

To: Members of the KAIST Family

From: Nam Pyo Suh, President of KAIST

Subject: New Year's Greetings and Thoughts for 2011

Happy New Year!

2011 is an important year for KAIST, as we celebrate our 40th anniversary. The 40th Celebration Committee, under the direction of Professor Y. M. Hahn and AVP Y.T. Im, is planning major events to commemorate this important milestone during the week of May 9, 2011.

Since opening its doors in 1971, KAIST has achieved a great deal, perhaps more than anyone expected. KAIST has become one of the world's leading science and technology universities, ranked 24th in engineering and IT and 57th in sciences in 2010. Our graduates have made and continue to make significant contributions to industry and academia, and in doing so, to society in general, both in Korea and abroad. Indeed, it is fair to say that Korea's industrial achievements over the last 40 years might not have been possible without the contributions made by the alumni and the faculty of KAIST.

As we celebrate our anniversary, we must reaffirm KAIST's mission: To contribute to Korea and the Korean people by becoming one of the world's leading S&T universities and by solving the most challenging problems facing humanity. To achieve this goal, KAIST will continue to hire outstanding professors and attract the best students to KAIST. We will make strategic investments in innovative educational and research programs, where we can be the most competitive, and at the same time, conserve our resources by eliminating ineffective programs and projects. It is imperative that we make choices that will benefit future generations of students and the Korean people.

### **2010 Achievements**

2010 was a year of transition at KAIST. A new team of administrators was put in place to move KAIST forward. They succeeded an outstanding group of leaders who served KAIST well from July 2006 to July 2010; during that four-year period, KAIST was transformed because of the collective efforts made by professors, staff and students. I would like to thank and congratulate everyone at KAIST for a job well done.

Many colleagues provided special leadership during my first term as president: the Provost, Vice Presidents, Deans, Department Heads, Directors, and Team Leaders. I am indebted to each of my colleagues. In particular, I would like to thank Provost Soon-Heung Chang, VP Ji-Won Yang, VP Sang-Soo Kim, VP Minho Kang, Auditor Bonjae Koo and Deans Young-Kyu Do, Sang-Yup Lee, Seung O

Park, Yong-Hoon Lee, Dong-Won Kim, Ravi Kumar, Kwang-Hyung Lee, Do-Kyung Kim, Kyung-Wook Paik, Hyun-Seung Yang, Hyun-Soo Yoon, Yong-Taek Im, Jae-Kyu Lee, Sun-Won Park and Directors Dong-Ho Cho, Byung-Man Kwak, Sang-Moon Lee and CFO Gook-Jun Cho. I am also most grateful to Messrs Dong-Hyuck Won, Boram Cho, and Yong-Seop Kang, and Ms. Yoonju Hong of the President's Office.

While there were many noteworthy accomplishments made in 2010, I would like to highlight just a few:

A-1. **Merger of ICU and KAIST**: KAIST and ICU have successfully been integrated. As a result, KAIST is a much stronger institution than ever before. Since the merger, Professors Sung-Hyon Myaeng, Kwang-Jo Kim, Ho-Jin Choi, Dae-Joon Joo, In-So Kweon, and Kyung-Cheol Choi of the College of Information Science and Technology have created new research programs and centers. We owe our special thanks to VP Min-Ho Kang and Dean Yong-Hoon Lee for their leadership and management of the merger. It could not have gone any better.

A-2. **Faculty Honors**: Many of our faculty members have made distinguished academic and research achievements. A number of grants have been won, including:

- Professor Sung-Hyon Myaeng : WCU grant for web science technology;
- Professor In-So Kweon : NCRC grant for electric-car research and education;
- Professor Ho-Jin Choi, in corporation with SNU medical school : NCRC grant for system bio-medical informatics;
- Prof. Dae-Sik Lim : Creative Research Program grant form MEST;
- Prof. Dong-Won Shin : Major grant for the series of Korean Science and Culture from the Academy of Korean Studies.

In addition to these honors, Professor Ji-Won Yang received a major grant for bio-mass research and Professor Soo-Hyun Kim received a funding for Unmanned Technology Center. Professor Dae-Joon Joo launched a research center for information security, Professor Kwang-Jo Kim received a grant for information security education and Professor Kyung-Cheol Choi launched the LGD-KAIST program for display education. Finally, the College of Business Green Finance Program was rated as the best and won the Korean Government's endowment fund in April 2010.

The KAIST faculty also made important scholarly contributions. There are too many to cite them all here. I will just cite a few examples here. Professor Sung-Eun Kim's paper on "Super Solid (flowing solid)" is getting much attention from the scientific community. Professor Tae-Young Yoon's paper on "Synaptic Vesicle Protein" is regarded as an excellent contribution to inter-disciplinary biophysics research.

Professor Hee-Seok Lee's paper on "The Impact of IT and Transactive Memory System on Knowledge Sharing, Application and Team Performance" was published in MIS Quarterly. Professor Gou Young Koh's paper on "Double antiangiogenic protein(DAAP)" was published in Cancer Cell and this paper was selected as "2010 Top 10 News in Biological research area" by BRIC.

A-3. **Bi-Modal Education**: KAIST has focused on bi-modal education to enable our students to think in the domains of both analysis and synthesis. To achieve this goal, we have developed the Freshman Design Course (FDC) and the Renaissance Ph.D. Program. Many countries are interested in adopting a version of FDC to teach at their universities. When I talk to students who have taken FDC, they feel that they have a much better appreciation of science and engineering. Many of our professors who have taught this subject with Professor Kate Thompson feel that FDC has changed the way students think about many issues.

A-4 **The On-Line Electric Vehicle (OLEV) Project**: Under the leadership of Professors Dong-Ho Cho, Joung-Ho Kim, Choon-Taek Rim, In-Soo Suh, Yong-Hoon Jeong, Haeng-Ki Lee, and Hwasoo Yeo, KAIST has made major progress on the OLEV Project. In addition to making many research contributions, we have installed an OLEV system in Seoul Grand Park. KAIST also has received many recognitions for OLEV. TIME magazine selected OLEV as "one of the 50 Best Inventions of 2010," and the 2011 World Economic Forum (WEF) at Davos has invited KAIST as one of the two major participants in the newly created session entitled "Smart Mobility: The Future Today." In addition, discussions are under way with a number of organizations that are interested in possible adoption of OLEV. Perhaps most exciting, the basic core technology of OLEV -- the Shaped Magnetic Field in Resonance (SMFIR) -- has many other environmental applications, which will be explored through research at KAIST.

A-5. **The Mobile Harbor (MH) Project**: Under the leadership of Professors Byung-Man Kwak, Soohyun Kim, Kyung-Soo Kim, and Pil-Seung Lee, the MH has developed its basic core technology, which has been demonstrated by making a 1:25 scale model and testing it in a water tank with a wave generator. We will be testing a 1:3 scale MH in open sea in June 2011. We are discussing the adoption of this important technology with many organizations both in Korea and abroad.

A-6. **New Faculty Members**: KAIST has added about 180 new faculty members since 2006, making the total number of tenure-track professors close to 600. In doing so, KAIST now has added some of the most outstanding young professors to our ranks. Since we do not pre-allocate faculty positions to each department to encourage competitive hiring of the most capable professors, some departments have grown faster than others. This policy will continue.

A-7. **KUSTAR/KAIST Collaboration**: KAIST has made a commitment to collaborate with Khalifa University of Science, Technology, and Research (KUSTAR) of Abu Dhabi, UAE, in its efforts to become a major research university. Professors Soon Heung Chang and Jong Hyun Kim are heading a team, including four of our professors in nuclear engineering, working with KUSTAR.

A-8. **KAIST Infrastructure**: Seven new buildings were constructed in 2010. The Chunghi and BJ Park KI Building, a magnificent structure made possible by the gift of Dr. and Mrs. B. J. Park, houses the interdisciplinary research teams of KAIST Institutes (KI). The Lyu Keun Chul Sports Complex, which was made possible by gifts received from Dr. Lyu, Chairman Joon-Yang Chung of POSCO, and former Chairman Young Key Hwang of Woori Bank, hosted the 2010 Graduation Ceremony. The exercise equipment in the Sports Complex was donated by Dean Dong-Won Kim. The International Center, which is used by student groups and others, was made possible by the gift of Hanbit Church (Minister Jong-Dae Eun). The Pappalardo Medical Center (the KAIST Clinic), which was made possible by Dr. and Mrs. A. Neil Pappalardo, is serving the KAIST community of students, staff and faculty. The International Faculty Apartment Building and the new student dormitories are nearly completed with funds provided by the Korean government. While receiving generous gifts and government support, KAIST incurred debt. However, our assets far exceed the debt thanks to major gifts received.

A-9. **KAIST Finances**: KAIST has more financial resources available than ever before in its history. Our assets exceed 1 trillion Won for the first time. However, we must be prudent and continue to cut unnecessary expenses. At the same time, we must use our resources effectively and wisely, investing in vital and critical programs and activities that will enable ongoing advances in research and education.

A-10. **Globalization of KAIST**: KAIST's international reputation has been gaining momentum. In addition to the KAIST/KUSTAR collaboration and the active participation in WEF at Davos, our professors and students are active in international conferences and meetings. Recently, New York City of the United States invited KAIST to establish a campus in New York City with their "significant commitment in the form of capital and City-controlled land – given Kaist – Korea Advanced Institute of Science and Technology's outstanding reputation in the academic and research community, we would be excited for you to work with us on this initiative. As we learn more about your vision for KAIST – Korea Advanced Institute of Science and Technology's presence in New York, we will work closely with you to ensure the optimal degree of support achieve your ambitions and priorities."

A-11 **Recognitions**: Many of our colleagues received important awards and recognitions in 2010.

- Prof. Ryong Ryu : Hoam Prize

- Prof. Yong-Hee Lee : Korea Science Award
- Prof. Chang-Hee Nam : Natural Academy of Science Award
- Prof. Sung-Chul Shin : Elected as the President of the Korea Physical Society
- Prof. Byung-Yoon Kim : Became the President of the Optical Society of Korea
- Prof. Kwang-Hyun Cho : Young Scientist Award
- Prof. Jekyun Park : Most cited lab-on-a-chip author in Korea 2001-2010
- Prof. Tae Gwan Park : Samsung High Polymer Science Award
- Prof. Mi-Young Kim : Selected as 2010's Chung Am Science Fellows
- Prof. Hak-Sung Kim : Awarded the 2010 Korean Biochip Society Academic Award
- Prof. Gou-Young Koh : Selected as a member of the Editorial Board of Blood
- Prof. Changwon Kang : 2010 Outstanding Results in Basic Research
- Prof. Suk-Joong Kang : Korean Engineering Award
- Prof. Sang-Yup Lee : Became a member of the U.S. National Academy of Engineering
- Prof. Jay-Hyung Lee : Became a fellow of IEEE
- Prof. Gyechun Cho : Young Scientist Award
- Prof. Sang-Ouk Kim : Young Scientist Award
- Prof. Yong-Hoon Chung : Prime Minister's Commendation for his part in the Korean Government's bid to win the contract to build a nuclear reactor in UAE
- Prof. Yong-Taek Im : Excellence for Research and Scholarship in the Area of Metal Forming and Manufacturing(GCMM 2010)
- Prof. Soo-Young Lee : ICA Unsupervised Learning Award
- Prof. Joung-Ho Kim : 2010 IEEE ECS Technical Achievement Award
- Prof. Kyoung-Soo Park : Best Poster Award from 2010 ACM SIGCOMM Conference
- Prof. Sue Bok Moon : Best Poster Award from 2010 ACM SIGCOMM Conference
- Prof. Soon-Tae Kim : Best Paper Award from 2010 IEEE International Conference on Computer Design
- Prof. Sangmin Bae : Awards from world's top design competitions including IF, IDEA, Red dot and Good Design
- Prof. Byoung-Kyu Choi : Korea Engineering Award and was announced as a Highly Cited Researcher by the ISI
- Prof. Hoi-Jun Yoo : Scientist of Month Award from the National Research Foundation of Korea
- Prof. Kwang-Yun Won : "Outstanding Leadership Award" from the International Digital Media and Arts Association
- Prof. Jae-Hyen Ahn : Appointed as 6th chairman of Korea Media Management Association
- Prof. Songchun Moon : Appointed as Asia representative of Europe IT Society
- Prof. Jae-Hyun Ahn : Best award at Gallup Korea

- Prof. Byungtae Lee : Best award at KMIS
- Prof. Dong-Suk Kim : Best award at Allied Finance Association
- Prof. Kwang-Woo Park : Best award at Allied Finance Association, Unified Management Conference
- Prof. Suk-Joon Byun : Best award at Allied Finance Association

A-12. **Important Gifts and New Programs at KAIST**: In 2011, we have been able to initiate two major programs thanks to the major unrestricted donations given to KAIST by Chairman Chun Shik Cho and Mrs. Ewon Oh. In recognition of Mrs. Oh's support, we created the Ewon Assistant Professorships to support outstanding new professors and appointed the following colleagues as the Ewon Assistant Professors: Prof. Chan-Ho Yang, Prof. Sang-il Oum, Prof. Dal-Hee Min, Prof. Mi Young Kim, Prof. Ji Ho Park, Prof. Bumjoon Kim, Prof. Seokwoo Jeon, Prof. Kyoungsoo Park, and Prof. Sung-Eui Yoon.

With the support of Chairman Cho The Chun Shik Cho Graduate School for Green Transportation. Professor Dong Ho Cho is the first Head of the Graduate School. The goal of the graduate school is to create new solutions to transportations problems that cannot be met by traditional technologies because of the need to be environment-friendly.

### **Thoughts for 2011**

KAIST will announce Vision 2025 at its 40th anniversary celebration. Vision 2025 will outline KAIST's plan for becoming one of the leading universities in the world. This document has been created by the Office of Academic Planning under the direction of Dean Hee Kyung Park based on the inputs provided by all academic and administrative units of KAIST.

Vision 2025 will address six key characteristics that all leading research universities possess. These include:

- High concentration of outstanding people, including scholars, scientists, engineers, researchers, professors, students, and staff
- “Idea factory” that continues to generate new ideas, theories, and paradigms
- Strong financial base built on a generous budget, endowment, and continuing stream of gifts
- “Freedom” to pursue ideas and dreams without undue external constraints
- Commitment to respond to national crisis and to solve major societal problems
- Strong educational programs and pedagogy

We will prioritize the most exciting and promising programs from Vision 2025 and invest our resources to realize the dreams and aspirations embodied in this document.

In the following sections, I will list some of the issues that should be addressed in 2011.

B-1. **Faculty:** To become one of the best universities in the world, KAIST must continue to attract the most prominent scholars, scientists, engineers, and professors. KAIST has a strong science faculty. However, we need to add more professors in the field of basic sciences to lead in the newly emerging fields of science and engineering. KAIST should double the size of its basic science faculty by searching for outstanding talents. We also need to strengthen our biological and brain sciences, physical sciences (including materials and chemistry), and mathematics.

B-2. **Research in Key Areas:** KAIST must conduct pioneering research in basic sciences and engineering of complex natural and manmade systems. Maintaining what is effective, KAIST must also seek better teaching and learning methods through new instructional paradigms and use of modern technology, which may also help the secondary and tertiary education throughout Korea. We also need to concentrate our resources toward innovative solutions to pressing problems of the 21st century, identifying the challenges we want to address and linking activities in basic sciences to engineering and technology as early as possible to shorten the time for creation of solutions.

KAIST should become the best – both in basic sciences and engineering – in the following three complex systems fields: healthcare systems, green transportation, and green energy (including nuclear power).

Healthcare Systems: The biggest budgetary item of many governments is healthcare. Korea, for example, will spend 16% of its GDP on healthcare by 2024. Similarly, 20% of the U.S. budget in 2011 will go toward healthcare; this is expected to grow to 40% in 2035. The reasons for the high cost of healthcare are many and include: inefficient delivery of healthcare, high cost of equipment and medicine, low productivity of healthcare workers, longer life spans of people who require more care and service, poor handling of chronic diseases, non-rigorous application of preventive measures, inefficient use of IT and systems engineering, and limited use of diagnosis and service by medical practitioner from distance.

To reign in the escalating costs of healthcare, we must apply all the disciplines of science and engineering, in addition to making advances in medicine and medical science. Science and engineering can help in every key area of healthcare from prediction and diagnosis/prognosis to prevention of illness and advanced therapy. To do so effectively, we may need to develop “Systems Healthcare” by judicious application of science and engineering to medical sciences from a systems perspective, in addition to more research in biology and medical sciences. In this regard, KAIST may need to establish an advanced research hospital (medical institute) for clinical trials of the advanced treatment techniques being made in our research laboratories.

Green Transportation Systems: Transportation (automobiles, trains, ships and airplanes) is the largest industry in the world and thus very important to the global economy. The automobile industry alone is a \$2 trillion (2000 Jo Won) business in Korea. However, transportation is also responsible for the largest use of energy and the emission of the most environmentally harmful gases (e.g., CO<sub>2</sub>, NO<sub>x</sub>, etc.). KAIST has an opportunity to transform traditional transportation systems to “green transportation systems.”

For example, cars with internal combustion engines (IC) can be replaced by KAIST’s On-Line Electric Vehicle (OLEV), which will drastically reduce the use of petroleum and lower the emission of pollutants. The core technology of OLEV is the “Shaped Magnetic Field in Resonance (SMFIR).” This technology can be applied to many fields. For example, it appears that it can increase the speed of KTX. It may also be applied to airplanes to reduce CO<sub>2</sub> and other pollutants; while an airplane is moving on the tarmac from the gate to a runway, SMFIR technology may be able to move the aircraft using electric power. It also can be applied to robots to give them a greater mobility by eliminating the electrical tether and batteries. In addition, the technology can be used to supply electric power to appliances, to move heavy equipment in harbors, etc.

Mobile Harbor (MH) eliminates the need for large harbors that use valuable shore land, require digging seabed, and cost \$2-3 billion to build. MH can also deal with the threat of terrorism by preventing large containerships with unknown cargo from coming into harbors. In many parts of the world, big harbors cannot be built for a number of different reasons, although the use of big containerships that are being built is to lower the cost of transportation. MH will change the logistics, economy, and safety of ocean transportation.

Airplanes are major polluters of the upper atmosphere. We can reduce the use of energy and the corresponding emission of CO<sub>2</sub> by redesigning airplanes with the use of assisted take-off and aerial re-fueling. The goal is to reduce the consumption of jet fuel by 30% for intercontinental flights.

KAIST should lead the transformation of the transportation industry by continuing to develop pioneering concepts, theories and innovations.

GREEN Energy: We must do more to create green renewable energy through the use of wind, solar, biomass, tidal energy, and others. KAIST can take the lead through fundamental research in many areas: conversion of CO<sub>2</sub> through photo-catalysis, hydrogen generation, and desalination using less energy than the current vaporization and reverse osmosis technologies.



B-3. **The KAIST Education Plan:** A great research university must be committed to excellence in teaching. At research universities, the mode of graduate education is “teaching through research” where professors and students become “Partners in Learning.” To achieve this goal, KAIST should establish a “KAIST Education Plan,” with the goal of transforming the traditional pedagogy of “analog education” into “education through digitized discrete knowledge acquisition (EDDKA)” with the help of software and information technologies.

In “analog education”, the professor delivers the lecture, hoping that the student can absorb, process, and understand the knowledge he or she provides. In this knowledge-transfer process, the professor delivers knowledge as a packet of “analog information” to the student. The effectiveness of knowledge transfer depends heavily on “pattern matching” between the professor’s delivery of the content and the student’s ability to absorb it. Often there is an inherent mismatch between the two because of the differences in their prior knowledge, background, and experience.

EDDKA utilizes a V-Model for teaching and learning. In this model, there are two legs: one for “teaching” and one for “learning” joined at the bottom of the V shape. The “teaching” leg of the V-Model represents the process of decomposition of the knowledge to be taught into lower-level concepts that can be understood by the student. The “learning” leg represents the process of integrating the ensemble of lower-level knowledge, which was produced in the “teaching” leg of the V-Model during the decomposition process. The V-Model provides the basic framework for structuring the decomposition and the integration process for effective knowledge transfer.

The purpose of EDDKA is to create an individualized instructional method that utilizes technologies to overcome the shortcomings of the traditional teaching methods, i.e., the lecture format. EDDKA creates a framework for knowledge acquisition by establishing the structure of the knowledge to be transferred. It uses the idea of “similitude” and “contradiction” to assist in learning the basic concepts behind the knowledge to be transferred.

By-products of EDDKA are expected to be many: new software systems and IT products that can improve the efficacy of learning and teaching. These new products may compete with and augment current commercial software systems such as Google.

EDDKA may suggest a better organizational structure for delivery of knowledge, which may be different from the current structure of university systems, especially research universities. For example, the current semester system, lecture format, testing methods, and the role of professors and administrators may not be the best suited for EDDKA.

KAIST should establish the Center for the KAIST Education Plan to investigate the potential impact of EDDKA. The Center director will oversee and coordinate the entire operation of this program. It should initially develop tools and products that can aid undergraduate education, with the goal of expanding gradually into all subjects and courses. EDDKA will have its own “campus” to enable isolated experiments of education and technology development.

This strategy may be integrated with the “KAIST Education 3.0 Project”, which will be disseminated in the near future. Education 3.0 Project should revolutionize the Korean education system by giving focus on “creativity” in education.

B-4. **Additional Physical Facilities**: Construction of four new buildings will start in 2011. The Kim Byung Ho IT Building will be constructed near the East Gate. The Natural Science Building with the Donald Kim Wing will be built near the current set of buildings that comprise the College of Natural Science. The Chung Moon Soul Building II for Brain Research will be built where the current Information Center is located. This building will also house a KAIST Museum and the Office of Admissions. A new building for Animal Facility will be built with the partial funding by the City of Daejeon.

B-5. **Technology Transfer**: KAIST must do a more effective job in translating the results of its research to its ultimate users/beneficiaries. KAIST has been spending more money for patents than the income generated by its intellectual properties (IPR). We apply for more patents than MIT, but MIT generates a healthy income, whereas KAIST has been subsidizing the cost of securing patents. We have to establish more new venture firms, license our technologies to users and encourage and support our professors and students in their entrepreneurial efforts. To do so, we will strengthen the KAIST Technology Licensing Office (TLO) to be more effective in transferring technologies. We also will work to transfer OLEV, SMFIR, and MH technologies to industry in 2011, thereby generating future revenues for KAIST. All innovations that are suited for commercialization should be evaluated and potential licensees should be sought.

This New Year’s message is much longer than I intended. Nevertheless, I hope that the thoughts I have presented can be discussed throughout the year as a basis for ongoing growth and success. Please accept my apologies if I have left out some important contributions of yours in this New Year’s message.

I wish everyone of the KAIST family a Happy, Healthy and Productive New Year.

Nam Pyo Suh