Opportunities to create new technologies, encourage a higher level of activity in industry, and enhance international competitiveness are increasing. In order to realize these aims, the concentrated “knowledge” of industry, academia, and government institutions is necessary. This issue of e-Navi introduces “joint research” in examples of industry/university/government cooperation at ENRI.

What is joint research?

Joint research is a system which can be expected to produce more creative research outcomes by establishing common research themes with private companies, universities, and public research institutes and promoting research cooperatively while exchanging opinions from a standpoint of mutual equality. When a theme has been decided, a joint research agreement is concluded and the project is implemented. For ENRI, this achieves a quantitative and qualitative expansion of research, while enabling our counterparts to use ENRI’s facilities and accumulated technology know-how. As a result, the system has mutual merits, in that research results can be obtained in specialized fields that the company itself does not possess and cost reductions can be realized.

Requirements for implementation of joint research

- It must be possible to expect higher efficiency and synergistic effects in comparison with independent research.
- The research theme must be consistent with the business purposes of ENRI.

Main joint research partners

- Private companies
  NEC Corporation, Toshiba Corporation, Mitsubishi Electric Corporation, Mitsubishi Space Software Co., Ltd., Oki Electric Industry Co., Ltd.
- Universities
  The University of Tokyo, Tokyo University of Marine Science and Technology, Waseda University, The University of Electro-Communications, Université de Nice Sophia Antipolis (UNSA)-France
- Public research institutes
  Geographical Survey Institute, National Institute of Advanced Industrial Science and Technology (AIST), Japan Aerospace Exploration Agency (JAXA), French National Center for Scientific Research (CNRS)

Applications for joint research

Applications proposing joint research projects are accepted at any time. Please feel free to contact the Planning Office, General Affairs Division at kikaku@enri.go.jp.
Research on Air Traffic Control Support System Utilizing Knowledge Processing Technology

(Joint research partner: STRI Inc.)

Because air traffic demand is expected to increase in the future at the same pace as it has to date, the work load on air traffic controllers will inevitably increase. Therefore, in this joint research, ENRI and STRI are engaged in research and development on a support system which will lighten the air traffic control work load on controllers by utilizing knowledge processing technology with the aim of providing a useful tool for realizing safe, efficient air traffic control in the future.

At present, systems which employ flight planning and other techniques to predict air traffic flows have already been introduced in field operation. However, the support system which is now under development attempts to realize functions equivalent to the sense and experience of air traffic controllers on a computer by accumulating past flight records in a neural network, etc. In order to realize functions equivalent to sense and experience, it is necessary to acquire the knowledge of air traffic controllers. Although this type of knowledge acquisition was extremely difficult with conventional techniques, automatic knowledge acquisition is possible in this system by using neural network and other advanced technologies. The aims of this development project are to predict the future positions of aircraft based on acquired knowledge, and ultimately to realize a function for detecting abnormal flight.

![Prediction of position from aircraft flight path](image)

**Prediction of aircraft position**

- **Case where aircraft passes through predicted area**
- **Case where aircraft does not pass through predicted area**

![Range of allowable deviation](image)

**Judgment of normal flight**

![Judgment of abnormal flight](image)

**Notification to air traffic controller**

Research on Modeling of Air Traffic Control Tasks

(Joint research partner: The University of Tokyo)

In air traffic control systems, the air traffic controller is in charge of the main functions. For this reason, analysis and study which cover the human factor are indispensable in research and development of air traffic control systems. In the joint research project “Modeling of Air Traffic Control Tasks” being carried out by ENRI and the University of Tokyo, School of Engineering, air traffic control tasks are being modeled from the viewpoint of the human factor, and the safety of air traffic control systems focusing on the air traffic controller is being analyzed and evaluated.

Research work planned for the future includes real-time simulations using ENRI’s air traffic control simulator, modeling of the controller’s recognition/action processes by analyzing the methods and patterns of air traffic control processing and the process of trial-and-error in air traffic control processing based on the simulation results, and extraction of the human factor problems necessary in the study of air traffic control systems.

![View of an experiment](image)
Research on Acquisition of Basic Data for GPS Signal Quality Monitoring using the Satellite Tracking System of Sugadaira Space Radio Observatory

(Joint research partner: The University of Electro-Communications)

High reliability is required in aircraft landing systems. Therefore, when GPS is used in systems of this type, a GPS signal quality monitor that detects GPS satellite signal anomalies and issues warnings to users (aircraft) is necessary. To realize this function, ENRI developed a SQM receiver, which is capable of acquisition of the detailed condition of received GPS signals.

In order to acquire the basic data for detection of anomaly signals, this SQM receiver was connected to the 3.6m φ parabolic antenna of the satellite tracking system in the Sugadaira Space Radio Observatory of the University of Electro-Communications, and the signal properties characteristic of GPS satellites are being measured with high accuracy.

Joint Research on Analysis and Evaluation of SBAS Signals

(Joint research partner: Furuno Electric Co., Ltd.)

Satellite Based Augmentation Systems (SBAS) show deteriorated performance in areas where no ground-based monitoring stations exist in comparison with the essential service region, where such facilities are available. The degree of deterioration varies depending on the arrangement of the ground-based monitoring stations and the distance from this monitoring network. Therefore, this joint research project was carried out in order to grasp the properties of differential data, integrity data, and receivers at the fringe area (area at the edge of geostationary satellite coverage) of the SBAS service region. In this joint research, data collection and analysis based on flight experiments, etc. were performed using the WAAS Pacific satellite (POR satellite) in the United States’ SBAS. The results showed that accuracy is higher than with independent positioning by GPS and there were no results in which positioning error exceeded HPL and VPL, confirming the validity of SBAS data in the coverage fringe area. (The following figures show examples of the positioning results by independent GPS and GPS supported by the WAAS POR satellite, together with integrity data.)

※1: Differential data means error data measured by a reference station. Transmitted to users to improve positioning accuracy.
※2: Integrity means completeness and no use of erroneous data. Integrity data are used to guarantee the correctness of positioning values, etc.
※3: Horizontal protection level: Shows the upper limit of horizontal positioning error.
※4: Vertical protection level: Shows the upper limit of vertical positioning error.
ENRI offers “lecture visits” to introduce its research achievements to users and reflect users’ thinking in its future research based on a direct exchange of opinions.

In these lecture visits, members of the ENRI staff go directly to the user and communicate research results through lectures and demonstrations.

● To schedule a visit, please contact the Planning Office,

“General Affairs Division at kikaku@enri.go.jp”.

Publications

To obtain the following ENRI publications, please contact the Planning Office, General Affairs Division.

“Introducing ENRI”
Pamphlet presenting an overview of ENRI’s work.

“GO FORWARD”
Pamphlet describing commissioned research and intellectual property at ENRI.

“ENRI Papers”
Reports on research results at ENRI.

“ENRI Annual Report”
Report on the results of activities during a 1-year period.

Publisher※For further information on this brochure, please contact:

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