FEATURE

Introduction to the New Medium-to-Long-term Plan and the Organization

Interview

Prospect of the Fifth Medium-to-Long-term Plan of NICT
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Prospect of the Fifth Medium-to-Long-term Plan of NICT

NICT commenced a new Medium-to-Long-term Plan, hereinafter, Mid-to-Long term Plan, this April and updated its organizational structure.

Generation change of technology is progressing in the information and communications field, while people have come to have higher expectations and requests for ICT amid the serious COVID-19 pandemic.

Under such circumstances, what challenges is NICT intending to address under what system in its Fifth Mid-to-Long term Plan? President TOKUDA Hideyuki explained the prospect of the plan.

Framework and characteristics of the Mid-to-Long-term Plan

—NICT has been operating based on five-year Mid-to-Long term Plan. Could you explain the framework of the Mid-to-Long term Plan, which was commenced this April?

TOKUDA

Basically, the fifth plan maintains the five priority R&D areas, which were determined in the fourth plan, and aims to create open innovation for the purpose of feeding research outcomes back to society. The five priority areas are “Watch: Advanced electromagnetic research,” “Connect: Innovative networks,” “Protect: Cybersecurity,” “Create: Universal communication,” and “Prime: Frontier science.” These are the very core for NICT.

In addition, the fifth plan designates four strategic fields of cutting-edge technologies indispensable for the next-generation ICT infrastructure, for which Japan should promote research in particular toward a new decade (Figure 1). These are “Beyond 5G,” “AI,” “Quantum ICT,” and “Cybersecurity.”

What are the changes uponcommencing the Fifth Mid-to-Long term Plan or what are the characteristics of the new plan?

TOKUDA

We have received substantial financial support from the Ministry of Internal Affairs and Communications upon commencing the Fifth Mid-to-Long term Plan.

Among the four strategic fields, “Beyond 5G” is the field of research with an eye on generations following “5G,” whose commercial use has just begun. In relation to this, in the supplementary budget for FY2020, 30 billion yen was allocated for our “Funds for Research under Public Application System to Promote R&D on Beyond 5G,” and approximately 20 billion yen was allocated for the development of the “Beyond 5G Shared Research Facilities (i.e., Testbed).”

Regarding AI, the second point, we are developing computing resources for a multi-lingual speech translation system, etc., in the Keihanna Science City, as one of our major projects, by using some 11.3 billion yen allocated in the supplementary budget for FY2020. We have expanded the functions of the AI Science Research and Development Promotion Center and have reorganized it as the Headquarters for AI Research and Development, thereby making a system to accelerate research on AI.
The third is a center for quantum ICT. The Integrated Innovation Strategy 2019 states that NICT should develop a base for quantum security technologies. We are now constructing that base in the northern side within the premises of the headquarters. For this purpose, nearly 8 billion yen was allocated in the supplementary budget for FY2019.

Regarding cybersecurity, the fourth point, we have been promoting the development of the “Cybersecurity Integrated Intellectual and Human Resources Foundation” (CYNEX) under the supplementary budget for FY2020. As a promoting organization, a new department, Cybersecurity Nexus, was established. We are aiming to strengthen the foundation for collecting and analyzing diverse cybersecurity-related data and enhance human resources development programs, which have so far been developed by the National Cyber Training Center. These are, so to speak, initiatives for increasing the degree of self-sufficiency in cybersecurity for Japan.

—Are there any other organizational changes or newly established organizations?

TOKUDA Additionally, we have newly established the “Beyond 5G Research and Development Promotion Unit” as an organization to promote Beyond 5G R&D in a cross-organizational manner, and the “Quantum ICT Collaboration Center” as an organization to promote R&D and social implementation of quantum ICT technologies.

As the core to facilitate digital transformation of NICT as a whole, the Operation Planning Department was also newly established for the purpose of reforming its R&D processes and operational processes, including those relating to accounting, financial affairs, contracts, etc. This is one of the significant characteristics of the fifth plan, showing NICT’s positive attitudes toward operational reform and organizational reform by the use of digital technologies.

In April 2020, we established a group, “Innovation Design Initiative (IDI),” having a function as a think-tank under the immediate control of the President. The group was reorganized as an official organization at the beginning of this term with the aim of strengthening its function as a think-tank (Figure 2).

■ Challenges revealed due to the COVID-19 pandemic

—Since the end of 2019, in particular, the spread of COVID-19 has caused significant changes to our daily lives. When considering new lifestyles amid the pandemic and after the end thereof, the roles expected for ICT are likely to become more and more significant. What do you think of this?

TOKUDA Amid the rapid spread of COVID-19 infection, various preventive measures have been taken. People’s lifestyles have changed drastically while avoiding the Three Cs and people’s activities have shifted to cyber space globally, not limited to Japan. However, there remain many problems concerning information security in the case of teleworking; for example, and online conferences eliminate travel costs but participants may find inconveniences in comparison with face-to-face conferences.

In an ongoing shift from face-to-face analog communications to remote digital communications, a larger number of people have become aware of the advantages of the former and what was lost due to the shift to digital communications. In that sense, the COVID-19 infection has provided us, researchers, with significant opportunities to recognize various challenges, although it almost goes without saying that it is a serious disaster for human society.

Some technologies held by NICT were hoped to have been disseminated earlier amid the pandemic.

One example is a deep ultraviolet (DUV) LED chip, for which research has been conducted by the Advanced ICT Research Institute originally as a next-generation communication device. Light with this wavelength breaks down DNA and RNA. When a single-stranded RNA coronavirus is irradiated with this light, the virus immediately becomes inactivated. As inactivation with ordinary ultraviolet rays takes minutes, this light will significantly reduce the required time. If mass production and commercialization are achieved, DUV LED chips may be utilized for sterilization or disinfection units to be mounted to existing air purifiers or the like.

Additionally, multi-lingual speech translation systems are increasingly being recognized as necessary tools to connect communications in multiple languages seamlessly as more and more people have come to have business communications using remote conference systems. Under recent circumstances, one of our significant challenges is the technology shaping in order to make our technologies accepted in society in a natural manner.

■ Great responsibility to support a sustainable society

—This is your second term as the President. Could you explain your own management policies and future vision, and give a message to people in and outside NICT?

TOKUDA I assumed the office of President four years ago, and at that time, the goals for the term for the fourth plan had almost been decided. However, fortunately, in the latter half of the fourth term, a taskforce to discuss themes for the fifth term was set up and I was able to participate in discussions. Therefore, I have been emotionally involved in the goals for the fifth term.

Cross-sectoral collaboration is becoming more and more important and the most significant reason therefor is the need to create a total system. Since its foundation, NICT has introduced splendid elemental technologies that we can boast to the world. However, in the fifth term, we will be tested as to whether we can properly link those technologies and organize them into a total system with excellent architecture.

The key is whether we can make NICT’s organizational culture more flexible and creative. For that purpose, we launched the basic policy, “COC2.0.”

The original COC, which I launched when starting to serve as the President, was made up of the initial letters of “Collaboration,” “Open Mind & Open Innovation,” and “Challenger’s Spirit.” Maintaining these three concepts, COC2.0 includes new key concepts, namely Digital Transformation (DX) of NICT itself and “Computing & Communication for Carbon Neutral.”

I talked about NICT’s research themes earlier, but I think that NICT needs to serve as a model in efforts to decarbonization toward a sustainable future society where diversity is respected, not merely creating ICT technologies as needed by society. Also in this respect, the fifth term plan contains challenging themes and is well worth pursuing.
TAIRA Kazumasa
Director General, Radio Research Institute
Since joining the Communications Research Laboratory (currently NICT) in 1991, he has engaged in research on mobile radio propagation channels, mobile communication systems, and electromagnetic compatibility. He was appointed to his current position in 2016. Ph. D (Engineering).

We promote R&D for utilizing various characteristics of electromagnetic waves in society so that we can identify changes in weather and the space environment promptly and precisely, and assess social conditions correctly. Highly accurate predictions for the future smart life in the real world will be enabled by using the identified results.

Our organization, called Society 5.0, has been proposed as a future society that Japan should aspire to. Society 5.0 is defined by the Cabinet Office as "a human-centered society that balances economic advancement with the resolution of social problems by a system that highly integrates cyberspace and physical space." By achieving Society 5.0, various knowledge and information will be shared in society, and required information will be provided at proper timings. As a result, unprecedented new values will be created, and wide-ranging social issues and difficulties will be overcome. In this context, there are ever-growing expectations for further sophistication of information and communications technology (ICT). Because of its potential to bring about drastic social and economic changes.

The Radio Research Institute engages in R&D of various technologies related to "electromagnetic waves", such as radio waves and light, and promotes activities for utilizing such technologies in society. We aim to realize Society 5.0 through utilization of electromagnetic waves, and are committed to playing the following three roles:

- A role to realize the function of "sensing" (measurement/observation) for aggregating information from physical space into cyberspace using various sensors
- A role to realize the function of "processing" (information processing) for creating "future visions" in cyberspace by analyzing various kinds of data
- A role to realize the function of "actuation" (operation/action) for creating physical space by utilizing data in cyberspace

Moreover, we will effectively coordinate the results obtained through each of these roles. As a result, we will be able to identify changes promptly and precisely in weather and the space environment, and correctly assess social conditions, including emergency situations such as disasters. We will also be able to make highly accurate predictions of the future to realize a smart life in the real world.

During the five years of the Fifth Medium-to-Long-term Plan, we will conduct R&D on the following technologies using electromagnetic waves for acquiring, collecting, visualizing, and providing information relating to a variety of targets in society; technologies to ensure electromagnetic compatibility (EMC) of various devices and systems; core technologies for generating, supplying, and utilizing high-quality time and frequencies, which serve as a basis of efficient social and economic activities; and core technologies for developing low-cost and highly efficient optical elements. We will also conduct standardization and dissemination activities that lead to diffusion and social implementation of R&D results inside and outside Japan. In addition, we will exert effort in developing R&D personnel who will lead the field of electromagnetic wave technologies in the future. In order to carry out these activities, we have established three Research Centers, five Laboratories, and the General Planning Office which effectively promotes our overall activities.

- Radio Propagation Research Center
- Electromagnetic Compatibility Laboratory, Space-Time Standards Laboratory
- Applied Electromagnetic Research Center
- Digital-Optics Laboratory

For the details of R&D conducted by each laboratory, please see the table above.
or the purpose of realizing the transformation of social systems through the advancement of Society 5.0, the Network Research Institute, by operating associated research centers and laboratories, conducts R&D on computing and AI-enabled networking technology,*1 next-generation wireless technology,*2 photonic network technology,*3 optical and radio convergence technology,*4 space communications fundamental technology,*5 and resilient ICT technology,*6 as key technologies for this purpose. The Institute also aims to drive standardization activities, disseminate R&D results, and implement them in society (Figure 1). It also operates an advanced ICT device laboratory, thereby contributing to the progress of ICT platform technologies that harmoniously integrate ultra-high frequency waves such as light waves and terahertz waves (Figure 2).

**Network Architecture Laboratory**

The Network Architecture Laboratory conducts R&D leading to the advancement of network architecture and fundamental technologies that enables stable and quality communications and data processing in order to support diverse network services in the Beyond 5G era sustainably.

**Photonic ICT Research Center**

The Photonic ICT Research Center conducts R&D on high-capacity photonic networks to support rapidly increasing communications traffic, access technologies that harmoniously integrate optical fiber and wireless communications, and flexible network technologies, all of which will be essential for the Beyond 5G era.

**Wireless Networks Research Center**

In anticipation of the coming Beyond 5G era, the Wireless Networks Research Center conducts R&D to realize and disseminate results of targeting wireless technology that will globally extend three-dimensional seamless communication networks including the ocean and space through the integration of terrestrial networks and non-terrestrial networks (NTN), and realize “connected” under any circumstances or in any environments.

**Resilient ICT Research Center**

The Resilient ICT Research Center engages in conducting R&D on information and communication technologies (ICTs) that contribute to the improvement of disaster resilience on a global scale, and implementing R&D results in various sectors. The center targets resilient ICT technologies against disasters and ICT useful at the time of a disaster, ranging from resilient ICT technologies for severe physical environments where communications are difficult and natural environment measurement technology to technologies for detecting signs of failure of optical networks and restoring their functions.

**Advanced ICT Device Laboratory**

The Advanced ICT Device Laboratory is an open innovation hub supporting and driving R&D on enabling technologies for innovative information and communication devices that can be used through combination of all frequency bands including light-wave and ultra-high frequency, based on advanced hardware development technologies applicable for designing, trial manufacture, implementation, and assessment of devices. As of the end of FY2020, 35 organizations use this laboratory.

In order to achieve broadband, ultra-reliable, and ultra-low latency communications that are desired in the Beyond 5G era, the Network Research Institute enhances fundamental and system technologies for wireless (terrestrial and satellite), and networking. Keeping in mind the basic premise that the resources on the earth and in space that humans can use are finite, we engage in establishing fundamental technologies for controlling and managing communication, computation, storage, and sensing resources that are highly scalable and flexible in terms of numbers and dimensions, and for providing various network services simultaneously. Flexibility of networks is also required in severe physical environments such as in a disaster or amid a network failure. For the management and operation of these resources, on-chip network technologies are required and division of roles allowing distributed and independent control and loose coupling is required. We at the Network Research Institute work together to integrate fundamental technologies and drive the dissemination of R&D results, thereby supporting society in the Beyond 5G era.
In order to strengthen innovation capability that will create unprecedented value and transform social systems in Japan, it is indispensable to sophisticate technologies in the cybersecurity area for protecting social systems against rapidly increasing cyberattacks as the national capacity to protect society (life, property and information). Against such background, the Cybersecurity Research Institute will carry out R&D as shown in the Table below under the Fifth Medium-to-Long-term Plan. The reorganized structure of the Institute is shown in Figure 1. The Cybersecurity Laboratory carries out R&D on visualizations to monitor cyberattacks from multiple aspects and support the assessment of the situation, techniques for automatic analysis and measures utilizing AI technologies, data-driven cybersecurity technologies that will lead to the establishment and enhancement of techniques for large-scale aggregation and cross-cutting analysis of diverse cybersecurity-related information. Furthermore, the Laboratory carries out R&D on emerging security technologies to establish techniques to verify the security of the latest communication devices, IoT devices, connected cars, etc. The Security Fundamentals Laboratory endeavors to work on technologies for secure data utilization that ensure security and privacy at each stage of provision, collection, storage, analysis, and development of data and promote data utilization including that through cross-organizational collaboration, as well as contribute to solving social problems such as those relating to teleworking. Additionally, the Laboratory carries out R&D concerning security evaluation of next generation cryptographic schemes, including post-quantum cryptography, and the cryptographic systems used for the e-Gov system, etc. to establish the cryptographic infrastructure for the quantum computing era.

The Cybersecurity Nexus, which was newly inaugurated, aims to formulate a government-industry-academia cybersecurity base and collect, store, analyze and provide cybersecurity-related information domestically, and to create a common platform for fostering cybersecurity experts as society-wide experts. It will be open to the public as a nexus connecting the government, industry, and academia (see Figure 2).

The National Cyber Training Center provides Cyber Defense Exercise with Recurrence (CYDER), a practical cyber defense training program based on the latest scenarios of cyber incidents in an environment simulating an individual organization’s network, targeting security operators at national and local government offices and critical infrastructure businesses. From FY2021, the Center is planning to start providing a training program called Response Practice for Cyber Incidents (RPCI) targeting Registered Information Security Specialists. Furthermore, the Center carries out SecHack365, a program to foster young security innovators through a one-year hackathon targeting those aged 25 or younger during which guidance is provided taking advantage of the latest monitoring data and R&D knowledge.

The National Cyber Observation Center will continue performing duties concerning survey of IoT devices with improper setting of passwords, etc. and information provision to internet service providers using technological knowledge held by NICT until the end of FY2024 for the purpose of making a contribution to measures for IoT devices to prevent their exploits for cyberattacks.

In order to make a contribution to cybersecurity measures for IoT devices, we will continue performing duties concerning survey of IoT devices with improper setting of passwords, etc. and information provision to internet service providers using technological knowledge held by NICT until the end of FY2024 in light of the national government’s policies, such as its cybersecurity strategies, based on the provisions of Article 6, paragraph 2 of the Supplementary Provisions of the Act on the National Institute of Information and Communications Technology.

In order to contribute to steady enhancement of national capacity to deal with cyberattacks and countermeasures against diversifying cyberattacks, we carry out R&D on techniques for monitoring, analyzing, visualizing and addressing cyberattacks that are becoming more and more sophisticated and complex. Techniques for cross-cutting analysis of diverse large-scale cybersecurity data and techniques for verification to enhance security for new network environments.

In order to surely ensure security and privacy for information indispensable for sustainable development of society, we will conduct R&D on cybersecurity technologies including post-quantum cryptography, privacy protection technologies, and their security evaluation. We also promote secure data utilization and endeavors to disseminate these technologies to various systems supporting the lives of the citizens.

Targeting security operators (personnel in charge of information systems) of administration organs and private companies, we provide exercises with the aim of developing their practical abilities to take proper initial responses to cybersecurity incidents. Additionally, we train young people aged 25 or younger into high-level experts who can research and develop innovative security software, etc. by themselves.

To Be a Nexus Connecting the Government, Industry, and Academia through R&D and Human Resources Development Broadly in the Cybersecurity Area!
To achieve universal communication and to establish mutual understanding among the people, we will create an AI research platform and carry out R&D and social implementation of the 3 core technologies utilizing those technologies in a balanced manner. The first is to provide ready-to-use software such as multilingual speech translation engines externally by granting licenses or other means. Through this, we aim to create new industries. The second is to continuously make systems and data open to the public. For example, by publishing large language models, we aim to contribute to bottoming up Japan’s research infrastructure. The third is to provide a highly secure environment or to demonstrate that it is possible to develop highly secure services. Through this, we aim to help create a safe and secure society.

As one of the leading research institutes of Japan in the AI area, the Universal Communication Research Institute aims to develop an AI research platform and carry out R&D and social implementation of the 3 core technologies utilizing those technologies in a balanced manner. We will contribute to solving social issues and creating new values by balancing "research" and "dissemination" of the core technologies; by removing the barriers of language, knowledge, and data utilization in global businesses, elderly care, environmental risk reduction, etc., and creating a New Normal.

UCHIMOTO Kiyotaka
Director General, Universal Communication Research Institute

In terms of R&D, we will create the most unprecedented, unique, and largest core technologies and hone them into universal technologies to be used broadly. We will develop and expand demonstration and commercialization systems utilizing those technologies in an industry-govern ment-academia collaboration for their social implementation and will feed knowledge sources created in society back to R&D activities. We aim to create a positive spiral of R&D and social implementation to disseminate the core technologies as those normally used in society.

The keys for successfully creating this positive spiral are the following three. The first is to provide ready-to-use software such as multilingual speech translation engines externally by granting licenses or other means. Through this, we aim to create new industries. The second is to continuously make systems and data open to the public. For example, by publishing large language models, we aim to contribute to bottoming up Japan’s research infrastructure. The third is to provide a highly secure environment or to demonstrate that it is possible to develop highly secure services. Through this, we aim to help create a safe and secure society.

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INTRODUCTION OF A NEW RESEARCH ORGANIZATION

5th Medium-to-long term Plan

DEVELOP

Creating and Developing Innovation beyond Conventional Concepts

WADA Naoya
Director General of the Advanced ICT Research Institute

The Advanced ICT Research Institute was launched as a frontier science R&D organization during the current Medium-to-Long-term Plan implementation period. The Center for Information and Neural Networks (CiNet) was recently incorporated into the Institute. We will research and develop advanced base technologies through interdisciplinary collaboration to facilitate technological breakthroughs.

ICT has been engaged in R&D in five strategic areas characterized by five keywords: observe, connect, create, protect and pioneer. Five research institutes lead these R&D efforts. The Advanced ICT Research Institute is carrying out advanced basic research with a pioneering spirit, aiming to open up new horizons in ICT research.

The Fifth Medium-to-Long-term Plan has been adopted in April 2021. The Advanced ICT Research Institute underwent two major changes.

First, our area of R&D focus changed from frontier research to frontier science research. The term “science” is added to heighten expectations for us to make significant breakthroughs by performing cutting-edge R&D. We view ourselves as pioneers exploring the frontiers of science.

The second change, CiNet in Suita, Osaka is transferred to our institute in Kobe, Hyogo and Koganei, Tokyo. This arrangement has made the Advanced ICT Research Institute the largest research organization within NICT and has expanded our R&D capabilities. As a result, we expect to work closely with four other leading research institutes with different R&D focuses (i.e., observing, connecting, creating and protecting) and may therefore potentially make contributions in these areas.

The Advanced ICT Research Institute—consisting of the Kobe Frontier Research Center, the Koganei Frontier Research Center and CiNet (Figure 1)—will work to create and develop innovation beyond conventional concepts (Figure 2).

Table 1 shows an overview of R&D projects the Advanced ICT Research Institute will carry out.

Focuses in R&D

New communications paradigm

New materials (inorganic-organic hybrid materials)
New functions (molecular, superconducting and combined functions)
New structures (nano, biological and processing structures)

Quantum networks
New systems (cerebral, biological and AI-based)
Highly energy-efficient systems
Molecular communications

Interdisciplinary collaboration (health, medicine, environment)

Biological sensitivity evaluation
Single photon measurement
Brain information sensing
Minimum intelligence

Creation of new platforms for the development of beyond 5G / 6G technologies
INTRODUCTION OF A NEW RESEARCH ORGANIZATION

Beyond 5G Research and Development Promotion Unit

The importance of communications has only recently begun. Meanwhile, competition in the development of beyond 5G / 6G technology is already underway because the importance of communications networks as social infrastructure is expected to significantly increase in the future. The Beyond 5G Research and Development Promotion Unit will ensure that NICT carries out effective R&D leading to socially beneficial technologies.

Practical implementation of fifth-generation mobile communications systems (5G) has only recently begun. Meanwhile, competition on the development of beyond 5G / 6G technology is already underway because the importance of communications networks as social infrastructure is expected to significantly increase in the future. The Beyond 5G Research and Development Promotion Unit will ensure that NICT carries out effective R&D leading to socially beneficial technologies.

Leading NICT’s Development of Beyond 5G / 6G Mobile Communications Technologies

HOSAKO Iwao
Executive Director of Unit, Beyond 5G Research and Development Promotion Unit

Dr. HOSAKO joined the Communications Research Laboratory (NICT’s predecessor), which was then under the Ministry of Posts and Telecommunications, in 1996. He has promoted R&D on terahertz technologies, including devices, cameras and communication systems, and he hopes to achieve standardization of these technologies. He has a Ph.D. in science.

Figure 1 Organization of Beyond 5G Research and Development Promotion Unit

Mobile communications systems have evolved at an amazing speed. They have progressed beyond earlier communications infrastructures (1G to 5G) to the more robust infrastructure (4G) vital to the public. 5G communications—which began to be introduced around 2020—now allow people around the world to communicate and interact with each other but are also capable of connecting distant devices. Wider adoption of digital transformation (DX) has increased the significance of interactions between people, between people and devices and between devices mediated by mobile communication systems, which are supported by core networks, servers on the internet and cyberspace. These interactions occur across organically integrated physical and cyber spaces (i.e., cyber-physical systems (CPS)).

Development of CPS technologies is therefore important. The COVID-19 pandemic has forced many people to rely on cyberspace resources, such as remote conferences, as their primary means of communication. As a result, remote communications tools are now widely accepted not only in business but also for many other purposes. People have realized the many advantages of these tools. Cyberspace-mediated remote meetings, for example, allow distant people to participate in meetings in real time. In addition, these meetings can be attended by significantly larger numbers of individuals than traditional on-site meetings. People can now enjoy various forms of businesses and entertainment using cyberspace tools. However, many users are not fully satisfied with the tools currently available because they fail to give users the feel of actual face-to-face meetings and conversation. I believe that this issue can be technically improved upon by resolving current network issues (i.e., communications delays, frequency bands currently used, insufficient numbers of access points and inadequate human interface quality). Although practical use of 5G technology has only recently begun, competition in the development of beyond 5G / 6G is already ongoing. This is because communications networks are important social infrastructures today and their importance is expected to increase significantly in the future. This expectation is shared not only by ICT researchers, developers and engineers but also by the general public as it experiences the ongoing pandemic. The Beyond 5G Research and Development Promotion Unit, which consists of the groups shown in Figure 1, will work to achieve United Nations Sustainable Development Goals (SDGs) and bring Japan’s Society 5.0 concept into reality. For these objectives, we will first formulate a beyond 5G / 6G concept (Figure 2) to facilitate NICT’s R&D on beyond 5G / 6G architecture and core technologies, including terahertz technologies capable of significantly speeding up communications network access and a wireless system emulator (a tool for creating CPSs).

Table. List of projects to be overseen by the Beyond 5G Research and Development

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<thead>
<tr>
<th>Project Area</th>
<th>Project Title</th>
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<tbody>
<tr>
<td>CPS USR R&amp;D</td>
<td>Development of beyond 5G / 6G concepts and architecture</td>
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<td></td>
<td>Development of cyber-physical system emulator (e.g., radio emulator)</td>
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<td></td>
<td>Development of key technologies for terahertz communications and their application to practical systems</td>
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<td></td>
<td>Terahertz remote sensing technologies</td>
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Figure 2. Conceptual diagram describing ways in which beyond 5G / 6G technology can help achieve United Nations SDGs and bring Japan’s Society 5.0 concept into reality

*From NICT Beyond 5G/6G Whitepaper (released on 2021.3.31)
Accelerating Open Innovation and Leading Social and Economic Reform to Achieve a “New Normal”

NOZAKI Masatoshi
Headquarters Chairman of Open Innovation Promotion Headquarter

KUBOTA Minoru
Director General of Social Innovation Unit

INTRODUCTION

This office developed a network of collaborators out by these offices, centers and departments are and the ICT Deployment and Industry Promotion Program Office, which works to transform R&D results produced by NICT into socially beneficial products and accelerates open innovation in a variety of ways, including commissioned research and collaboration with industry, academia, the public sector and international ICT communities.

The Open Innovation Promotion Headquarters changed the General Produce Office in April 2021 to enhance coordination within the headquarters and with external parties. In addition, the headquarters will promote the development of beyond 5G (BSG) component technologies and advance international standardization efforts by encouraging participation in BSG R&D projects using NICT’s third supplementary budget for FY2020. The Social Innovation Unit has been working to expedite open innovation since NICT’s previous Medium-to-Long-term Plan implementation period. Specifically, this unit established the Strategic Program Office, which works to transform R&D results produced by NICT into socially beneficial products, and the ICT Testbed Research and Development Promotion Center, which develops and operates testbed platforms for cutting-edge ICT technologies. Envisioning that BSG technologies will be put into practical use by around 2030, the unit is taking comprehensive, strategic action in close coordination with the Innovation Promotion Department, the Global Alliance Department and the ICT Deployment and Industry Promotion Department. The specific activities being carried out by these offices, centers and departments are described below.

NISHINAGA Nozomu, Director, Strategic Program Office

This office developed a network of collaborators within local communities, industry and academia during the previous NICT Medium-to-Long-term Plan implementation period. Using this network, we work to transform NICT’s R&D results into socially beneficial products and facilitate interactions between various NICT components and external parties. This office manages two subordinate offices: the Research Planning and Promotion Office, which oversees ethical and regulatory aspects of NICT’s activities, and the Regional/Industry-Academia Collaboration Promotion Office, which facilitates NICT’s collaboration with local organizations, industry and academia. These offices work together in close coordination. The Research Planning and Promotion Office actively addresses issues associated with rapidly changing research environments, such as the handling of personal data and ethics concerning biological research. For these purposes, this office organizes various committees, develops web portals to make selected data open to the public and holds review sessions before publicizing data. The Regional/Industry-Academia Collaboration Promotion Office facilitates NICT’s collaboration with local organizations, industry and academia. In a continuing effort from the previous Medium-to-Long-term Plan implementation period, this office works to identify locally important issues by hosting hack-a-thons and idea-a-thons, widely publicizes R&D results produced by NICT and carries out commissioned research to resolve local ICT-related issues, thereby helping transform NICT’s R&D results into socially beneficial products.

KOJIMA Fumihide, Director General, ICT Testbed Research and Development Promotion Center

NICT develops advanced ICT technologies for users with diverse needs in collaboration with industry, academia, and the public sector. This center facilitates the development and effective operation of testbeds used in evaluating the technical validity and usability of these technologies. As a public research organization, this center provides testbeds suitable for R&D activities, experimental verification and usability testing. In addition, the center invites research organizations and companies (e.g., private companies and public organizations) to transform NICT’s research results into open innovation. NICT’s previous Medium-to-Long-Term Planning period. Using this network, we work to promote NICT’s R&D results and carry out commissioned research. For these purposes, this office organizes various committees, develops web portals to make selected data open to the public and holds review sessions before publicizing data. The Research Planning and Promotion Office, which oversees ethical and regulatory aspects of NICT’s activities, and the Regional/Industry-Academia Collaboration Promotion Office, which facilitates NICT’s collaboration with local organizations, industry and academia. These offices work together in close coordination. The Research Planning and Promotion Office actively addresses issues associated with rapidly changing research environments, such as the handling of personal data and ethics concerning biological research. For these purposes, this office organizes various committees, develops web portals to make selected data open to the public and holds review sessions before publicizing data. The Regional/Industry-Academia Collaboration Promotion Office facilitates NICT’s collaboration with local organizations, industry and academia. In a continuing effort from the previous Medium-to-Long-term Plan implementation period, this office works to identify locally important issues by hosting hack-a-thons and idea-a-thons, widely publicizes R&D results produced by NICT and carries out commissioned research to resolve local ICT-related issues, thereby helping transform NICT’s R&D results into socially beneficial products.

SHIOZAKI Mitsuhiro, Executive Director, Innovation Promotion Department

This department facilitates joint research by NICT and external organizations to resolve issues (e.g., security) and leverages NICT’s strengths and potential to contribute to social and economic reform. It aims to maximize the benefits of NICT’s R&D results and promote NICT’s open innovation.

FUKABORI Michiko, Executive Director, Global Alliance Department

ICT is often the main focus of R&D and is an important component of our societal needs and R&D industry. The department helps overseas researchers and research organizations in Japan to resolve ICT-related issues. It promotes international interaction by providing information on business start-ups and promotes NICT-led open innovation on a global scale, the Global Alliance Department promotes international interaction by providing information on business start-ups and promotes NICT-led open innovation on a global scale. Security has become a major concern when transferring people, materials and technologies across national borders due to the increasingly complex international environment. We will ensure safe and smooth international collaboration and international publications of R&D results by providing proper information and support to NICT researchers.

HIROSHIGE Kenji, Executive Director, ICT Deployment and Industry Promotion Department

This department facilitates joint research by NICT and external organizations to resolve issues (e.g., security) and leverages NICT’s strengths and potential to contribute to social and economic reform. It aims to maximize the benefits of NICT’s R&D results and promote NICT’s open innovation.
66th Maejima Hisoka Award presented by the Tsushinbunka Association

- TERAI Hirotaka, Advanced ICT Research Institute
- MIKI Shigehito, Senior Researcher, Advanced ICT Research Institute
- YAMASHITA Taro, Associate Professor, Graduate School of Nagoya University (Co-reciever)

**Achievement recognized**: Joint research and development of a superconducting nanowire single-photon detector

**Award reception date**: April 9, 2021

**Summary**: Our detector achieved detection efficiencies higher than 80% at the telecommunication wavelength, significantly higher than those achieved with semiconductor photon detectors. The detector has been used by various advanced technologies, greatly contributing to the outstanding research results in quantum communications, biology, and so on.

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**NICT Terahertz International Standardization Team**

- OGAWA Hiroyo (Team representative), Terahertz Technology Research Center
- HOSAKO Iwao, Director General, Terahertz Technology Research Center
- KASAMATSU Akifumi, Terahertz Technology Research Center
- KANNO Atsushi, Research Manager, Network Science and Convergence Device Technology Laboratory, Network System Research Institute
- INAGAKI Keizo, Senior Researcher, Network Science and Convergence Device Technology Laboratory, Network System Research Institute
- SAWADA Hirokazu, Research Manager, Wireless Systems Laboratory, Wireless Networks Research Center
- FUJII Katsumi, Senior Researcher, Terahertz Technology Research Center
- SEKINE Norihiko, Director of Collaborative Research Laboratory of Terahertz Technology, Terahertz Technology Research Center

**Achievement recognized**: Standardization efforts achieving practical use of terahertz frequency communications

**Award reception date**: April 9, 2021

**Summary**: We have been collaborating with the US Institute of Electrical and Electronics Engineers (IEEE) and the Radiocommunication Sector of the International Telecommunication Union (ITU-R) for over a decade to put communications at frequencies of 275 GHz or higher into practice. These efforts greatly helped the establishment of the world’s first de facto standard for the use of the 300 GHz band and the revision of the radio communications regulations.

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**FY2021 The Commendation for Science and Technology by the Minister of Education, Culture, Sports, Science and Technology Prizes for Science and Technology**

**Prizes for Science and Technology, Promotion Category**

- ETO Masashi, Director of Cyber Training Laboratory, National Cyber Training Center
  - All persons beneath are members of National Cyber Training Center
- KANAHAMA Nobuhiro, Senior Technical Researcher
- HANADA Tomohiro, Senior Technical Researcher
- SATOH Hironobu, Senior Researcher
- ISHIKAWA Hiroki, Senior Technical Researcher

**Achievement recognized**: Training the public in defense procedures against cyberattacks using a Japan-made simulation program

**Award reception date**: April 14, 2021

**Summary**: We developed CYDERANGE, an automated cyberattack simulation program, as a tool to efficiently and effectively train large groups of people and develop cyber security experts to meet Japan’s urgent demand in this area. The training we offered using this technology helped improve Japan’s overall cyber security capabilities.

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**Prizes for Young Scientist**

- AONO Yoshinori, Researcher (Tenure-Track), Security Fundamentals Laboratory, Cybersecurity Research Institute

**Achievement recognized**: Pioneering research on assessing the security of lattice-based cryptography

**Award reception date**: April 14, 2021

**Summary**: He has researched the security of lattice-based cryptography, one of the most emerged post-quantum cryptography. In particular, he theoretically bound the computing time to break the cryptosystem, and also demonstrate it for the parameter selection method to make lattice-based cryptography secure over a long time. These achievements are expected to facilitate research on lattice algorithms used in cryptography.