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National Institute of Information and Communications technology

Interview with NICT President Dr. Makoto Nagao on the Second Middle-Term Plan

"NICT — Pioneering the Future of Information and Communications Technology, Japan's Essential Strength"

NICT is presently about to commence a new middle-term plan.
We interviewed President Dr. Nagao on the new activities at NICT relating to his plans for taking the global lead in technological development and for further expansion of new technological fields.

First, now that we are on the threshold of the Second Middle-Term Plan, could you give us your evaluation of the First Middle-Term Plan?

Nagao: The former Communications Research Laboratory, which became an incorporated administrative agency in FY 2001, was unified with the Telecommunications Advancement Organization (TAO), a chartered corporation, in the fourth year of the First Middle-Term Plan to form the present incorporated administrative agency, the National Institute of Information and Communications Technology (NICT). This unification meant that this single organization now was responsible for both R&D and funding activities, and was given the mission of conducting the entire process—from research and development to garnering external support—under a single, coherent policy. In these past few years, efforts have been focused on achieving an organic mobilization of the organization, and I believe that these efforts have been successful. In retrospect, I think these two years were spent elaborating a number of methods to provide a gradually more comprehensive outlook on information and communications for our R&D activities, which is essentially what the National Institute of Information and Communications Technology is all about.

Furthermore, we have actively partaken in collaborative activities with a number of foreign research institutions. When I first took office as president of NICT, the organization seemed to lack the international recognition it deserved, despite having of multiple remarkable achievements in various fields of research. It was my belief that this imbalance between international recognition and the actual capabilities of NICT could be resolved through collaboration with foreign institutions. Communications and information technologies must be applicable on a global scale, and so international appreciation is crucial for a new technology, regardless of the extent of its recognition within Japan. Thus, international collaboration is essential when promoting research if we are to generate technological achievements on a global scale. Our efforts toward this goal will continue into the future. To date, we have concluded research cooperation agreements with France and China and launched joint international research efforts based on these agreements. We have also hosted international meetings, both in Japan and abroad, as part of an overall NICT promotion campaign.

We have heard that NICT is not only carrying out research within the organization, but that it is also commissioning R&D activities to external organizations.

Nagao: NICT assigns its own research staff to R&D activities that are judged to be difficult for industry or academia to pursue. However, there are some R&D themes that may be pursued more efficiently or effectively using external R&D resources. It is sometimes possible to achieve far greater results by commissioning these activities to external organizations such as private businesses.

There is also another advantage to commissioned research, which is that it provides a more solid path for the actual application of our R&D achievements, from the initial research stage to the development stage and finally to commercialization. In reality, this is the area that requires the most effort, and although results cannot be produced overnight, we will continue with our steady and continuous efforts.

NICT also has another task that must not be forgotten: to keep track of the results of research and to publicize these results actively. In the past, public organizations failed to recognize the importance of public relations activities, mainly due to societal factors. However, today and going forward, one of the tasks of a research organization must be to publicize its achievements. Furthermore, there is no question as to the importance of the management of the division handling intellectual property and the acquisition of patents, but what is even more important is to raise the grade of our intellectual property, or research achievements, to the level of international standards. Among my goals is to see Japan's research achievements gain international recognition and find use in global applications. Having one's technology standardized is a difficult process both domestically and internationally, but it has to be done so that our efforts are not wasted.

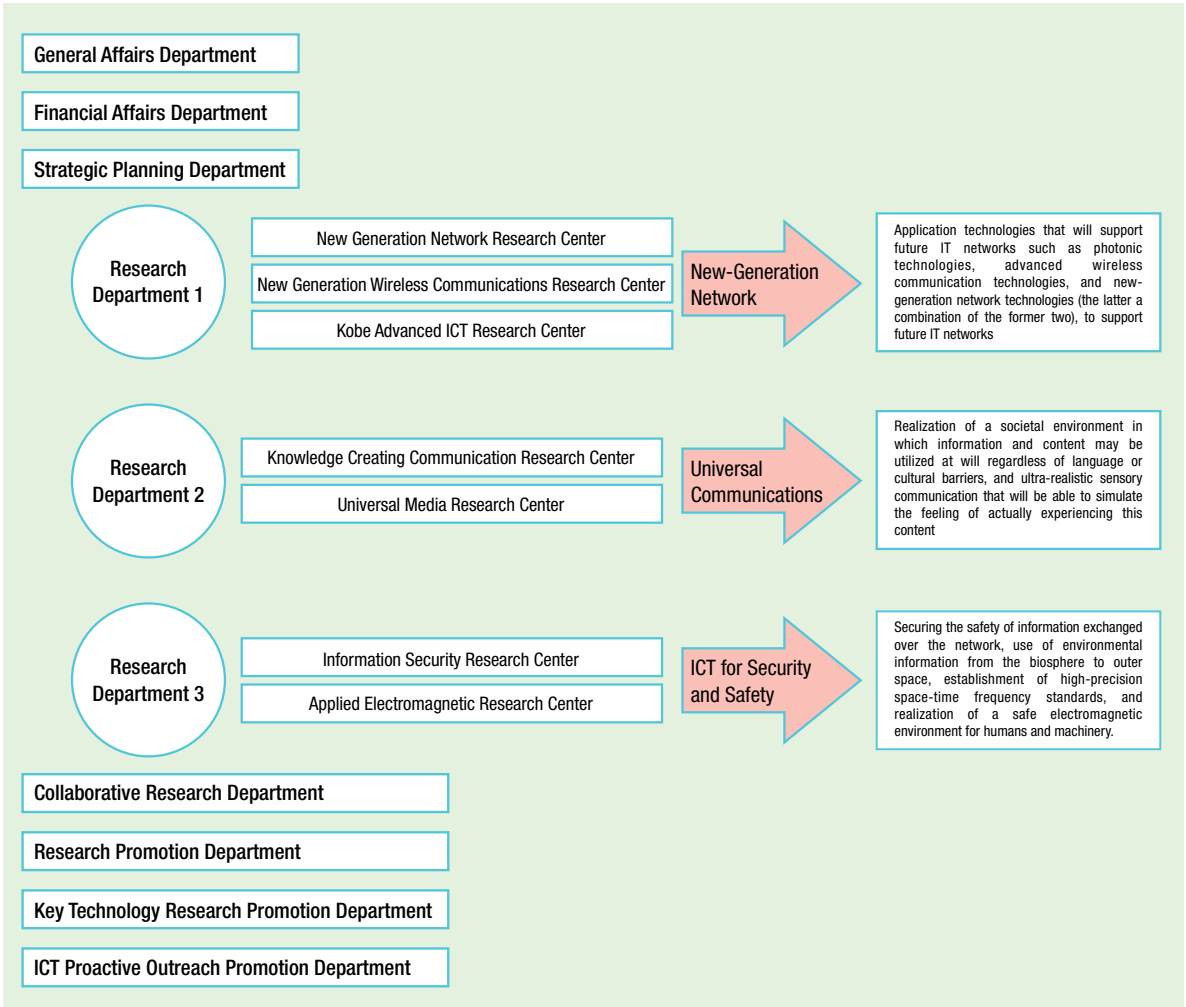
"Among my goals is to see Japan's research achievements gain international recognition and find use in global applications."

It seems that there has been a novel restructuring of the NICT organization along with the adoption of new strategies for the launch of the Second Middle-Term Plan.

Nagao: There are three components to this strategy, and my intention is to create an organization capable of executing each one. The first component consists of "New-Generation Network Technology," in which R&D efforts will be centered on photonic networks in order to realize our future vision of such networks. In this field, research on ultra-fast network technology will be promoted for wireless communications and space communications. The second component is "universal communication technology," which will render IT technologies more accessible. The final component is "IT technology for security and safety." We still have a great deal of ground to cover in this area, such as response and security during large-scale disasters. The NICT organization has been restructured into seven research centers to promote the above three areas of research. Research groups have been established in each center, and R&D will be conducted within the remodeled organization under the command of the various group leaders, pursuing their respective research themes.

In addition, we have incorporated a new Program Director into the system. In order to render NICT's coordinated research activities with external organizations consistent with the above goals, we have to establish mutually cooperative relationships with external organizations. From a comprehensive viewpoint, the Program Director formulates research strategy and efficiently manages research efforts. First, experts from outside organizations are invited to assume the roles of Directors, coordinating activities in six programs. Although this is a completely new initiative, the Directors are all first-rate specialists and we have high expectations of them.

New organizational structure of NICT (as of April 2006)



How will R&D on "Universal Communications" generate a return for society, and what will the role of NICT be at that point?

Nagao: A great deal is required for us to arrive at universal communications. We can see a representative example in infrastructure technologies for ultra-fast communications, which includes photonic communication, wireless communications, and space-communication technologies. We must have research and development into advanced means of exploiting these technologies in order to realize a ubiquitous society in the broadest sense of the phrase. From the perspective of human interfaces, studies must be conducted on technologies for overcoming language barriers and for allowing access to communication networks from any room in the house.

Universal communication technologies will realize a more human-friendly world of communications. For example, you presently see TV programs asking viewers to respond to content by fax, but in the future, each individual will be connected to every other individual on a one-to-one basis. In particular, IT technologies in applications nearer to immediate human use—such as mobile phones and wearable computers—are expected to contribute significantly to the realization of universal communications.

The future will also see a new mode of communication carried out by groups; in other words, not on a one-to-one but rather on a one-to-many basis. This is the key to next-generation networks.

NICT President Dr, Nagao, discussing the Second Middle-Term Plan

On the other hand, we face the problem of the language barrier, which cannot be ignored when considering global communications. In the past, translation technologies have mostly been focused on translations between Japanese and English, but in the future, bilateral translations between Japanese and Chinese as well as other Asian languages will become just as important. It's safe to say that we are facing a need to respond to the demands of a new era, one in which networks will expand from the world of transmissions to a world of communications.

I believe that our R&D activities will contribute significantly to the realization of a universal communication environment in which anyone can safely enjoy the benefits of the communications network at any time and in any place.

What you are saying, then, is that universal communication technologies will eventually overcome the barriers to communication.

Nagao: Yes, and this will not apply only to human-to-human communications. Universal communication must also enable human-to-machine communication. For example, the day will certainly come when communication with machines will become necessary—to talk with a housekeeping robot, for example: "Clean this room," "Go shopping," or "Show the guests in."

This will surely evolve eventually into situations involving machine-to-machine communication. In a case where multiple robots are present, they must be able to communicate to cooperate and accomplish a given task. In the case of showing the guests in, robot A may be in charge of guiding the guests to a certain point from which robot B will be in charge. Even inside the house, digital cameras and video monitors will communicate to initiate wireless links.

In this way, future IT technologies will become more integrated into the home and will contribute to the creation of a more enjoyable and interesting household environment. For example, wide-screen TVs now provide larger viewing areas, but in the future we will see televisions evolve to offer ultra-realistic sensations to the viewer, in which events worlds away will seem to unfold right in front of your eyes.

However, such technologies require advanced content that can fully exploit the new communication environment. Studies must be conducted on how to import and apply resources such as movies, music, and novels. NICT is currently also undertaking research under this theme.

Behind all the flashy features of the new content lies the issue of the increasing need for security and safety, which also represents another major research theme. It is easy to envision an environment providing communications to "anyone, anywhere, anytime" in day-to-day life. However, securing such communications during disasters and unexpected emergencies is a serious issue, and NICT is

currently conducting studies to investigate this issue from a fresh perspective. Until now, these technologies have involved communication via helicopters and satellite communication for monitoring on-the-ground developments, disaster conditions, and volcanic eruptions, but in the future, we believe that it will be necessary to develop monitoring technologies for the global environment, including global environmental changes, if we are to create a safer world for everyone.

Last but not least, will you give us your views on the future prospects of the Second Middle-Term Plan from your perspective at its outset?

Nagao: Only two years have passed since the implementation of the new NICT organization structure, and at that time the First Middle-Term Plan was still in progress. Presently, the new Middle-Term Plan has just begun to take off as envisioned. There are a variety of different fields involved in IT technologies, and I believe that innovative R&D activities—not simple extensions of past technologies—will be facilitated with the development of systems in which communications and information technologies are further integrated. One example of such an innovative technology would be a network that can dynamically and autonomously change its state through the appropriate application of acquired information (including multifaceted external conditions), such as the status of the user and the location of a major disaster.

It is also important to investigate measures to prevent interruptions in communications. In this context, I believe that the development of a new communications technology must incorporate the above-mentioned information (including multifaceted external conditions) into the world of communications. Another area of focused interest is the field of electromagnetic measurement. With advances in our global observation technologies, remote-sensing techniques will likely make significant contributions toward countering global environmental problems.

Are there specific goals for the Second Middle-Term Plan?

Nagao: It is not yet possible to give numerical targets for the next five years, but one of our goals in the field of optical communications is to establish the basic technologies for an ultra-fast world-class photonic network at the 100-Tbps level. We will also aim to establish the basic technologies to overcome the language barrier, which will dramatically improve the ability of people to communicate. And in terms of ICT for security and safety, we will strive to establish a comprehensive communication and security technology that will enable everyone to exchange information securely and safely over networks.

In the same vein, I would like to point out that there is a shared understanding among countries that information and communications technology, in general, is an importance source of national power and development. The United States

"IT technologies are considered to be an important source of national power."

spends a great deal of its budget on IT technologies in general and is working to establish its influence not only within its own borders but throughout the world as well. Both the business and political communities in Japan also consider IT technologies to be an important factor in national power, and this theme has been the subject of debate at the Council for Science and Technology Policy. We also plan to make recommendations on Japan's IT policies through the Ministry of Internal Affairs and Communications. Japan's IT policy and the themes and research directions that Japan promotes as a country should be closely interrelated. Compared to industry and academia, we hold a unique position from which we may make active contributions to both, and therefore, our job is both challenging and rewarding.

We hope that you will follow our future activities with interest.

Thank you.

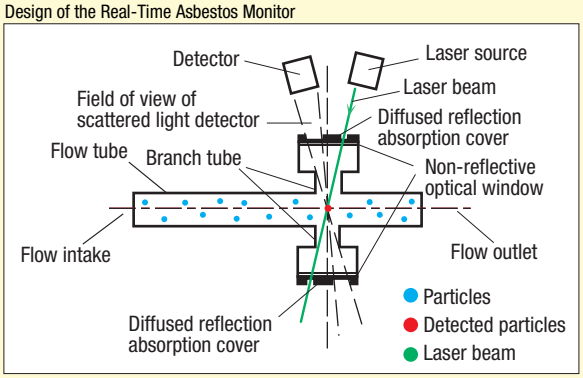
A Pioneering Future Technology: The "Real-Time Asbestos Monitor" — a Sharp Eye out for Hazardous Particles Suspended in Air

Asbestos has become a serious and widespread problem.
We interviewed the researchers who developed the "Real-Time Asbestos Monitor," which applies optical principles to the detection of suspended micro-particles in the air.

Q. What were the most difficult moments in the design and development of this device?

A method of identifying fibrous particles by measuring the polarization of scattered light was already in our minds when we first proposed our R&D plans for the device. So we first asked Professor Shigeo Itoh at Toyo University to develop a program for optical scattering by cylindrical and spherical particles, and came to the conclusion that the best method would be to measure the polarization parallel to the direction of the incident laser beam, based on the results of optical scattering polarization computations made with the help of students working on their graduate theses. However, it is nearly impossible to measure extremely weak scattered light in the direction of the strong incident beam. Therefore, we decided to measure the scattered light at an angle just slightly off of the incident laser beam.

Design of the Real-Time Asbestos Monitor



Q. Can you share any interesting episodes related to the difficulties faced in these development efforts?

Although only small amounts of asbestos were used in the experiment, we exercised extreme caution in handling this hazardous substance, such as wearing masks and gloves and using specialized vacuum cleaners. Since it was essential to compare the performance of our device with the Phase Contrast Microscope (PCM) method, the standard method for measuring fibrous particle concentration, we received training on the use of PCM at the Health Science Center of Kitazato University, and we received an A-rank grade in a technical counting analysis test. We then relayed these acquired skills to our joint researcher Mr. Kosei Hashiguchi at ESCOM Incorporated, who ended up counting so many samples on the microscope that his eyes hurt.

Conventional asbestos-counting methods required visual observation under the microscope

Q. We have heard that the "Research Result Practical Use Support System" was involved in modifications of the device.

In order to make the device applicable to the asbestos problem and increase its reliability in terms of commercialization, we applied to the "Program for Research Achievement Deployment Support," which was newly founded in FY 2005; our work was then selected as the program's target research. With the support of this program, we mainly conducted field experiments and calibration work, the latter mainly performed by Sibata Scientific Technology Ltd. and ESCOM Incorporated, which was responsible for manufacturing. With the help of these two companies, we succeeded in constructing a prototype. Our overall hope is that NICT's technologies may contribute in some measure to resolving the asbestos problem.

Q. What are your future ambitions and plans for research?

The developed device detects fibrous particles in the air. In work areas that handle asbestos, the main component of these fibrous particles is asbestos; however, under normal conditions, there are many other types of fibrous particles in the air or inside buildings, and asbestos is just one of these types of particles. Thus, it will be necessary to distinguish asbestos from other fibrous particles. Demand is increasing for devices that can monitor the scattering of asbestos from asbestos-removal sites and buildings using materials containing asbestos. The problem of asbestos identification also arises under the fibrous PCM method, and methods such as the dispersion staining method and polarizing microscope method are currently being examined. We are also conducting research and development on methods of asbestos identification with our real-time monitor device, which uses scattered light; this represents my main challenge for the future.

Technical specifications
Inventor: Norihisa Hiromoto
Patent number: 2881731

Patents acquired by NICT may be used with license from NICT. For more information on the details of these patents and technical information, please contact the address below.
Intellectual Property Management Group
Research Promotion Department
National Institute of Information and Communications Technology (NICT)
TEL: (int)-81-42-327-7464
E-mail: ip@ml.nict.go.jp

Mining the Future of Mobile Communication Systems — "Wireless Communications Week at YRP"

The "Wireless Communications Week at YRP" was held in the No.1 Building of the Yokosuka Research Park from March 28 to 30, 2006. The event consisted of the "NICT New Generation Mobile Communications Symposium" hosted by NICT on the 28th, the "IMT-Advanced (4th-Generation Mobile Communications Systems) Workshop" hosted on the 29th by the Ministry of Internal Affairs and Communications and co-hosted by NICT, the YRP R&D Promotion Committee, and others, and the "MOCCA-WWI Workshop on Future Mobile Communication Systems" on the 30th. The event was one of the largest so far, with 300 people (34 from foreign countries) attending each of the workshops on the 28th and 29th.

Since FY 2002, NICT has promoted R&D on mobile communications systems for the future in the "New Generation Mobile Network Project" and the "Project on Commissioned Research Private Businesses" begun by its predecessors, the Communications Research Laboratory (CRL) and Telecommunications Advancement Organization (TAO), respectively. Ever since its inauguration in FY 2004, NICT has pursued R&D in ultra-wideband technology, software-defined radio technology, wireless security platform technology, media independent handover technology, and wireless access technology.

The "NICT New Generation Mobile Communications Symposium" was held as a grand encapsulation of the project, which spanned a total of four years. Keynote Speeches were given by Mr. Mori, Director of the New Generation Mobile Communications Promotion Office of the Ministry of Internal Affairs and Communications, and Dr. Sakata, Professor of Chiba University, followed by reports on "New Generation Mobile Network Research Project" by managing director Dr. Adachi and three group leaders from the Yokosuka Radio Communications Research Center, as well as reports from researchers at KDDI Corporation and Mitsubishi Electric Corporation on their respective commissioned research projects as representatives of the participating businesses.

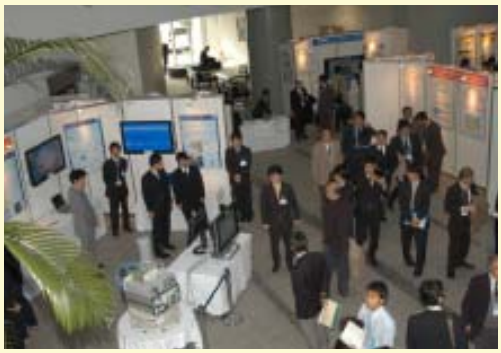
In the lobby of the YRP No.1 Building, 16 booths were set up for exhibitions and demonstrations of research results, and during the three and half hours of the exhibition, crowds of visitors were seen listening attentively to the explanations provided.

Conference room during the "NICT New Generation Mobile Communications Symposium"

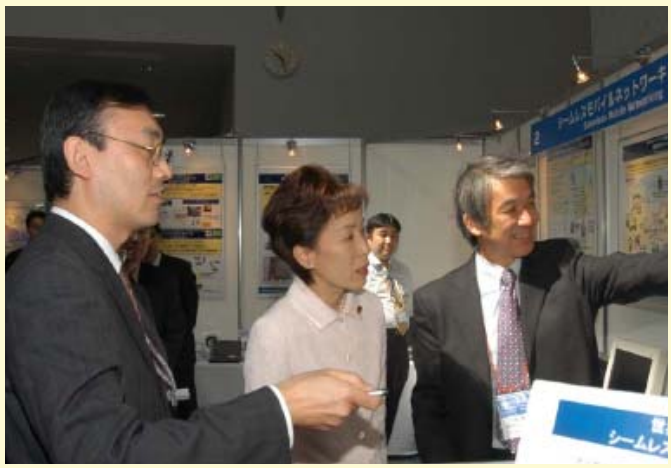
The "IMT-Advanced (4th-Generation Mobile Communications Systems) Workshop" opened with a speech by Ms. Furuya, the Parliamentary Secretary of the Ministry of Internal Affairs and Communications, and a welcoming speech by Dr. Nagao, president of NICT, which were followed by keynote speeches and lectures by both domestic and foreign experts covering a wide range of subjects from policies to international standardization to technical developments related to IMT-Advanced. After her opening speech, Ms. Furuya visited the exhibition booths with evident enthusiasm.

As a final note, we would like to thank all those at the Ministry of Internal Affairs and Communications, YRP R&D Promotion Committee who rendered their various services in organizing this event.

"Wireless Communications Week at YRP"
Date: March 28–30
Venue: 1 Bankan (No.1 Building) of the Yokosuka Research Park (YRP)
Report by: Kazuharu Yamada, Director
Project Promotion Office
New Generation Wireless Communications Research Center



Exhibition and demonstration booths



Ms. Furuya (Parliamentary Secretary of MIC) listening to an explanation of seamless handover technology

Completion of Two Projects

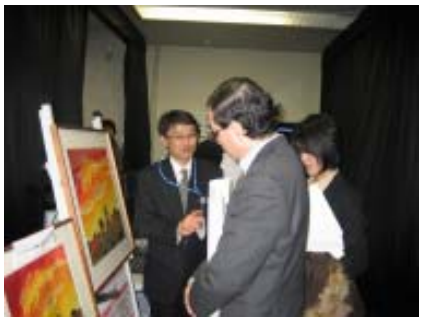
Two projects by the Collaborative Research Management Division of the Collaborative Research Management Department (presently the Collaborative Research Management Group of the Collaborative Research Department) were completed in March 2006.

PROJECT-1

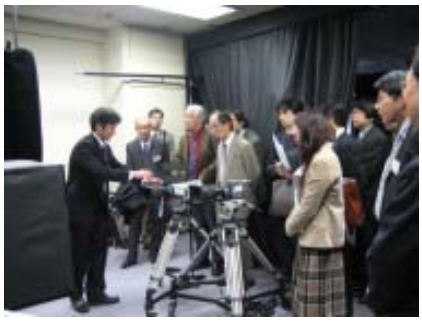
R&D on Natural Vision (Formerly of the Akasaka Natural Vision Research Center)

This project spanned five years beginning in FY 2001 and was aimed at the development of technologies for accumulating, transmitting, and displaying data on the color, quality, solidity, and luster of photographed objects for a more faithful reproduction of actual colors.

In February 2006, an exhibit to present research results was held as the project's grand finale. At the exhibition, the results were demonstrated using a natural-vision camera, projectors, and other developed devices. We also introduced our efforts in applications of natural-vision technologies anticipated for the future. For example, in the field of medicine, an experiment was performed to show how the skin may be photographed and displayed using natural-vision technologies to check the reproduced color against the original color, representing one step toward assessment of the technology's feasibility in tele-medicine applications. Over 260 people visited the exhibition during the three days it was held.



Description of exhibit in which natural-vision technologies are applied to printing



Main components of satellite-onboard optical communication device using optical antenna having approx. 10-cm aperture

PROJECT-2

R&D for Next-Generation Optical Satellite Communication Technologies (Formerly of the Hongo Optical Satellite Communication Technology Research Center)

In this project, R&D was conducted to establish technologies that will be necessary for large-volume, high-speed communication in optical inter-satellite communications (communications between satellites using laser beams).

In FY 2005, a communication experiment was conducted using an "optical inter-satellite communication device" developed under the auspices of this project. A prototype weighing 50 kg and featuring a transmission speed of 2.4 Gbps was constructed, both lightweight and capable of handling larger transmission volumes relative to existing devices consisting of antennas and repeaters (using radio waves). The performance of the prototype was verified by laboratory and outdoor experiments. In these validation experiments, we measured the error rate to confirm the basic communication performance of the prototype and succeeded in transmitting data of a high-definition image (an example of a large-volume application) without compression.

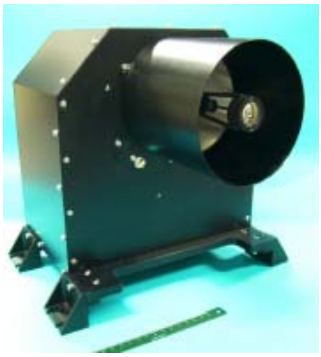


Exhibit comparing natural-vision cameras to normal video cameras

A part of the device used in the validation experiment (green light is the laser beam)

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■ Tel: (042) 327-5392 ■ Fax: (042) 327-7587
■ e-mail: publicity@nict.go.jp
■ URL: http://www.nict.go.jp/

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