In this symposium, experts will present us their perspectives on future railways 20 years from now, and our young engineers will make speeches as well. If JR East is to continue as an enterprise, we cannot be viable without striving for new technologies. The speeches of our young engineers might sound like merely dreams, but I do hope you will enjoy them. It is quite important to chase after dreams. And I expect each and every member of JR East Group to chase after his or her dream.

We had never experienced a time in the human history when science and technology have been as deeply rooted in society as they are today. But, fundamentally, science and technology have different origins and are completely different from each other.

Technologies had already been in existence when human culture begun. Some examples are technologies of the primary industries such as agriculture and fishery, social technologies such as medical technologies, military technologies and postal technologies, and other craftsmanship. And we see a characteristic whereby experts of those technologies form groups according to the individual technology like a master-apprentice system of craftsmen, and clients who use the technologies of those experts always exist outside of such groups.

On the other hand, science emerged for the first time in Europe in the 19th century. Scientists also formed expert groups called “scientific communities” as technical experts did, but the clients of the knowledge that scientists created were simply the scientists themselves. Scientific communities were formed internally. But things changed in 1935 when a scientist named Wallace Carothers was employed by DuPont and successfully developed Nylon manmade fiber on a company assignment. In the Manhattan Project from around 1940, of the top scientists at that time in USA were mobilized and their knowledge and skills were used for a national objective of developing an atomic bomb. It was believed that such an all-out mobilization system of science should be maintained even in the peacetime, and National Science Foundation was established in 1950. As scientific research results have been directly incorporated in society, science gained a close relation to political issues, and decision-making has begun to require the decision of the experts.

Recently, an innovation has been achieved whereby decision-making needs to be based on the total knowledge and consciousness of stakeholders such as governments, industries, judicial organizations, media, educational organizations and citizens. In light of that situation, we need to design our future society.

JR East holds its R&D Symposium annually, to send out information and to receive information on excellent technical seeds and comments on development directions.

We celebrated the 20th anniversary of our foundation in April 2007; and on that occasion, we have embarked again on new creation. In this context, we organized the 14th R&D Symposium on February 13, 2008, under the theme of “Perspectives for Future Railways—Aiming for Next-Generation Railway Systems”.

(Posts and positions noted herein are as of the holding of the symposium.)
more diversified needs. In the process of concluding the discussions, a phrase “open rail” emerged, which means a railway system that departs from constraints of traditional frameworks and itself evolves. Today, we will introduce our discussion results from four aspects of operation, rolling stock, stations and maintenance.

### Innovation of Operation—From “Line Optimized” to “Area Optimized”
Takashi Kunishi
Manager, Advanced Railway System Development Center, Research and Development Center of JR East Group

In order to meet customer needs that are becoming more and more diversified and advanced, it is imperative that we make transport seamless and flexible. For this purpose, the keywords for the dispatch system could be “autonomous and decentralized” and “wide-range cooperation”. In other words, the present dispatch system per line has to be innovated into a dispatch system for the total area; and we have to develop an integrated system linking on-train and wayside facilities. We will proceed with the development of on-train systems for route control mainly by on-train and automatic unmanned operation. As for wayside systems, we will thoroughly work to switch to wireless communications and develop decentralized wireless protection devices and a sensor network. We also aim at more efficient energy system by developing a new energy network and a next-generation power cell device.

### More Attractive Rolling Stock—From “Evolution” to “Revolution”
Kenji Fujino
Manager, Advanced Railway System Development Center, Research and Development Center of JR East Group

Development of future Shinkansen rolling stock requires a technical revolution. In order to maintain an advantage over air flight, Shinkansen trains have to be able to run at 400 km/h and reach Aomori from Tokyo within two hours. That requires innovations such as a car body structure of strong and lightweight new material, pantograph-less current collection using microwave power transmission, high deceleration non-adhesive brakes using magnetic force, and a high speed steering bogies that can follow curves. For customer service, we try to achieve 360-degree scenery viewing using organic light emitting displays, a passenger cabin that is quiet through active noise control and does not convey vibration to passengers, variable seats that follow the passenger’s figure and individual air-conditioning. For environmental issues, we will develop a cyclic energy system and a fully recyclable car body, and reduce noise and micro pressure waves.

### Station Innovation—From “Closed Public Space” to “Open Personalized Space”
Takeshi Nakagawa
Manager, Frontier Service Development Laboratory, Research and Development Center of JR East Group

We are aiming to achieve stations that can give a more familiar feeling to people and offer more detailed and personalized service. For that purpose, we will develop things like gates that can detect danger and perform security checks through images, a safety lane for children and aged customers, and a patrolling security robot. Our other developments will be a floor navigation system using human body communication technologies and a robot for guiding and assisting. We will also make stations more intelligent using AI to give station staff information on congestion and passengers, and we will develop an assistance system with items such as headsets and communicators. In terms of environmental structure, we will use new energy and natural lighting, develop self-healing construction material, and improve the quake resistance and flexibility of structures.

### Maintenance Innovation—From “Time Based” to “Condition Based”
Masanobu Kozeki
Manager, Technical Center, Research and Development Center of JR East Group

Today we mainly conduct “time based” maintenance such as periodic inspections. But we are aiming for “condition based” maintenance where we can make diagnosis of rolling stock and wayside facilities by nearly constant monitoring to detect any sign of deterioration. In “condition based” maintenance, we identify the condition of wayside facilities using sensors on trains in service and data transmitted from wayside sensors. For items that are not suitable to on-train monitoring, we use wayside sensors to identify the condition of all trains passing. Furthermore, we check overhead contact lines for the temperature and movement distance of lines, monitor contact with acceleration sensors of pantographs and assess the running condition with wheel load sensors and lateral force sensors on wheels or rails. If a serious irregularity is found in such “condition based” maintenance, we carry out urgent repair or take the car in question into a car depot to prevent any possible accident or operation disruption.

### Video: Railways 20 Years in the Future

Video of an imagined railway 20 years in the future was played, focusing on a businessman in Tokyo. That video showed thinks like car sharing, information given on floor displays and by robots, solar and wind power generation, baggage delivery system, seamless operation, on-train functions and monitoring of wayside facilities by trains in service.
Panel Discussion: Expectation for Stations and Railways 20 Years in the Future

[Panelists]
Noriaki Okabe
Representative president, Noriaki Okabe Architecture Network
Professor, Kobe Design University

Hiroshi Yasuda
Professor, Department of Information Systems and Multimedia Design, School of Science and Technology for Future Life, Tokyo Denki University
Professor Emeritus, the University of Tokyo

Shunji Yamanaka
Product Designer
Takayo Yamamoto
Research Director, Hakuhodo Institute of Life and Living, Hakuhodo Inc.

[Coordinator]
Fumio Hasegawa
Director, Frontier Service Development Laboratory, Research and Development Center of JR East Group

(Prof. Okabe) As an architect, I have designed things including the Centre Pompidou in Paris, the Kansai International Airport Passenger Terminal Building, and the Odakyu “Romancecar” limited express train. Architecture and railways are very closely related. As shown in art paintings by Monet, stations symbolize the civilization of the time. In designing the terminal building of Kansai International Airport, I sought both a large space for people like European stations built in the 19th century and a new creative design. It is important to create transparent and easy-to-understand space even without signs. Since the terminal building is disaster-resistant too, it served as a disaster management base at Great Hanshin-Awaji Earthquake. As for the Romancecar, I designed with an aim of harmonizing with the season’s scenery and being a part of the landscape. In designing its interior, I valued human sensibility and feeling and aimed for a space with softness. Stations and rolling stock of railways are movement spaces that are used by more people than public buildings are. Thus, we have to carefully build a network of movement spaces, while improving our design capability and paying attention to environmental issues too.

(Prof. Yasuda) Based on my professional experiences such as standardization of JPEG and MPEG, communications, the Internet and security as well as my personal experiences with railway travel, I would like to suggest what IT can bring about for stations and railways 20 years in the future. Ubiquitous technology will achieve door-to-door travel by combining railway and road transport. Seamless linkage technology will link real functions and virtual functions. PCs, mobile TVs and other communication terminals will keep connected without interruption when by getting on and off trains. Information such as that on transfers and locations of elevators will be offered according to the passenger’s movements. Customizing the environment according to the individual passenger is important too. That will provide a quiet environment where every passenger will be able to arrive at the destination in the desired time, and where those who would like to sleep can do so, those who feel happy can enjoy a lively environment, and those who feel down can gain healing. That requires quality improvement, such as cutting noise and vibration to zero by forecasting running conditions. I would thus like for engineers to offer us the environment to watch content rather than for them to develop content.

(Mr. Yamanaka) As an engineer-turned-product designer, I have designed cars, robots, cameras and watches. First, as a hint to think of the future, I will introduce an example of the design of Suica ticket gate machines. New technology typically causes discord with people. Initially, Suica faced repeated errors because users did not hold the IC card toward the machine as desired. By repeating experiments on prototypes of different shapes and considering the height and the size of antennas, we finally tilted the reader of the machine by 13 degrees, which achieved the error level as low as one occurrence among 100 users. Next, I will introduce a completely new electric car now being researched. We are to focus on solving existing problems, but rather developing cars that apply the latest robotics technology exemplified by bipedal walking. The Suica ticket gate is a practical example, and the electric car is a dream that we are not sure will be useful. But, I’d like to say that such a gap gives us a view of the future.

(Ms. Yamamoto) I am studying lifestyles of women in their 20s to 40s, mainly on their mentality and actions. I have built relationships with 113 female office workers in Tokyo using e-mail correspondence that allows instant rapport. With that very demanding and self-centered group, I have tried to come up with the ideal station and railway. Those women do not necessarily need a high-tech station; they only need to be comfortable. They want a station like a mother that accepts everything and creates for them. So, we have named the concept “Mother Station” with a meaning of it being the foundation of lifestyle. There, the stationmaster greets users every day, and users can use valet bicycle
parking service or free rental umbrellas. On the platform, there are porters other than station staff who take heavy baggage and call to those who look to be in trouble. Since a person—station staff for example—one first talks with in a location can define the first impression of that location, a station is a quite important place.

(Mr. Hasegawa) Since the field of railways often requires long-term thought and vision, it is future-oriented. As groups of specialists, railway engineers tend to think based on the status quo; but I hope future railways will develop three dimensionally by balancing the comments from our panelists today and the image of railways 20 years in the future from our young engineers.

Closing Speech
Nobuyuki Hashiguchi
Executive Vice President, East Japan Railway Company (JR East)

Today we have had many evocative comments in the lectures and the panel discussion. In the coming 20 years, we will bring substance to dream of railways through our research and development. Society, economy and other environmental factors, customer’s needs and our people themselves will be changing. Still, we need technical innovation and research and development; so, I hope our people keep the dream in mind throughout their endeavors. And also, I hope our guests today keep their dream for railways 20 years in the future.