2 Photonic Research Activity at CRL

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Researches on photonic technology from device to system have been performing in Basic and Advanced Research Division of CRL. The researches cover wide area of projects from the technologies for its utilization to the future communication technologies. This special issue on the photonic technology is presented the researhes doing at the Koganei area of the Basic and Advanced Research Division.

Keywords

Photonic technology, Photonic network, Photonic device, Quantum communication, Optical transmission in space

1 Introduction

The demand for very high capacity of the info-communication is expected to continue growing soon due to the realization of IT (information technology) period. Currently, the backbone of info-communications networks is primarily based on optical fiber communication. It appears that the adoption of photonic technologies to photonic networks will be the key factor in fulfilling future info-communications needs.

As shown in Fig.1, the CRL's Basic and Advanced Research Division was started from the merger of the Photonic Technology Division, First Special Research Laboratory, and the Kansai Advanced Research Center of the former CRL (CRL before reorganization into an independent administrative institution in April 2001). The goal of combining these groups was to promote efficient research on and development of innovative info-communications technologies. This special issue introduces the research conducting at five research groups, including the former Photonic Technology Division, former First Special Research Laboratory, and the Quantum Information Technology Group (established in April 2001). The Photonic Technology Division was started from July 1997 to conduct R&D on optical technologies to be essential in establishing an IT-oriented society. This former Photonic Technology Division consisted of three research sections: the Optical Communications Research Section (formerly the Ultra-Fast Network Section of the Integrated Communications Division), the Opto-Electronics Research Section (formerly the Optical Technology Section of the Electromagnetic Wave Technology Division), and the newly-established Integrated Photonics Research Section. In addition to the establishment of the Photonic Technology Division, the CRL proposal project entitled "Research on Advanced Technologies in Optical Communications and Sensing was selected as one of the projects of COE (Center Of Excellence)"–promotion program by the former Science and Technology Agency in 1994. This project accelerates the research activity in optical technology area of CRL.

2 Overview of Research Activities

Fig.2 illustrates the history of the research projects that have been conducting to date, as well as mid-range goals for the next five years for the Basic and Advanced Research Division. As described in this special issue, these mid-range research plans include: (1) "R&D

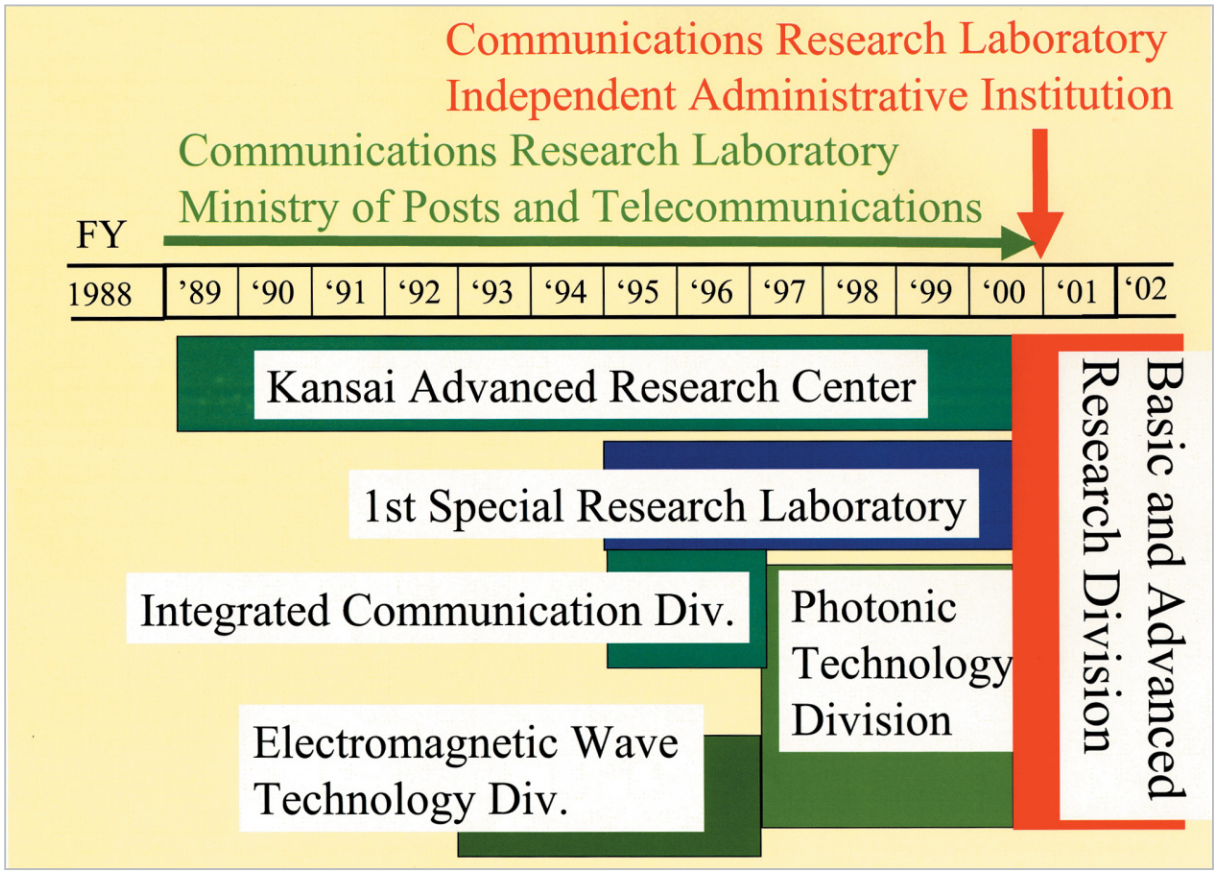

Fig.1 *Reorganization of the Basic and Advanced Research Division*

on the basics of peta-bit class photonic networks," which involves R&D on the basics of next-generation info-communications, (2) "Basic Research on photonic communications," which involves research on the basics of info-communications. Fig.2 provides further details on projects that have been developed and incorporated into the mid-range research plans.

An optical network comprises optical fiber links that constitute the backbone of the info-communications infrastructure, nodes that switch traffic based on address information, and access lines that deliver data from nodes to end users. Despite remarkable growth in the transmission capacity of optical fiber links, the demands of the future IT world are expected to require an info-communications network with a capacity over 1,000 times that of the present capacity. The realization of such high-capacity networks will depend on the development of photonics technology, which offers the potential for providing ultra-fast, high-capacity networks not attainable with conventional electronics. Our great concern of this particular issue involves research results on optical network systems and optical devices, which are described in the sections on optical networks, optical wireless technologies, and optical device technology. For rapid development of optical device, a building with a 600 m^2 clean room was completed in 2001 for optical device research activities.

Quantum information technology has attracted the attention of industry, government, and academic sectors as the technology that will realize quantum encryption.In FY 2001, we launched a new project for basic research on quantum communications. This special issue introduces the theories and experimental results obtained.

Optical transmission is not limited to the vehicle of optical fiber. Photonic transmission in space is often used for communications and measurement as well as the optical fiber. CRL has continued with research on optical trans-

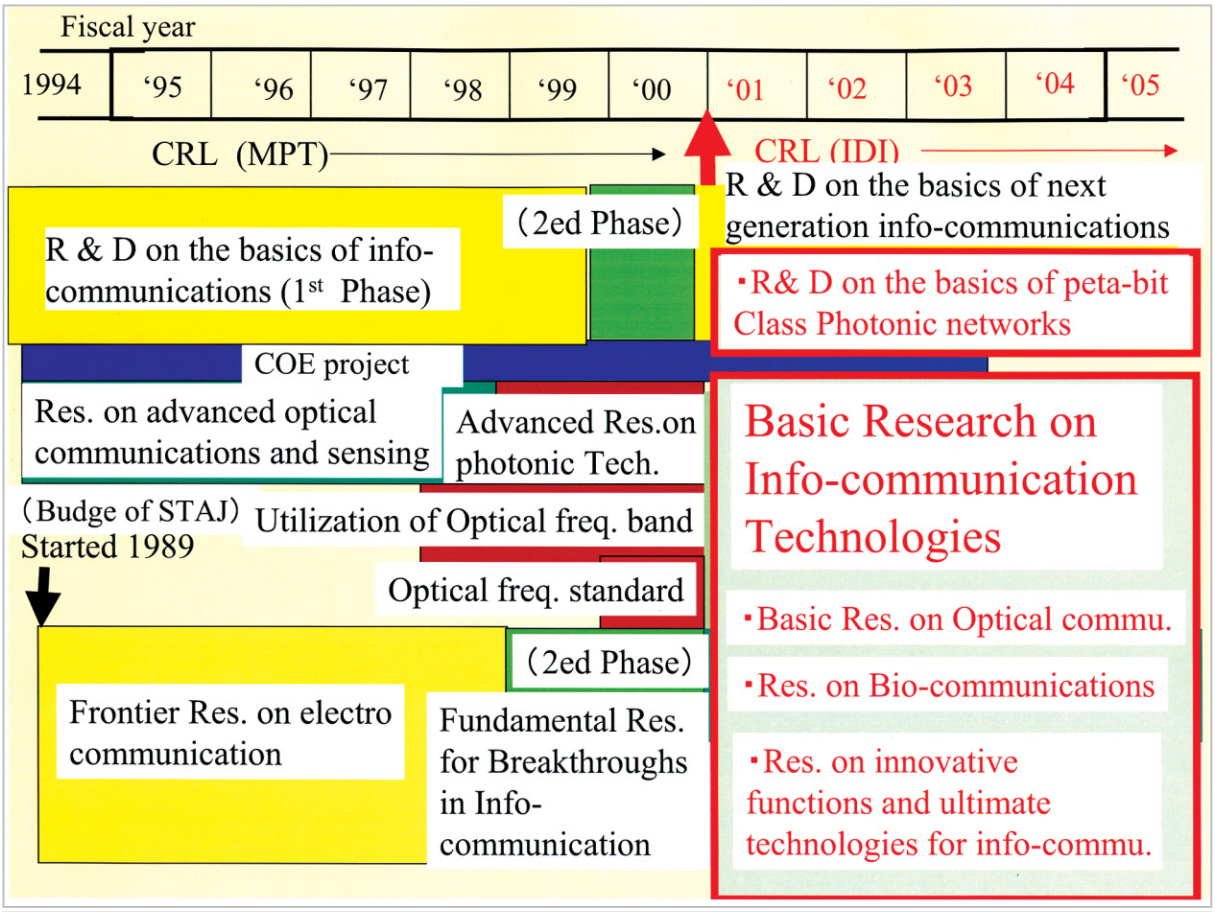

Fig.2 *History of projects including ones currently underway at the Basic and Advanced Research Division*

mission in space as part of fundamental research into optical space communications and optical remote sensing for quite some time, research efforts that extend back to the days of the former Radio Research Laboratories. Correcting wave distortions caused by atmospheric turbulence is essential for optical transmission in space. The section on light propagation technology in this issue introduces a technique for generating an artificial star that should prove critical in studying turbulence during transmission in space, as well as a technique for correcting distorted images during transmission in space or optical fiber using non-linear optical effects.

For optimal progress in optical communications research, research on systems and devices must proceed in close partnership. Optical communications research has significantly influenced investigations of quantum communications and light propagation phenomenon, and vice versa. In R&D on optical technology and in other research fields, collaboration between research groups is essential for carrying out the most efficient research.

3 Toward the Innovative Information Processing Technology

In FY 2001, CRL was reorganized as an independent administrative institution. The structure of its research divisions was streamlined into four divisions. Research projects related to optics are now carried out within the Basic and Advanced Research Division. Fig.3 shows the organizational structure of research groups in the Basic and Advanced Research Division. I expect these groups to continue forging ahead with research on optics, in close collaboration with researchers involved in many basic research projects conducting at the

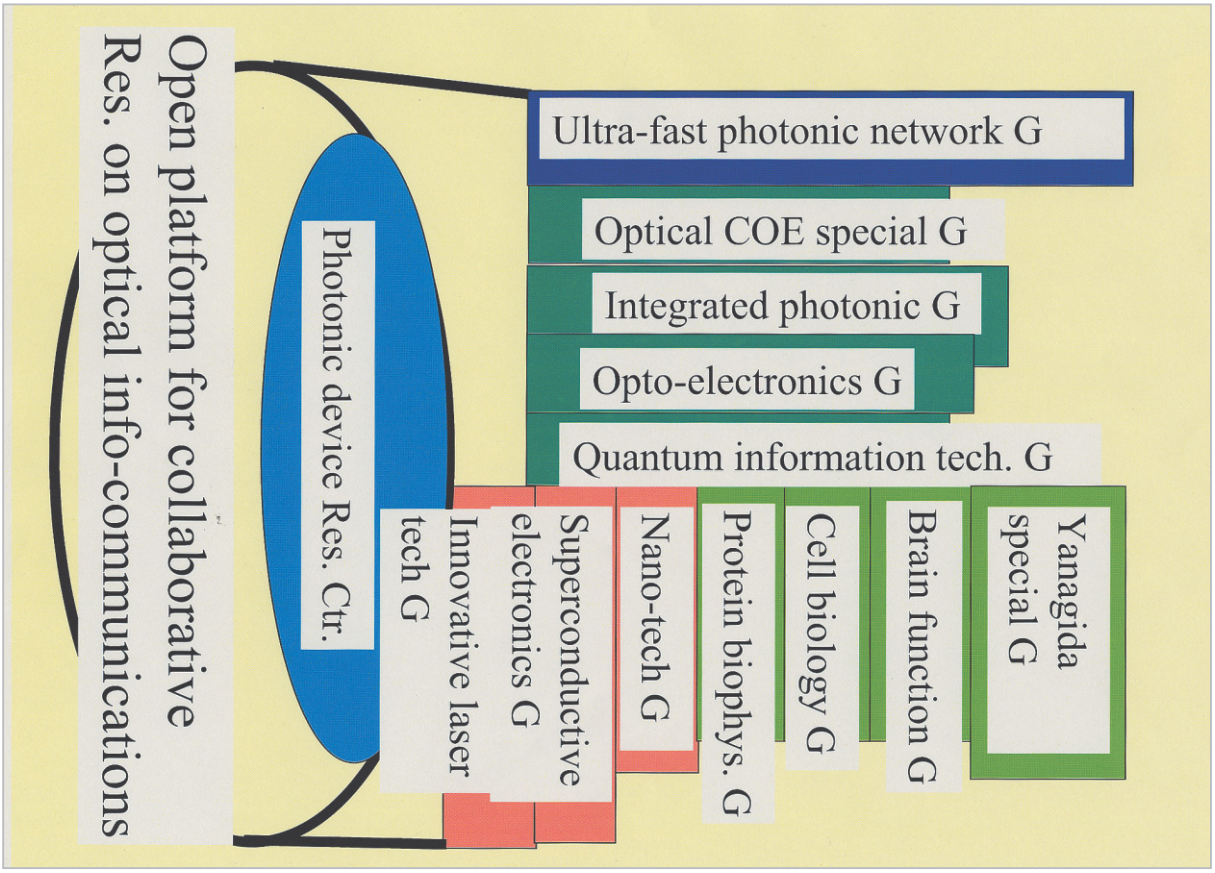

Fig.3 *Organizational structure of research groups in the Basic and Advanced Research Division*

Kansai Advanced Research Center as shown in Fig.3.

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Laser Remote Sensing, Atmospheric Physics