Electronic Navigation Research Institute—Third-year Mid-term Goals

The Electronic Navigation Research Institute (ENRI) is expected to conduct research and development related to the development of air traffic systems in order to respond precisely to society's expectations, such as an increase in air traffic, improvement in air traffic safety, and the protection of the global environment. As an independent administrative agency supporting the technical aspects of the aviation administration through research and development, it is essential for ENRI to work so that its research results will be utilized for the benefits of the aviation administration while strategically focusing on the solution of highly important issues assigned to the aviation administration, thus contributing to society.

Besides, ENRI will efficiently and effectively implement its management autonomously, spontaneously, and transparently, and actively transmit information obtained through its research.

Furthermore, it is necessary for ENRI to aim for becoming the central institution of the research and development of air traffic systems in Asia in order to play an internationally significant role in research and development (R&D) activities.

With consideration of the above, ENRI has set forth the following plans in order to accomplish ENRI's mid-term goals of fiscal 2011 specified for ENRI by the Minister of Land, Infrastructure and Transport under the provisions of Paragraph 1 of Article 30 of the Act of General Rules for an Incorporated Administrative Agency (Act No. 103, 1999).

1. Matters concerning Improvements in Public Service and Work Quality
 (1) Strategic Implementation Focused on Research and Development to Meet Social Needs
   1) Basic Policy on Research and Development
      ENRI is expected to grasp exact social and administrative needs accurately in a timely manner, and promptly and flexibly make necessary arrangements for the solution of technical problems for the satisfaction of social and administrative needs. ENRI will implement intensive and strategic plans with the proper selection of R&D projects of high necessity and importance with consideration of measures that will ensure from the planning stage the smooth utilization of the results of such research and development. Moreover, ENRI will maintain foresight and flexibility so that it can accurately detect all social condition changes and social and administrative needs in a timely manner during the implementation of research and development and promptly make countermeasures for the changes.

   2) Goals of Research and Development
      The basic goals of ENRI's research and development in the implementation period of the mid-term

goals are improvements in the operational safety and efficiency of aircraft carriers with an expected increase in air traffic in the future, improvements in the convenience of airline users, and a reduction of environmental impacts (e.g., CO_2 and noise). ENRI will decide on R&D projects in its mid-term plans and accomplish them intensively and strategically.

(a) Research and development of advanced in-flight operation

(b) Research and development of advanced flights near airports

(c) Research and development of technology and safety connecting the sky and ground

3) Technical Issues

Specifically, ENRI will intensively work on the following R&D projects to solve the technical issues specified as the mid-term goals.

(a) Research and development of advanced in-flight operation (expanding the capacity of flight paths)

In this R&D field, ENRI will work on research projects, such as the development of trajectory prediction techniques, air traffic management (ATM) performance, and efficiency improvements in flight routes, in the aim of air traffic expansion, operational efficiency improvements, and environmental protection with a reduction of fuel consumption. These projects will contribute to the realization of trajectory prediction techniques and control technology indispensable to trajectory-based operations, quality improvements in trajectory prediction utilizing the flow prediction of air traffic and weather information, and better ATM performance.

To be specific, ENRI will make arrangements to accomplish the following items within the implementation period of the mid-term goals.

With regard to the R&D project of trajectory prediction techniques, ENRI will develop a 4-D trajectory prediction model to calculate the time and position of aircraft at each passing point from departure to arrival. This will realize trajectory prediction of flight time from departure to arrival within a maximum error of 3%.

With regard to the R&D project of ATM performance, ENRI will develop a model simulating an air traffic flow to conduct the quantitative pre-testing of the reduction effect of fuel consumption with the introduction of a new control management system.

With regard to the R&D project of efficiency improvements in flight routes, ENRI will calculate the most fuel-efficient flight route from oceanic airspace to a runway and develop a simulator that can simulate control operations. This will realize flight route settings that make it possible to improve operation efficiency while maintaining the safety of control operations (e.g., a fuel reduction of approximately 1,000 pounds and a flight time reduction of approximately three minutes for an international flight arriving at Haneda).

(b) Research and development of advanced flights near airports (Increase in processing capacity of congested airports)

ENRI's R&D projects include: Research on advanced-category operations using the Global

Navigation Satellite System (GNSS), development of trajectory prediction techniques for airports, sophistication of surveillance technology, and development of approaching methods through curved routes using the GNSS for congested airports to process a large amount of data speedily, eliminate surface traffic congestion, and improve punctuality and convenience of flights. These projects contribute to the sophistication of satellite navigation systems, systems precisely monitoring flight conditions, and development of the performance-compliance operation of aircraft according to operational performance requirements for the aircraft specified.

ENRI will make specific arrangements to attain the following assignments within the implementation period of the mid-term goals.

In the research on advanced-category operations using the GNSS, a high level of safety required from high-category precision entry (integrity $1-1\times10^{-9}$) will be demonstrated by the development of the Ground-Based Augmentation System (GBAS) to achieve a safe landing using the GNSS under weather conditions equivalent to category III (a visibility of approximately 100 m).

In the development of trajectory prediction techniques for airports, a model to predict the airport surface running time of aircraft based on an analysis of airport surface traffic has been developed. By devising the schedule of airport surface running of aircraft with the model utilized, airport surface congestion resulting from an increase in air traffic will be mitigated.

In the sophistication of surveillance technology, ENRI will realize an independent operation system for parallel runways. This system will be supported by a new technology that monitors aircraft in the vicinity of airports at a frequency twice as much as that attained by the conventional Secondary Surveillance Radar (SSR) System by integrating a number of surveillance systems, such as the Wide-area Multilateration System and SSR Mode S System.

In the development of approaching methods through curved routes using the GNSS, ENRI will undertake research on landing approaches through efficient curved routes utilizing the GBAS and the ability of the aircraft provided with onboard equipment.

(c) Research and development of technology and safety connecting the sky and ground (Realization of safe and efficient operations)

ENRI will implement R&D projects, such as the evaluation of a new aeronautical data link, application of general-purpose high-speed communications technology for next-generation aeronautical communication, analysis of workloads on air traffic controllers, and development of technology of human error reduction, to realize safe and efficient operation control, eliminate bottlenecks from aeronautical communication, and introduce an aeronautical data link. These projects will contribute to the development of air-ground high-speed communications technology, environmental technology allowing all parties concerned to share operation-related information, and human error prevention technology.

To be specific, ENRI will make arrangements to accomplish the following items within the

implementation period of the mid-term goals.

With regard to the evaluation of a new aeronautical data link, an L-band air-ground data link that enables approximately a 10-time increase in transmission speed compared with the conventional data link (VDL2) with a reduction of the rate of transmission errors to 10^{-7} (from a conventional value of 10^{-4}).

With regard to the application of general-purpose high-speed communications technology for next-generation aeronautical communication, ENRI will develop a test bed employing general-purpose high-speed communications technology for a system of traffic control communication that requires high security, thus achieving high-speed communication to cover the entire airport surface.

With regard to the analysis of workloads on air traffic controllers, ENRI will develop a knowledge structurization system based on a task analysis of control work, summarize the experience and knowledge of air traffic controllers into a model for visualization, and realize the use of the model for measures to reduce human errors.

With regard to the development of human error reduction technology, ENRI will evaluate and verify the correlation between data collected by a speech analyzer and that on other physiological parameters, such as brain waves, thus evaluating the reduction in the arousal level of air traffic controllers resulting from fatigue.

4) Measures for R&D Activities in Process

At the time of selecting R&D projects, ENRI will clarify social and administrative needs and the justification of the development projects to support the needs. ENRI will focus on R&D projects that are really necessary and that cannot be accomplished by other institutions, such as those closely related to Japan's air traffic control measures (e.g., the planning of relevant administrative policies and establishment of technical standards). In such a case, ENRI will grasp the contents of research conducted by other R&D institutions as much as possible, consider the utilization of knowledge and technology in advance, and eliminate duplicated research and development.

At the time of selecting R&D projects, ENRI will consider the contents of the research projects concretely with sufficient adjustments made with the government as the transmission source of the needs and parties concerned, such as carriers, while setting quantitative targets as much as possible in the aim of attaining practical results. At the time of making plans, ENRI will study R&D strategies including introduction costs and other external factors to be taken into consideration.

ENRI will evaluate the research and development in advance, manage the progress of the research and make an intermediate evaluation of the research, and properly make a final evaluation on completion of the research so that the results of the research will become benefits for society and improve the international status of ENRI. Meanwhile, ENRI will properly reflect the results of evaluation in research plans in the future through appropriate measures including a review or the interruption of the research. Outside experts will evaluate intensive R&D projects, the results of

which will be opened to the public to maintain the transparency of the research and development.

(2) Accumulation of Core Technologies with Implementation of Basic Research

With improvements in the potential and expertise of ENRI's researchers, ENRI will be able to give appropriate response to technical issues assigned by the government more easily and innovative research results can be expected. While considering the world's trends in electronic navigation, ENRI will accumulate core technologies required from a long-term perspective viewpoint and increase its R&D capabilities through basic technological research, the development of which is expected in the future, research on the application of advanced or innovative promising technologies for air traffic systems, and exploratory research based on new ideas.

(3) Reinforcement of Cooperation with Relevant Organizations

ENRI will conduct effective and efficient research and development with ENRI's limited human resources, improve the quality of its research and development, and increase the potential and presence of ENRI. In order to accomplish this, ENRI will actively promote its cooperation with domestic and international air traffic control organizations, independent agencies that are implementing research and development related to the work of ENRI, universities, and private companies. Then ENRI will achieve excellent research and development results that cannot be attained by ENRI only and make efforts to the utilization and expansion of the results. Therefore, ENRI will make at least 40 joint researches during the implementation period of the mid-term goals. Furthermore, in order to promote and facilitate ENRI's close cooperation and exchanges with relevant organizations, ENRI will hold at least 30 exchange meetings of its researchers and engineers during the period. Furthermore, ENRI will actively utilize external human resources with relevant expertise, such as the invitation of visiting researchers, adoption of fixed-term researchers, and personnel exchanges, for research and development utilizing knowledge and technology in which ENRI is not specialized. Specifically, ENRI will employ at least 30 fixed-term and visiting researchers during the period. Furthermore, ENRI will contribute to the training of young researchers by accepting overseas trainees and students.

(4) Participation in International Activities

Many technologies and operating systems related to aviation should be shared worldwide. Therefore, ENRI will actively promote technological exchanges and cooperation with aviation authorities, research institutes, and enterprises overseas, thus contributing to international research and development. During the implementation period of the mid-term goals, in particular, ENRI will contribute to the activities of international standard organizations, such as the International Civil Aviation Organization (ICAO), Radio Technical Commission for Aeronautics (RTCA), and European Organization for Civil Aviation Equipment (EUROCAE).

Specifically, ENRI will actively participate in meetings sponsored by the ICAO and other international standard organizations and provide necessary technical support to Japan while giving at least 120

presentations at such meetings during the period, thus contributing to the drafting of standards. Besides, ENRI will make necessary responses to proposals of other countries after considering the influence of the proposals on Japan and the technical suitability of the proposals to Japan so that international standardization will not disadvantage Japan.

ENRI will reinforce its cooperation with related organizations in the Asia-Pacific region through technical exchanges and joint researches, thus creating mutually beneficial outcomes. In addition, ENRI will hold approximately two international workshops during the period in the aim of being a core institution in Asia. Furthermore, ENRI will hold approximately three technical seminars for Asia during the period.

(5) Dissemination of Research and Development Results and Promotion of Using Them

ENRI will utilize various means, such as the opening of facilities to the public, the holding of workshops, the publication of research reports and newsletters, to publicize the activities and achievements of ENRI. Besides, ENRI will actively participate in international conferences, academic meetings, and symposiums, disseminate or utilize its research and development results through lectures and presentations, and actively dispatch technical data and various information that ENRI obtains in the process of research and development. Furthermore, ENRI will actively work on technology transfer to administrative authorities and enterprises through the holding of workshops and the creation of manuals in order to return ENRI's accumulated research and development results to society.

Specifically, ENRI will announce each research and development project through academic societies and professional journals at least once a year while holding approximately three lecture meetings during the implementation period of the mid-term goals. ENRI will hold extension lectures at enterprises and other external organizations in order to help the public understand ENRI and disseminate its research results widely to connect the results to technological exchanges in the future. Furthermore, ENRI will aim for the adoption of approximately 80 peer review reports during the period.

ENRI will make necessary arrangements to protect its research and development results as intellectual property with sufficient consideration of the usefulness and necessity of the results. Moreover, ENRI will actively introduce technologies to enterprises interested in ENRI's research results in order to utilize its registered intellectual rights. Therefore, ENRI will actively publicize and disseminate them through newsletters, brochures, and patent exhibitions.