



# International Newsletter

Research Institute for Sustainable Humanosphere, Kyoto University, Japan

= Foreword =

## Exploration and Promotion of New Interdisciplinary Research Projects on a Sustainable Humanosphere

Prof. Yuji Imamura  
Head of the Center for Exploratory  
Research on Humanosphere



The Center consists of three laboratories: the laboratories of exploratory research programs, fusion research programs and interdisciplinary research programs. The objectives of the Center are to explore and promote new interdisciplinary projects that align with the Institute's mission and to create new scientific fields in collaboration with Department of Collaborative Research Programs and Research Divisions.



View of an "open seminar"

The mission research fellows and on-campus guest researchers are staffed the Center, and study the inter-"sphere" sciences of human habitats, the forest sphere, the atmosphere and space, and contribute to developing and expanding new interdisciplinary fields by amalgamating these four fields. In FY 2007, the following six mission research fellows were involved in exploratory research:

Dr. Hideki Koyanaka: A treatment method for preserved wood waste to achieve minimal emissions in the detoxification process.

Dr. Taro Sonobe: Development of a microwave thermal conversion process toward a fossil resource-free society.

Dr. Thi Thi Nge: Development of novel functionalized bacterial cellulose-based biomimetic composites.

Dr. I.V.Subba Reddy: Climatological characterization of precipitation and

humidity observed by satellite-borne sensors over the tropical region (including Indonesia area).

Dr. Tsugumi Masuno: Development of phytoremediation technology with heavy metal transporter genes.

Dr. Motoko Fujita: An ecological study for sustainable use of *Acacia mangium* plantations.

The Center calls for interdisciplinary research projects on the science of the sustainable humanosphere. The following subjects are being conducted by on-campus researchers with the collaboration of our staff.

Dr. Makoto Ando (Field Science Education and Research Center): Effects of climate change on the decline of Fagaceae species: Long-term ecological research in a cool temperate forest.

Dr. Toshihiko Iyemori (Graduate School of Science): Development of a portable vector gradiometer and its use in estimating secular variation.



Dr. Yoshiko Kosugi (Graduate School of Agriculture): Measurement of BVOC (Biogenic Volatile Organic Compound) emissions from a tropical rainforest.

Dr. Junichi Susaki (School of Global Environmental Studies): Development of a physical model to estimate soil moisture in paddy fields based on microwave scatterometer measurements and estimation of soil moisture using satellite Synthetic Aperture Radar (SAR) images.

Dr. Junji Takabayashi (Center for Ecological Research): Ecological information networks mediated by green leaf volatiles.

Dr. Takahiro Tagami (Graduate School of Science): Fundamental research on climatic and environmental changes in the Asian equatorial region: High-resolution correlation between isotopic data of speleothems and growth-ring data of tropical trees.

Dr. Ichiro Tayasu (Center for Ecological Research): Basic research on the metabolism of inorganic elements in termites.

Dr. Takuji Nakamura (RISH): Development and application of a laser spectroscopy technique for field measurements in the atmosphere, the biosphere and the forest.

Dr. Yoichi Fukuda (Graduate School of Science): Feasibility study on landwater monitoring by means of a future SSI (Satellite to Satellite Interferometry) gravity mission: Applicability of Along Track Range Rate data.

Dr. Takeshi Hori-nouchi (RISH): Development of a database and analysis system for numerical data on the tropical humanosphere.

Fifty open seminars were organized through FY 2006, and in FY 2007 seminars are continuously being convened by staff, on-campus guest researchers



The mission research fellows in FY 2007  
From left to right; (Below) Thi Thi N., Y. Imamura,  
I.V.S. Reddy, (Above) T. Masuno, T. Sonobe,  
(Upper) H. Koyanaka, M. Fujita

and related researchers. The Center designs the forums, seminars, symposia and workshops, and publicizes the research achievements for better and deeper understanding of the humanosphere to inspire the creation of new mission projects.

= RISH International Symposium =

## The International Symposium in Bandung, Indonesia on July 25, 2007 on "International Collaborative Programs in Indonesia"

Prof. Toshitaka Tsuda  
Head of the Department of Collaborative Research Programs

organized through intensive collaboration between RISH, LAPAN and LIPI (Indonesian Institute of Sciences). This meeting was a follow-on symposium from the RISH 47th symposium entitled "Toward the Harmonization of Economy and Ecology" held on August 28-29, 2006 at the Biotechnology Center of LIPI, Cibinong, Indonesia.

The convener of the symposium was Dr. Thomas Djamaluddin of LAPAN, Dr. Bambang Subyanto of LIPI and Prof. Toshitaka Tsuda of RISH. A total of 84 scientists, 7 from Japan and 77 from Indonesia, attended the meeting. The one full day symposium consisted of important scientific subjects on the humanosphere, which is composed of space, atmosphere, forest-sphere and living environment. A diverse group of experimentalists, modelers and theoreticians all having a common focus on humanosphere science were brought together.

The symposium was opened with

The 73<sup>rd</sup> RISH symposium on Science for Sustainable Humanosphere was held at the auditorium of LAPAN (Indonesian National Institute of Aeronautics and Space) in Bandung, Indonesia on July 25, 2007. This international meeting was devoted to the recent achievements and future directions of "International Collaborative Programs in Indonesia", and was





welcome addresses by Prof. Endang Sukara, Prof. Shuichi Kawai, and Dr. Bambang Tejasukmana, who represent LIPI, RISH and LAPAN, respectively. A total of 44 papers were presented, out of which 12 presentations were given orally, and 32 were displayed as posters. Because of the interdisciplinary nature of the subjects, talks ranged from the ground to space, technology to science, biochemistry, material sciences, atmospheric environmental science, and space engineering. Many of them were accompanied by lively and productive discussions.

The symposium also provided a discussion session chaired by Prof. T. Tsuda, in order to review and discuss the present and future directions of the international collaborative programs between Japan and Indonesia with a main focus on promoting interdisciplinary sciences, utilizing large facilities in Japan and Indonesia, continuing education programs, and so on. We hope that this symposium has successfully assessed the current understanding of the science for a sustainable humanosphere.

We greatly appreciate the participation of the speakers, and the constructive and valuable suggestions they, and the participants, provided. Moreover, we are especially grateful to the local organizing committee of LAPAN for their contribution to the success of this meeting.

### 73rd RISH Symposium; International Collaborative Programs in Indonesia, July 25, 2007, LAPAN in Bandung

- # Opening Remarks: Prof. Shuichi Kawai (RISH), Dr. Bambang Tejasukmana (LAPAN), Prof. Endang Sukara (LIPI)
- # Solar Activity and Its Impact on the Earth and Environment: Prof. Clara Yono Yatini
- # Power from Space to Islands of Indonesia -Solar Power Satellite-: Prof. Kozo Hashimoto
- # Indonesian Sustainable Forest Management: Prof. Wahjudi Wardoyo
- # Sustainable Forest Production and Utilization of Acasia: Prof. Shuichi Kawai
- # Utilization of Fast Growing Trees and Agrowaste: Prof. Bambang Subiyanto
- # Termites; Are They Pests or Angels in Sustainable Humanosphere?: Prof. Yuji Imamura
- # Research and Developments for Seismic

Houses made of Wood from Man Made Forest: Prof. Maryoko Hady

- # Research and Developments for Enhancing Seismic Performance of Wooden Dwelling Houses in recent Japan: Prof. Kohei Komatsu
- # Supporting Strategy for Urban Development and Housing Construction in Developing Countries regarding Global Climate Change: Prof. Hideyuki Kobayashi
- # Recent Advances in Observations and Modeling of the Diurnal Convection in the Maritime Continent, and Probable Implication for Operational NWP in Indonesia: Prof. Tri Wahyu Hadi
- # Collaborative Observations of Equatorial Atmosphere over Indonesia: Prof. Toshitaka Tsuda
- # Atmospheric Research to Support Sustainable Development in Indonesia: Prof. T. Djamaluddin
- # Discussion: Prof. Toshitaka Tsuda (chair)



= Visiting Professor =

## Dynamics of the Troposphere and Lower Stratosphere-Research at RISH

Prof. Gopa Dutta  
Visiting Professor from India



I head the Department of Physics (Post-Graduate Section) of Anwarul-Uloom College, Osmania University, Hyderabad, India. Currently I am visiting RISH on the invitation of Prof. Toshitaka Tsuda for a period of six months. I am working in the area of

Atmospheric Dynamics. I have undertaken a collaborative research work at RISH on "Seasonal Variation of Short Period (<2 hours) Gravity Wave Activity for a Low Latitude Station, Gadanki, India".

One of the most important dynamical

properties of the atmosphere is its ability to support wave motions. Atmospheric waves can be classified into various ways, according to their physical or geometrical properties. The important role of internal gravity waves



in the atmosphere was first recognized by Hines in 1960. These waves are generated in the lower atmosphere by a variety of mechanisms. Basically, gravity waves act as a vehicle for energy and momentum transport into the middle atmosphere. Parameterization of gravity wave effects still lacks accuracy and the knowledge of gravity wave sources in the lower atmosphere, detailed wave properties and measures of wave variance and momentum flux are necessary inputs for global circulation models (GCM).

I have studied seasonal variations of the wind velocity variance, momentum flux and drag force induced by short

period (<2 hours) gravity waves in the troposphere and lower stratosphere of a low latitude station, Gadanki (13.5° N, 79.2° E). The out-come of this joint research has been communicated to Journal of Geophysical Research (JGR) of American Geophysical Union.

I have delivered two seminar lectures to the Professors, Research staff and students of RISH Tsuda Lab Research Meeting.

1. "Long period atmospheric oscillations and study of some atmospheric parameters during total solar eclipse" on 21 February, 2007.
2. "Study of gravity wave momentum flux over Gadanki, India" on 22 June, 2007.



During 20-23 March, 2007 I attended the International symposium on Coupling Processes in the equatorial Atmosphere (CPEA) held at Kyoto University clock tower Centennial hall, Kyoto, Japan.

I attended the



lively cherry blossom party at RISH on 4 April, 2007. It was a memorable experience. I have also visited historical and important places like Hiroshima and Mt. Aso, the biggest live volcano. My six months' stay in Japan was really enjoyable both scientifically and socially. I express my deep sense of gratitude to my host Prof. T. Tsuda who gave me this opportunity to work in this unique research environment of Kyoto University. I thank my colleagues at RISH for their kind cooperation. Thanks are particularly due to Mrs. Michiko Okazaki who helped and guided me at each step during my stay at RISH with a smiling face.

I hope to continue collaborative work with RISH and very much wish to visit this great institute again in future.

= Visiting Professor =

## Canadian-Japanese Researchers Collaborated to develop Natural Fibre Reinforced Engineered Wood

Prof. Ying-Hei Chui  
Visiting Professor from Canada



In the last few years at my laboratory in Canada, we have conducted a series of projects on a structural wood product, prefabricated wood I-joint (Figure). When I discussed with Prof. Kohei Komatsu about a possible research topic during my term as Visiting Professor at the Laboratory of Structural Function, RISH, I suggested a research project aimed at developing a method of reinforcing wood I-joints to produce a high performance product. In

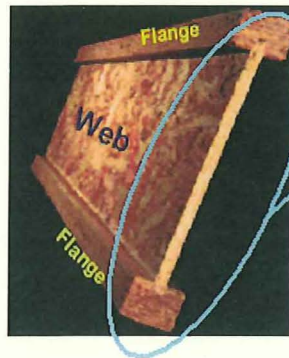
view of increased interest in using bio-based materials, Prof. Komatsu and I have agreed that the research should focus on reinforcement material made from natural fibers. Given that RISH also consists of two world-class research groups in Laboratories of Active Bio-based Material and Sustainable Materials, there are few institutes around the world that are better suited for me to conduct the proposed research, since both these laboratories

are very strong in research on natural fiber composites. I am particularly in debt to Prof. Komatsu and Dr. Kenji Umemura for their excellent input and support given to the project, and to JSPS Fellow, Dr. Kiho Jung and PhD candidate, Mr. Sasa Sofyan Munawar for their assistance in the conduct of the project and the many useful technical discussions. The valuable discussions I had with Prof. Shuichi Kawai and Hiroyuki Yano were also very helpful



in shaping the direction of the project.

This project was conducted between January and June 2007. The ultimate goal of the project was to develop a suitable natural fiber composite and a procedure to attach the composite to the flange of wood I-joist which will enhance its mechanical properties. This project was conducted in three phases. Phase 1 was a preliminary attempt to make reinforcement composite using natural fibers and common resin materials. A literature review conducted at the beginning of the project led to the identification of two natural fibers for investigation in this project. These were Manila hemp and jute (burlap). The review also identified epoxy and polyurethane, two resins commonly used in reinforcing and manufacturing of engineered wood products, as suitable binders for these fibers. Accordingly, Phase 1 focused on fabrication of fiber-reinforced composites using these materials. Fiber composites were fabricated in the laboratory using these



**"I" shape in cross section**

*Prefabricated wood I-joist*

materials, and tested for mechanical properties. Unfortunately, the test results revealed that the mechanical

properties of the fabricated composites were low. A different approach of making the composite was therefore necessary. After some discussion with Prof. Komatsu and Dr. Umemura, and Mr. Sasa Sofyan Munawar, a different approach was adopted, whereby the Manila hemp and burlap fiber mats were first soaked in phenol formaldehyde (PF) resin, allowed to dry, stacked in a layered structure and then hot-pressed at a relatively high pressure. As in Phase 1 the natural fiber composites

were tested for mechanical properties. It was found that this procedure produced composites with mechanical properties that are substantially higher than those of solid wood. These results were encouraging and further work at RISH has shown that the developed composite can be attached to wood using common structural adhesives such as polyurethane and epoxy. In the next phase of the project, Phase 3, wood I-joists and natural fiber composites were fabricated. The composite was attached to some of the fabricated wood I-joists and both the reinforced and unreinforced wood I-joists were tested for mechanical properties. Phase 3 was conducted at Hokkaido Forest Products Research Institute (HFPRI), Asahikawa. At the time of writing this newsletter all reinforced and unreinforced (control) wood I-joists have been fabricated, and mechanical testing is being conducted.

Finally I would like to express my greatest gratitude to Prof. Komatsu for hosting my visit, the opportunity to visit companies and research organizations and the excellent support given to this project.

= Students from Abroad =

## Profound Kyoto, Quiet Uji, Research Activities at RISH

Ming Tang

Master course student from China



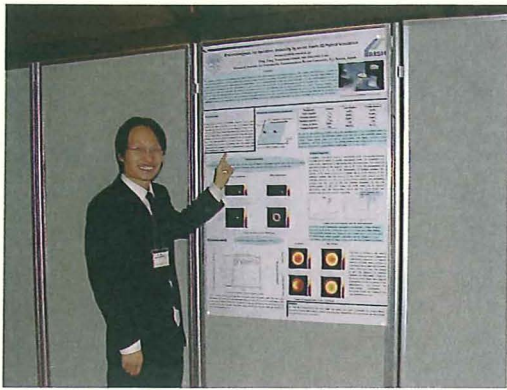
I deeply appreciate the opportunity to share something significant around my study in RISH. I well remember the hot day in the summer of 2005 when I first called on my advising prof., Yoshiharu Omura, at the UJI campus of Kyoto University. Under his direction, I have been able not only to gradually smooth away some difficulties because of the deep barrier between the fields of electrical engineering and electronics and that of space plasma physics, but have also accumulated valuable experiences for developing a large-scale sim-

ulator with an Advanced Kyoto-daigaku Denpa-kagaku Keisanki-jikken (A-KDK) computer.

The topic of my research is the interaction between artificial ion beams from a large-scale ion engine and magnetospheric plasma. Because of the highly complicated nature of magnetospheric plasma, we are unable to construct an artificial environment to simulate it in the laboratory; the only choice for this kind of research is computer simulation. In order to breathe life into our computer model, we developed a

two-dimensional electromagnetic hybrid code, which is able to treat the ion plasma as particles and the electron plasma as a fluid. This way, we could eliminate the limitation of scale with a full-particle code, and trace all ion particles in a comparatively large simulation space, rather than using only one particle to infer the traces of the other particles, as would have been the case if we adopted the MHD simulation code. From now on, results corresponding to the close simulation case have





been nearly solved in both linear theory and simulation, and we have found there are types of low-frequency

cyclotron waves growing and generating non-neglectable disturbance in the magnetospheric plasma. At present we are improving the boundary condition, so as to capture the relative environment of the space environment with an open code. Finally, we intend to change the general hybrid code into an application specific to the ion engine simulator, so that the

effect on the magnetospheric plasma is able to be reproduced in reality, as closely as possible.

= Students from Abroad =

## My Life as a PhD Student in Japan

Sasa Sofyan Munawar  
Ph.D. student from Indonesia



First, I would like to express my sincere appreciation to Prof. Shuichi Kawai and Prof. Toshiaki Umezawa, who have given me this opportunity to present an article in this International Newsletter.

In 2001, I had the dream of commencing a PhD study in Japan, when I finished my Master program at the Faculty of Forestry, Gadjah Mada University, Indonesia. I took the first step towards fulfilling this dream in 2003 when I became a new member in the Research and Development unit for Biomaterials (RDUB) at the Indonesian Institute of Science (LIPI), Indonesia. Prof. Bambang Subiyanto (Head of RDUB), Dr. Subyakto and Dr. Wahyu Dwianto, who have been RDUB researchers since its inception, helped me pursue my dream, encouraging me to communicate with Prof. Shuichi Kawai, Prof. Hiroyuki Yano and Dr. Kenji Umemura. I applied for a MEXT scholarship via the JSPS-LIPI Core University Program in the field of Wood Science to support my PhD research in Japan.

In September 2004, before my PhD study, I participated in the fifth International Wood Science Symposium (5<sup>th</sup>

IWSS), held at Kyoto University Clock Tower Centennial Hall. On October 7, 2004, I was thrilled to be admitted into the PhD program at the Laboratory of Sustainable Materials (LSM) at Kyoto University's Research Institute for Sustainable Humanosphere (RISH). I commenced my PhD program in April 2005.

Under the supervision of Prof. Shuichi Kawai and Dr. Kenji Umemura, my research has focused on the characterization of the properties of seven non-wood plant fiber bundles which can be used for composite products.

Plant fibers known to provide good physical properties have been widely used as construction materials, paper



*The measurement of fiber diameter by using optical microscope*

Although this is a highly specialized and technical study, the atmosphere of my research lab has been very invigorating. Besides progress in my research, each day brings pleasant interactions with other scientists associated with our lab. In the future, I hope to see many students who have studied electrical engineering and electronics to come to RISH as graduate students, especially our particular research lab. The beneficial impacts of this kind of innovative, interdisciplinary setting are felt on the intellectual, technical, and personal levels.

and clothes. The mechanical properties of plant fibers depend on their physical, chemical and morphological properties, including fiber orientation, cellulose content, fiber texture and fiber diameter. These natural fibers have the potential to be applied as reinforcement materials in composite products.

The first step of our research project was to characterize the morphological, physical and mechanical properties of seven Indonesian plant fiber bundles, namely abaca leaf, pineapple leaf, sansevieria leaf, sisal leaf, coconut husk, kenaf bast and ramie bast fibers. From this work, ramie bast, pineapple leaf and sansevieria leaf fibers provided the best mechanical properties and were selected for the next part of the project. We submitted one paper on this work, which was published in *Journal of Wood Science* (53(2): 108-113).

After the initial fiber property characterization research, we carried out the second part of our research, which focused on characterizing the properties of these three fiber bundles after alkali, chitosan solution and mild steam treat-



ments. Ramie fiber showed the best mechanical properties of the three fibers, and the mild steam treatment was found to be an effective method to enhance the mechanical properties of fibers for use in high-performance plant fiber composites. A second article, based on treatment research, has been published online by the Journal of Wood Science. During this research, I also worked at the Laboratory of Active Bio-based Materials, under the supervision of Dr. Fumio Tanaka.

For the third part of my research, I investigated the properties of oriented mild steam-treated plant-fiber board. At the time of writing this article, we have found that mild steam treatment of fiber bundles improved the mechanical properties of the board. Detailed investigation of this research is still ongoing.

During my three years of research, I have had the opportunity to attend and present papers at various international

and national conferences. I also visited the Forest Research Institute in Nara, two wood/board companies in Osaka and Kyushu, and Ashiu Forest, a wonderful site north of Kyoto. In addition, the professors and other members of RISH, especially at the Laboratory of Sustainable Materials and the Laboratory of Structural Function, continually helped me by giving scientific advice, valuable comments, and untiring support in my research work and also in my daily activities.

Another, unexpected benefit of these past three years is that I have



*A snap shot in the Ashiu Forest field trip*

been enriched with a variety of cultural and social learning experiences. Likewise, I have shared my culture with my host country by giving performances of traditional Indonesian music together with other Indonesian students.

= News Topics =

## G-COE "In Search of a Sustainable Humanosphere in Asia and Africa"

Assoc. Prof. Takahisa Hayashi

version, atmosphere and space technology, with the background of forest science, infrastructure engineering and atmospheric engineering, based on various overseas stations including the wood study center, equatorial atmosphere radar stations, and large-scale tree plantation plots mainly in the equatorial zones of Southeast Asia.

We plan to carry out the following four core projects:

Project 1: "Long-term dynamics of environment, technology and institutions", studies the impact of the technology and institutions which human society has imposed on the environment in Asia and Africa in historical perspective, in order to determine the directions of technological and institutional changes that are desirable in the next hundred years.

Project 2: "The structure of the humanosphere", investigates the material and energy flows and conversions of local societies, and relates these observations as well as concerns for global environmental constraints to more conventional issues concerning the interactions between man and nature.

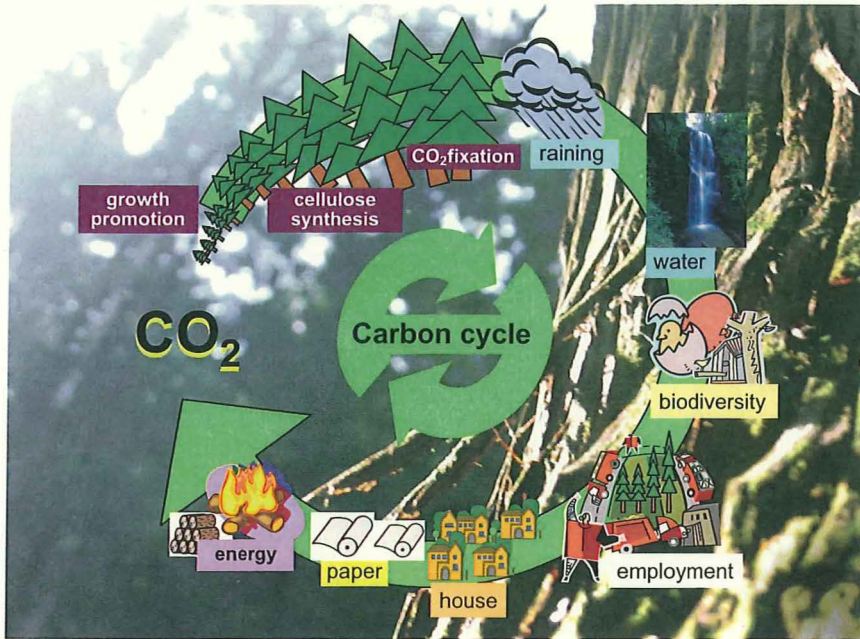
It is a pleasure to announce that our program "In Search of a Sustainable Humanosphere in Asia and Africa" has been selected as one of the five-year G-COE (Global Center of Excellence) program research projects. The project leader is Prof. Kaoru Sugihara at the

Center for Southeast Asian Studies and the Graduate School of Asian and African Area Studies.

The integration of area studies and humanosphere studies has already been started in Indonesia, which has extensive experience in this kind of research, and where a jointly organized international seminar, "Science for Sustainable Humanosphere: Toward the Harmonization of Economy and Ecology", was held in 2006, in Cibinong. Humanosphere studies is a relatively recent and exciting development at Kyoto University incorporating wood science, biomass con-







Project 3: “The forestry model of a sustainable humanosphere”, attempts a comprehensive interdisciplinary study

of local societies dependent on forestry products to examine the impacts of the frontier technologies of molecular biol-

ogy, wood engineering and forest science on: a) land use, b) commercial forestry, c) commercialization of forest waste, d) the growth of local towns, e) employment generation, f) changes in customary law, g) local administration, and h) local politics.

Project 4: “Knowledge and capabilities of local societies”, focuses on the identification of cultural, religious, social and institutional resources that have accumulated in local societies and that might contribute to a sustainable humanosphere and sustainable development.

We hope that all members of RISH will participate in one of the four core projects and enjoy pursuing their research with the paradigm of study for a sustainable humanosphere.

= Information =

## MOU with Foreign Institutions

Name of institution	Date of Conclusion	Research field
Nanjing Forestry University, CHINA	25 <sup>th</sup> October, 1996	Wood and wood-based materials
Forintek Canada Corp., CANADA	4 <sup>th</sup> November, 1997	Wood and wood-based materials
Center National de la Recherche Scientifique Center de Recherches sur les Macromolecules Vegetales, FRANCE	31 <sup>st</sup> January, 1998	Plant macromolecules
The National Institute of Aeronautics and Space of the Republic of Indonesia (LAPAN), INDONESIA	8 <sup>th</sup> September, 2000	Equatorial atmospheric dynamics
School of Biological Sciences, Universiti Sains Malaysia, MALAYSIA	24 <sup>th</sup> July, 2001	Biology and wood science
University of Brighton (Structural Timber Research Unit), UK	3 <sup>rd</sup> February, 2003	Wooden construction
Research and Development Unit for Biomaterials, Indonesian Institute of Sciences (LIPI), INDONESIA	17 <sup>th</sup> September, 2004	Wood and biomaterial science
Universiti Putra Malaysia, MALAYSIA	6 <sup>th</sup> September, 2006	Wood science
VTT Technical Research Centre of Finland, FINLAND	20 <sup>th</sup> March, 2007	Biotechnology and material science

RISH has been conducting international collaborating research programs in various humanospheric science fields under “Memorandum of Understanding”(MOU) with foreign institutions. We have nine MOUs at the present as follows:

### The Committee of International Academic Exchange

Toshiaki Umezawa (Chair),  
 Shuichi Kawai,  
 Toshitaka Tsuda,  
 Yuji Imamura,  
 Kazufumi Yazaki,  
 Mamoru Yamamoto,  
 Tsuyoshi Yoshimura,  
 Naoki Shinohara and  
 Ayako Honda (adm. office)

Published by S. Kawai  
 (Director of RISH)

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