2 Research Strategy of Yokosuka Radio Communications Research Center

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CRL Yokosuka Radio Communications Research Center has been established with aim to become an international center of excellence for research and developments of mobile communications in Yokosuka Research Park (YRP). We have three following concepts.

–To play a core role in carrying out joint research projects in Yokosuka Research Park, which is expected to become an international center of excellence for research and developments of mobile communications.

–To carry out user-oriented strategic research on mobile communications technologies and contribute to the global standards.

–To play a core role in the Asia-Pacific region by collaborating with western countries.

Now in the age of Independent Administrative Institution, novel concepts are expected. The outline is given.

Keywords
Research strategy, Wireless communications, Yokosuka Research Park

1 Introduction

With the rapid spread of mobile computing and the evolution of information-communications technology, expectations are growing for the realization of multimedia mobile communications, including the exchange of high-definition video images relying on augmented data-transmission speeds and the highly-secure and -reliable all-IP network.

These are considered steps toward the 4G (fourth generation) in mobile communications, beyond the current 3G. Playing a central role in the attainment of this goal is the implementation of a mobile-computing service that can provide users with the optimal connection platform for data transmission at several tens of Mbps to 100 Mbps. In consideration of such needs, this article describes the research strategy of Yokosuka Radio Communications Research Center.

2 Research Themes of the Yokosuka Radio Communications Research Center

Fig.1 shows the major aspects of our research plan. With terrestrial wireless communications technology as the focus, we have extended our research efforts to the mobile-communications network, electromagnetic compatibility, and communications devices, among other areas.

Our basic ideas regarding the development of wireless communications technology are as follows. With the increasing sophistication of fiber-optic network technology and the growing popularity of network use, we are witnessing the arrival of a full-scale network era — a multimedia era. Broadband multimedia services, provided through the exchange of high-definition images and high-speed data transmission relying on terrestrial super-high-speed fiber networks, are expected to become available to anyone, anytime, anywhere thanks to

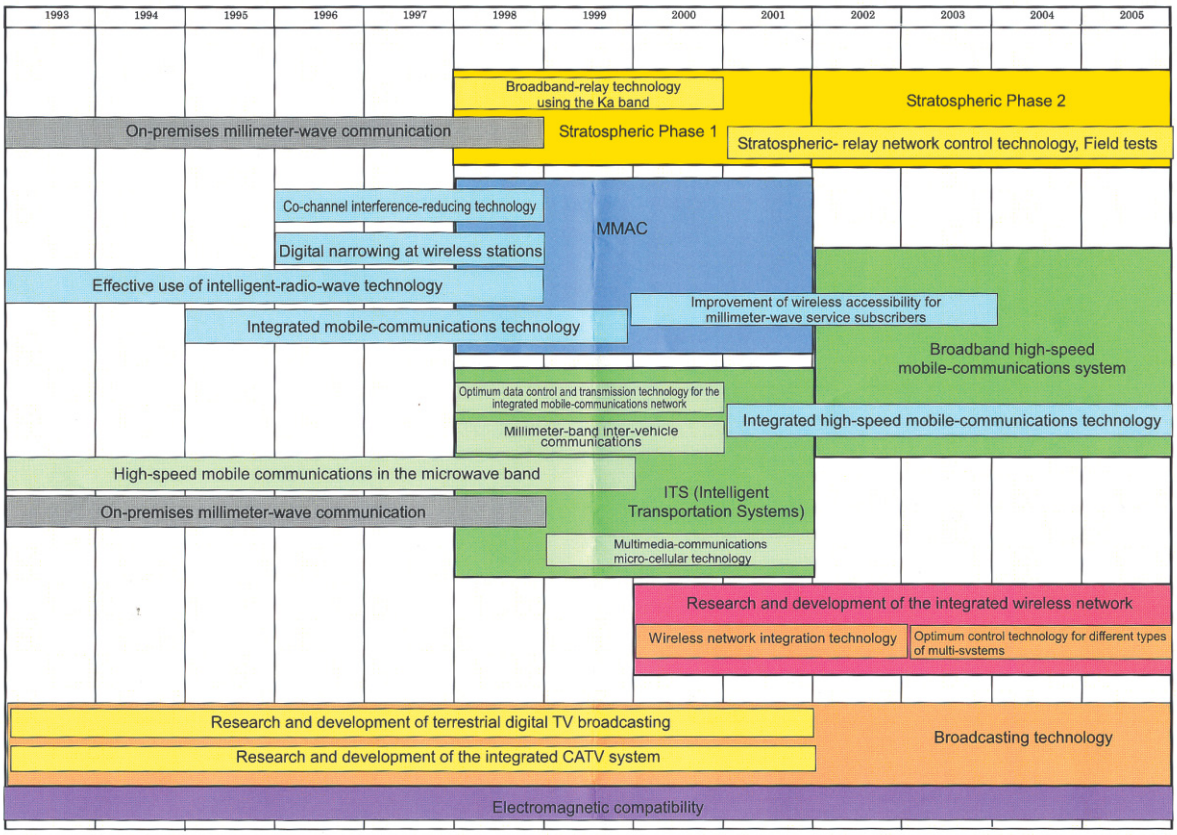


Fig.1 *Timetable of research projects conducted at Yokosuka Radio Communications Research Center*

wireless technologies. Such broadband services will increase the convenience of everyday life and energize the economy. Our goal is to investigate a broadband mobile multimedia wireless communication network that will be essential in realizing such multimedia services. The areas investigated for the implementation of a multimedia wireless network will be as follows: all-wireless network technology relying on optical-wireless links between stratospheric platforms (described in section 3-2 of this special issue); wireless network integration technology [3-1] that enables the use of networks with no need to consider spec differences among various wireless networks, such as the stratospheric radio relay system, MMAC [3-3], and ITS [3-4]; sophisticated multimedia mobile-access technology that enables multimedia communications through the use of wearable wireless terminals technologies; analysis of the radio-wave propagation characteristics observed under diverse conditions of use and the resulting flexible, high-performance mobile information-communications technology; the integrated broadcasting system [3-5]; and the millimeter-wave communications device technology [4] serving as the basis of multimedia wireless communications.

We have developed the following plan for research on the electromagnetic compatibility [5]. A great deal of attention has been focused on problems with broadcasting services caused by electromagnetic interference resulting from the widespread use of electronic systems such as computers, as well as on malfunctions of electronic devices caused by radio waves emitted from such increasingly popular wireless devices as cellular phones, and the effects of such waves on the human body. We investigated electromagnetic-compatibility building technology for the safer and balanced use of radio waves, focusing on two

major research fields — EMC technology and biological-impact estimation technology. In our research on EMC technology, it is important that we gain an understanding of the electromagnetic compatibility consisting of wireless and electronic devices, and analyze the mechanism of their mutual interactions. At the same time, we set forth guidelines for the prevention of interference and device malfunction, and develop specific prevention measures that meet the proposed guidelines. Meanwhile, in our research on biological-impact estimation technology, we determine the influence of radio waves emitted from wireless stations on the human body. Based on this analysis, we establish anti-electromagnetic-wave protection guidelines and develop a precise evaluation method to ensure the health and safety of humankind. In the near future, a series of next-generation wireless communications systems will come into practical use. In line with such trends, higher-frequency bands such as the microwave and millimeter wave bands, which have not been adopted by current wireless systems such as cellular phones, are expected to be in widespread use within approximately 10 years. We will continue our research and development of electromagnetic-compatibility building technology to meet the need for the use of such radio-wave bands, and to realize the safer and more efficient use of radio waves.

3 Evolution to New Stage with Next-Generation Mobile-Communications Technology as the Focus

There is constant demand for higher levels of mobile-communications technology. Indeed, mobile communications have evolved beyond the basic concept of the telephone and had a profound impact on society, especially on our culture and eclectic lifestyles, as seen in the explosive spread of mobile Internet users. On the other hand, as the level of communications technology increases, the amount of traffic and the demand for further communications services are growing rapidly. We are now faced with a variety of technological challenges, such as the improvement of terminal devices, the development of new techniques for creating seamless links among different networks, and the expansion of IP-based networks.

Under the circumstances described above, in July 2000 the government established the IT Strategy Council and IT Strategy Headquarters for promotion of the IT revolution. Based on the IT Basic Law (Basic Law on the Formation of an Advanced Information and Telecommunications Network Society), the IT Strategy Headquarters (Advanced Information and Telecommunications Society Promotion Headquarters) was established in January 2001 to serve as the core organization supporting the IT revolution, in cooperation with the government and private sectors. The IT Strategy Headquarters developed the “e-Japan Strategy” in January, with the goal of making Japan the world’s leading IT country within five years. In March, the Headquarters developed the “e-Japan Strategy,” which specified actions for promoting the IT revolution in Japan. The “e-Japan Priority Policy Program” include the following with respect to the so-called “mobile IT.”

[Improvement of mobile-communications technology]

(1) Japan will integrate the relevant ITS expertise and build a high-speed Internet platform for ITS on the cutting-edge high-speed wireless network. For this purpose, Japan will bring the developed technologies to operational status by FY2005, allowing cars traveling at high speeds to receive a large amount of diverse information via the wireless network.

(2) Japan will build a world-leading mobile IT platform by establishing a sophisticated high-speed wireless Internet and a fourth-generation mobile-communications system capable of providing seamless communications services. Relying on our leading technology in the field of information-

communications and our expertise accumulated in the industrial sector, Japan will accelerate its technological development. In addition, Japan will contribute significantly to the establishment of international standards and the development of essential elemental technologies by 2005, aiming at practical use by 2010.

(3) Japan will develop by 2005 the required technology to allow users to easily and flexibly select diverse wireless communications services for greater convenience in network use.

In accordance with such national policies, a framework for next-generation mobile communications was presented at the Telecommunications Council in June 2001. This innovative next-generation mobile-communications system will be a combination of a cellular system (fourth-generation mobile-communications system) with enhanced interconnectivity, and a high-speed wireless access system. Its distinctive features are broadband throughput and a seamless configuration.

(1) Fourth-generation mobile-communications system

- A fourth-generation mobile-communications system with a data transmission rate in the downlink channel (base station to terminal) capable of reaching 50-100 Mbit/s is scheduled to be developed by approximately 2010. A 3.5-generation system with a data transmission rate of approximately 30 Mbit/s is scheduled to be developed by around 2005 (for example, 2 Mbit/s is the limit in both uplink and downlink channels in the current IMT-2000).
- Next-generation mobile-communications technologies such as software radio technology (in which the employed frequency and communication mode can be flexibly changed simply by replacing the software) will be introduced.

(2) High-speed mobile wireless access system

A high-speed mobile wireless access system that is operable at a minimum of 100 Mbit/s and is available even in hot spots will be developed.

(3) Functional integration and improvement of systems

- Development of multimedia mobile communications, including the exchange of high-definition video images.
- Enhancement of interoperability with the Internet protocol for the future use of IPv6 (Users may select services, applications, and networks as desired).
- Seamless connection with other media, including short-distance wireless links such as the next-generation Bluetooth, wireless home links, and digital broadcasting.
- Systems of high security and secured authorization.

(4) Frequency

- As the frequency band for potential use in the fourth-generation mobile-communications system, an additional 1.2-1.7-GHz band will be required in 2015.
- Frequencies below 5-6 GHz may be employed.

The following strategies have been presented for the intensive promotion of relevant activities.

(1) Promotion of R&D and international standardization

- Acceleration of international standardization taking into account worldwide competition and collaboration.
- Establishment of a forum for the promotion of R&D and international standardization.

(2) Improvement of R&D organizations

- Increase in the number of integrated R&D centers.
- Preparation of test beds.
- Conducting and encouraging preliminary experiments in the local area.
- Strengthening relationships among research institutes such as universities and academic societies.

(3) Preparations for the creation of new application markets

- Acceleration of R&D and standardization encouraging the creation of new application markets.

- Acceleration of the investigation and standardization of mobile EC.

(4) Promotion of global collaboration
- Intensive involvement in ITU activities.
- Cooperation with Western and Asian countries in the field of R&D and international standardization.

To keep pace with the above advances, a national project sponsored by the Ministry of Public Management, Home Affairs, Posts and Telecommunications will be launched to encourage related research and development in FY2002, with the development of super-high-speed data-transmission technologies and terminal devices as its focus. In addition, the Communications Research Laboratory is conducting intensive research and development of next-generation mobile communications, with Yokosuka Radio Communications Research Center as the core of its activities.

Meanwhile, YRP, located on a hill in the Miura Peninsula facing Tokyo Bay, has been active in the investigation of IMT-2000 (third generation), with the goal of becoming an international R&D center for information-communication technologies. YRP began as a national project for the promotion of civil activities, launched in 1987 by the former Ministry of Posts and Telecommunications. Today, YRP is made up of more than 40 domestic and overseas research institutes, and additional lab buildings continue to be constructed. It has become a huge R&D center where several thousand people work, primarily investigating mobile communications.

The Communications Research Laboratory of the former Ministry of Posts and Communications established the Yokosuka Radio Communications Research Center on the premises of YRP in FY1998. This research center has been pushing ahead with research activities based on the following three basic policies, in order to play a central role in collaboration between industry, academia, and government, providing the participants with perfect opportunities for technical exchanges.

(1) To play a core role in carrying out joint research projects in Yokosuka Research Park, which is expected to become an international center of excellence for research and developments of mobile communications.

(2) To carry out user-oriented strategic research on mobile communications technologies and contribute to the global standards.

(3) To play a core role in the Asia-Pacific region by collaborating with western countries.

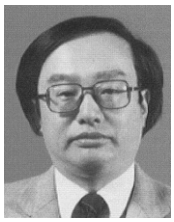
There are a variety of approaches to upgrading the research compatibility of YRP and the Yokosuka Radio Communications Research Center. Of particular importance is the establishment of a test bed. "Test bed" refers to facilities that have a common wireless platform that individual institutes may utilize, and applications to which mobile terminals can have access for conducting field tests on a wide array of wireless technologies. Through operational tests that examine interconnectivity, for example, it is possible to conduct investigations taking into account international standardization and commercialization. YRP will be able to provide a high-quality test bed.

Plans call for the seventh floor (available area: 11 spans, approximately 1260 m^2) of YRP Building 1 to be added to the current area (second and third floors of Building 1, 2500 m^2 in total) in FY2002 for the next-generation mobile projects, and for the ACT facilities to be transferred (see "An advanced CATV System with Wireless Distribution" in this special issue).

4 Conclusions

A comprehensive examination of the current status of mobile communications reveals that increasing efforts are being made to develop applications and content, as well as hardware technologies. As a result, the content is more upgraded and diverse than ever before. Mobile communications have the potential even to transform the social struc-

ture, penetrating into the fields of finance and public welfare and our everyday lives. Functions of mobile communications such as data communications, remote monitoring, and remote control are in use in the transportation, construction, and other industries. Innovative services have often been suggested not by those involved in research on communications systems, but by general users. In consideration of this, widespread collaboration with out-of-house people such as general users will be essential for upgrading wireless-communications technologies and networks. I expect that such casual exchanges will provide results of great importance.



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Wireless Communication