





## Greeting from the Director

Tohoku University was founded in 1907 as Tohoku Imperial University. The Research Institute of Electrical Communication (RIEC) was established in 1935 as a research institute affiliated with Tohoku Imperial University. At that time, within the Department of Electrical Engineering there was a growing tendency towards research on the application of light currents, especially the science and technology for electrical communication. Great efforts in these fields produced pioneering researches such as the Yagi-Uda antenna and divided anode-type magnetron, which were developed in the department in the late 1920s.

In the seven decades since RIEC was established, it has continued to excel as the only research institute affiliated with a national university that addresses information technology, with various research fields ranging from hardware to software. In 1994, our research institute became one of the National Centers for Co-operative research, addressing “theory and applications of intelligent information science and communication theory”. Information science and communication technology have developed rapidly and brought about great social change including globalization of communication and physical distribution. All the staff members in our institute will assume leadership in creating new information technologies that works in harmony with human nature, through national and international collaboration with researchers in these fields.

To meet the needs and demands of a new age, our 30 or so research groups working on basic research for information communication with a 20 year horizon are organized into four research divisions. Two research facilities with 8 research groups working on next generation technology have been established with a 10 year horizon. The Research Center for 21st Century Information Science and Technology has been established to realize the rapid commercialization of technologies developed by the institute with a 5 years horizon.

Furthermore, this institute's mission is to train researchers and engineers to internationally high standards through close co-operation with the Graduate Schools of Engineering, Information Sciences and Biomedical Engineering.



**Director Prof. Masafumi YANO**

# Preface

The Research Institute of Electrical Communication (RIEC) is a unique university-run institute, which is dedicated to research on communication and information processing. It comprises four research divisions with 23 subsections (including 4 subsections allocated for visiting researchers), three research facilities with 12 subsections. Each of the subsections is headed by a professor. In 1994 the Institute was designated as a National Centre for Cooperative Research, centered on the development of “barrier-free” communication technologies.

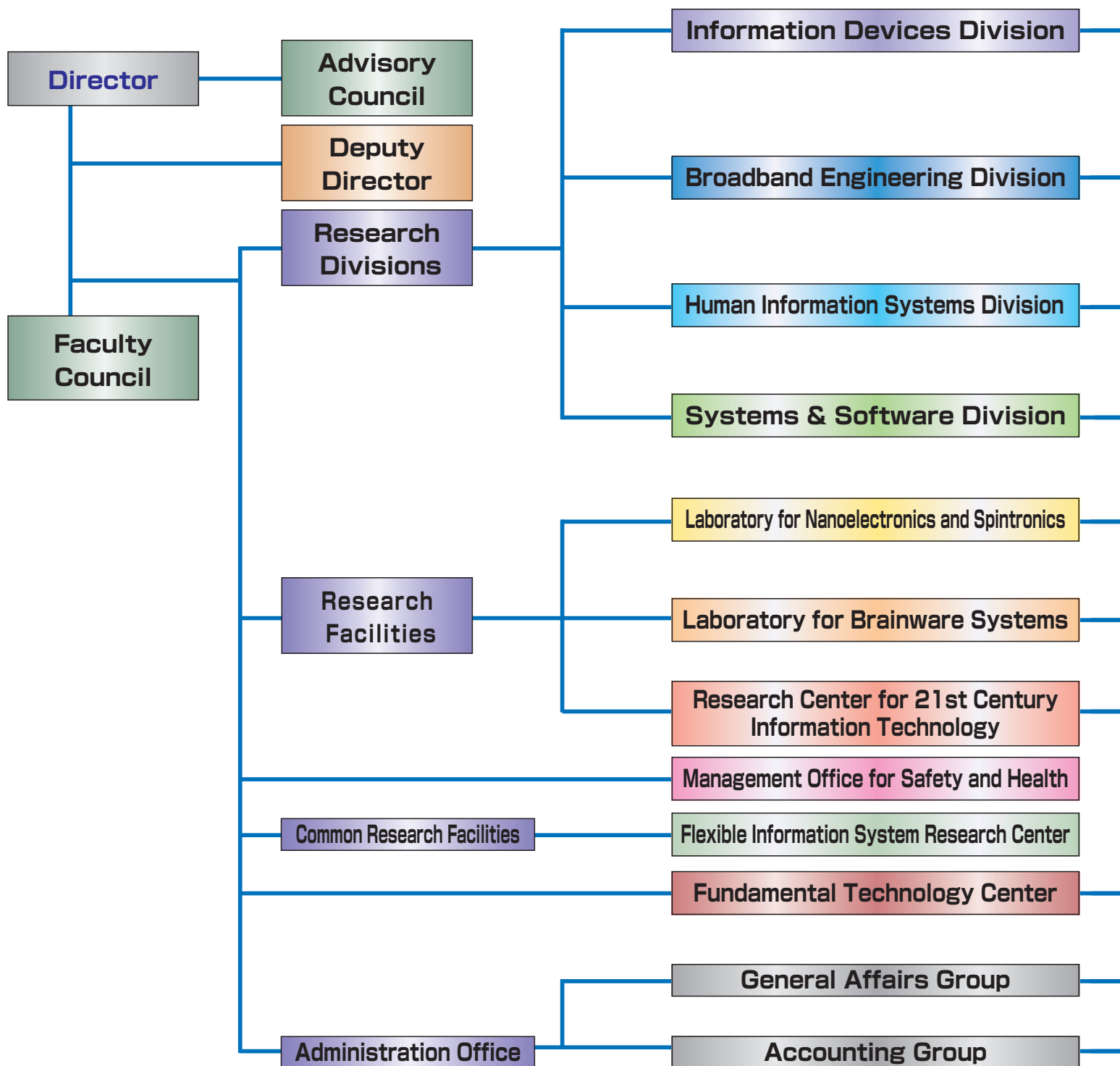
The Information Devices Division carries out research into materials and devices for communication technology, whilst the Broadband Engineering Division focuses on the development of new technologies for the transmission and storage of vast quantities of data. The Human Information Systems Division researches into intelligent information processing and the Systems and Software Division is developing advanced system software for the new information society.

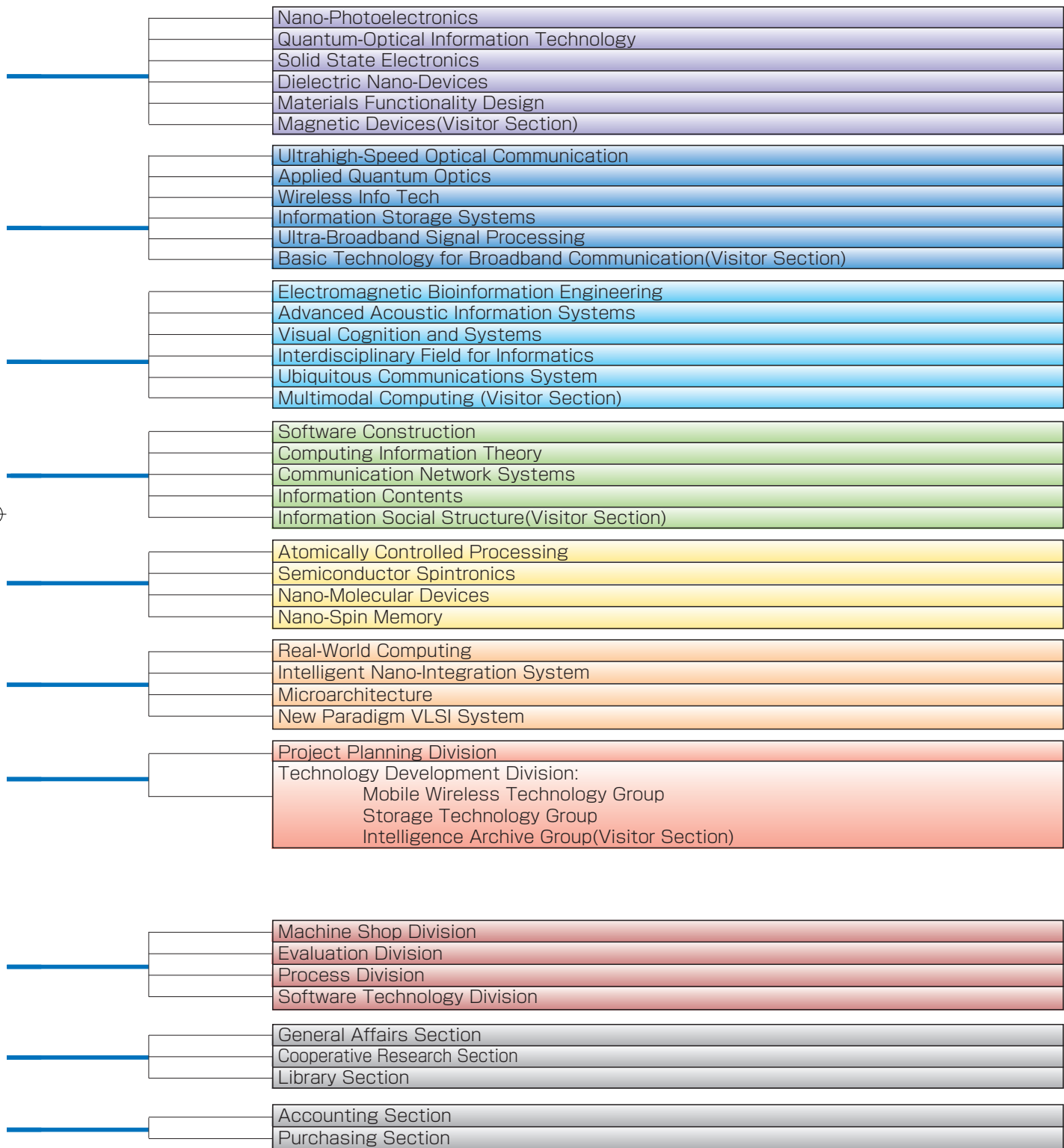
The three research facilities are focused on short, medium and long-term projects. The Research Centre for 21st Century Information Technology was established in 2002 as a five-year collaboration between the Institute and industrial partners. The Centre aims to develop information technology products using the advanced technologies and intellectual property developed at the Institute. For the medium term, the Laboratory for Nanoelectronics and Spintronics, housed in newly-built facilities, is carrying out fundamental research into high-speed semiconductor devices and advanced nano/spin science. Smaller and faster electronic devices, non-volatile memories and molecular and bio-information devices are some of the expected fruits of this research. Meanwhile, the Laboratory for Brainware Systems is working towards its long-term goal of the seamless fusion of real and virtual worlds at the human-computer interface.

Since its establishment in 1935 the Institute has played an internationally leading role in the fields of microwaves, ultrasonics, magnetic recording, optical communication, acoustic communication, semiconductor devices and information theory. The accomplishments in these fields are the result of close cooperation with the Graduate Schools of Engineering, Information Sciences and Biomedical Engineering. The past accomplishments of the Institute have made significant contributions to the betterment of ordinary life by providing many of the basic technologies that became the foundation of the prosperity of the Japanese economy. The Institute and its members aim to continue this tradition of world-class research and innovation far into the future.

# Organization

## 1. Organization Chart





## 2. Staff

(2009.7.1)

Classification	Division	Laboratory for Nanoelectronics and Spintronics	Laboratory for Brainware Systems	Research Center for 21st Century Information Technology	Fundamental Technology Center	Administration Office			Total
						Head Official	General Affairs Group	Accounting Group	
Professors	19	3	4	3					29
Associate Professors	12	4	1	1					18
Assistant Professors	17	3	5						25
Research Fellows	8	4	3	1					16
Technical Officials					17		1	1	19
Administrative Officials						1	6	7	14
<b>Total</b>	<b>56</b>	<b>14</b>	<b>13</b>	<b>5</b>	<b>17</b>	<b>1</b>	<b>7</b>	<b>8</b>	<b>121</b>

## 3. Land and Buildings

Site: Katahira 2-1-1, Aoba-ku, Sendai 980-8577, Japan

Total building area: 12,913m<sup>2</sup>Total floor area: 28,776m<sup>2</sup>

(2009.7.1)

Name of Buildings	Structure	Year of Completion	Floor Area
Building No.1	Reinforced Concrete, 4 floors	Building-S:1962,1963 Building-N:1959,1960	7,772m <sup>2</sup>
Building No.2	Reinforced Concrete, 4 floors	1962,1963	7,085m <sup>2</sup>
Laboratory for Nanoelectronics and Spintronics	Steel-frame, 5 floors	2004	7,375m <sup>2</sup>
Laboratory for Brainware Systems	Reinforced Concrete, 1 floor	1967,1968,1972	525m <sup>2</sup>
	Reinforced Concrete(partly steel-frame), 2 floors	1986	1,553m <sup>2</sup>
	Steel-frame 1 floor	1996	598m <sup>2</sup>
	Light-weight steel-frame, 2 floors	1999	147m <sup>2</sup>
Research Center for 21st Century Information Technology	Reinforced Concrete, 3 floors	1930	1,343m <sup>2</sup>
	Steel-frame 1 floor	2002	435m <sup>2</sup>
Evaluation and Analysis Center	Reinforced Concrete, 2 floors	1981	790m <sup>2</sup>
Helium Sub-Center	Reinforced Concrete(partly light-weight steel-frame), 1 floor	1972	166m <sup>2</sup>
Machine Shop	Reinforced Concrete(partly light-weight steel-frame), 1 floor	1965,1966,1978	479m <sup>2</sup>
Others			508m <sup>2</sup>
<b>Total</b>			<b>28,776m<sup>2</sup></b>

## 4. Budget

(Unit:1,000Yen)

Financial Year	Personnel Expenditure	Supplies Expenditure	Research Grant		Total
			Ministry of Education, Science and Culture	Partnership Between Universities and Industry	
2004	902,978	1,233,357	338,459	1,432,607	3,907,401
2005	984,113	1,050,647	554,680	1,303,028	3,892,468
2006	971,482	927,090	599,040	937,441	3,435,053
2007	970,961	813,724	700,615	888,833	3,374,133
2008	879,481	953,000	694,883	1,069,832	3,597,196

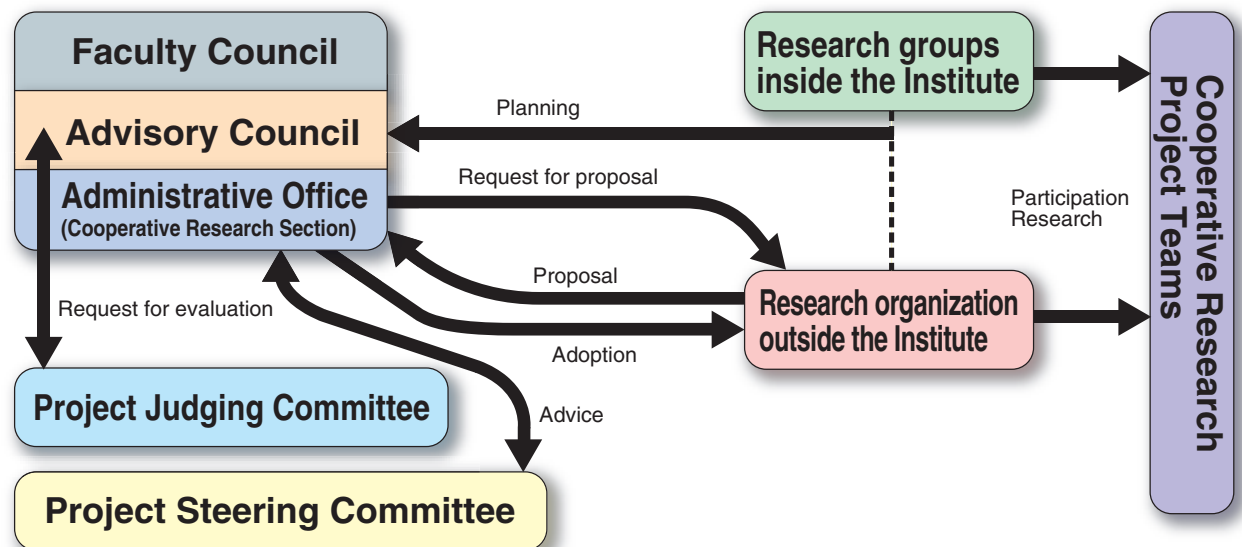
# Nation-wide Cooperative Research Projects

The Institute has a long history of fundamental contributions in many fields of engineering and science that include the fields of semiconductor materials and devices, magnetic recording, optical communication, electromagnetic technology, applications of ultrasonics, acoustic communication, non-linear physics and engineering, and computer software. On the basis of this rich historical background the Institute was designated as National Center for Cooperative Research in 1994. Accompanying Tohoku University's transformation to "a national university juridical entity" in April, 2004, this institution plays a leading role on the world stage, as its researchers, both domestic and foreign, continue the task of "investigating the theory and application of universal science and technology to realize communication, to the enrichment of humanity."

In such background, the Institute organizes Nation-wide Cooperative Research Projects by coordinating its activities with research workers. The main themes for Cooperative Research are selected annually by the Committee for Cooperative Research. Then invitations for project proposals and participation are extended to university faculties and government laboratories as well as industrial research groups. Each project approved by the Faculty Council of the Institute is carried out by a team of researchers that include members of the Institute as well as outside participants.

The Advisory Council which includes members from other institutions has an advisory function to the Director in defining the general direction of the research at the Institute and its Nation-wide Cooperative Research Projects.

The Project Judging Committee that includes members from the outside of Tohoku University has a judging function for project proposals. The purpose of the Project Steering Committee is the proper operation of approved projects.





# Research Fields

The Research Institute of Electrical Communication (RIEC) maintains a close cooperative relationship with the Graduate Schools of Engineering, Information Sciences and Biomedical Engineering in its research and educational activities, especially with the Departments of Electrical and Communication Engineering, Electronics, Computer and Mathematical Science, System Information Science and Applied Information Sciences. This cooperation enriches the research activities of RIEC as a "National Center for Cooperative Research." The research fields of four divisions are:

- (1) Information Devices Division: Advanced Nano-Information Devices Utilizing Physical Phenomena
- (2) Broadband Engineering Division: Next Generation Systems for Ultra-Broadband Communication
- (3) Human Information Systems Division: Creation of Information Systems Harmonizing People and Environments
- (4) Systems & Software Division: Advanced System and Software for Information Society

## Information Devices Division

### Materials Science and Device Science

- Solid State Electronics
- Dielectric Nano-Devices
- Materials Functionality Design
- Atomically Controlled Processing
- Physical Fluctuomatics \*
- Intelligent Integrated Systems \*
- Advanced Management of Integrated System Technology \*
- Solid State Electronics \*
- Wave-Triggered Nanomedicine \*

### Electronic and Optical Quantum Science

- Nano-Photoelectronics
- Quantum-Optical Information Technology
- Image Science and Information Display \*
- Biomodeling \*

### Plasma Science

- Electromagnetic Theory \*
- Magneto-Plasma-Dynamic Engineering \*

### Visitor Section

- Magnetic Devices

## Broadband Engineering Division

### Information Technology

- Wireless Info Tech
- Technology Development Division Mobile Wireless Technology Group
- Ultrasonic Micro-Spectroscopy \*

### Ultrahigh-Frequency Engineering

- Ultra-Broadband Signal Processing
- Communication Engineering \*

### Optical Communication / Applied Quantum Electronics

- Ultrahigh-Speed Optical Communication
- Applied Quantum Optics
- Optical Physics Engineering \*
- Light Medical Engineering \*
- Synergetic Photonics \*
- Neural Electronic Engineering Laboratory \*

### Information Recording / Material Science

- Semiconductor Spintronics
- Information Storage Systems
- Technology Development Division Storage Technology Group
- Nano-spin memory
- Microelectronics \*
- Electronic Physics Engineering \*
- Algorithm Theory \*
- Nanometer-scale Magnetic Recording \*
- Medical Nanosystem Engineering \*
- Spin Electronics \*
- Magnetic Materials \*

### Visitor Section

- Basic Technology for Broadband Communication

## Human Information Systems Division

### Bioinformation

- Electromagnetic Bioinformation Engineering
- Electromagnetic Theory \*
- Applied Power Systems Engineering \*

### Human Information Processing

- Advanced Acoustic Information Systems
- Visual Cognition and Systems
- Intelligent Communication Network \*
- Electronic Control Systems \*
- Advanced Information Technology \*
- Medical Ultrasound \*

### Communication Environment

- Ubiquitous Communication Systems
- Electromagnetic Wave Engineering \*
- Firmware Science \*

### Bioelectronics

- Nano-Molecular Devices
- Interdisciplinary field for Informatics
- Basic Plasma Engineering \*
- Biomedical Electronics \*
- Nano-Biomedical Engineering \*

### Real World Computing

- Real-World Computing
- Biomedical Electromagnetics \*
- System Control Engineering \*
- Bioelectromagnetics \*

### Visitor Section

- Multimodal Computing

## Systems & Software Division

### Computer Science

- Software Construction
- Computing Information Theory
- Foundations of Software Science \*
- Intelligent Systems Science \*
- Advanced Management of Integrated System Technology \*
- Information Sciences Education \*
- Multimedia Education \*

### Internet Communication

- Communication Network Systems
- Information Contents
- Fundamental Engineering for Information Society \*
- Information Network Systems \*
- Information Technology \*
- Academic Information \*

### VLSI System

- Intelligent Nano-Integration System
- New Paradigm VLSI System
- Microarchitecture
- Intelligent Electronic Circuits \*
- Power Electronics \*
- Computer Structures \*

### Visitor Section

- Information Social Structure

\*Laboratories in Graduate Schools