NICT 独立行政法人 情報通信研究機構 NEWS
National Institute of Information and Communications Technology

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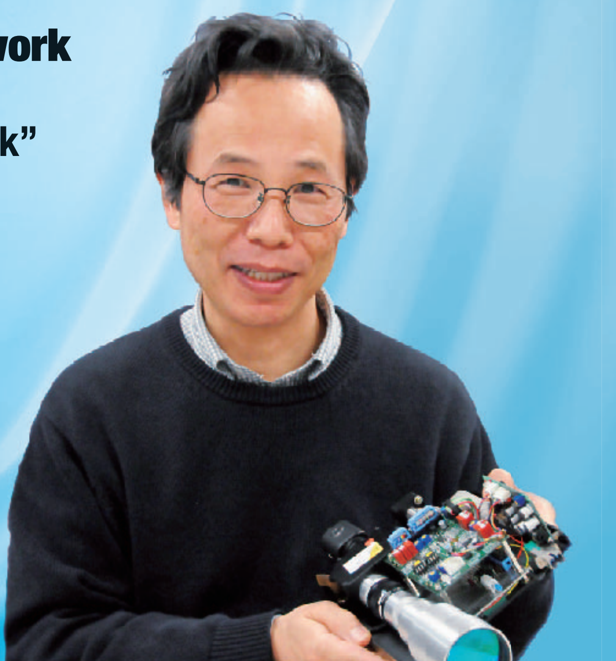
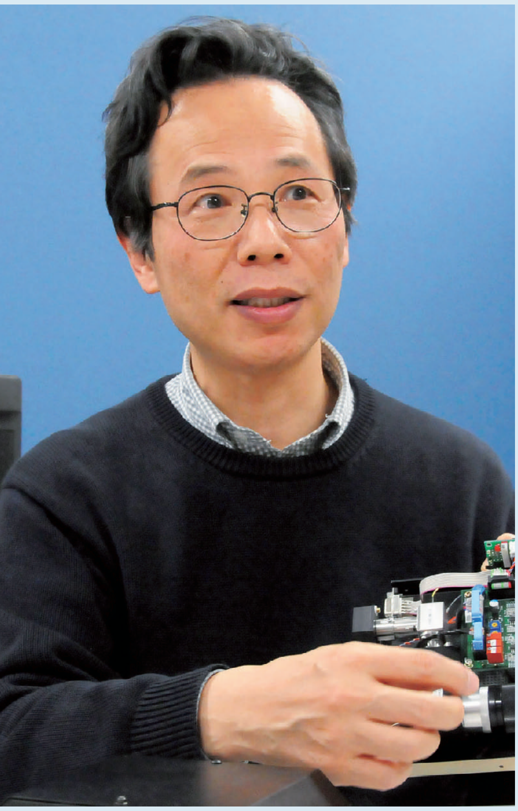


NiCT



# Developing a New Free-space Optical Communication Terminal that Realizes High-Speed Broadband Communications

## High-speed broadband communication network can be available in 1-km link distance even in an area where laying optical fibers is difficult


**Yoshinori Arimoto**

**Senior Researcher, Space Communications Group, New Generation Wireless Communications Research Center**

Completed a master's course of graduate school of Osaka University, Yoshinori Arimoto joined Radio Research Laboratory (the former entity of NICT) in 1979. He has been engaged in the researches in the fields of satellite control, space communications, and free space optical communications. Doctor of Engineering.


NICT has promoted a research that utilizes the satellite communication technology for accurate the pointing and tracking system using very narrow laser beams for the realization of optical intersatellite communications over more than 10 years, which allows us to build a high-speed, broadband communication network even in an area where laying optical fibers is difficult.

### The world's first free space optical communication terminal providing multiple of 10-Gbps or more bandwidth

**—— First of all, I would like to ask what the term "new free space optical communication terminal" means. Is it also called "optical wireless communications"?**

**Arimoto:** When I started to study optical intersatellite communications in the 1990s, I used the term "free-space optical communications." Naturally, the media between the two satellites communicating each other using laser beams is a "space." However, for communications on the ground, the meaning of the term "free-space optical communications" or FSO in short is not easily understood by Japanese. I think using the word "optical wireless" makes the concept more accessible.

**—— What aspects are "new"?**

**Arimoto:** Optical wireless communications are already commercially available. In Japan, two major manufacturers provide these products. However, the FSO terminal we have developed is a new system different from those products. The first aspect in which our system differs from those conventional products is the wavelength it uses.

The conventional optical wireless communication systems use an near infrared laser whose wavelength is 0.78-0.85 μm. Our system aims to achieve the exact functional equivalent to fiber optic communications so that the wavelength is also the same as these systems.

Long haul fiber optic communications use two major wavelengths of 1.3 μm and 1.5 μm for multi-Giga bps or larger transmissions; our system also uses the same wavelengths. Therefore, although our system uses the same infrared laser, the wavelengths are not similar to visible light but almost twice as long as those for conventional products.

Another aspect in which conventional optical wireless communication systems are different from ours is that the new system minimizes transmitting beam divergence to the diffraction limit. In general, high-speed, broadband data communications need power for optical signals, requiring higher power laser transmission into the space. Our FSO terminal can provide high-speed, broadband communications without increasing the transmission power so much by minimizing the beam divergence by using diffraction limited narrow laser beams.

**—— When did the optical wireless communications technology begin?**

**Arimoto:** Many manufacturers in North America, Europe, Japan and others began to develop the technology just in the so-called IT bubble era from the end of the 1990s to the early 2000s, and published several research papers on this technology. However, after the IT bubble burst, the technology for high-speed, broadband FSO communications was not commer-

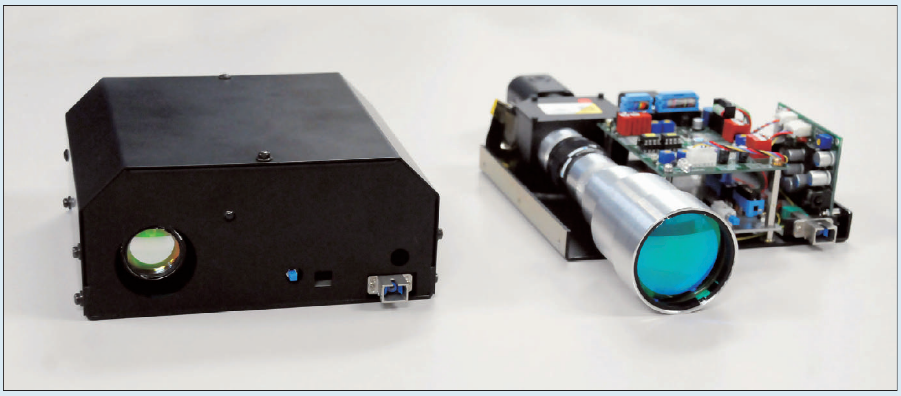


Fig. 1 ●Free space optical communication terminal (left) and the same system with a large telescope attached for long-range communications (right)

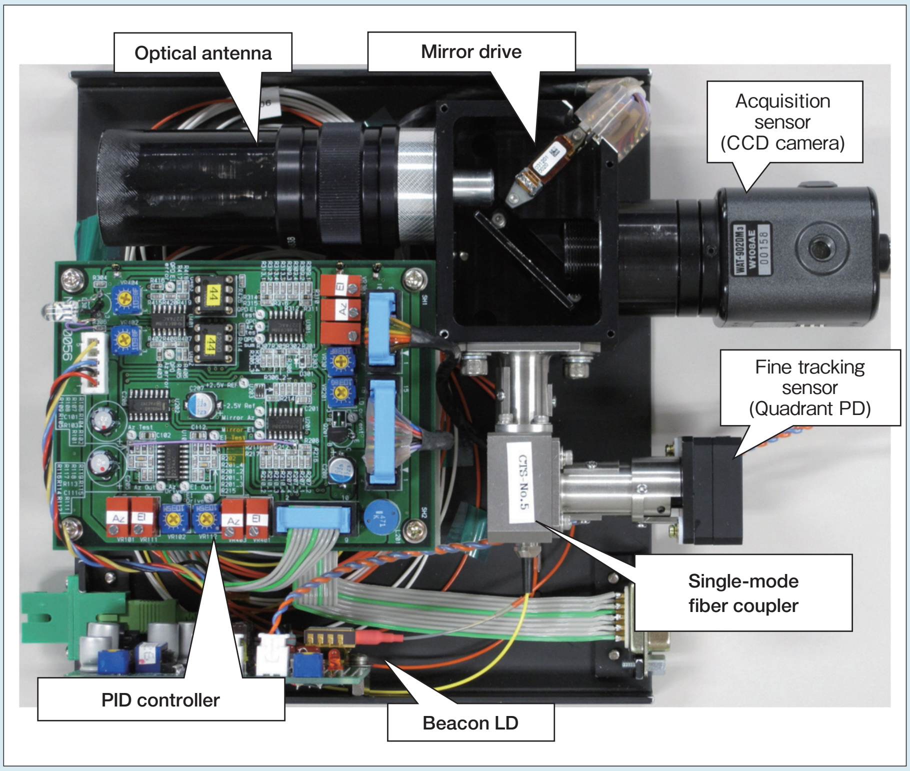



Fig. 2 ●Inner structure of the free space optical communication terminal

cialized. Therefore, the FSO terminals developed by NICT are the only operational system that achieves multiple of 10-Gbps transmission bandwidth, which is the same as provided by fiber optic communications, and is ready for commercial distribution (Fig.1).

Conventional optical wireless communications are mainly used for LAN extensions between buildings. Cost effective and timely network construction has been demonstrated using these system, because optical fiber or external leased circuits are far more costly for installation of 100 Mbps LAN between the head office, the laboratory, and each factory located about 10 km away from each other. In another case, a free space optical communi-cation system was installed for connecting the buildings scattered around the wide campus of a university.

The technology also has a proven track record that a free space optical communication product made by a Japanese manufacturer was used for recovering the mobile phone base stations that were broken down during the 9/11 attacks in New York in several days.

**—— What is the limit of communication speed with conventional systems?**

**Arimoto:** The limit of conventional systems is said to be 1–2 Gbps. We believe these systems can satisfactorily accommodate the present demands, such as those for mobile phone base stations. However, these base stations will need to enhance their communication capacity for the future broadband Internet connections. Our FSO terminal may be useful in that case. The realistic communication speed of our system is about 20 Gbps per one wavelength. Bandwidth higher than 20 Gbps will be easily achieved by wavelength multiplexing.

One of the reasons why conventional systems could not raise the speed to that level is that increasing the transmission bandwidth to 20 Gbps, for example, needs to send 20 times stronger optic power than that for 1Gbps. Simply put, this means the previous 1 mW output becomes 20 mW, a laser power that requires a safety measure for protecting human eyes. These administrative and technical problems have prevented the conventional systems from upgrading their speed.

By narrowing down beams, our system can provide transmissions of 10 Gbps to the destination several kilometers away even with 1 mW output. The 1 mW power is unconditionally safe even for direct eye exposure.

**—— What aspects were technically difficult?**

**Arimoto:** First, the technology required to appropriately integrate optical fiber transmission technology with wireless communications system. Specifically, it is the technology that is needed to constantly hit the beam coming through the space to the single mode fiber.

Optical fiber is a glass cable as thin as a human hair, and signals go through the central part which has a large refractive index, called as “core.” Optical fiber is of two types. Multi-mode fiber, one of these types with a thicker core, is used for transmissions of several hundred meters to 2 km, such as typical LAN. The core diameter is about 50–60 μm, a thickness that light coming through the space can pass through even if the light hits a point slightly different from the core.

But long-distance and ultra high-speed communications, such as 10 Gbps transmissions, need the single-mode fiber (SMF), whose core diameter is about 10 μm, to reduce the waveform distortion of transmit optical signals. This requires a precise pointing and tracking system to stabilize the beam focus at the center of SMF core. More specifically, this type of communications needs the beam focus precision of about 1μm.

However, when the free space optical communication system is used in the field, the direction of incoming beam fluctuates due to atmospheric turbulences. In addition, the direction of optical receiver will be changed due to the vibration of the terminal support or the skew of buildings caused by thermal expansion. Resolving these fluctuation problems for hitting light precisely at the fiber center was the most difficult part.

**—— How was it achieved?**

**Arimoto:** Our solution is first to convert incoming light to thinner beams using an optical antenna, then stabilize the direction using a mirror actuator that changes reflection angles of the beams, which counteracts the fluctuation of incoming laser beam to lead it to the fiber core.

In fact, some commercially available optical wireless communication systems had applied a similar principle, but these systems could only provide a precision single or double digits worse than 1 μm that our system achieved. Such a high precision was not required for the operation of conventional terminals, but we had to develop the technology with the goal of hitting sharp beams to the targeted satel-

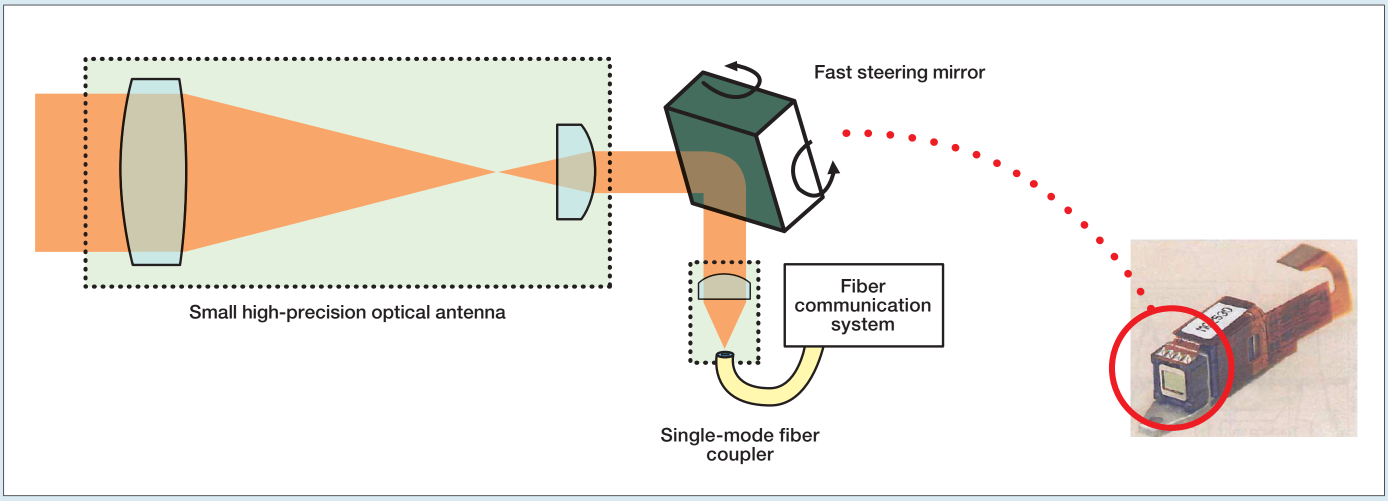



Fig. 3 ●Operating principle of the terminal
Free-space laser beam will be converted to a small collimated beam and then stabilized in its direction by the fast steering mirror so that the beam focus exactly matches the center of the single mode fiber aperture.

lite at an utmost distance where high precision pointing and tracking is essential.

Our research on intersatellite communications in the 1990s has already led to the development of the technology that achieves the 1 µm precision. However, during the actual procedure to realize this precision, we found some insufficiencies of our technology and it was in 2007 that we finally developed a system sufficiently operable in the outdoor operational environment.

The next challenge was to preserve incoming light intensity to SMF without loss. Larger attenuation weakens light and reduces the distance the light can travel. As of last summer, we achieved a internal terminal attenuation of 3 dB, a performance ensuring that 50% of incoming light reaches the SMF connected terminal equipments.

Today the attenuation has been decreased to 2 dB, which means 63% or more light is available at the SMF based receiver. We still continue to improve the efficiency and other relevant efforts toward practical application.

**—— The system you showed me now is not yet a commercially available product but a system made by hand. I suppose that you had much difficulty assembling this system.**

**Arimoto:** The optical antenna for receiving and transmitting laser light was difficult. The current system applies interchangeable lenses like a single-lens reflex camera to cover from a short distance to a long distance. It is a kind of telescope.

The external beam diameter of the long-distance telescope is 4.8 cm, and those of the short-distance telescope are 2.4 cm and 1.5 cm. These optics form a delicate part, but their lens holders were also handmade. The alignment adjustment process to arrange internal optical components precisely to meet the beam control precision was difficult, too. Although the process may be easier by investing a large amount of money, we have aimed at a system feasible with one or two million yen budget.

**—— Laser light travels in a vacuum in the intersatellite communications; hence, the absorption and scattering of light does not have to be considered so much, but it is important to know how much the propagation characteristics are important for laser light traveling in the air.**

**Arimoto:** For 1 km transmission in an urban area, we found several things when calculating the transmittance in an average air also containing particles and other materials.

First, light beams of several wavelengths will not reach to the target due to the absorption of water vapor. On the other hand, the transmittance of 0.78 µm or 0.85 µm used by conventional optical wireless communication systems is about 60%. The transmittance of 1.3 µm and 1.5 µm that we are going to use is about 80%. This means that lasers from our system reach a location 1 km away with 80% power if there is no rain or fog.

Using the data published by the meteorological organization, we have examined how the power is affected if there is rain or fog. The results show that the loss is not so serious with the distance of 1 km. In one out of 10 days, light will not travel easily due to rain or fog and hence decreases to 50%, which means that in nine out of 10 days light will travel better. In other words more familiar to our life, this also means that the transmission is available when we can visually recognize the destination.

**—— On the basis of this data, how much distance is realistic for using the practically applied system?**

**Arimoto:** We think it is 1 km basically. Conventional free space optical communication systems are commercially available with 1 km transmission. We hope our system will be used as a replacement of the conventional systems for ensuring high-speed, broadband transmissions.

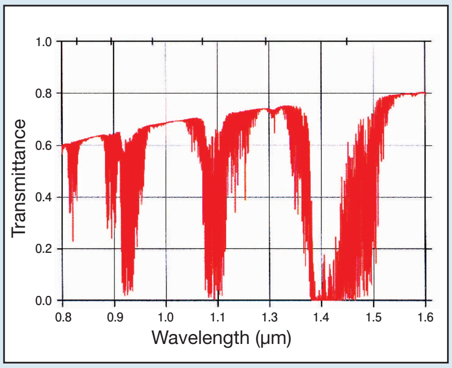



Fig. 4 ●Propagation characteristics in urban atmosphere
An example of calculated absorption attenuation of laser light in 1 km horizontal propagation distance in an urban area. The longitudinal axis shows transmittance, and the abscissa axis shows wavelength. The parts of deeply declined transmittance indicate the effect of water vapor absorption. The transmittance of 0.78 µm or 0.85 µm wavelength used by conventional optical wireless communication systems is about 60%. The transmittance of 1.3 µm and 1.5 µm wavelength used by long-haul fiber optic communications and NICT's free space optical communication systems is about 80%.

## Exclamation “We never imagined you could do that!” Success in the world fast 1.28 Tbps transmission experiments

—— **Tell me about the transmission experiments actually conducted in the open air.**

**Arimoto:** For about 3 weeks from August to September 2008, we conducted transmission experiments in Pisa, Italy. With the help of Professor Matsumoto of Waseda University, who stayed in Pisa and with whom we were engaged in a joint research on 10 Gbps transmission experiments before, we installed the system on the roof of the building of Center of Excellence for Information and Communication Engineering (CEIIC), Santana University, and communicated with a building 210 m away. In the first week we conducted 40 Gbps × 8 channels = 320 Gbps transmissions, and in the third week we multiplied the transmissions to 32 channels and achieved the world’s fastest transmissions of 1.28 Tbps. This record is not broken as yet. In addition, we have never heard the news that a system equivalent to this has been developed, so we believe the system probably continues to be the champion for the next 2 or 3 years.

We achieved high-quality signal transmissions without any degradation or noise. We also realized the error free transmissions over several hours in daylight summer condition. These achievements mean that the quality of our system is equal to the quality of optical fiber transmission.

Besides Pisa, we conducted experiments in Yufu city, Oita prefecture in December 2007. The experiments were executed as part of demonstration experiments planned by the “Study group for the penetration of new technology toward next generation bidirectional broadband networks” of Ministry of Internal Affairs and Communications. These were the first experiments wherein we used our system for transmissions in an open air. The transmission distance was 380 m and the optical signal was sent through a window. We placed the system on the second floor of a pension and beside the restaurant of an equestrian club near the pension, demonstrating for the first time that our system correctly operated even in such a realistic placement environment.

During the experiments, we have a light rain for the first time and the transmissions were intermitted due to night dew on the window in the early morning. These experiments gave us a good opportunity to verify the incidents that may occur during actual use.

—— **Was there any case where transmissions were intermitted by reasons other than rain, fog, or night fog?**

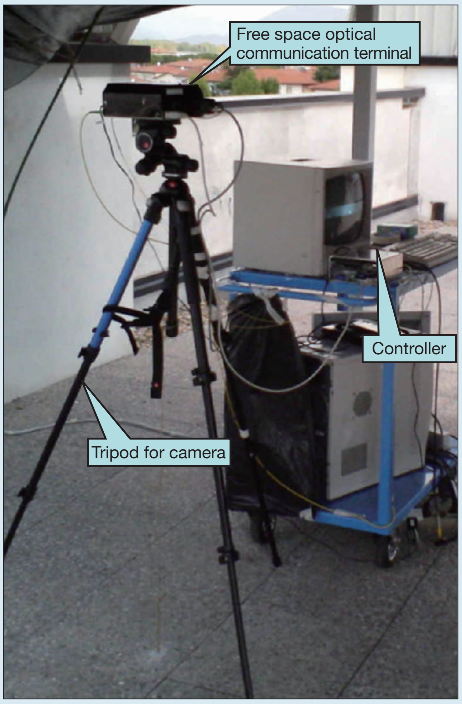
**Arimoto:** Anything crossing the beam may affect the transmission. In Oita at the moment when raindrops passed the focus of the beacon light, the transmissions were intermitted. Although it was for about one millisecond, a system with these intermissions is not practical. We are now improving on this aspect.

Furthermore, we conducted experiments between the tower of NICT’s head office in Koganei city and National Research Institute of Fire and Disaster in Chofu city, a distance of about 8 km, from last January to February. However, these were not signal transmission experiments; they were rather a preparation stage to research how far beacon could be tracked or how much the atmospheric turbulences were. Further experimentation is required in this regard.

—— **How was the response when you released this free space communication technology?**

**Arimoto:** We have not introduced this technology so much in academic meetings or other equivalent occasions in Japan. However, when we made a presentation at a community of fiber optic communication companies, the participants were excited and said “We never imagined you could do that!”

Since this technology has not yet generally been known well, we are now looking for possible users by demonstrating the technology in events such as NICT Super Event held at CEATEC JAPAN. However, there are few users who handle ultra-high-speed, broadband transmissions of 1Tbps.



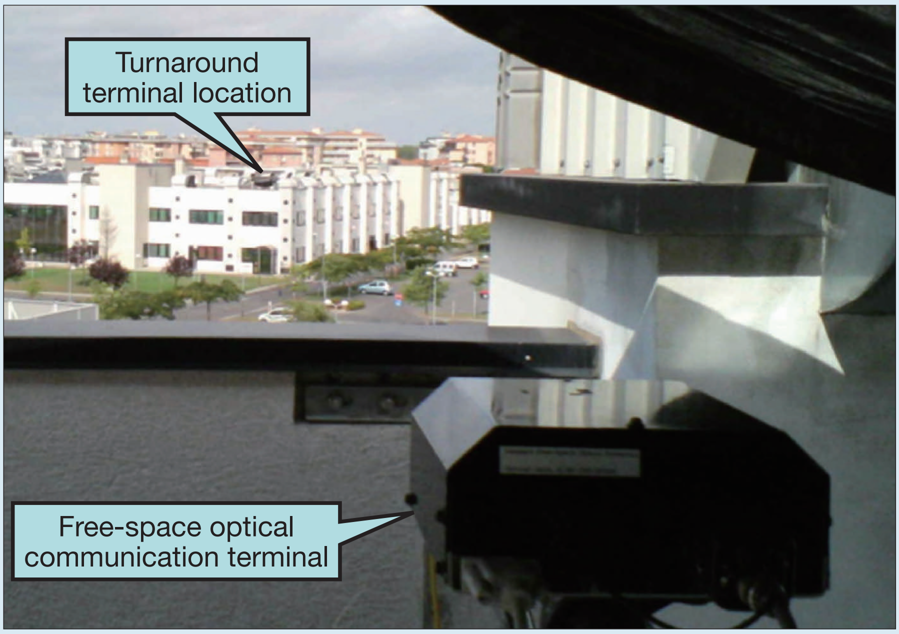




Fig. 5 ●The exterior appearance of free space optical communication system installed on the roof of Center of Excellence for Information and Communication Engineering (CEIIC), Santana University (left) and the turnaround terminal location viewed from the free space optical communication terminal (right)

—— **Then, in the foreseeable future, will the system be used only in cases where laying optical fiber costs too much for about 1 km distance or the construction is too difficult?**

**Arimoto:** As is conventionally done, optical fiber will be used in cases where the installation is not difficult. Our system will be used in cases where the conventional method is difficult to be implemented. At the Tokyo station, for example, it is almost impossible to lay new optical fiber cables crossing over many railway tracks and running trains, nor is it possible to construct new pipe conduits crossing underground for laying optical fiber lines.

Our system may also be used for a large-scale river network. It is said that except for a case where there already is a bridge across the river, laying optical fiber across the river is significantly difficult. The width of such places, including expressways, is no more than 100 m or 200 m, where our technology could be practically applied.

Furthermore, our system may be used in European urban areas where laying optical fiber is difficult. In Pisa, for example, a construction will stop for 2 or 3 years for investigation of remains discovered during the digging of the ground. Against this background, Europeans are highly interested in wireless broadband accesses, and I received some inquiries from them.

—— **Do you consider transferring the developed technology?**

**Arimoto:** We have been considering the transfer for the past 2 years, but where to transfer is not yet specified. General users whom we met at exhibitions or other events expressed their intention of using such a system if it is available. On the other hand, the developers said that they were willing to develop if there were many customers.

## Leveraging the experiences gained in the cosmic space to advance to free space optical communications

—— **Briefly talk about the process in which your research has advanced from space communications to the use on the ground.**

**Arimoto:** I originally started this research around the end of the 1980s. During the 1990s, I was engaged in the project to conduct the experiments for the world's first laser transmissions between a geostationary satellite and the ground station using the engineering technology satellite called "Kiku VI." Actually the satellite could not be put into a geostationary orbit, but we conducted 1 Mbps laser transmissions between the NICT's facility and the satellite.

Next, from 1998 to around 2002, I had developed a 2.5 Gbps optical communication system to be installed in the exposed facility of the International Space Station. However, this development program was terminated as a result of various circumstances.

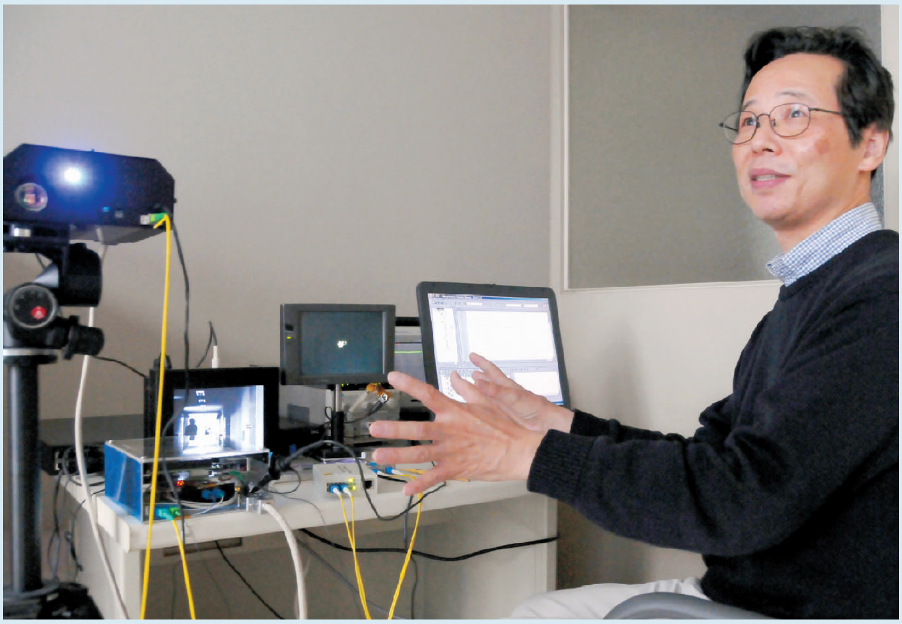


Fig. 6 ●Indoor demonstration system installed at the NICT's laboratory facility

The technology was used in the joint experiment with Japan Aerospace Exploration Agency (JAXA) using an experimental airship in the Stratospheric Platform program in 2004. This experiment was conducted by applying space optical communications for the broadband signal transmission between an airship and the ground station. However, this plan was also terminated after the first flight with successful bidirectional beacon tracking.

As we thought at that time, the actual experiments using an artificial satellite or an airship end in several hours despite many years' hard preparation. To effectively utilize the preparation, should we master this technology on the ground where more frequent experiments are available? For this reason, we started more practical systems with higher performance in parallel with experiments for the stratospheric platform.

—— **Is it the current system? Is the system used for the stratospheric platform one generation before this system?**

**Arimoto:** Yes it is one generation before. However, part of the previous system is used in the current system. Some components made for the experiments of the stratospheric platform as spare are also used in the current system. The fast steering mirror actuator was actually prepared for the stratospheric platform experiment. It took 3 years for us to develop a practical system.

The research for practical application, including the design required for operational system stability, reliability, and costs, has almost been completed. If there are markets and users, the system will be commercially available at any time.

The features of this technology are that it uses fundamental technologies for high-speed, broadband communications with the International Space Station and satellites. The technology that had never been developed except for optical intersatellite communications reaches an almost practical product. We would like to explore and stimulate possible targets for technology transfer and users.

—— **Thank you very much for your talk today.**

# Symposium Reports

Toshiyuki Okuyama, Research Manager, Project Promotion Office, Information Security Research Center

## ◆NICT Information and Communications Security Symposium “Security in the Era of Cloud Computing”

NICT Information Communications Security Symposium was hosted by NICT and sponsored by the Ministry of Internal Affairs and Communications, the Information Security Policy Council, and related academic societies, at KOKUYO Hall (in Tokyo) on February 12 (Friday), 2010, aiming to introduce the latest R&D trend of security measure technologies in the Information Security Research Center, as well as to promote R&D related to information security.

Focused on cloud computing that supports the development of future information communication network, this symposium provided lectures by experts in each field and researchers of the Information Security Research Center, and panel discussions about the relationship between cloud computing and security, from four different perspectives corresponding to the four research groups of the Research Center (Network Security Incident Response, Traceable Secure Network, Security Fundamentals, and Disaster Management and Mitigation). About 200 people, attending mainly from related companies in the communications, manufacturing, and services sectors, highly appreciated the symposium and actively participated in the discussion with many questions and opinions.

Keynote speech at “NICT Information Communications Security Symposium”

## ◆CRYPTREC Symposium 2010 ～Technical presentation by the applicants of the submitted algorithms～

CRYPTREC (Cryptography Research and Evaluation Committees): a project to evaluate and monitor the security of e-Government Recommended Ciphers List, as well as examine the establishment of evaluation criteria for cryptographic modules, which is jointly operated with related ministries including the Ministry of Internal Affairs and Communications, publicly sought for new ciphers last year in the run-up to the revision of e-government recommended ciphers scheduled in the fiscal year 2013. There were six applications to this offer. The CRYPTREC symposium was hosted by NICT and the Information-technology Promotion Agency, Japan (IPA), and cosponsored by the Ministry of Internal Affairs and Communications and the Ministry of Economy, Trade, and Industry, at KOKUYO Hall on March 2 (Tuesday) and 3 (Wednesday), in order to hear the explanation of each technology by the applicant.

Besides the technical presentation by the applicants of the submitted algorithms, this symposium also comprised lectures related to further expansion and future of cryptographic researches in terms of the overview of CRYPTREC’s activities last year and in the future, and panel discussions related to implementation of cryptographic technologies and the latest trend of public key cryptosystem technologies. The symposium successfully concluded with about 230 people participating from related companies, universities, governments, and public institutions.

A session at “CRYPTREC Symposium 2010”

# Report on "Research Project of Neural Systems and Information Networks" Kick-off Symposium

Tohru Kubota, Director, Project Promotion Office, Kobe Advanced ICT Research Center

NICT has just started research under the organization for "Research Project of Neural Systems and Information Networks" toward practical application of new information communications using brain functions, jointly with Osaka University and Advanced Telecommunications Research Institute International (ATR).

In celebration of the launch of the "Research Project of Neural Systems and Information Networks", this Kick-off Symposium jointly hosted by these three organizations was held at the Tokyo International Forum on March 10, 2010 (cosponsored by the Okawa Foundation).

It was a flourishing symposium with about 400 participants in the conference hall, showing high social interest in the field of brain information communications research.

In the opening session, with presidents of three host institutions, namely NICT, Osaka University, and ATR, appearing on the stage, showing the fusional relationship of the three, Hideo Miyahara, President of NICT, gave the opening greeting on their behalf. Then, Mr. Kensei Hasegawa, Vice-Minister for Internal Affairs and Communications, extended a congratulatory speech as a guest of honor, conveying the strong expectation for this symposium and the future fusion research as a message from Mr. Kazuhiro Haraguchi, Minister for Internal Affairs and Communications.

In the first session, Professor Toshio Yanagida from Osaka University (NICT Program Coordinator), gave a keynote speech as the introduction to "Research Project of Neural Systems and Information Networks" and the overview of the research, and Dr. Kazuhiro Oiwa, Director General of Kobe Research Laboratories, outlined the fusion research. These lectures discussed the possibilities of brain information fusion research for the issues information communications research should address (issue of impacts on energies and human beings).

Session of the Symposium

In the second session, invited speakers Professor Takeo Watanabe, a world famous scientist of Boston University (Guest Researcher of ATR Computational Neuroscience Laboratories), and Professor Shigeru Kitazawa from Faculty of Medicine, Juntendo University, gave lectures. Both professors pointed out that the excellent human capability mechanism has rapidly been uncovered by brain research and, at the same time, new perspectives and paradigms are emerging.

In the third session, Dr. Mitsuo Kawato, Director of ATR Computational Neuroscience Laboratories, and Professor Tomaso Poggio from Massachusetts Institute of Technology gave commemorative lectures of The Okawa Foundation Prize. They talked about the episodes of their relationship, the story that both of them contributed to the foundation of the "computational neuroscience" field, and their achievements concerning BMI (Brain-Machine Interface) technology through fusion with robot engineering.

Just before the closing of the symposium, Mr. Kazuhiro Haraguchi, Minister for Internal Affairs and Communications, arrived at the venue after the Diet session and expressed his expectations for the possibilities to utilize brain science for the ICT growth strategy and for potentials of brain science as a support for the challenged people, making this symposium more meaningful for accelerating the "Research Project of Neural Systems and Information Networks."

NICT will continue its collaboration with external parties to promote the "Research Project of Neural Systems and Information Networks."


From left, Yasuo Hirata, President of ATR, Hideo Miyahara, President of NICT, and Kiyokazu Washida, President of Osaka University


Kazuhiro Haraguchi, Minister for Internal Affairs and Communications


Kensei Hasegawa, Vice-Minister for Internal Affairs and Communications


Kazuhiro Oiwa, Director General of Kobe Research Laboratories


Mitsuo Kawato, Director of ATR Computational Neuroscience Laboratories


Toshio Yanagida, Professor of Osaka University

# New employees

Eighteen people joined NICT as new staff. Here are their introductions with their aims at NICT.

**Research Promotion Department**
**Outcome Promotion Group**

## Yasunori Kuroda

I do my best to be one of work force by mastering job.

**Strategic Planning Department**
**Strategic Planning Office**

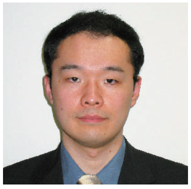
## Hideki Kashioka

I would like to achieve high goals with cooperation in mind.

**New Generation Network Research Center**
**Network Architecture Group**

## Ved Prasad Kafle

I would like to contribute to the society through R&D of new-generation network technologies.



**New Generation Network Research Center**
**Quantum Group**

## Kentaro Wakui

I will do my best to contribute to NICT in the field of quantum information and communication technology.

**New Generation Network Research Center**
**Space-Time Standards Group**

## Thomas Hobiger

I will do my best to meet NICT's expectations in conjunction with this new position.

**New Generation Wireless Communications Research Center**
**Space Communication Group**

## Tetsuharu Fuse

I will research into information and telecommunications on the basis of the study of artificial satellite orbits.

**Kobe Advanced ICT Research Center**
**Biological ICT Group**

## Kenji Leibnitz

I hope to bridge information technology and neuroscience, as well as Japan-German exchange.

**Kobe Advanced ICT Research Center**
**Biological ICT Group**

## Guoxiang Liu

I would like to contribute to the development of a new research domain, brain-based information and communication.

**Kobe Advanced ICT Research Center**
**Nano ICT Group**

## Shin-ichiro Inoue

I will strive for the realization of unprecedented optical devices that open up new exciting possibilities in photonic applications.

**Kobe Advanced ICT Research Center**
**Nano ICT Group**

## Taro Yamashita

I do my best to propose and realize novel superconducting devices.

**Knowledge Creating Communication Research Center**
**Spoken Language Communication Group**

## Chiori Hori

We, NICT, aim for being an internationally recognized institute in the field of spoken language processing.

**Universal Media Research Center**
**3D Spatial Image and Sound Group**

## Kenji Yamamoto

I will have a serious commitment to research and be open to different viewpoints to guide my direction.

**Information Security Research Center**
**Security Fundamentals Group**

## Miyako Ohkubo

I would like to establish a high-level target and work toward achieving such a target in daily work.

**Applied Electromagnetic Research Center**
**Radiowave Remote Sensing Group**

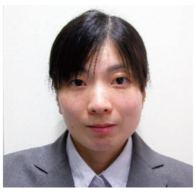
## Jumpei Uemoto

I would like to work hard in researches, keeping in mind to take wide views.

**Applied Electromagnetic Research Center**
**Space Environment Group**

## Takuya Tsugawa

I would like to do my best to live up to expectations placed on me.



**Applied Electromagnetic Research Center**
**Electromagnetic Compatibility Group**

## Maya Mizuno

I would like to strive to be a researcher who can contribute to the society.

**Collaborative Research Department**
**Network Testbed Research Promotion Group**

## Eiji Kawai

I would like to work for R&D from a perspective of practical applications.

**General Affairs Department**
**Personnel Affairs Team, Personnel Affairs Office**

## Hidenori Yazawa

I will try to be self-critical and responsible in my actions.

# Prize Winners

Prize Winner ● **Hiroshi Kumagai** / Vice President, Member of the Board of Directors

◎DATE : March 12, 2010

◎NAME OF THE PRIZE : **Maejima Award**

◎DETAILS OF THE PRIZE : Development of a satellite borne millimeter-wave cloud profiling radar

◎NAME OF THE AWARDING ORGANIZATION : Teishin Association

◎Comments by the Winner

I am very happy to receive the prestigious Maejima Award. I would also like to share this happiness with my senior researchers who guided me to conduct research, my colleagues, and my followers who are now continuing the research, and express my gratitude to every party in concern. My research in cloud radar started in 1993 when I participated in a meeting organized by Jet Propulsion Laboratory (JPL) in the United States, entitled as “Utility and feasibility of a Cloud Profiling Radar,” and I got vividly aware of its significance and technological challenges. Since then, I have been engaged in this research for nearly 20 years. With time, the system has been changed from airborne to satelliteborne and I have received immense guidance from many people during this period, to whom I would like to express my thanks again.


Prize Winner ● **Fumito Kubota** / Executive Researcher


◎DATE : March 12, 2010

◎NAME OF THE PRIZE : **Maejima Award**

◎DETAILS OF THE PRIZE : A study on network architecture of ultrahigh-speed network

◎NAME OF THE AWARDING ORGANIZATION : Teishin Association

◎Comments by the Winner

I am really honored to receive the Maejima Award that should be given to one who contributes to the development of communication technologies. Again I would like to express my sincere gratitude to President and all members of NICT. The award was given for my research on network architecture of ultrahigh-speed network. I deem this award given to me and representing every team member who shared difficulties with me in our network researches for 22 years since my experience at the Radio Research Laboratory. I owe much to my senior researchers and my followers who supported me, as well as to the teamwork of the companies and universities participating in my research. I would like to thank them again.

These days when a new type of information infrastructure is to be born from fusion of telecommunication networks and the Internet, as well as broadcasting networks, I am encouraged by the importance of challenges for network researchers including me.

**Prize Winner ● Kamya Yekeh Yazdandoost** / Expert researcher, Medical ICT Group, New Generation Wireless Communications Research Center

◎DATE: September 15, 2009

◎NAME OF THE PRIZE: **Best Paper Award**

◎DETAILS OF THE PRIZE:

A Statistical Path Loss Model for Medical Implant Communication Channels

◎NAME OF THE AWARDING ORGANIZATION:

The 20th Personal, Indoor and Mobile Radio Communications Symposium 2009

◎Comments by the Winner

In this joint research work at Medical ICT group, NICT, and Information Technology Laboratory group, NIST, USA, we developed a model and visualization environment to obtain wireless channel characteristics inside a human body for implant wireless communication.

I am very pleased that this work is evaluated in the PIMRC 2009 and we will do our best at Medical ICT group, NICT, to provide more results in the nearest future for medical implant communication as tissue implanted devices are of great interest for different clinical usage.

I would like to thank everyone in the Medical ICT group for their support.

**Prize Winner ● Masugi Inoue** / Research Manager, Network Architecture Group, New Generation Network Research Center

◎DATE: September 16, 2009

◎NAME OF THE PRIZE:

**Communications Society: Distinguished Contributions Award**

◎DETAILS OF THE PRIZE:

His significant contributions to dedicated activities in planning and management at the Communications Society as well as to vitalization of academic exchanges

◎NAME OF THE AWARDING ORGANIZATION:

IEICE Communications Society

◎Comments by the Winner

I worked for the Communications Society as a Director, General Affairs for 2 years. My main commissions included management of 12 meetings of IEICE-CS Board of Directors, planning and management of IEICE CS General Meeting, selection of IEICE fellow candidates and next CS president candidates, and coordination with other IEICE societies through the society coordination meetings, etc. I was extremely busy during my term of office but those were valued experiences for me because of the opportunity to meet many people. From now on, I would like to work for my R&D by taking advantage of CS.

**Prize Winner ● Yoichi Miyawaki** / Research Expert, Biological ICT Group, Kobe Advanced ICT Research Center

**Yusuke Morito** / Expert researcher, Biological ICT Group, Kobe Advanced ICT Research Center (Affiliation at paper submission: NIPS, National Institutes of Natural Sciences)

Joint Prize Winners:

Hajime Uchida (Nara Institute of Science and Technology)
Okito Yamashita, Masa-aki Sato, and Yukiyasu Kamitani (ATR Computational Neuroscience Laboratories)
Hiroki C. Tanabe and Norihiro Sadato (NIPS, National Institutes of Natural Sciences)

◎DATE: September 25, 2009

◎NAME OF THE PRIZE:

**Japanese Neural Network Society Excellent Paper Award**

◎DETAILS OF THE PRIZE:

Visual Image Reconstruction from Human Brain Activity using a Combination of Multiscale Local Image Decoders (Neuron, Volume 60, Issue 5, 915-929)

◎NAME OF THE AWARDING ORGANIZATION:

Japanese Neural Network Society

◎Comments by the Winner

Yoichi Miyawaki

Yusuke Morito

We are very proud to receive the Japanese Neural Network Society Excellent Paper Award. We would like to express our gratitude to all members of the Society who thought highly of our research. We are engaged in the research to read the visual images in human brain during seeing and thinking, and to reconstruct them on the screen. In the future, we would like to contribute to the development of communicational methods for physically handicapped persons and a new method of information and telecommunications using brain information.

**Prize Winner ● Yoshimi Yamashita** / Research Expert, Advanced Device Research Group, New Generation Network Research Center

**Issei Watanabe** / Senior Researcher, Advanced Device Research Group, New Generation Network Research Center

**Nobumitsu Hirose** / Senior Researcher, Advanced Device Research Group, New Generation Network Research Center

Joint Prize Winners:

K. Ikeda, M. Harada, T. Yamamoto, S. Nakaharai, N. Hirashita Y. Moriyama, T. Tezuka, N. Taoka, N. Sugiyama (MIRAI Project)
S. Takagi (MIRAI Project, The University of Tokyo)

◎DATE: October 7, 2009

◎NAME OF THE PRIZE: **SSDM Paper Award**

◎DETAILS OF THE PRIZE:

High Mobility sub-60nm Gate Length Germanium-On-Insulator Channel pMOSFETs with Metal Source/Drain and TaN MIPS Gate

◎NAME OF THE AWARDING ORGANIZATION:

The 2009 International Conference on Solid State Device and Materials (SSDM2009)

◎Comments by the Winner

From left, Issei Watanabe, Yoshimi Yamashita, and Nobumitsu Hirose

We have been engaged in R&D of Ge-MOSFET, one of post-silicon devices, jointly with MIRAI project. Using a technology of forming insulator film, proprietary to NICT, we achieved high-speed performance for nanoscale gate Ge-On-Insulator (GOI) channel pMOSFET for the first time in the world and demonstrated this result in SSDM2009. We are very proud that this paper was highly appreciated by this Society, and at the same time we have realized the importance of developing proprietary technologies and of joint researches with other institutes.

# A report on "Next-generation home network service open experiment 2010"

## - to implement "next-generation home network" able to provide various services -

Kiyoshi Hamaguchi, Group Leader, Medical ICT Group, New Generation Wireless Communication Research Center

Home network, made by interconnecting various IT devices at home, is expected to play an important role in providing various services to users of the next-generation networks. Looking at intelligent home appliances, different transmission methods are separately studied for each field including AV home appliances, white goods, etc. It is, however, required to establish interoperability among such transmission methods to implement universal connection between all of the intelligent home appliances.

In such a situation, NICT is working for R&D, standards promotion, and diffusion promotion of the next-generation home network environment, in conjunction with the Next Generation IP Network Promotion Forum and the Japan Advanced Institute of Science and Technology (JAIST). As a part of these activities, these organizations held the "Next-generation home network service open experiment 2010" on March 4 at Ishikawa Science Park (in Nomi City, Ishikawa Prefecture).

Opening ceremony (aim explanation by the chairman of the Executive Committee, Prof. Yasuo Tan)

A full view of NICT booth

These open experiments, the fourth one held this time, have shown advancement of technologies year by year. This time, even though held in a local place, the exhibitions for new technologies of home network, and technology lectures contained 29 themes, and dynamic exhibitions attracting many participants (about 370 people). NICT demonstrated biological information collecting devices (BAN), a home electronic appliance power consumption monitoring system using and ZigBee (a wireless transmission standard of low power consumption), a digital signage based on zero-dimension code, and others. The result of questionnaires to the participants shows that more than 90% of the participants gave high opinions, including "Very satisfied" and "Satisfied" for service open experiment, technology seminar, and each of exhibition booths, and many participants expressed their expectation for the next exhibition. Ishikawa Prefecture, where the exhibition was held, showed its high concern toward the exhibition by delegating the prefecture's Director of Commerce, Industry and Labor Department with the personnel from prefectural organizations and companies in this area. The exhibition was also visited and reported by many newspapers and TV stations.

## Information for Readers

The next issue will feature R&D of virtual nodes to support the implementation of new networks.

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