

# NICT NEWS

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National Institute of Information and Communications Technology

Special Issues Featuring the Universal Media Research Center

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# Challenging to the Development of New Communication Technologies Benefiting the Birthplace of Japanese Culture

**Kazumasa Enami** Director-General of Keihanna Research Laboratories and Executive Director of Universal Media Research Center

After graduating from Tokyo Institute of Technology, joined NHK (Japan Broadcasting Corporation) in 1971. And then, was engaged in researches including digital image processing and research management at Science &

Technical Research Laboratories of NHK until 2006, appointed to the Director-General of the Laboratories in 2004. Joined National Institute of Information and Communications Technology (NICT) in September 2006. Doctor of Engineering.

## Aiming at the realization of universal communications

### Could you tell us the goal of Keihanna Research Laboratories?

**Enami:** Keihanna Research Laboratories have two research centers. One is Knowledge Creating Communication Research Center, and the other is Universal Media Research Center. In communications, there are various hurdles such as distance, time or language. Both centers aim to remove these hurdles to enable people to enjoy more spiritually affluent and richer communications than ever with different people. We call these interactions “universal communications.” Keihanna Research Laboratories are also in charge of most of the research to identify and develop applications, which will be built on new communication infrastructures studied in New Generation Network Research Center. Keihanna Research Laboratories are located on the border of Kyoto, Osaka and Nara prefectures. The place is the birthplace of Japanese culture and the source of Japanese mind, which is the most suitable location for the research of universal communications that are facing human beings and cultures.

### You mean that we should study more about human factors to realize universal communications, don't you?

**Enami:** Yes, I do. I think we should study for achieving something more psychological, linguistic or cultural than something like conventional technologies. Creating a spiritually affluent interface also needs a psychologist, as well as a neuroscientist. Based on this understanding, various professionals from different fields have gathered here. Keihanna Research Laboratories were established in April, 2008, when I facilitated to relocate the core functions of Universal Media Research Center including Executive Director's Office and Project Promotion Office which had been located in Koganei, adding to Knowledge Creating Communication Research Center which was the only one existing function. I believe that these centers will be integrated and collaborate each other to offer more effective researches. My mission is to coordinate and encourage researchers to be united and positively pursue their research activities.

### Could you describe the concept for the future researches in the laboratories?

**Enami:** The basic concept is being spiritually affluent, and respecting relations among human beings or between human beings and machines.

We have another concept. Although, in these days, people are making enormous efforts including energy saving to eliminate negative effects of social issues, our growth will not be achieved just by only these approaches and there is no dream.

The other concept of mine is creating positive effects as well as eliminating negative effects. For example, many conflicts occur in the world now. If we not only seek for a world without any conflict but also build a society where



External View of Keihanna Research Laboratories



people all over the world culturally interact and exchange to understand each other, the world will become more affluent and brighter. To attain these goals, we promote the research for machine translation of languages here. NICT is now halfway through its medium term plan started in 2006. We

hope to establish new visions unique to Keihanna Research Laboratories that further make use of the features of our laboratories when the next medium term plan begins.

***Leading the world with ultra-realistic communication technology integrating human five senses and leading-edge technologies***

**Next, could you explain the research activities in Universal Media Research Center?**

**Enami:** In the center, we offer the researches to acquire the function of human senses, and then we realize an ultra-realistic communications. There are two directions when developing three-dimensional television. One is the direction to precisely reproduce three-dimensional images, and another is the direction to create the most appropriate system for the person watching the television with which the human audience can enjoy three-dimensional images. The research group in Koganei is developing the former system, and Keihanna Research Laboratories are in charge of the latter system.

**There are few cases in other countries of the approach which integrates human senses, aren't there?**

**Enami:** I recently introduced the Japanese status of these researches in an EC symposium, where after my presentation. I received a lot of questions and requests for collaborative development with us. I suppose that our research pursuing holography or three-dimensional image technology comfortable to human beings, which goes beyond the scope in Europe, drew such enthusiastic responses there. Research in this field may be advanced the most in Japan. In May, 2008, Council for Science and Technology Policy, Cabinet Office decided fifteen themes for future innovative technologies, in which three-dimensional and advanced imaging technology were included. Japan is striving to promote these technologies as one of its national policies.

**To what degree is the holography for three-dimensional images advanced?**

**Enami:** Last November, we released a system delivering real-time three-dimensional images in color movie, although these images were rather small. Providing such images on an about 60 inches display in the future may require new display devices.

**Do you expect that there are a lot of needs for ultra-realistic communications?**

**Enami:** I think so. There are various potential applications including telemedicine services which allow people in depopulated areas to undergo operations by highly skilled doctors, the virtual education which provides virtual chemical experiments that are dangerous if carried out in schools, or teleconferencing.

**Keihanna Research Laboratories seem to always include the focus on future applications to the society even when providing basic researches, don't they?**

**Enami:** We are providing basic studies, however, the most important is that these researches are useful and valuable for people in Japan. In order that such policy can be understood by them, we are going to show them what society will be achieved after the research themes which we are now committed to be attained. We believe that, through such activities, new visions will be created, and that they lead to the next medium term plan.



Members in the Laboratories Gathering to Attend the Inauguration Ceremony of Keihanna Research Laboratories

# Development of Ultra Realistic Communications System

Approaching from Both Engineering and Human Five Senses

*Aiming at the development of ultra-realistic communications technologies that prompt human sensibility*

**Could you show us the outline of the research in Multimodal Communication Group?**

**Inoue:** Our Multimodal Communication Group is one function of Universal Media Research Center. 3-D Spatial Image and Sound Group, which is another group of the center, studies so-called ultimate image or acoustic rendering technologies, while our group is in charge of the research, instead of physically realistic, on systems to offer realistic sensation based on the concept “how human beings feel realistic sensation.” These researches include not only images and sounds but also tactile senses and smells. In other words, we are appropriately integrating both researches: for transmitting multisensory information and for investigating how human beings feel realistic sensation, to promote our research and development activities.

**What specific activities are you doing in the research for conveying information from human five senses?**

**Inoue:** As part of the research for transmitting multisensory information, we are studying displaying technologies of three-dimensional images in the visual system field. In theme parks or other amusement facilities, equipped are devices providing images which look three-dimensional when the audience see them with particular eye-glasses put on. Among various approaches for three-dimensional display, we are developing displaying technologies using the approach called spatial images reproduction method, which enables us to view three-dimensional images without using such particular eye-glasses. In the acoustic system field, we can't move the sound just within the arranged speakers while in a 5.1ch surround system. Hence, we are studying three-dimensional acoustic rendering technology which reproduces the distance from a human being to sound source along with the direction of the sound, using the functional values, called HRTF (Head-Related Transfer Function), which represent sound conveyance characteristics from sound source to human eardrums. We also hope to enhance the three-dimensional acoustic rendering technology of this method to the practical

● Profile ●



**Naomi Inoue**  
**Group Leader**  
**Multimodal Communication Group**  
**Universal Media Research Center**

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After completing a master's course in the graduate school of Kyoto University, joined KDD (current KDDI) in 1984. And then, was engaged in research and development of human interface technologies including voice recognition and graphic processing in KDD R&D Laboratories. Temporarily was transferred to National Institute of Information and Communications Technology (NICT) in 2006. Doctor of Engineering.

level.

In the tactile sense field, seeking for more advanced touch sense rendering than PHANTOM, a device for rendering these senses, we are engaged in the research of technologies to reproduce tactile senses in the feeling of gripping things. In the smell field, since several rendering technologies have already been pro-posed, we don't study the rendering technologies themselves but research how human beings feel realistic sensation when a smell spreads.

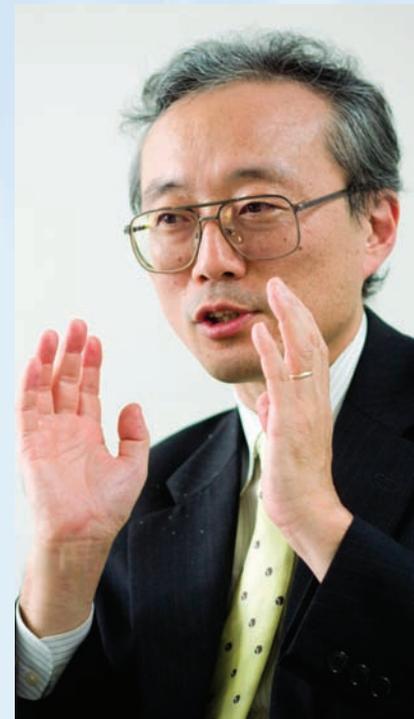
**How do you investigate realistic sensations that human beings are feeling?**

**Inoue:** We evaluate how human beings are feeling realistic sensations by the method to investigate their psychological or brain activities. For example, we measure which parts of brain are activated when a person is watching images, using fMRI (functional Magnetic Resonance Imaging). In addition, although they are not developed yet, we are studying tools to measure brain activities when a person smells some perfume, which are operated in fMRI. Including developing such tools, we are pursuing researches on how human beings feel.

*NICT's world leading researches on ultra-realistic communications*

**In other countries, is there any institute which is undertaking similar researches?**

**Inoue:** In the United States, there are few laboratories studying from the perspective of ultra-realistic communications. In Europe, some researchers are studying in the close field to ultra-realistic communications that integrate the engineering and



human sensational aspects. There are also projects for three-dimensional images or human five senses, however, few cases exist with which comprehensive research is performed like NICT.

**The research by NICT is one of the few unique cases in the world as well as being on the leading edge, isn't it?**

**Inoue:** That's right. The three-dimensional images which we are now developing experimentally would be classified in the highest level in quality that any other technologies have not reach in the world.

*Aiming at the realization as soon as we can*

**What do you think about the prospects for the research?**

**Inoue:** We aim at both very fundamental and practical researches. In many cases, basic research is performed but the results of its research are not practically applied in the industry. This situation is called "death valley" that represents a profound discrepancy or gap between these two research phases. We believe resolving this gap is one of our missions, while understanding the importance of basic research. Technologies for three-dimensional images, acoustic rendering and tactile senses will be advanced in the direction to bridge the "death valley" when they attain to a certain level. As for three-dimensional display technologies, since the existing project will be completed in the fiscal 2010, we plan to build a prototype by that year, and finish the field tests by around 2012 to put this technology to practical use.

**In this case, companies' cooperation will be critical. What actions is NICT making to get it?**

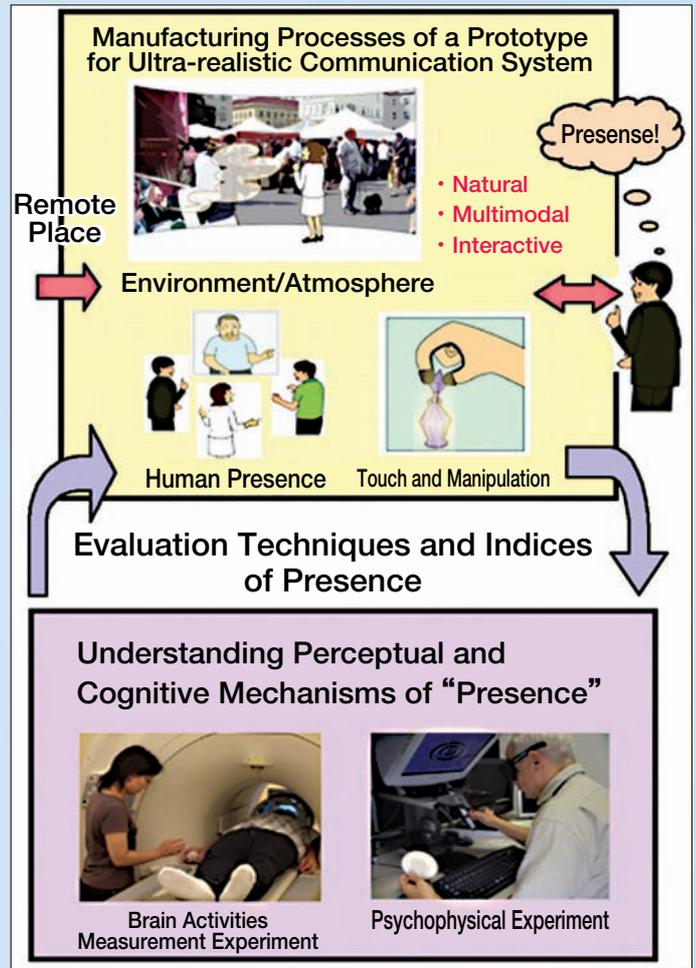
**Inoue:** We are pursuing the research in collaboration with electrical manufacturers because it is difficult only for ourselves to overcome the "death valley." Roles of both parties are divided. For example, with displays for three-dimensional images, our laboratories are in charge of proposals for system configuration, system evaluation, development of information processing technology to display highly qualified contents and other

technological aspects, and manufacturers are producing hardware.

**Practical application will be steadily expanded from three-dimensional display, three-dimensional acoustic rendering to tactile senses, won't it?**

**Inoue:** We hope so. Although the touch sense technology will take a little more time, we plan to promote the research for three-dimensional display and three-dimensional acoustic rendering and put them to practical use as soon as possible in future.

Thank you very much.



Ultra-realistic Communication System



**Examples of Future Application**

Design of Highly Qualified Texture Shape, Experience of Traditionally Cultural Assets, Virtual Education and Trainings, Teleshopping by Human Five senses, Virtual entertainments, etc.



Examples of Future Application

# How do humans experience realistic sensations?

Establishing Evaluation Technology of Realistic Sensations for System Development

## Quantitatively evaluating realistic sensations

**Could you specifically explain what you are studying to realize ultra realistic sensations?**

**Ando:** In the research of ultra realistic sensations, objectively and quantitatively evaluating how humans experience realistic sensations is one of the most important areas, and I am mainly in charge of this kind of research.

**How do you measure these values?**

**Ando:** We use human beings as test subject for experimental investigations, where we introduce two methods. One is an approach to directly observe brain activities using fMRI (functional Magnetic Resonance Imaging) and other associated technologies. Another is an approach called psychophysical method, with which we give the human subject various physical conditions to collect his/her behavioral data, or how the person reacts for each condition.

## Reflecting collected data from experiments to system development

**What is realistic sensation in the first place?**

**Ando:** Realistic sensation is not a simple sense but actually an aggregate of various senses. We categorize these senses into three elements. The first is spatial element including the sense of 3-D, surface quality, and immersion. The second is time element including the



Profile

**Hiroshi Ando**  
**Research Manager**  
**Multimodal**  
**Communication Group**  
**Universal Media**  
**Research Center**

After completing the doctoral course of Department of Brain and Cognitive Sciences, MIT in the United States, joined Advanced Telecommunications Research Institute International (ATR). Served as Senior Researcher and Department Head, became Research Manager of Multimodal Communication Group in NICT in 2006. Has been engaged in researches including brain and cognitive sciences, visual information processing, and multimodal interfaces. Ph.D. in computational neuroscience.

sense of object movements, and synchronicity. The third is physical element such as self-presence sense that a person feels as if he/she were there, or interactive sense, and this element also includes affection. Therefore, we have to clearly identify which realistic sensation we are examining in each experiment to avoid confusion.

**There are issues of brain itself, aren't there?**

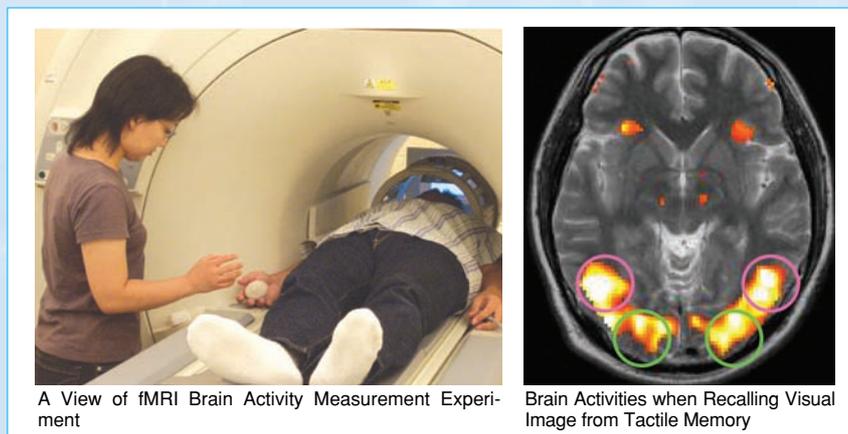
**Ando:** That's right. Humans receive and integrate external information to feel something, but they also have memories accumulated in their brains which were learnt through various experiences, and they understand things by employing these memories. Naturally, each person has different memories. Since realistic sensation is created by integrating external information and imagery generated from individual memories in the person's mind, we should investigate both of these components.

**Have you collected enough data of experiments?**

**Ando:** Yes, we have. The number of human subjects is as many as several hundreds so far in total.

**The next stage is how you will reflect the data to system development, isn't it?**

**Ando:** We have to deliver the data on what is optimal for the system, while at the same time, the system cannot be developed unless we decide the acceptable range within which humans don't feel discomfort. Recently we are gathering the data of to what extent humans naturally feel the image when its quality is degraded. The results of these experiments will be



A View of fMRI Brain Activity Measurement Experiment

Brain Activities when Recalling Visual Image from Tactile Memory

Brain Activity Measurement Experiment

accumulated to be reflected to the system side.

## Developing multisensory interaction systems

### Is there any application example of this research to date?

**Ando:** Force-feedback device is a system that provides some kind of tactile sense. This device outputs force, and if a person touches a virtual object with a special pen attached to a kind of robot arm, a force feedback generated by the motor is applied. Integrating this device with three-dimensional stereo display, we developed "Multisensory Interaction System." The system we are offering as demonstration is realistically reproducing the three-dimensional image, tactile sense, acoustics of Kaiju-budo-kyo, an ancient copper mirror with relief of imaginary marine animals and grapes, which was excavated from Takamatsuzuka ancient tomb and designated as a national important cultural property. Using special stereo-glasses, a person will feel as if the real mirror were in front of him/her.

### How does a user experience this image?

**Ando:** The user can touch the three-dimensional image at hand using a special pen, and tactual sound is also generated when touching. Since humans feel the quality of material from the generated sound when tapping or scraping it, the sound generated by touching is important to increase the reality. In addition, if the user turns the

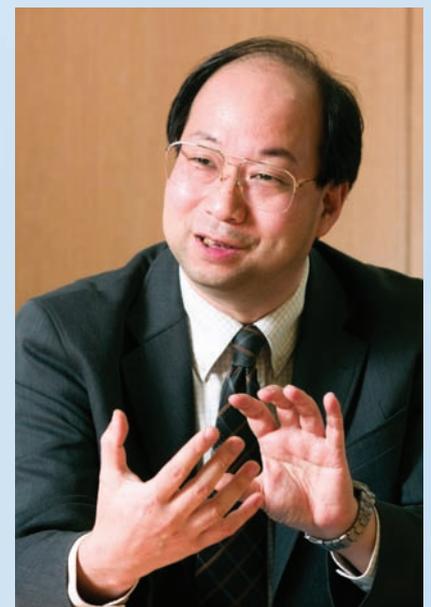
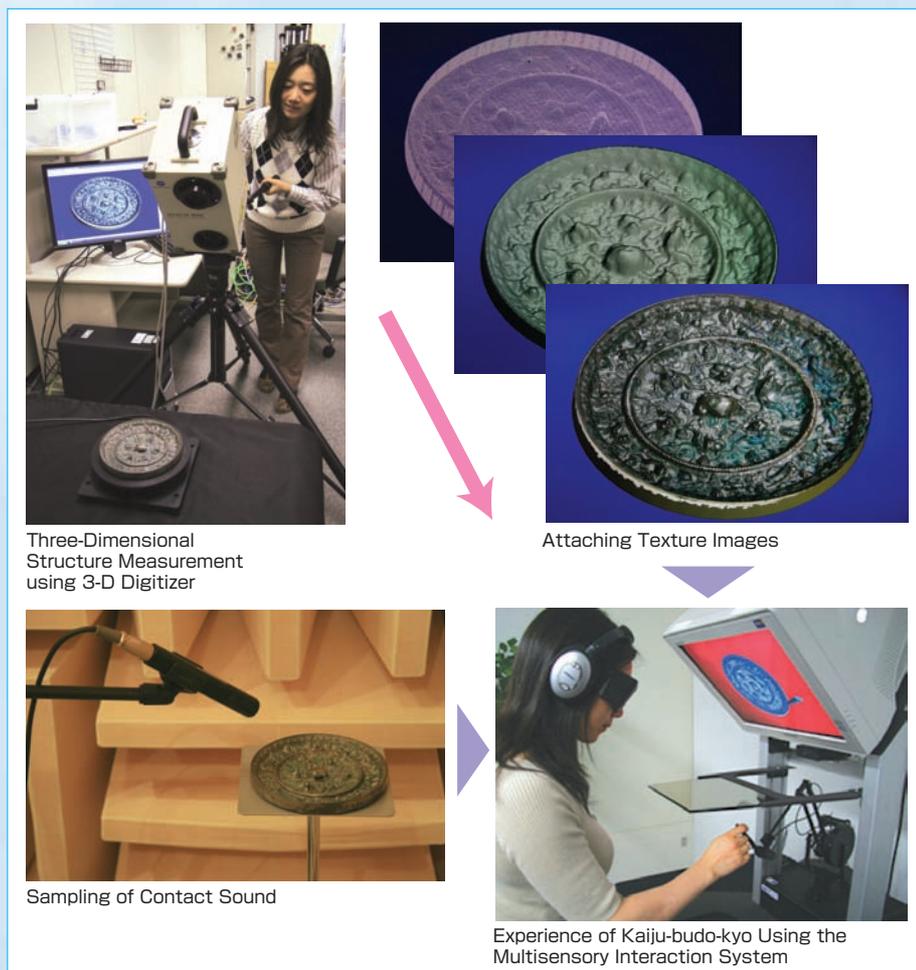
mirror by the pen to look at the back side, he/she can feel the weight of the mirror. The status of rust is accurately reproduced and the user can even see the details by expanding the image. Because the image is virtual, it can immediately reproduce the status shining in gold as if the mirror were just molded. Using such system, people can freely touch and experience cultural assets of national importance which they can only look at through glass cases.

### Many application examples will be expected, won't they?

**Ando:** These valuable experiences may be applied to education and other training opportunities, as well as to medical services for surgical operation simulation, and high-quality production design with texture feeling. In the far future, with Internet shopping, for example, consumers might be able to purchase products after checking the texture and hand feeling along with photos or images. We are considering various directions.

### How do you expect the future of your research?

**Ando:** We think that we will not be able to understand all about humans and the brain in the next two and half years when the ongoing five-year project completes. Carefully reviewing the remaining issues, we have to define the next strategy beyond the current project. We believe the relationship between reality and the fine sensibility generated in the human brain will especially emerge as an important theme.



Acquisition of Kaiju-budo-kyo Data, and Process to Reproduce Three-Dimensional Image, Tactile Sense and Acoustics

# Research on Three-Dimensional Acoustic Rendering Providing Ultra Realistic Sensations

Aiming at Development of Totally New System through Repeated Hypothesis and Demonstration

*“Star Wars” is the source of idea*

**Could you explain the research on three-dimensional acoustic rendering which you are engaged in?**

**Katsumoto:** You may imagine 5.1ch surround from three-dimensional acoustic rendering. Our group, however, provides the research on acoustic rendering technique used for three-dimensional television delivering a spatial reproduction in the next, next generation or so, which provides an acoustic environment entirely different from the conventional model. I am in charge of this research from the theory to production.

**What is the difference of this technology from the conventional one?**

**Katsumoto:** The conventional acoustic rendering technology provides sound around a listener and includes the audience in the environment or immersive experience. The technology advanced from monaural, stereo sounds, to 5.1ch surround. On the other hand, we are aiming at the realization of a system with which the player or sound source provides the sound in front of the listener. In a SF movie “Star Wars,” for example, when a robot called R2D2 reproduces a message, the image of Princess Leia appears in the front space and says “Help me.” We are trying to develop a television of such spatial reproduction, however, it is meaningless if the person coming up in an image doesn’t look like actually speaking. This research was born based on these concepts.



**What principles is the system delivering sound from a vacant space based on?**

**Katsumoto:** The technology rendering images in a space using holography has slightly preceded the acoustic rendering. With the latter technology, while the theory was identified to a certain level, the development of practical devices has just begun. A method called stereo-sonic,

Profile



**Michiaki Katsumoto**  
Senior Researcher  
3D Spatial Image and  
Sound Group  
Universal Media  
Research Center

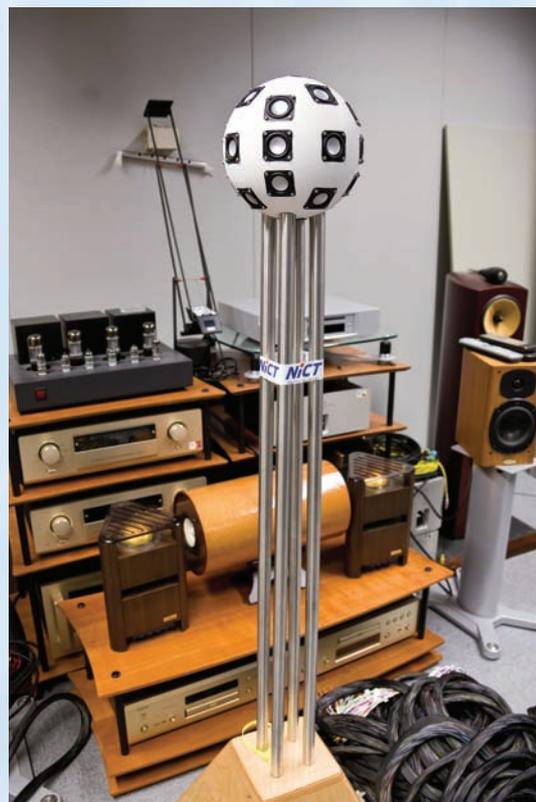
After completing a postgraduate school, joined Communications Research Laboratory (current NICT) in 1996. After being engaged in the research on advancement of internet protocols and next generation applications towards the establishment of next generation platform, currently in charge of research and development of spatially reproducing three-dimensional information rendering system. Doctor of Engineering.

which uses two speakers to concentrate the sound energy to a single point, cannot achieve effective performance if the listener sits in an inappropriate position. We found that the distance sense can be reproduced when delivering sound using speaker walls, in an approach called wave field synthesis method which applies the Huygens principles and resolving the previously mentioned defects. Although we theoretically understand that integrating these two approaches will achieve acoustic rendering and distance sense, there is an issue that the technology requires hundreds of loudspeakers to attain appropriate results.

*Repeating hypothesis and demonstration to advance the research*

**What points are difficult for pursuing the research?**

**Katsumoto:** There are two difficult points. One is that no conclusive theory exists to date. Another is that when we verify our hypothesis, no loudspeaker is available for

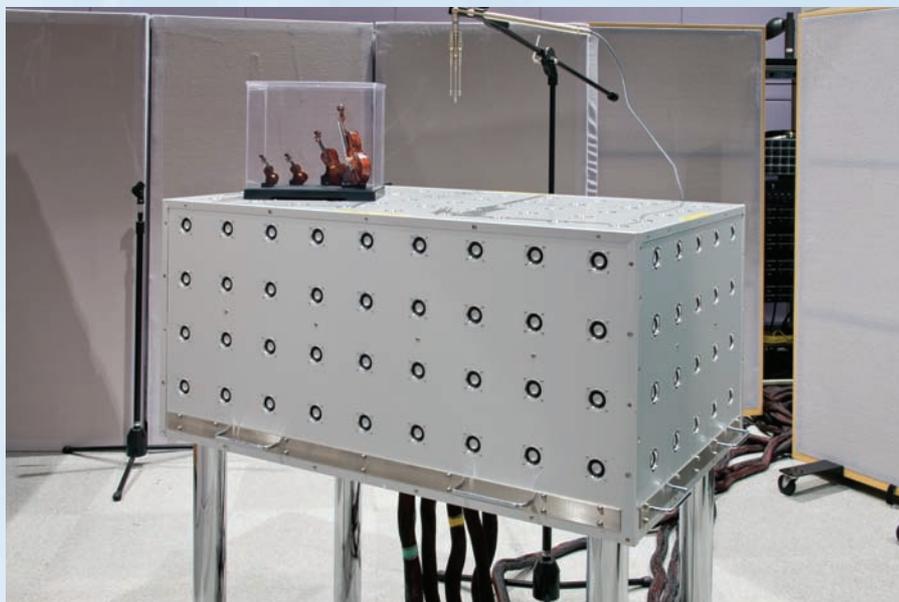


Spherical Speaker Delivering Different Radiation Directions

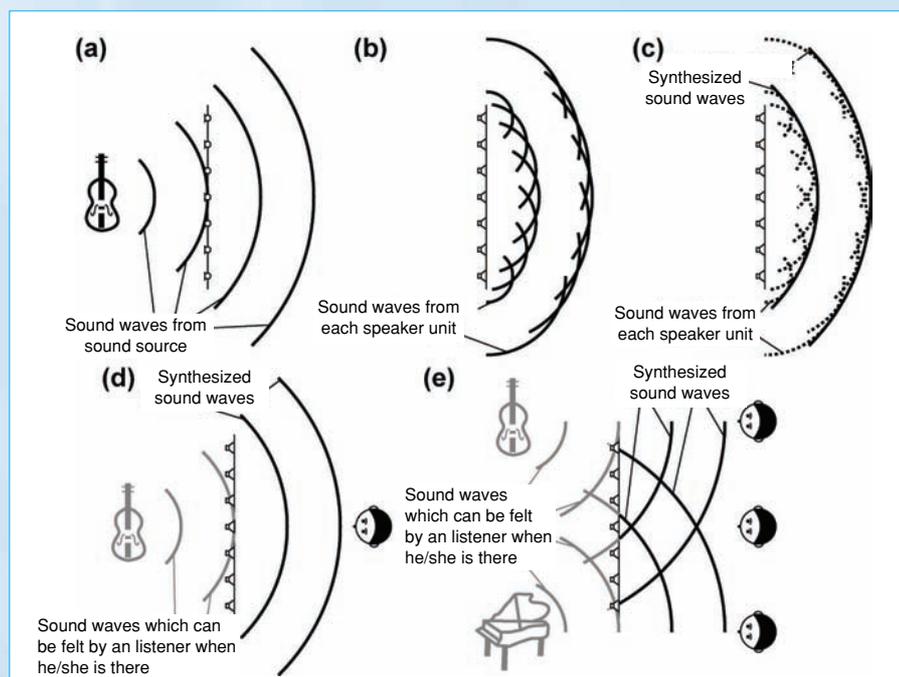
the test in the first place, and therefore we must begin with developing the loudspeaker.

**You mean that you are validating the theory along with creating it, don't you?**

**Katsumoto:** Yes, I do. We have a lot of things to do. While many parts are not cleared yet, we learn to realize that these issues ought to be resolved by applying our theory. Since NICT has to provide research on what people can use, we need to gradually generate physical products and disclose these achievements one by one also in the perspective of practical application. We already successfully developed the technology of a sound space to deliver omni-directional sound. For example, with the device we developed recently, the spherical radiated loudspeaker reproduces the precisely realistic play sound of violin or other instruments, and from the rectangular radiated loudspeaker, the locations of four players in the quartet can be accurately listened.



External View of Three-Dimensional Acoustic Rendering Loudspeaker System



Principle Chart of Wave Field Synthesis Method

From now on, we need to seek for reproducibility and quality of sound.

**Is the research of such system pursued in other countries?**

**Katsumoto:** I don't think so. I believe that NICT is the only institute engaged in full-fledged research of three-dimensional acoustic rendering with different radiation directivity.

### Three-dimensional acoustic rendering technology with broad application range

**When the system is realized, can we use it at home?**

**Katsumoto:** I suppose that the system will be used in general households at first. Since human beings feel a thing as three-dimensional material only within the 1-2m range, the holography television and three-dimensional acoustic rendering system are naturally placed within the range which the audience takes the device or of close reach. The technology will be further developed in a form of personal use such as mobile phone or video game machine.

**Don't you think that there will be other usage?**

**Katsumoto:** Yes, I do. For example, it can contribute to the resolution of noise pollution issue. We are studying the fundamental mechanism to produce sound, which may include the possibility of soundless structure. We may also be able to provide a sound space comfortable in human life without integrating it with images. I think it is highly likely that the application range will be broadly expanded.

**What are challenges in the future?**

**Katsumoto:** From a wider perspective, we have to create new culture. As I mentioned earlier, since these systems are ultimately personal information devices, we need to get people's support to this technology at first. We are committed to pursuing various types of research activities that will be recognized by many people, and acquire acclaims "three-dimensional information rendering devices are necessary" or "the technology is very interesting."

**Thank you very much.**

# Signing of the MoU for Comprehensive Research Cooperation with the South Korean Electronics and Telecommunications Research Institute (ETRI)

**Werner Klaus**, Senior Researcher, International Alliance Group, Research Promotion Department

**Junichi Nakajima**, Senior Researcher, Project Promotion Office, New Generation Wireless Communications Research Center

The National Institute of Information and Communications Technology (NICT) and the Electronics and Telecommunications Research Institute (ETRI) signed a Memorandum of Understanding (MoU) for comprehensive research cooperation in the field of information and communications technology on December 4, 2008. The signing ceremony was held during the 7th NICT-ETRI Joint Workshop organized at ETRI's headquarter, which is located in Daejeon city, South Korea. Dr. Miyahara, President of NICT and Dr. Choi, President of ETRI signed the MoU and shared a warm handshake in a friendly atmosphere. So far, ETRI and NICT had exchanged MoU's solely dedicated to collaboration in the field of wireless communications. However, on the occasion of this workshop, both parties concluded an MoU henceforth allowing them for a wider range of collaboration. The contents of this MoU was already reflected in the workshop, where the latest research achievements were presented by both parties in the fields of new generation wireless, new generation network and universal communications technologies. It is expected that this MoU will further encourage

research cooperation in fields of mutual interest through exchanging researchers and information, and the promotion and implementation of joint research projects by both institutes.

ETRI was established in 1976 as a national research institute, and is the largest public research organization in the field of information, communications and electronics in South Korea, consisting of four research departments with about 2,000 researchers. Over thirty years, the institute has produced numerous research results mainly through academic-industrial collaborations in a wide range of fields including mobile communications, semiconductor and digital broadcasting technologies.



A Scene Showing Dr. Miyahara, President of NICT and Dr. Choi, President of ETRI after Signing the MoU



Speakers and Participants Attending the MoU Signing Ceremony Held in the NICT-ETRI Joint Workshop

# Osaka University and the National Institute of Information and Communications Technology (NICT)

## Conclusion of “Basic Agreement on Integrated Research in Brain Information and Communications”

**Kazuhiro Oiwa**, Director General of Kobe Research Laboratories /  
Executive Director of Kobe Advanced ICT Research Center

The National Institute of Information and Communications Technology (NICT) and Osaka University have concluded the “Basic Agreement on Joint Research in Brain Information and Communications” on January 7 (Wed.), 2009.

To date our institute and Osaka University have engaged in various cooperative activities under the “Agreement to Advance Collaboration in Information and Communications Technology” (concluded on February 22, 2007); this includes the joint research, the collaborative graduate school agreement and the exchange of researchers in the fields of photonic network technology, bio ICT, nano ICT and others. In addition to further advancing this collaboration, both organizations will strengthen the cooperation with other organizations in the industry, academia and government. The integrated research project started by this agreement will effectuate research and development from basic to applied research in the brain information and communications technology.

This agreement is based on five principles underlying the integrated brain information and communications researches’ philosophy, which are stated as “Contribution,” “Openness,” “Unification,” “Dignity” and “Cultivation.”

This agreement aims to stimulate research and development in the brain information and communications technology in Japan, and realize new generation networks inspired by brain functions and



Dr. Miyahara, President of NICT (Left) and Dr. Washida, President of Osaka University (Right) Sign the Agreement

the information and communications technology which can convey the “heart and mind”. We will examine the operation and management system of this project between our institute and Osaka University, as well as specific research themes, research environments required for the project implementation, and other requirements. To effectively use the existing facilities and equipment, we plan to start a preliminary research activity and joint research at the Suita campus of Osaka University. In addition, a symposium on the integrated brain information and communications research organized by Kobe Research Laboratories will be held on June 8 (Mon.), 2009.



After the Signing Ceremony, Dr. Miyahara, President of NICT and Dr. Washida, President of Osaka University Shaking Hands



Affiliated People in Lining-up after the Signing Ceremony (Left: Participants from NICT, and Right: Participants from Osaka University)

# Supporting the Seed Excavation and Entrepreneurial Initiatives by ICT Ventures, Private Enterprises and Other Organizations or Individuals

National Institute of Information and Communications Technology (NICT) supports various projects in the communications and broadcasting business field.

We held briefing sessions nationwide to broadly recruit applicants for the subsidy of various supporting programs in fiscal 2009. The application of each project is planned to start from early March, and those details will be announced on the press release page of the NICT's website as soon as the preparation is completed.

Applications will be accepted during about one month. Applied projects will be strictly screened through their document review and hearing on them, and selected candidates will be decided within two months after the deadline for applications.

With regard to the outline of these system and the application details of these programs, please contact the following address:

Contact Point: Special Research Group, Collaborative Research Department  
(Contact Persons in charge: Mr. Hakata and Mr. Nakano, Tel: 042-327-6014)

※Related URL: <http://www2.nict.go.jp/pub/whatsnew/press/h20/081219/081219.html>



A View of a Briefing Session on the Programs for Fiscal 2008 (The Session in Tokyo, in February, 2008)

System Name	Outline of Support Project	Eligible Applicant	Support Conditions, etc.
Subsidy as for Advanced Technology Research and Development (Telecom Incubation)	Subsidizing a part of the research and development cost for venture enterprises and other organizations which provide advanced research and development in the information and communications field	Private Venture Enterprises and Other Organizations	The smaller amount between either a half of subsidy for the subject cost and 30 million yen will be subsidized.
Subsidy as for International Joint Research	Subsidizing the research and development cost for the research and development by international joint research in advanced information and communications technologies	Universities, Private Enterprises and Other Organizations Implementing International Joint Research	The smaller amount between either a half of subsidy for the subject cost and 10 million yen will be subsidized.
Subsidy for Elder and Disable People as for Communications and Broadcasting Services Enhancement Research and Development	Subsidizing a part of the research and development cost for private enterprises and other organizations which provide the research and development of communications and broadcasting technologies on the research and development of communications and broadcasting services to serve the elder and disable people for their convenience.	Private Enterprises and Other Organizations	The smaller amount between either a half of subsidy for the subject cost and or 30 million yen will be subsidized.
Subsidy System for New Communications and Broadcasting Services Project (Information and Communications Venture Support)	Subsidizing a part of the cost required for new entrepreneur projects of ICT venture enterprises in the initial stage of their establishment, under the terms and conditions of private venture capital investment or other terms	ITC Venture Enterprises and Individuals Scheduled to Establish a Venture Business	The smaller amount between either a half of subsidy for the subject cost and 20 million yen will be subsidized.
Subsidy System for Communications and Broadcasting Services Providing and Promoting their development for Disable People (Information Barrier Free Project Support)	Subsidizing a part of the cost for private enterprises and other organizations which provide or develop services of communications and broadcasting which contribute to the increase of convenience for disabled people concerning communications and broadcasting services	Private Enterprises and Other Organizations	The amount up to a half of subsidy for the subject cost will be subsidized.

## Information for Readers:

In the next issue, we will include the interview featuring terahertz technology with which its application is expanding in various fields.

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