maximum output capacity of 32 kW, Mobile Zoo provides quick radiography. This ensures sharp images with minimal blurring, even if the patient moves.

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