HITACHI
Inspire the Next

HITACHI TECHNOLOGY 2001–2002

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Laying the Groundwork for the Ubiquitous Information Society

I am very pleased with the release of *Hitachi Technology 2001-2002*, and I am confident that this report will give people a deeper and more comprehensive understanding of Hitachi.

Surveying the current business climate in this first year of the 21st century, we can clearly see from the global-scale mega-competition and Internet-based global network that have emerged that a massive paradigm shift is under way, impacting both business and society at large. With the recent announcement and implementation of the company's intermediate management plan, the "*i.e. HITACHI Plan,* " Hitachi is very much in the forefront of these developments as we continue our quest to become our customers' best solutions partner.

This expression "*i.e. HITACHI*" represents Hitachi's use of *knowledge* and *IT* that supports the company's information electronics, and signifies our commitment to offer and provide a full range of optimum solutions that are precisely tailored to our customers' needs. *Knowledge* denotes Hitachi's extensive expertise and know-how. The company's competence has grown steadily through wide-ranging achievements and strategic partnerships and alliances. It is based on technical expertise gained through numerous large-scale infrastructure projects and on state-of-the-art know-how in the latest technological fields. This *knowledge* is coupled with *IT*, the technical expertise to build and integrate high-performance, dependable systems.

Hitachi's *knowledge* and *IT* are applied not only to information systems, but are also applied extensively to financial systems, power and industrial systems, transportation systems, and other areas of infrastructure support. The company's strengths in *knowledge* and *IT* are also exploited to provide services and solutions that are closely tailored to each customer's needs in a host of new business areas that have emerged relating to the environment, energy, life science, multimedia, telecommunications, and more.

Today we are witnessing a rapid migration toward a *ubiquitous information society* in which anyone will be able to connect to the network anytime and anywhere. The advent of the *ubiquitous information society* will dramatically increase people's freedom of action and profoundly transform the values of individuals and companies alike, for it will open up many more possibilities for people to do what they truly want and move toward realization of their dreams. In laying the groundwork for this society, our role will be that of a total provider, one who not only furnishes the communications infrastructure and storage systems for the network society, but also one who provides information and security-related technologies and a host of other capabilities based on the vast experience and expertise that Hitachi has gained over the years.

Hitachi has unveiled the name *Cubium* as a company-wide brand name for Hitachi's net service, which is designed to approximate the ideal net society. Under this brand name, the entire Hitachi Group will provide fully secure and easy-to-use net services, provided the latest cutting-edge technologies to the full spectrum of customers, from corporate clients to individuals.

Inspired by our corporate slogan "*Inspire the Next*" and committed to being a leader in providing inspired and innovative solutions to the next generation, Hitachi is actively engaged in implementing a comprehensive brand management program. By leveraging the Hitachi brand—one of the company's most valuable assets—and by further consolidating the strengths and capabilities of the entire Hitachi Group, we can enhance the value of our brand even more and make further progress toward our goal of becoming the most reliable *best solutions partner* to our global clientele.

Let me thank you in advance for redoubling your commitment to lead and support Hitachi in its efforts.

Etsuhiko Shoyama
President

"Lightning9900 Series" –the world's fastest, largest capacity disk array subsystem–

In the backdrop of rapidly expanding Internet business, the volume of data being distributed over networks is increasing at a dramatic rate. At the same time, activities such as the integration of information systems that accompany corporate mergers and tie-ups, as well as the construction of data warehouses for rapid analysis of large volumes of data, are becoming increasingly important elements of corporate strategies. For this reason, Hitachi, Ltd. released in June 2000 "Lightning9900 Series," a super-large scale disk array subsystem—largest (27 Tbyte) and fastest in the world—for use in storage area networks (SANs). The goal of this subsystem is to achieve "storage consolidation," which will support high-speed information applications and storage integration for data accumulation.

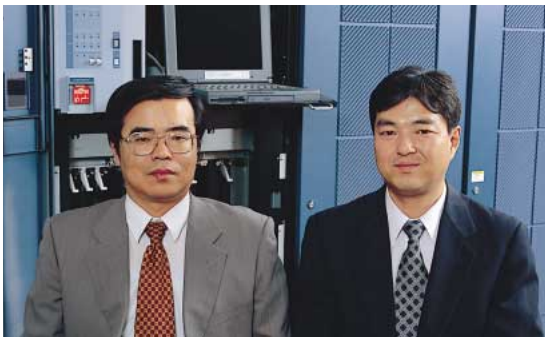
Adopting the World's First Hierarchical Star Network Architecture

—Background

"Because Internet business involves interactions with large, unspecified numbers of customers and terminals, data traffic volumes can change suddenly, and are extremely difficult to predict. Furthermore, while non-stop services operating 24 hrs a day, 365 days a year, are becoming essential, the number of servers is also increasing drastically with the addition of new services and new users. In this context, much attention has been drawn to SANs, which establish connections between storage units and the multiple server mainframes located throughout large companies through the use of 'Fiber Channels'—next-generation high-speed interfaces that will take the place of existing SCSIs (small computer system interfaces). The recently developed Lightning9900 Series have achieved a level of performance unequalled anywhere in the world, by incorporating many forms of advanced architecture aimed at attaining unprecedented speed, capacity, connectability, and reliability in large-scale SAN environments."

—Main Features, and the Technologies Used to Achieve Them

"Features the world's largest capacity disk drive with a speed of 10,025 rpm and a memory capacity of 73 Gbytes. The subsystem capacity has been expanded to 27 Tbytes—the world's largest—which is equivalent to about 3.6× that of existing units. The system can also accommodate up to 32 Gbytes of cache memory; the number of ports for simultaneous data transfers with Fiber Channel server connections has been increased to 32—twice that of existing units—and disk drive data transfer performance has been increased to a maximum of 100 Mbyte/s—five times the speed of existing units—through the adoption of Fiber Channels. This system is the first in the world to adopt 'Hierarchical Star Network Architecture,' which connects the cache memory and controller on the system side and the disk drive side using a high-speed, 6.4 Gbyte/s switch, thus increasing internal transfer capabilities to eight times that of existing units. In this way, the system increases the subsystem's data access processing capabilities to four times that of current systems, providing stable accessibility even in the case of large-scale storage consolidation."



Yoshinori Okami, Chief Engineer (left) and Dr. Yasuo Kurosu, Chief Engineer (right), of the Disk Array Systems Division, the Information & Telecommunication Platform Systems; both were involved in the development of the Lightning9900 Series, the world's fastest and largest-capacity disk array subsystem.

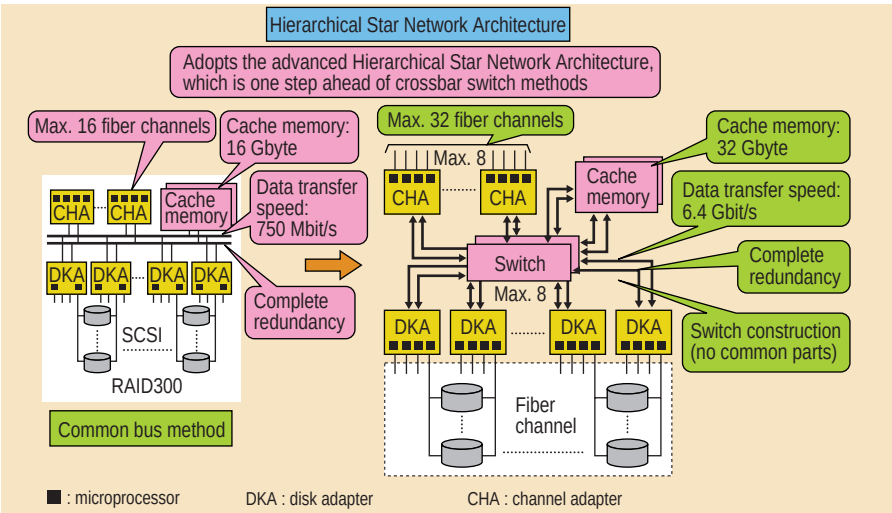
Achieving High-speed Back-up and Data Sharing

— Features of Solutions

"With the support of the integrated storage solution 'Storeplaza,' we have significantly improved both reliability and efficiency of data operations. 'Data Protection Solutions' achieve such features as redundancy of remote data, including asynchronous modes, between disk array subsystems not connected via a host, and a function that enables parallel processing of on-line back-up batch operations through the creation and use of a volume replica within the subsystem. In 'Data Sharing Solutions,' we have developed such functions as sharing of disk volumes between differing platforms for high-speed data exchanges and volume-by-volume back-up and restoration of open system data using mainframe back-up software. 'Storage Management Solutions' offer an environment that enables SAN-connected storage and operation of connection devices using unified procedures."

— Developments in the Future

"Naturally, we will be pursuing even greater speeds and larger capacities, but in addition we hope to create software that enables the use of storage resources without concern for the SAN environment, thus offering an easy-to-use operation environment for a wide range of platforms."



Lightning9900 Series architecture

Position Location Technology Applicable to Enhanced 911 Calls

Attention has begun to focus on new services using position information as a new function of mobile phones. The trigger was the request of Federal Communications Commission(FCC) in the United States that all mobile phones shall have position location function for emergency calls with accuracy within 50 meters for 67 percent of calls. This requirement is well known as Enhanced 911 (E911). The method currently used to locate position is Global Positioning System (GPS). GPS is accurate for outdoor, especially open sky circumstances, but it is difficult to locate positions indoors. Hitachi, Ltd. has developed a new position location technology without GPS which is applicable to E911 both outdoors and indoors.

Mikio Kuwahara (left) and Katsuhiko Tsunehara (right) of the Communication Systems Research Department, Central Research Laboratory, where Hitachi's new high-precision position measurement technology for mobile phones was developed.

Hitachi's New Position Location Method

—Improvement of Indoor Availability

"The well-known position location method is GPS, which receives signals from satellites and calculates the position of the mobile terminal from propagation distance of those signals. Signals from GPS satellite are very weak, so these signals are hard to be detected indoors, and it makes GPS poor indoor availability. Hitachi succeeded to develop a new method that conquered this difficulty. As Hitachi's new method achieved position accuracy within 50 meters for 67% of calls both outdoors and indoors which satisfies E911 requirement, users are able to obtain position information services without concern for their locations, which represents a substantial increase in serviceability."

—How Are You Locating Positions?

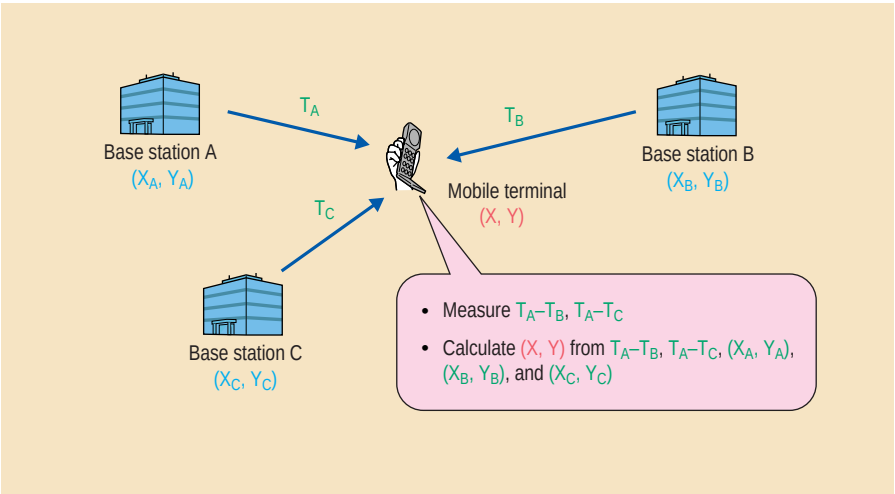
"In Hitachi's method, wireless base stations take the place of the satellites; the position of the mobile terminal is determined based on the signals transmitted from these base stations. Signals transmitted from multiple wireless base stations are received simultaneously by the mobile terminals; the distance between mobile terminals and each base station is then measured based on the arrival interval for these signals, and the position is calculated by the principle of trilateration using these distances. In order to minimize measurement error, we have developed new signal processing technologies that enable detection of weak signals from distant base stations, and technologies for making optimum selection of which base stations to use."

—Reduction of Size and Cost of Mobile Terminals

"Because Hitachi's method does not require extra antenna and receiver for GPS signals, it is possible to achieve a reduction in both the size and cost of mobile terminals. Position information can be obtained simply by installing a signal processing chip inside the phone unit, and the customer enjoys the merit of being able to use position information services using terminals that are the same size as mobile phones currently in use."

Position Information Services

"In the United State, the E911 call becomes obligatory from October 2001 and position information is predicted a drastic increase in demand. In Japan, attention is being focused on a variety of new services; for example, 'human navigation,' which searches and displays a path from a pedestrian's current position to his or her destination; 'spot information searches' for displaying information on shops in the immediate area; functions to confirm the location of children and aged people who have wandered off; and the management functions for checking the position of sales staff to enable efficient and centralized dispatching. Our goal is to move into the field of positional location in mobile phones by compact, low-cost terminals and their ease of use in any locations."



Conceptual drawing of position measurement using mobile phones

e-Government Showroom

In the backdrop of the rapid popularity of the Internet and Information Technologies, many have become aware of the urgent need to establish "e-Government" that will provide a variety of government services in a speedy, one-stop format. In order to achieve this, Hitachi, Ltd. has developed e-Government Solution, a set of e-Government solutions to support the creation of a high-value added e-Government that incorporates activities in all levels of government offices and municipalities, as well as private corporations and citizens. Moreover Hitachi has opened Japan's first dedicated e-Government showroom. In this showroom, people can experience e-Government mock systems and also exchange a wide range of valuable information.

Three staff members at the e-Government Project Promotion Department, the Government & Public Corporation Information Systems Division, which developed the set of e-Government Solution: Naoya Matsumoto, Section Manager (left); Yoshito Ohkawa, Section Manager (center); and Noriko Kosuge (right).

Targeting Richer Lifestyles for Citizens

—What Are the Merits of e-Government?

"The advantages are clear, I think, if you imagine that government offices which were only open between 9 am and 5 pm will now be 24 hours a day, 365 days a year. Through the use of information technologies, government operations will become more advanced and more efficient. At the same time, citizens will be able to obtain a wide range of services—including paying taxes, receiving benefits, and freely accessing information—in a one-stop format via their own PCs and the Internet. Companies, meanwhile, will be able to file applications and enter bids for public undertakings fairly and in real time, which will in turn lead to increased speed in decision-making processes and improved strength in global competitiveness."

—Features of e-Government Solution

"e-Government Solution is comprised of four main elements: 'Government Service Infrastructure Solution,' which is based on Hitachi's proven technologies on authentication, encryption, IC card and network infrastructure; 'Government Service Development Solution,' which enables the creation of specific operations including e-applications, e-notifications, e-procurement, and information disclosure; 'Government Service Outsourcing Solution,' which reduce system development and operation costs through the use of highly reliable data centers, ASP services, and other related resources; and 'Government Service Consultation Solution,' which support evaluations not only of information systems but of service operations as a whole. The greatest strength of e-Government Solution is that it offers comprehensive support, from consulting through to development, operation, and evaluation of e-Government systems. An systematic combination of these components and services enables the construction of advanced, secure, high-quality e-Government systems, in a short time and at low cost."

The Showroom also Functions as a Venue for Information Exchange

—The Role of e-Government Showroom

"e-Government Showroom is a place where visitors can experience and evaluate 21st-century government services, but at the same time it functions very effectively as a place for us to hear a wide range of opinions and requests with regard to e-Government. Since it was opened in March 2000, the Showroom has welcomed far more visitors than was originally anticipated, including the Prime Minister himself and representatives of central and local government agencies. Visitors have given us some very positive feedback after seeing the presentations—for example, 'I got a clear image of e-Government for the first time' and 'I can now see which issues require immediate attention.' This feedback is a great encouragement for the whole staff."

—Future Developments

"While continuing to offer services in keeping with the implementation schedules for laws such as Foundation Law for Information Technology, we will expand on our presentations in the showroom using mobile phones, PDAs (personal digital assistants) and other mobile devices. We also hope to continue offering the best possible comprehensive proposals to ensure that Japan's government services are among the best in the world."

Dedicated e-Government Showroom

"AMN6100" 1.28-Tbit/s Ultra-long Haul Wavelength Division Multiplexing Transmission System

Amid drastic increase in volume of network data communication due to rapid increase of Internet and Intranet usage, attention is being focused on DWDM (dense wavelength division multiplexing) systems that will form the core of next-generation ultra-long haul and large capacity communication era. With this in mind, Hitachi, Ltd. has developed "AMN6100" DWDM system which achieves ultra-long haul transmission of over 1,040 km as well as high capacity transmission of up to 1.28 Tbit/s (10 Gbit/s × max. 128 channels). Hitachi is actively marketing this system in North America.

Junya Kosaka, Engineer (left) and Yoshihiro Sugeta, Senior Engineer (right) of the Telecommunication Systems Division, Information & Telecommunication Platform Systems; both engineers were involved in the development of the "AMN6100," a 1.28-Tbit/s ULH wavelength division multiplexing transmission system.

Ultra-long Haul Transmission (1,040 km) of Capabilities up to 1.28 Tbit/s

— Features of the AMN6100

"In the North American market, reducing facility cost and eliminating communication fee's dependence on distance are becoming essential conditions for telecommunication carriers to win fierce competition among them. In order to succeed, carriers require ULH (ultra-long haul) systems that can transmit great distance without interruption. ULH systems can minimize traditional regenerator terminal even when transmitting high-capacity gigabit or terabit class DWDM signals. With 'AMN6100,' Hitachi has simultaneously achieved large transmission capacity of 1.28 Tbit/s and ultra-long haul transmission distance of 1,040 km. This distance is more than double the previously attainable distance of 450 km. Furthermore, by adjusting the gain of individual wavelength, we are proud of the fact that we can offer a major advantage by ensuring overall system robustness. With an AGC (automatic gain control) function, gain of individual wavelength is adjusted to dramatically reduce fluctuation in multiplexed output."

— The Technology That Achieves Ultra-long Haul Transmission

"There are two core technologies. One is GTC (gain tilt compensation), and the other is 'Low Noise Figure' amplifier. First, in reference to GTC, DWDM uses such method that wavelengths of differing colors are multiplexed and amplified with an optical amplifier, and are sent from one end terminal to another. At an end terminal, wavelengths are broken down to individual wavelength. However, problems arise due to optical characteristic known as 'gain tilt.' In long distance transmission, the signal that has color with high power becomes distorted, and the signal that has color with weak power is vulnerable to noise. To respond to these issues, we have installed a GTC amplifier that automatically compensates the 'gain tilt' at a relay site, thus enabling constant and stable long-haul transmission. Meanwhile, as the number of amplifiers increases — that is, the closer we come to achieving ultra-long haul transmission — the amount of noise also increases. 'Low Noise Figure' technology dramatically cuts this noise, and enables even weak optical signals to be received. AMN6100 adopts this 'Low Noise Figure' technology in each amplifier, including GTC, to improve the amplifier function by as much as 3 dB compared to traditional amplifiers."

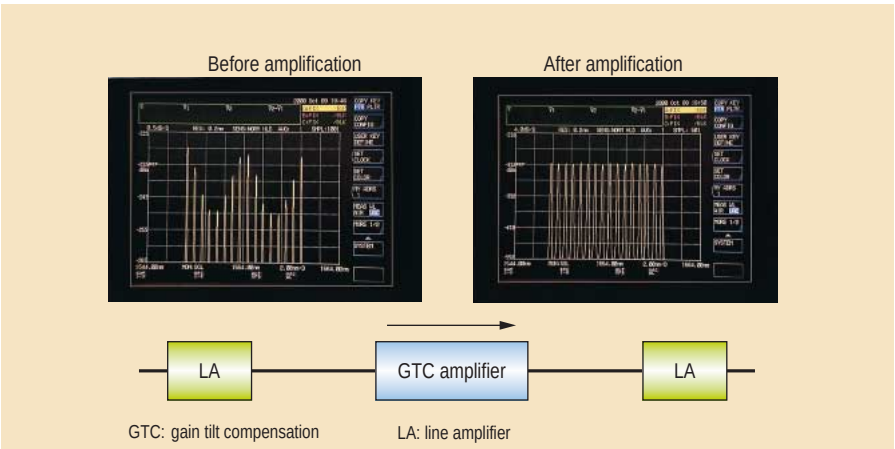
Achieving High Capacity with L-band Extensions and 50-GHz Channel Spacing

— The Technology to Achieve High Capacity of 1.28 Tbit/s

"In addition to red-band and blue-band which are the conventional optical wavelength bands, we have adopted L-band extension function that can expand the wavelength band even further. Furthermore, we have made possible to offer a flexible and low cost network by allowing L-band extension at a later date when the customer requires it without risking any degradation to ULH characteristics. Previously, WDM wavelength interval was set at 100 GHz, but we have now developed 50-GHz channel spacing, thus doubling the previous wavelengths. This new technology increases the accuracy of the color of each wavelength. What this means is that we have achieved high capacity transmission of up to 1.28 Tbit/s (10 Gbit/s × max. 128 channels), by taking advantage of both the L-band extension, which expands the overall wavelength capacity and 50-GHz channel spacing, which narrows the wavelength transmission interval. Currently, several major North American carriers are deploying this system."

— Future Developments

"We will continue to provide an ever-evolving AMN6100 System while promoting development of technologies and solutions that will achieve high-capacity, ultra-long haul communications."



Example of a GTC transmission spectrum

"DVD World" — finding endless new ways to enjoy multimedia —

DVD-RAM (digital versatile disc random access memory) has gained much attention as a media for integrating the fields of Audio-Visual (which is seeing great advances in digital image and sound technologies) and PCs (which are characterized by increasingly large capacity hard disks), due to its very high compatibility with both of these fields. Aside from taking the initiative in the standardization of DVD-RAM in its capacity as chairman of the "DVD Forum"—a working group that promotes the international standardization of DVDs—Hitachi, Ltd. also promotes the development of digital consumer devices that incorporate DVDs based on the concept of "DVD World," and has commercially released the world's first DVD video camera and DVD video recorder.

The World's First DVD Video Camera: Recording Images on DVD-RAM

—The "DVD World" Concept

"'DVD World' is Hitachi's own original concept word—the aim is to easily create links among various high-volume image information sources using DVDs, which offer high compatibility with both AV fields and PCs, while at the same time offering customers a wide range of ways to enjoy these contents. In the past, Hitachi has developed and commercially released first-generation DVD-RAM drives (2.6 Gbyte/face), followed by second-generation DVD-RAM drives (4.7 Gbyte/face) that offered increased density and speed, as well as PCs with these drives built-in. Now, as an extension of its line of consumer-oriented products based on these technologies, Hitachi has developed the world's first DVD video camera and DVD video recorder."

—Features of the DVD Video Camera

"In order to achieve more compact bodies as well as attain lower power consumption and improved picture quality, we have developed, for example, a dedicated 8 cm (1.46 Gbyte/face) DVD-RAM disk drive, a low power consumption MPEG-2 codec LSI, and technologies to improve vibration resistance. In this way, we have enabled 60-minute video recording per disk in high-resolution mode and 120-minute recording in long-play mode, as well as recording of high-resolution still images (1,280 × 960) on the same disk. One of the advantages of using DVD-RAM is to manage unrecorded disk sectors with accuracy, eliminating any risk of overwriting valuable images whenever the 'record' button is pressed. A 'disk navigation' function allows the user to quickly search for a desired video segment using a thumbnail index display, and the DVD video camera unit itself even offers functions for editing and playback order rearranging. Because the recorded disks can be used on PCs with built-in 4.7-Gbyte DVD-RAM drive, software products from various software manufacturers enable mutual editing and playback functions, as well as video file e-mail attachments and inclusion as home page contents — in other words, flexible media applications that were not possible with previous systems."

Masuo Oku, Manager of the Digital Media Systems R&D Division, Digital Media Group (left), and Masanori Yoshino, Manager of the Digital Media Systems Sales Division, Digital Media Group (right). Both managers are involved in the development of products related to video disk technologies.

In Pursuit of Even Higher Compatibility

— Features of the DVD Video Recorder

"This unit allows recording of up to four hours of high-quality images on a 12-cm DVD-RAM disk, and enables the user to maintain a digital video collection with high resistance to image deterioration. Unlike videotapes, there is no risk of images being accidentally overwritten, and the user can quickly jump to search for a desired video segment. Another notable feature is that the disks recorded using a DVD video camera can be replayed directly, simply by placing them in the tray of a DVD recorder. We feel that our ability to put to use long years of technical experience and know-how cultivated through our work in DVD-ROM and DVD-RAM drives for PCs allowed us to develop a marketable consumer product ahead of any other manufacturer in the industry."

— Future Developments

"First of all, we plan to market a DVD video player with a DVD-RAM playback function. Then, we would like to further expand the 'DVD World' concept, using a single media type to creating links among a wide range of devices while gradually establishing compatibility with as many DVD video player types as possible."

Hitachi's "DVD World" concept

GO TO THE RELEVANT SITE

Kiln-type Gasification/Melting Systems and Dioxin Precursor Monitors that Contribute to Reductions in Dioxin Levels

Some 70-80% of dioxins—which have drawn attention recently in the context of environmental problems—are discharged from refuse incinerators. Hitachi, Ltd. has developed a "Kiln-type Gasification/Melting system—a next-generation refuse incinerating plant that dramatically reduces dioxin discharge—in efforts to resolve this problem in newly installed incinerators. In a further effort to improve even existing plants, it now offers the world's first commercially available "Dioxin Precursor Monitor," which provides, online and in real time, a new index aimed at reducing dioxins.

Toshio Nakahira, Senior Engineer (middle) and Satoru Ohashi, Senior Engineer (right) both of the Environment Systems Business Division, Power & Industrial Group, were involved in the development of the Kiln-type Gasification / Melting System; and Jōji Honda, Manager (left) of the Environmental Systems Cluster, Instruments, was involved in the development of the Dioxin Precursor Monitors.

Dramatic Reductions in Dioxins Through High-temperature Combustion

— Features of the New Processing System

"The Kiln-type Gasification / Melting System combines a gasification furnace, which is based on technologies developed by THIDE Environment Co. in France, and a rotary melting furnace based on Hitachi's original coal gasification technologies. Refuse is steamed under oxygen-free, low temperature conditions in a gasification furnace and decomposed, so that metals and other valuable resources can be recovered in a form that allows reuse of these materials. Then, the remaining materials are subjected to high-temperature combustion (1,300–1,400°C) in a melting furnace, thus dramatically reducing dioxins. Ash containing dioxins are melted into slag, transformed into harmless waste, and recycled, for example, as materials for use in making roads. This system—which produces about 30% less exhaust gas than existing incinerators, and through exhaust gas processing reduces dioxin concentrations to within tenth parts of regulation levels—is extremely effective in cutting dioxins released into the atmosphere, and in modifying ash into a harmless, reusable form."

— Merits in Terms of Operation—

"The gasification furnace and the melting furnace can be operated separately, making it possible to implement an independent carbonization system centered on the gasification furnace segment. The carbon fuels that can be derived from this carbonization system are easy to transport and can also be stored, so can be carried from individual municipalities to a shared melting furnace for wide-area processing. The pyrolitic gas derived from gasification of refuse is used as a heating source for gasification furnaces, enabling reduced running costs as well as reductions in the volume of CO_2 generated when using other outside energy sources. The gasification furnace also offers space-saving effects; for example, the dryer for removing moisture from waste materials has been separated from the rotary kiln, reducing the total length of the furnace by around 50% in comparison to traditional configurations."

Reduction Indexes Offered in Real Time

—In the Background of the Development of Dioxin Precursor Monitors

"In order to develop technologies to reduce the dioxins discharged from refuse incinerating plants, it is essential to measure the discharged dioxins quickly and continuously. Because the volumes of dioxins contained in exhaust gas, are extremely minute and difficult to measure, however, in the past it took several weeks before measurement results could be obtained. To resolve this problem, we now offer the "CP-2000" Dioxin Precursor Monitor, which focuses on chlorophenol—a dioxin precursor demonstrating a strong correlation with dioxin concentrations in exhaust gases—as an alternate index for these dioxins. Furthermore, because it executes continuous measurements as it takes in combustion exhaust gases discharged from refuse incinerating plants, it allows rapid measurement results within one minute of the actual condition being measured. Our Dioxin Measurement Technology Development Team received an award at the 10th Nikkei Global Environmental Technology Awards in 2000 for its significant contribution to resolving the problem of dioxin pollution."

—What Types of Effects Can Be Expected?

"By combining this monitoring device with a variety of dioxin reduction technologies, it is possible to optimize operation and management of refuse incinerating plants, thus reducing the volumes of dioxins generated. In addition to operation and management, it also contributes to reductions in development time, by offering rapid indexes that are effective in the context of research and development targeting facilities for reducing dioxin levels."

Demonstration plant for Kiln-type Gasification / Melting System

Targeting Total Solution Services by Sales Scientists in the Genome Business Field

Japan, which has always trailed behind the United States in the field of Genome Business, but over the past few years, we have finally begun to gain a reputation as having attained a comparable level of ability. In the field of pharmaceuticals development, the genome-related information that in the past had been maintained independently by pharmaceutical manufacturers—as well as the information that will be required in the future in this field—has grown to such an extreme that it is no longer possible to process this information in-house. This situation gave rise to the practice of outsourcing for data analysis starting two or three years ago. Hitachi, Ltd. thus established in October 1999 a "Life Science Group"—which specializes in providing services related to genome information—thus setting out to respond to needs of companies in Japan and throughout the world.

Yoshinori Harada, Department Manager, Planning Division, Life Science Group (left), and Takeshi Sakamoto, Manager, Proteomics, Life Science Group (right), who began the system of total solution services offered by sales scientists.

Total Processing of Analysis Services

— Background to the Establishment of the Life Science Group

"Hitachi has a long history spanning some 50 years of work in biotechnology, including the fields of waste water processing and bacteria cultivation. There was a biotechnology boom in Japan about 20 years ago, and while many companies participated, including electrical device manufacturers, most have withdrawn from the business since then. Hitachi established an Advanced Research Laboratory in 1985, and has conducted continuing research in the fields of DNA and proteins. Around ten years ago, genetic information generated using genetic engineering technologies and other means came to be used in industry, and human genomes quickly began to attract attention. In this backdrop, Hitachi put to work the capabilities it has accumulated to start up a Life Science Group in October 1999."

—Activities of the Life Science Group

"The main activities of this business group involves mainly practical information provision services; this includes analyses of gene expression, protein functions, gene polymorphism, and DNA sequences; in addition, this group processes information using 'Bioinformatics' (software for clarifying bio-information) and adds related information to provide to customers. There are two types of Analysis Services :'Dry' services, which involve information processing and development of analysis devices for obtaining high value-added information, and 'Wet' services, for analyzing 'live' samples. The special feature of Hitachi's Life Science Group is that it can handle both types comprehensively. Our group is the only one in Japan that can provide both services in an integrated format; in fact, we are likely one of the few in the world that can accomplish this. We use a specialized genome analysis technology called a 'Multi-capillary' method, as well as an original temperature control technology for SNP (single nucleotide polymorphism) analysis. Both of these are considered world-leading technologies."

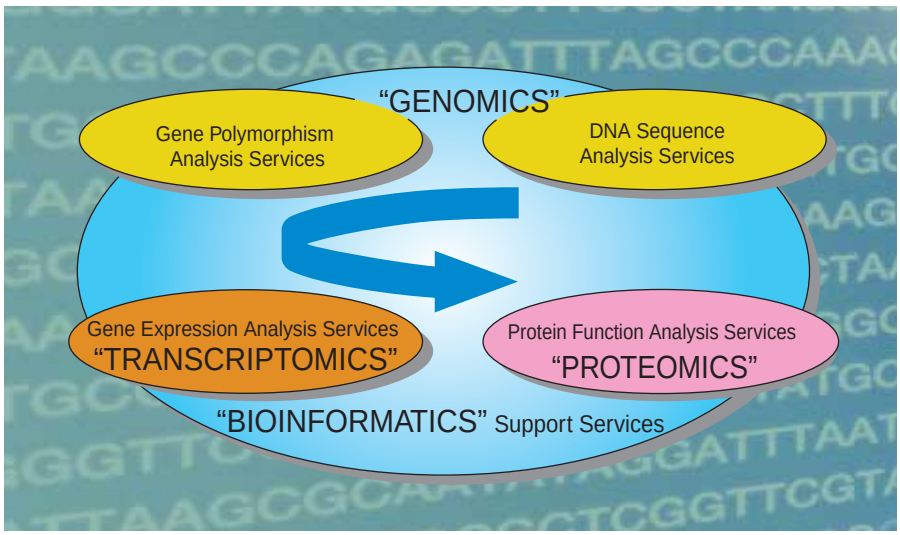
The Role of the Sales Agent

—Sales Points of the Life Science Group

"Due to the large number of negotiations with pharmaceutical manufacturers and researchers, the sales person cannot carry out meaningful interactions without a measure of specialized knowledge. For this reason, we have researchers with Ph.D.s visit the customer's location themselves. We call these individuals 'Sales Scientists.' When consulting with pharmaceutical manufacturers, they don't simply provide data, but rather fulfill the role of a true 'solutions partner,' with knowledge on a level with the researchers, and taking the initiative in terms of both know-how and the sharing of 'Intellectual Property.' This is the task carried out by the Sales Scientists."

—Outlook for the Future

"Rather than just providing data, the Sales Scientist actually becomes involved in health and medical research, acting as a partner for researchers, pharmaceutical and food product manufacturers, and companies in the agri-biotechnology field. In the future, we hope to create an original database aimed business activities based on the creation and sales of Intellectual Property. We will also cooperate with companies in the U.S. and other countries, opening up sales routes not only in Japan but in various countries and regions throughout Asia and Oceania as well."



Solution service menu

Perpendicular Magnetic Recording at 52.5 Gbit/in^2 (approx. 6.45 cm^2)

In the backdrop of the increasing popularity of the Internet and multimedia, the memory capacity demanded from hard disks has continued to increase in recent years. Using current longitudinal recording methods, however, increasing recording density gives rise to concerns regarding "thermal fluctuation"—that is, that data on the disk may be erased due the effects of heat—and there have been demands for the rapid establishment of an alternative technology. For this reason, Hitachi, Ltd.—on a commission from the Association of Super-Advanced Electronics Technologies, and in cooperation with Research Institute of Electrical Communication of the Tohoku University and the Akita Institute of Advanced Technology—became the first in the world to succeed in verification tests of a perpendicular magnetic recording method that achieves an areal recording density of 52.5 Gbit/in^2 (approx. 6.45 cm^2), taking the first major step toward practical applications.

Masaaki Futamoto, Chief Researcher (left), and Hisashi Takano, Department Manager (right), of the Central Research Laboratory's Storage Research Group, who were involved in R&D and verification tests for the perpendicular magnetic recording method.

Achieving High Recording Density in a Compact Space

—What is the Perpendicular Magnetic Recording Method?

"Traditional longitudinal magnetic recording methods, which use magnetization of the disk surface and in parallel directions, are extremely susceptible to 'thermal fluctuation'—by which magnetized information gradually disappears due to heat energy—and so it has been noted that the limit for areal density was around 50–100 Gbit/in^2 (approx. 6.45 cm^2). In contrast, in Perpendicular Magnetic Recording methods—using a method proposed in 1977 by Shin'ichi Iwasaki, Professor Emeritus at Tohoku University —currently President of the Tohoku Institute of Technology, recording layers are magnetized in a perpendicular direction. Stated simply, it is possible to achieve high recording density in a compact space by closely packing bar magnets standing upright and bundled with alternating N and S poles."

—Merits in Comparison to Traditional Methods

"Because it not only improves recording density but also allows in increasing in the volume of the magnetic particles in the recording layers, this technology features strong resistance to thermal fluctuation. This method has already received extremely high evaluations as a technology for dramatically increasing the recording density of hard disks. There are still many technological issues to be overcome, however, and longitudinal magnetic recording methods have also demonstrated the potential for expanded capacity through continued improvements. As a result, manufacturers other than Hitachi have abandoned research into Perpendicular Magnetic Recording methods. The perpendicular magnetic recording method for which we have conducted successful verification tests offers the same level of recording density as the latest in existing technologies; in the future, we expect to surpass a midway point of 100 Gbit, eventually achieving super-high density of over 1 Tbit/ in^2. In this sense as well, there is no doubt that this technology will represent a major breakthrough in the process of hard disk evolution."

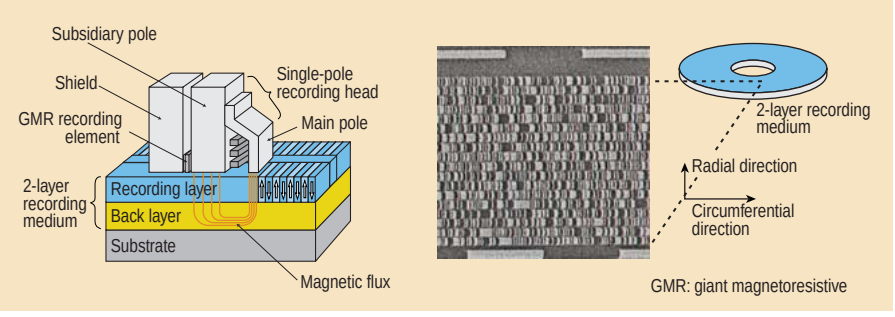
Newly Developed Single-pole Heads and 2-layer Recording Media

—Technical Factors in Successful Applications

"Perpendicular Magnetic Recording technologies achieve high-density recording through the use of 'Single-pole Recording Heads' and '2-layer Recording Media.' The current joint research team has produced a head that combines a Single-pole Recording Head using an alloy with high saturation flux density with a Playback GMR (giant magnetic resistance) head using the same production line, and has set a target for volume production. In terms of the 2-layer recording media, by further reducing the grain size of the magnetic particles that make up the recording layer and controlling the crystal orientation, it has succeeded in both reducing noise and increasing playback output signal. It is also promoting development aimed at practical application of an LSI for optimum signal processing in perpendicular recording channels."

—Future Developments Targeting Practical Applications

"There are still many issues to be overcome, but we are targeting product release, and development is proceeding with the combined efforts of the entire operation division. For example, if this technology is incorporated into the 2.5" hard disk in a notebook PC, it should be possible to increase capacities of 20 Gbyte, which represent the high-end models using current methods (2-disk sets), to as much as 100 Gbyte. Then, by pursuing even higher capacities and more compact sizes, we hope to further develop these units as next-generation hard disks for use in a wide range of devices, including TV set-top boxes, PDAs, and mobile phones."



Schematic of perpendicular recording system showing single-pole head coupled to vertically magnetized medium with magnetically soft underlayer (left) and magnetic force microscope image of pattern recorded on perpendicular medium (right).