Biographical Sketch of NAM PYO SUH (2014)

Dr. Nam Pyo Suh was the 13th and 14th President of the Korea Advanced Institute of Science and Technology (KAIST). He assumed this position on July 13, 2006, and was reappointed in 2010 and served until 2013. He is also the Ralph E. & Eloise F. Cross Professor, Emeritus, M.I.T.

Under the leadership of Dr. Suh, KAIST became the second highest-ranked university in Asia in the 2014 QS ranking of Asian universities, outdistancing much older universities such as Seoul National University of Korea, the University of Tokyo of Japan, and Tsinghwa University of China. According to QS, the rapid ascension of KAIST is due largely to its research contributions (citations and number of papers), thanks to a large number of outstanding young professors it has hired since 2006.

Since his inauguration in 2006, Dr. Suh pursued the goal of making KAIST one of the best science and technology universities in the world. To achieve this goal, he made a number of important changes in the governance, academic structure, education, curriculum, faculty tenure policy, and research structure of KAIST. He initiated major research and educational activities in energy, environment, water, and sustainability (EEWS) and in healthcare, education, and defense (HED), in addition to strengthening the fields related to IT, BT, NT, and complex systems. He created the KAIST Institute to promote multi- and cross-disciplinary research in emerging fields. He also introduced the I-Four educational program (also known as Education 3.0) in order to transform the undergraduate education to a student-centric, group learning system that introduces the mass-customization concept to instruction and uses ICT extensively. Under I-Four, students listen to lectures stored in the Internet and spend class time for discussions and recitations. Student response has been extremely positive. This I-4 educational was expanded to include collaboration with other global institutions by creating a specially endowed program, the KAIST SYL International Education Initiative. (KIEI).

One of the most important achievements of Dr. Suh at KAIST is the strengthening of the faculty by hiring more than 350 new (mostly young) professors, increasing the faculty size by 50 percent, from about 400 to over 620 professors. This was done without the full budgetary support of the Korean government by generating other income sources. Dr. Suh also added a number of new departments to lead KAIST into new frontiers of knowledge. Under his leadership, 14 new buildings (The BJ and Chunghi Park KI Building, the Pappalardo Medical Center, Apartments for International Faculty, four Undergraduate Dormitories, the BH Kim IT Building, an animal facility, the International Center, the GC Liu Sports Complex, central testing facility, Chang Young Sin Student Activities Building, the Natural Science Building, and MS Chung Building II) either were constructed or are being constructed, increasing the floor space of KAIST by nearly 50 percent. Old buildings were renovated to expand the space for cultural science fields. He financed this expansion without full government support by generating gifts, and other income from research contracts, etc. He created Distinguished Professorships and chaired professorships, including Ewon assistant professorships and KAIST chairs for outstanding mid-career professors. He also increased the number of undergraduates to 4,000 from 3,000, but kept the number of graduate students about the same at 6,500, split equally between Ph.D. and M.S. students. He increased KAIST's annual budget from about $300 million to $740 million a year and doubled its assets to over $1 billion. Research volume was increased by a factor of about 2.5 (from about $118 million to $258 million) during the same period, increasing overhead income by a factor of more than four. He changed the giving culture of Korea by raising about $180 million of gifts from various donors.

Under the leadership of Dr. Suh, KAIST created several new departments, including Ocean Systems, Knowledge Systems Engineering, Green Transportation, and Nano Science and Technology. In 2007, KAIST received the highest award from the President of Korea for its contributions to Korea. At KAIST, he invented the On-Line Electric Vehicle (OLEV), which was selected one of the 50 Best Inventions of 2010 by Time magazine, and as one of the ten Emerging Technologies of the World by the 2013 World Economic Forum in Davos. He also invented the Mobile Harbor (MH), which was ranked second in the "10 best start-up ideas of 2011" by StartupSmart, an Australia-based consultancy firm. He successfully executed the merger of ICU and KAIST in 2009. In 2012, KAIST was named one of the Thomson Reuters Top 100 Global Innovators. [For comments on the KAIST programs, see Abelard to Apple: The Fate of American Colleges and Universities, Richard A. DeMillo, MIT Press, 2011.]

Dr. Suh was a member of the Presidential Committee on Science and Technology of Korea (2009-2010) and the chairman of the Commission for New Economic Growth of the Ministry of Economy and

Knowledge (2008-2009). From 2008 to 2010, he was also the President of the Accreditation Board of Engineering Education of Korea (ABEEK).

He has been at MIT since 1970. He was the Ralph E. & Eloise F. Cross Professor, Founding Director of the Park Center for Complex Systems (formerly the Manufacturing Institute), and the Head of the Department of Mechanical Engineering (1991 to 2001). He was also the Founding Director of the MIT Laboratory for Manufacturing and Productivity (1977-1984), the Founder and Director of the MIT-Industry Polymer Processing Program (1973-1984), Head of the Mechanics and Material Division of the Mechanical Engineering Department (1975-1977), and a member of the Engineering Council of MIT (1980-1984 and 1991-2001).

In October 1984, Professor Suh took a leave of absence from MIT to accept a Presidential Appointment at the U.S. National Science Foundation (NSF), where he was in charge of engineering. President Ronald Reagan appointed him to this position, and the U.S. Senate confirmed his appointment. During his tenure at NSF, he created a new direction for the Engineering Directorate and introduced a new organizational program structure for supporting engineering research in order to strengthen engineering education and research and "to insure that the United States will occupy a leadership position in engineering well into the 21st century." [Ref: "Enabling American Innovation: Engineering and the National Science Foundation" by Dian Olson Belanger (1998)].

During his tenure (from 1991 to 2001) as the Head of the Department of Mechanical Engineering at MIT, the Department redefined the discipline of mechanical engineering to be more effective in the information and biological sciences era of the 21st century. His goal was to transform mechanical engineering from a physics-based discipline into one based on physics, information, biology, and design science. A new curriculum was established, and an endowment fund was created to support book-writing and teaching-material development activities of the faculty. Oxford University Press under the MIT/Pappalardo Series of Mechanical Engineering Books publishes these books. In addition, endowed undergraduate laboratories (i.e., the Pappalardo Laboratories, the Der Torossian Computational Laboratory, the Cross CAD/CAM Laboratory, and the AMP Laboratory) were created that changed the quality of undergraduate education at MIT. To strengthen research activities of the Department, the d'Arbeloff Laboratories for Information Systems and Technology, the Laboratory for Bio-instrumentation System, the Rohsenow Heat and Mass Transfer Laboratory, the Laboratory for 21st Century Energy, the Hatsopoulos Microfluids Laboratory, and the Center for Innovation in Product Development were established. Dr. Suh significantly increased the number of endowed faculty chairs, the endowment, and the research volume of the Department. Many generous donors supported these initiatives. More than twenty outstanding young faculty members joined the department during his tenure, half of whom had degrees outside of the mechanical engineering field.

Dr. Suh has received many awards and honors. He received nine honorary doctoral degrees: Doctor of Humane Letters from the University of Massachusetts-Lowell in 1988; Doctor of Engineering from Worcester Polytechnic Institute in 1986; Honorary Doctor (Tekn. Hedersdoktor) from the Royal Institute of Technology (KTH), Stockholm, Sweden, in 2000; Doctor of Engineering *Honoris Causa,* University of Queensland in 2007; Doctor Scientiarum Honoris Causa from the Technion, Israel Institute of Technology in 2007; Doctor of Science and Technology from Carnegie-Mellon University in 2008; Honoris Causa from Babeş-Bolyai University, Cluj-Napoca, Romania, in 2009; Honorary Doctor of Philosophy from Bilkent University, Ankara, Turkey, in 2012; and Doctor Honoris Causa, The Universidade Nova de Lisboa of Lisbon, Portugal, in 2013. Also in 2011, the Technical University of Denmark awarded him the Gold Medal, its highest honor for engineering achievements.

He is the recipient of the 2009 ASME Medal, the highest honor bestowed by the American Society of Mechanical Engineers, given to no more than one person per year. In 2006, he received the General Pierre Nicolau Award, the highest honor given by the International Academy for Production Engineering (CIRP). He was also awarded the National Science Foundation's Distinguished Service Award with a medal in 1987.

Also from ASME, he received the Gustus L. Larson Memorial Award, the Blackall Award, the Best Tribology Paper Award, and the William T. Ennor Manufacturing Technology Award. The TIME selected his invention of the On-Line Electric Vehicle (OLEV) as one of "The 50 Best Inventions of 2010." OLEV was also chosen as one of the Emerging Technologies of 2013 by the World Economic Forum in 2013. He is the recipient of the Leadership in Technology Management (LTM) Award from PICMET in 2012. Also

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in 2010, the MIT Geospatial Data Center created the "Professor Nam Suh Award for Innovation in Design of Software Systems." In 2011, the Society for Design and Process Science (SDPS) selected him for the 2011 transformative Achievement Medal and the Korea Economic Institute awarded him the Korean-American Achievement Award. In 2008, he was given the second Pony Chung Award of the Pony Chung Foundation and the Inchon Education Award of the Inchon Memorial Foundation. He received the F.W. Taylor Research Award of SME; an SPE Best Paper Award; Federal (NSF) Engineer of the Year Award from NSPE; and the American Society for Engineering Education Centennial Medallion. In 1994, he was awarded the KBS Korean Compatriot Award for Scholarly Achievements. He is also the winner of the 1997 Ho-Am Prize for Engineering. In 2000, he was the recipient of the Mensforth International Gold Medal of the Institution of Electrical Engineers of the United Kingdom. In 2001, he received the Hills Millennium Award from the Institution of Engineering Designers of the United Kingdom. In 2006, the Academy of Transdisciplinary Learning and Advanced Studies (Society for Design and Process Science) awarded him the Academy Gold Medal of Honor. In 2007, he received the Lifetime Achievement Award of SPE. He was awarded the 2008 Proud Korean award for educational contributions by the Korea Association of Journalists. The same year, Carnegie Mellon University awarded him the Distinguished Alumni Award.

Listed in *Who's Who in the World, Who's Who in America, Who's Who in Science and Technology,* and others, he is a Fellow of ASME and SME. He is a member of Pi Tau Sigma, Sigma Xi, Phi Kappa Phi, ASEE, SPE, and AAAS. He is also a Foreign member of the Royal Swedish Academy of Engineering Science (IVA), a fellow of the International Academy for Production Engineering (Collége International pour l'Etude Scientifique des Techniques de Production Mécanique—CIRP), the Life Fellow of the Korean Academy of Science and Technology, and Foreign member of the Korea National Academia of Engineering. He is a Fellow of PICMET.

His research interests are broad. His current research projects are in the fields of design, manufacturing, tribology, materials processing, On-Line Electric Vehicle (OLEV), Mobile Harbor (MH), innovation processes, education and research policies.

He has made important contributions to science and technology of three fields: tribology, design, and materials processing / manufacturing. His contributions to the field of tribology include the delamination theory of wear, the solution wear theory, a theory on the genesis of friction, coated cutting tools, the use of undulated surfaces to lower friction and wear, and new woven electrical connectors. The Institute of Scientific Information (ISI) selected his paper on delamination theory of wear as a citation classic. His invention of electric connectors that have low friction and low contact resistance (originally manufactured by Tribotek, Inc., now acquired by Methode Electronics, Inc.) received the Product of the Year award of Power Electronics Technology magazine in 2005. In the field of design science and technology, he has developed Axiomatic Design theory, which is taught worldwide. It is required for certification of Master Black Belts by the American Society of Quality. He also advanced a theory of complexity and the concept of Functional Periodicity. Using these theories, many systems and products were designed. In the field of polymer processing, he invented many industrially-important processes and devices, including microcellular plastics (commercially known as MuCell, trademark of Trexel, Inc.), the USM foam molding process, the Axiometer for moisture measurement in polymers, the Electrostatic Charge Decay NDE technique (commercialized by QEA, Inc.), and the foam/straight plastic lamination/forming process (sold in billions by Sweetheart Plastics, Inc.). In metal processing, he invented a new metal processing technique called the Mixalloy Process with some of his co-workers. At KAIST, he invented the on-line electric vehicle (OLEV) and the Mobile Harbor (MH). OLEV is being commercialized by two firms, one for the Asian market and the other for the American market. They share other markets.

Professor Suh has made many inventions, many based on his theory on Axiomatic Design. His first invention was the product, process, and the manufacturing system for making laminated plastic articles, which is covered by his first patent. This invention was the result of the first industrial job he held during his undergraduate study at MIT. He worked for Guild Plastics, Inc. as a part-time development engineer while an undergraduate student at MIT. Another major industrial invention he made was at USM Corporation, which he joined after finishing his S.M. degree from MIT, which was the method of making composite foamed plastic articles, which has been used to make automobile components, furniture panels, etc. He also invented conductive grinding wheel while a student at MIT under the sponsorship of Corning Glass. With his students at MIT, he has invented the following: the charge decay NDE technique, which is used to detect flaws in composite parts; microcellular plastics, commercially known as MuCell (Trexel

Corporation), which is used to make automotive parts. MuCell produces lighter plastic parts that are distortion free, faster and at lower cost; coated tungsten carbide tools (Surftech Corporation), and many others. He is also the inventor of the Mixalloys, a TiB_2 dispersion-strengthened copper, which was used to make electrical welding tips, and the process of making Mixalloys (manufactured by Sutek Corporation). His more recent inventions are OLEV (On-Line Electric Vehicle) and MH (mobile harbor). OLEV and MH were invented at KAIST while he was the President. These inventions were results of KAIST research to solve the most important problems of humanity in EEWS (energy, environment, water and sustainability). OLEV was invented to eliminate the internal combustion engines from our streets and reduce the generation of CO2. OLEV buses are commercially used in Seoul, Gumi, and KAIST campus. OLEV receives its power from underground cables wirelessly. Only 10 to 20% of the roadway has the underground power supply systems, since OLEV carries a small battery for use when the vehicle is on the road without the power supply system. MH is invented to eliminate the need for large harbors for large container ships. MH goes out to the ship anchored in deep waters and transport the containers to their nearest final destination without the need for large harbors, which cost 2~3 billion dollars and damages environment. Many of his inventions, including very large complex systems, were implemented in relatively short times (typically 2 to 3 years), because the basic thinking, reasoning, and executions are based on Axiomatic Design Theory (AD), which has two axioms. He advanced AD to provide the scientific basis for system design.

He is the author of over 300 papers and seven books, holds more than 70 patents, and edited several books. Among the books he has authored are *Elements of the Mechanical Behavior of Solids* (with A.P.L. Turner published by McGraw-Hill, 1975), *Tribophysics* (Prentice-Hall, 1986; translated into Chinese), *The Principles of Design* (Oxford University Press, 1990; translated into Japanese and Korean), *The Delamination Theory of Wear* (Elsevier, 1974), *Axiomatic Design: Advances and Applications* (Oxford University Press, 2001, also translated into Japanese and Chinese), *Complexity: Theory and Applications* (Oxford University Press, 2004), and *Axiomatic Design and Fabrication of Composite Structures* (with D. G. Lee, Oxford University Press, 2004).

Professor Suh has taught axiomatic design, polymer processing, and tribology to many university professors and a large number of industrial engineers at major corporations all over the world. He taught axiomatic design at Ford, Mercedes Benz, Corning Glass, Alcoa, SAAB, Tetrapak, Ericsson, ABB, Daewoo, SVG, GM, Telemecanique, Lockheed Martin, NASA, DoD, Delphi, and others. Many of these organizations have adopted the axiomatic design principles in their work. MuCell technology has been licensed to many companies worldwide. He has given a large number of lectures throughout the world, including at the World Economic Forum, many professional societies, and universities.

Professor Suh was a Series Editor for the Advanced Manufacturing Series and an Editor of the MIT/Pappalardo Series in Mechanical Engineering of Oxford University Press. He was also the Founding Co-Editor-in-Chief of the International Journal *Robotics and Computer-Integrated Manufacturing* from 1981 to 1996, and also serves on editorial boards of many journals. He is currently a Senior Editorial Advisor of the Journal of Integrated Design and Process Science.

He is a member of the Board of Directors of Parker Vision, Inc, Axiomatic Design Software, Inc., OLEV Technology, Inc., and Petari USA. He was a member of the board of directors of Silicon Valley Group, Inc., Therma Wave, Inc., the founder and member of the board of directors of Trexel, Inc., Integrated Device Technologies, and Tribotek, Inc. He is a member of the Board of Trustees of King Abdullah University of Science and Technology (KAUST) and a member of the International Advisory Board of the King Fahd University of Petroleum and Minerals (KFUPM) of Saudi Arabia, and the Khalifar University of Science, Technology and Research (KUSTAR) of UAE. He has been a consultant for many industrial firms.

He is a Fellow of the University of Tokyo. He is also a board member of the International Advisory Board of King Fahd University of Petroleum and Minerals (KFUPM). He is an Honorary Professor at Yanbian University of Science and Technology, China; Honorary Professor of the University of Hong Kong; and Advisory Professor of Shanghai Jiaotong University, China. He was an Eminent Visiting Professor at the Korea Advanced Institute of Science and Technology, Korea. He has been on visiting committees of Georgia Institute of Technology, Stanford University, the University of Michigan, and the University of California - Berkeley. He was a member of the DoD Panel on "Global War on Terrorism" and served on a research award committee of ASEE. He was a consultant of the Lawrence Livermore National Laboratory

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and Korea Electric Power Research Institute. He was a member of the Visiting Committee for the National Institute of Standards and Technology (a statutory committee). In addition, he was a member of the Development and Advisory Council of the Texas A&M University Department of Mechanical Engineering and a member of the Science Board of MacroChem Corporation. He served on advisory committees of the Lawrence Livermore National Laboratory, the Idaho National Engineering Laboratory, and Alcan Aluminum Corporation. He was a member of several NRC and NAE committees. He was also the chairman of the ASME Productivity Committee. He was a member of the Scientific Committee of the ENDREA Program of Sweden. He also evaluated a Kplus Center in Austria.

He has consulted extensively for governments, the World Bank, the United Nations, universities, and many industrial firms throughout the world on various technical matters, the development of economic policies, and the creation of new products and processes. He was the architect of the Five-Year (1980-85) Economic Development Plan of the Republic of Korea.

Professor Suh was educated at Buckingham, Browne and Nichols School (1955), MIT (S.B., 1959, and S.M., 1961) and Carnegie-Mellon University (Ph.D., 1964).

Prior to joining the MIT faculty, Professor Suh was with the University of South Carolina (1965-1969), USM Corporation (1961-1965), and Guild Plastics, Inc. (1958-1960, part-time). He is a Fellow and was also a Visiting Professor at Tokyo University, Japan (1989) and Yonsei University, Korea (2001). He was the William Mong Distinguished Fellow at the University of Hong Kong (2002). While at Guild Plastics during his undergraduate years, he invented the foam/straight lamination/forming process, which became a major industrial process, having produced over tens of billions of plastic parts. At USM, he invented the high-pressure USM foam molding process. USM Corporation sponsored his doctoral study and research at Carnegie-Mellon University. Other industrial firms are using his other inventions.

Professor Nam P. Suh is married to Young J. Suh (née Surh). They have four daughters, four sons-in-law, and seven grandchildren. He is a U.S. citizen. Their main residence is in Sudbury, Massachusetts, U.S.A.
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