REPORT

INTERNATIONAL ENGINEERING EDUCATION PARTNERSHIP WORKSHOP

May 30 – June 3, 2002

Southeast University
Nanjing, China

Edited by:

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INTERNATIONAL ENGINEERING EDUCATION PARTNERSHIP WORKSHOP

May 30 – June 3, 2002
Southeast University, Nanjing, China
Hosted by:
President: Prof. Gu Guanqun
Senior Vice-President: Prof. Wu Jieyi
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PROVISIONAL AGENDA
(Updated: May 21, 2002)

Saturday, June 1, 2002

Workshop Co-Chairs: Wu Jieyi and Win Aung

9:00 AM	Introduction and Welcome – Gu Guanqun/Wu Jieyi, Southeast University
9:15 AM	Southeast University – Wu Jieyi, Prof. and Senior Vice President
9:30 AM	Purpose of the Workshop – Win Aung, NSF and iNEER and Wu Jieyi, SEU
9:45 AM	International Cooperation in Engineering Education and Research – Win Aung, NSF and iNEER
10:00 AM	New Jersey Institute of Technology – Saul Fenster, Prof. and President
10:15 AM	Tsinghua University (A) - Yu Shou Wen, Professor and Vice President
10:30 AM	Break
10:45 AM	Tsinghua University (B) - Wu Min Sheng, Prof. and Dean
11:00 AM	University of Puerto Rico – Pablo Rodriguez, Acting Chanceelor (assisted by L. Morell, E. Santiago, R. Vasquez)
11:15 AM	Shanghai Communication University – Ye Qu Yuan, Prof. and Dean
11:30 AM	International Accreditation – S.T. Mau, New Jersey Institute of Technology
11:45 AM	Zhejiang University – Ye Min, Prof. And Dean
12 Noon	Lunch

1:00 PM	History of U.S.A. – China Cooperation in Heat Transfer Research – F.K. Tsou, Prof. Emeritus, Drexel University and Alumnus of SEU
1:15 PM	Shanhai Communications University – Ye Qu-yuan, Prof. And Vice President
1:30 PM	International Cooperation – V. Rao, Prof. and Director of Intelligent Systems Center, U. of Missouri – Rolla
1:15 PM	Higher Education Research Institute, SEU – Li Jia Zeng, Professor
1:30 PM	University of Florida – Winfred Phillips, Prof., Vice President and Dean of Graduate School
1:45 PM	Zhejiang University – Ye Min, Dean
2:00 PM	Examples of Conventional Cooperative Education Today – Yu-Sun Tang, Retired Engineer, and Alumnus of SEU, Pittsburgh, PA, USA
2:15 PM	Tongji University – Huang Zi-ping, Dean
2:30 PM	University of Manchester Institute of Technology - Peter Hicks, Prof. and Dean
2:45 PM	Break
3:00 PM	Hewlett-Packard Company (1) – Christopher Hsiung, External Research Program, University Relations, Palo Alto, CA
3:15 PM	Hewlett-Packard Company (2) – Kwok-yin Chan, General Manager, China Software Solutions Center, Hewlett-Packard Company, Shanghai.
3:30 PM	Comments from an Alumnus of SEU – K.K. Wang, Prof. Emeritus, Cornell University
3:45 PM	A Proposal to Strengthen Library Collection for International Collaboration - John T. Ma, Retired Librarian, and Alumnus of SEU
4:00 PM	Summary and Plan for Future Workshops
4:15 PM	Adjourn

SCOPE AND SCHEDULE

May 30,2002:	Invited guests arrive in Nanjing.
May 31,2002:	Centennial Celebration and Dedication of Chien-Shiung Wu Memorial Hall at Southeast University.
June 1,2002:	Workshop from 9 AM - 3 PM.
June 2,2002:	Sightseeing.
June 3,2002:	Departure of guests.

(1) Invited guests will pay their own travel expenses to and from Nanjing; all local expense will be covered by SEU. SEU will help with making arrangement for those who wish to extend their stay for the purpose of discussing future collaboration. SEU will invite some University presidents and deans to attend the workshop, such as Tsinghua University, Shanghai Community University, Tianjing University, etc.

(2) Invited guests are requested to prepare a 1-2 page write-up concerning their institutions, including its interests and recent activities on international cooperation.

(3) SEU personnel will meet or see off every participant at the airport or railway station if arrival and departure information is provided on time. If necessary, please take the airport bus to Hankou Road (about 25 yuanRMB; US$1 is about 8 yuanRMB) then take taxi (about 10 yuanRMB) to Jinling Hotel; or take taxi directly from airport to Jinling Hotel (about 160 yuanRMB). SEU reception personnel will wait at the Hotel all day on May 30. SEU contact for arrival and departure is Ms.Yin Lei, ylei@seu.edu.cn, tel: 0086-0-13851889990. General contact for the workshop is Ms. Chen Hua (ch_hua@sina.com).

(4) The address of Jinling Hotel is: Nanjing Xinjiekou, Tel:0086-025-4711888; fax:0086-025-4711666.

PARTICIPANTS

SPEAKERS FROM CHINA

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4. Ye Min, Professor and Dean, ZheJiang University, China; yem@zju.edu.cn
5. Li Jia Zeng, Professor, Higher Education Research Institute, SEU, Nanjing, China; heri@seu.edu.cn
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OTHER ATTENDEES FROM CHINA

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9. Ma Chong-fang, Prof. and Dean, College of Environmental and Energy Engineering, Beijing Polytechnic University; 8610-6739-1655 (O); fax: 8610-6739-1983; machf@bjpu.edu.cn
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13. Wang Bao-guo, Vice Dean and Professor, Tianjing University; Tel: 8622-2740-5154; bgwang@tju.edu.cn
14. Kwok-yin Chan, General Manager, China Software Solutions Center, Hewlett-Packard Company, Shanghai.
15. Wang Gui-cai, Vice Dean and Professor, Jiangsu University of Science and Technology; Tel: 86-511-878-0041
16. Yi Hong, Vice President, Southeast University, Nanjing; Tel: 8625-379-2317

PARTICIPANTS FROM OVERSEAS

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5. Ramón E. Vásquez, Dean of Engineering, University of Puerto Rico at Mayagüez, PO Box 9001, Mayagüez, PR 00681-9001; reve@ece.uprm.edu

6. John T. Ma, Consultant, Asia and Middle East Division, The New York Public Library; Address: 138-10 Franklin Ave., #3-D, Flsuhing, NY 11355, U.S.A.; johntajenma@worldnet.att.net

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14. Fu-Kang Tsou, Professor-Emeritus, Department of Mechanical Engineering, Drexel University, Philadelphia, PA; Address: 988 Franklin Street, Suite 1208, Oakland, CA 94607, USA; fktsou@worldnet.att.net

15. Saul Fenster, President, New Jersey Institute of Technology, Newark, New Jersey, USA; fenster@njit.edu

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INTERNATIONAL ENGINEERING EDUCATION PARTNERSHIP WORKSHOP
Nanjing, China
June 1, 2002

A Global Partnership Network for Engineering Education and Research

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INTRODUCTION

The recent upturn in interest in international cooperation has been motivated in part by the global expansion of marketing and R&D by many industrial companies. International cooperation in R&D has provided companies with access to leading-edge fundamental developments, technologies, and fresh ideas.

Meanwhile, in order to meet new challenges in the 21^{st} century, universities around the world are seeking to broaden their engineering education systems. Issues of concern include a curriculum that is more informed by industrial practice, and that incorporates information technology and distance learning, hands-on experience for undergraduates, global perspectives, and an emphasis on interpersonal and communications skills. Progress in these areas will require international cooperation.

The two primary products of engineering education are its graduates and new knowledge base that is the foundation of new technologies for nations' economic development. Increasingly, the economies of nations are interconnected, and graduates must possess the education that enables them to work in the international marketplace. Consequently, engineering education is becoming an international enterprise. Institutions of different nations must, therefore, work together. Such international cooperation needs the support and active participation of faculty. Equally important is the support and participation of the top administrators of educational institutions. Faculty and administrators alike must find innovative ways to work together across international boundaries. Recent advances in information and communications technologies are providing a new impetus for international cooperation in education and research.

EMERGENCE OF iNEER

Recently, a new professional organization has been formed by the international engineering education community. Called the International Network for Engineering Education and Research, or iNEER for short, this organization aims to cultivate, nurture and sustain international cooperation where it makes sense, within the limit of its resources. A"virtual" global organization born in the information age, without constraints imposed by geography and culture, iNEER's principal approach is to use recent advances in information and communications technologies to foster the creation of collaborative networks and partnerships in the engineering education and research communities worldwide. It recognizes that, to achieve mutual progress, it is important to increase personnel and information exchanges, and link ongoing, already funded domestic research and education programs. It is built upon the belief that we have the best chance to make progress if we work together as a coordinated network, united by a desire to share ideas and information, and leverage our resources, and jointly formulate new solutions.

The business of iNEER is carried out by the General Secretariat headed by the Secretary-General under the direction of the iNEER Board.

MEMBERSHIP

The iNEER community, at over 6,000 strong currently (April, 2002) is comprised of educators and researchers from academe, industry and government bonded by a desire to work collaboratively to elevate the quality of engineering education in institutions around the world.

An organization without walls, iNEER invites and welcomes to its community membership educators who support the iNEER goals, and are interested in working collaboratively with other members. iNEER membership may be obtained by self-nomination or second-party nomination by sending an e-mail to the Secretary-General. Nominations by existing members are especially welcome. Membership is free, and is available without regard to national origin or creed.

PROGRAMS

iNEER develops and sponsors the following activities:

International Conferences on Engineering Education (ICEE). Seven ICEEs have been held in different parts of the world. In addition, future conferences are scheduled as follows: ICEE-2002 – Manchester, England; ICEE-2003 – Valencia, Spain; and ICEE-2004 – Gainesville, Florida, U.S.A. For ICEE-2005 and beyond, six proposals are under review from Portugal, Poland, South Korea, Puerto, Singapore, and Blacksburg, Virginia, U.S.A. At ICEE-2001 held in Oslo, Norway, 320 papers were presented by speakers from 47 countries. For ICEE-2002, a record total of 482 abstracts have been received from 48 countries. Further information about these conferences, and the proceedings of past conferences, have been posted on the website **http://www.ineer.org**.

Partnership Workshops. Education workshops are an important component of iNEER and are a regular features of ICEE. At ICEE-2001, the US-Czech Republic-Poland Workshop and the US-Scandinavia Workshop were coalesced into an umbrella workshop, the "ICEE International Partnership Workshop." A US-Taiwan-Korea workshop was also held. In addition to ICEE-related workshops, iNEER also develops and helps sponsor regional partnership workshops such as the present one held in Nanjing.

Outreach to Expand the Global Partnership. In an effort to promote international understanding and cooperation, the Secretariat disseminated to the iNEER community and posted on the website, "Letters" written following outreach visits to a number of education institutions each year. A "Letter" written following a visit to Manchester, England in conjunction with a planning meeting for ICEE-2002 has been posted also. To see these "Letters", visit the iNEER website (http://www.ineer.org) and from the navigation menu on the front page, click on "ICEE-ISC Communications".

Facilitating Partnership Agreements. Upon request, iNEER facilitates and coordinates the development and signing of new cooperative agreements by heads of academic institutions. As a direct result of these agreements, coupled with past ICEE workshops, numerous international exchanges have started. The signing ceremony for international cooperative agreements usually takes place at the conference banquet. This was carried out in front of about 400 attendees during ICEE-2000 in Taiwan. To see photographs of the signing event conducted in Taiwan, visit the www.ineer.org website and click on "Photo Albums".

iNEER Awards. The citations of these annual awards are posted on the iNEER website.

Photo Albums. The following photo groups have been added to "Photo Album" on the iNEER website: "ICEE-ISC Meeting 2001, Manchester"; "ISC Meeting 2000, Porsgrunn"; "Scenes from Kiev, June 2001"; "DonSTU Celebrates 80th, May 29-June 3, 2001", and "Scientific Board Meeting, VSB Technical University of Ostrava, May 25 2001."

iNEER Talks and Papers. Selected articles and papers related to international cooperation in engineering education and research are posted on the iNEER website.

CONCLUSIONS

iNEER represents a new mechanism for international cooperation in engineering education and research. The strong participation by the international community in its conferences and workshops indicates that iNEER is indeed filling a need. It is gaining recognition, acceptance and support by the international engineering education community. Still, iNEER needs to be more engaged in countries such as Russia, China, India, Argentina, Japan, South Korea, Germany, France, United Kingdom, Mexico, Canada, Argentina and others. To accomplish this, it is necessary for it to develop a cadre of active members in each of these countries. For this, it needs the help and support of all members of the iNEER community.

ACKNOWLEDGMENTS

The contributions of the global community members, either through active programming involvement or attendance of conferences and workshops, are by the iNEER Board and Secretariat. iNEER gratefully acknowledges the generous support of Hewlett-Packard Company, Microsoft Corp., Technical University of Ostrava and New Jersey Institute of Technology. The significant in-kind support provided by the iNEER Maryland Secretariat should be acknowledged here also.

INTERNATIONAL ENGINEERING EDUCATION PARTNERSHIP WORKSHOP
JUNE 1, 2002, NANJING, CHINA

Overview of New Jersey Institute of Technology

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Since its founding in 1881, NJIT has been transformed from a local technical school to one of America's top 200 research universities with national rankings and stature. While moving steadily to increasingly higher levels of excellence in educational performance, NJIT has become a research and development hub, participating in entrepreneurial development and building business partnerships through research and development initiatives. NJIT has evolved into an international presence, both in the scope of its educational programs, including on-site and distance learning offerings, attraction of international students to its programs, and through the reach of its educational, scientific and technological influence at international forums and in international research projects.

NJIT is a student-centered university. The promotion of student success drives all university activity and planning. Student progress is carefully monitored. University governance bodies and assessment mechanisms proactively seek to elicit student response and opinions regarding university performance, activities, and planning. Student input is applied to all components of university educational improvement, management, and planning.

The NJIT student body continues to increase in size and improve in the level of academic preparation. NJIT enrollment continues to grow, and reached more than 8,800 students in 2001, including 5,698 undergraduate and 3,164 graduate students growth in enrollments over the past eight years.

NJIT awards approximately 1,900 degrees annually from the baccalaureate through the Ph.D. in an array of engineering and technology disciplines, computer and information science, architecture, management, applied sciences, liberal arts, mathematics and biomedical engineering. The university offers Ph.D. programs in eighteen professional areas, master's programs in forty-two specialties, and thirty-five baccalaureate degree programs.

Faculty include 418 full-time faculty and instructional staff and approximately 225 part-time and adjunct faculty. Faculty are evaluated on quality of instruction, research and service. Students routinely rank the overall quality of instruction and the quality of the academic program among the most satisfying components of their college experience. NJIT's reputation for the quality of instruction is one of the chief reasons given by students for applying to NJIT. NJIT is currently ranked 30th in the nation on faculty resources by *U.S. News and World Report.* Rankings take into account such factors as class size, the proportion of faculty who are full-time, salary levels, and the number of faculty with terminal degrees in their specialties.

In 1983, NJIT embarked on an ambitious plan to become a computing intensive university. Investments in planning, training, and infrastructure over the last eighteen years have placed NJIT in the forefront in the use of libraries, information access, computing, and other technologies as learning resources. NJIT's president led the state effort to create the NJEDge.Net higher education network. NJEDge.Net is a non-profit corporation of the New Jersey Presidents' Council that was designed to enhance the missions of instruction, research, and public service of New Jersey's colleges and universities. The range of capabilities, resources, and services offer economies of scale, provide expanded opportunities for integrating emerging technologies, and promote new forms of inter-institutional collaboration. This private, statewide inter-institutional infrastructure effectively "raises the bar" for high performance data and video capabilities across the state's three LATA boundaries and extends the reach of higher education to off-campus learners, K-12, corporate, and community constituencies.

NJIT students have available to them all the advantages of a digital library and campus. Continuing and distance learning at NJIT have become core activities. NJIT has been playing a leadership role in this arena since as far back as 1978 with the publication of the seminal book, *The Network Nation: Human Communication via Computer,* by Starr Roxanne Hiltz and Murray Turoff, now both NJIT College of Computing Sciences Distinguished Professors. In 1984, the results of their scholarship led NJIT to coin and trademark the term, "Virtual Classroom®." By 1989, NJIT had registered the mark with the U.S. government and had begun to offer the first classes based on this model. Since then, as New Jersey's technological research university, NJIT has been using multiple modes of technology to offer enrollment both to the on-campus student in need of flexible course scheduling alternatives and to the remote student who, for a variety of reasons, is unable to reach the NJIT campus. Each semester NJIT currently enrolls approximately 1,600 students, representing 20% of its academic student body, in distance learning courses. Over 4,000 students currently participate annually in distance-based, non-credit professional development training

NJIT's evolution to a vital research university has been achieved through an aggressive faculty recruitment plan matched by an extensive building effort that doubled the size of the main campus over the past decade and added major research facilities for environmental engineering and science, advanced manufacturing, and microelectronics. Annual research expenditures are now approximately $52 million. The strong applications orientation of the university's research program has allowed NJIT to respond to state, federal, and industrial initiatives, to help address pressing public policy issues, and stimulate economic growth.

Research activities, often carried out by interdisciplinary teams of investigators, are focused especially on sustainable manufacturing systems, infrastructure, information technologies, environmental engineering and science, biotechnology, architecture and building science, and management. Major funding for instructional and research programs is obtained from leading corporations, foundations, and government agencies including the National Science Foundation, the United States Department of Defense, the U.S. Environmental Protection Agency, the U.S. Department of Transportation, the New Jersey Commission on Science and Technology, the New Jersey Department of Environmental Protection, and many others.

NJIT's operating budget in 2000-2001 totaled $194 million, and total revenues exceeded total expenses by $3.6 million. NJIT completed a fund-raising campaign and exceeded its goal of $120 million by 2001.

NJIT has long been an active community partner in the development of Newark's and New Jersey State's economy, playing a large role in Newark's revitalization. NJIT is currently a leader in the development of University Heights Science Park, which is a collaborative venture among Newark's educational institutions, the city and community of Newark, and private industry. As president of NJIT, I haveserved on numerous city and statewide taskforces and international educational and community service projects. I am currently is Vice Chair of University Science Park. NJIT is also a key player in the high technology corridor in New Jersey, which constitutes a hub of research and development activity in support of service, manufacture, and distribution of goods and services in New Jersey and from New Jersey to the world.

NJIT's 50 acre, computing-intensive, residential campus is located in the University Heights section of Newark, less than 10 miles from both New York City and Newark International Airport. It is easily reached by interstate highways and public transportation. Graduate, undergraduate, and continuing education classes are offered at the main campus, at the Mount Laurel Campus, and at extension sites at colleges and other locations throughout New Jersey and increasingly through a variety of electronically mediated distance-learning formats. Courses are also delivered on-site and through distance learning at many other locations and internationally.

TheCenter (University of Florida) ranked NJIT 101st (adjusted for controls) of 4,700 institutions with higher education offerings in the nation in its 2001 report on *The Top American Research Universities*, and highest in the nation for positive change in the ranking for federal research funding from 1990 to 1999. *Money Magazine 1998: Best College Buys Now* ranked NJIT as the sixth "Best Value" among the top "Scientific and Technical Schools" in the United States. And *U.S. News and World Report: 2001 Annual Guide to America's Best Colleges* placed NJIT among the top 200 "Best National Universities" for the fifth straight year. *Yahoo!* has ranked NJIT among the top 10 "most wired " public university campus for four consecutive years. *Careers and Colleges* included NJIT in its list of 15 great schools at great prices.

As NJIT's president I have played a key role in developing international contacts and forums for NJIT. I was a principal developer of the International Network for Engineering Education and Research (INEER), serve on its Board, and was the keynote speaker at its international annual conference held in Taipei in 1999. In July of 2001, I was keynote speaker at the International Conference on Collaboration Between the United States and Thailand in Bangkok and spoke on "Research and Human Resource Development in Science, Technology and Education." Shortly thereafter,. I also gave a keynote address at the 2nd International Conference on Information Technology Based Higher Education and Training at Kumamoto, Japan, where I spoke about 'Economic Development, Curriculum Change and Knowledge Diffision." In 1999, I was privileged to receive the Global Award for fostering the growth and development of social, cultural and educational aspects of society from the Privadashni Academy, India.

iNEER Blueprint for International Cooperation[1]

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ABSTRACT

The 21st century is viewed by many as the onset of the era of Knowledge Based Economy in which the source of wealth is to be found in Ideas people have. The constraints on production is not so much the provision of Capital, but the Creativity and Innovation. In such an environment Universities have an even greater role to play in their traditional learning/teaching and research functions.

iNEER therefore has an important role to play globally in facilitating contact among universities as an essential preamble to fostering international cooperation. This cooperation on the global scale includes sharing of resources as well as exchange of academics, and in general nurturing, enhancing and sustaining its many networking functions. This note provides elements of a template that could prove a useful guide in realising these aims.

BACKGROUND

The International Network for Engineering Education and Research (iNEER) was established about two years ago with overall mission to promote quality engineering education and research world wide. It currently has some 6000 members from 100 countries, and therefore represents a formidable information and ideas resource, among other things. It stands for networking, real and virtual, in Engineering Education and Research. It is the "virtual" component that makes it especially accessible to all.

The starting point for many an international collaboration is often through participation of individual members in its annual ICEE conferences which iNEER sponsors. It is the aim of this note to provide a tentative blueprint how this might be facilitated more effectively.

A BLUEPRINT FOR COLLABORATION

An iNEER member has access to already formidable network of institutions and individuals. The mechanism of accessing the necessary resources is to combine into partnerships without frontiers. Many would argue that partnerships, especially of the international kind, enjoy enhanced chances of success when competing for funds.

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[1] Adapted from paper presented at iNEER/ICEE RETREAT, February 19 – 24, 2002, Taipei, Taiwan

Thus, an iNEER Blueprint for cooperation in Engineering Education and Research may be structured as follows:

1. Identification from the iNEER data base of individuals whose expertise if relevant to the project in hand. With this in mind, it is clear that the key to success is an expanding membership and frequent database updates. An efficient database search engine is essential here.

2. Having identified the individuals relevant to the project, the initiator of the project assumes (by mutual agreement) the project coordinating role and provides each participant with the project description and the envisaged contribution each project partner would be expected to make.

3. A joint application for funds is then made.

4. After the successful application, all participating members proceed to work to completion on their part of the project.

5. Following conclusion of the project and publication of results, the initial partnership may either disband or tackle new projects.

Because of its nature, iNEER should seek international sponsors, such as UNESCO, professional engineering societies, such as IEEE and ASME International, and be made visible at all Engineering Conferences by way of a poster or an endorsing logo in conference publications. The latter could well be a sign of an international Quality Assurance standard.

iNEER should also form partnerships with local Engineering Education societies, such as The American Society for Engineering Education (ASEE) and The Australasian Association for Engineering Education (AAEE) in Australia, because of many mutual benefits such an association would have.

ACADEMICS EXCHAGE

An important aspect of international collaboration is facilitation of exchange of academics between institutions. Readily identifiable from the vast iNEER membership database, appropriate contacts can be made with the view of exchanging academics – an excellent way to foster research partnerships, as well as pave the way for student exchange programs. This is especially of importance for those institutions, such as this author's university, where the traditional sabbatical leave has been abolished, or those which are new to the mainstream activities.. The exchange of academics between institutions could well be a first step in establishing an institutional partnership. Ready access to the iNEER database coupled with a versatile search engine are of vital importance here.

It is noteworthy that the success of the iNEER is directly proportional to its membership size, at least in the statistical sense, and therefore its marketing is imperative.

CONCLUSIONS

An iNEER Blueprint for international cooperation in Engineering Education and Research is centered around having a comprehensive membership database together with a versatile search engine. It is then simply a matter of the initiating member contacting appropriate iNEER colleagues with the view to forming a project partnership such that all could jointly apply for funds.

Exchange of academics is often a precursor to institutional collaboration, and is especially useful for those institutions in which the sabbatical leave has been abolished, or which are new to the mainstream international activities. As
in the case of partnerships, a comprehensive iNEER member database with a versatile search engine are essential

The more members there are, the more effective will be the search for suitable partners as well as in the matters of academics exchange. Therefore marketing of iNEER is imperative.

INTERNATIONAL ENGINEERING EDUCATION PARTNERSHIP
WORKSHOP
June, 1, 2002, Nanjing, China

HP'S Engagement with Chinese Research and Education Institutes – An Initial Report

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ABSTRACT

As a citizen of the global business community, HP is in the early stage of re-assessing its roles and responsibilities. Ever since our CEO, Carly Fiorina, took office more than two years ago, and especially after the Director of University Relations, Wayne Johnson, came on board last summer, HP has begun embarking on a full range evaluation of our corporate strategy and engagement of the international university community, especially in the Asian Pacific region. As a pilot program in China, we are sponsoring a set of research and education projects in Tsinghua University, and in Chinese Academy of Sciences, over a new generation of high performance computer architecture, the native mode 64-bit Itanium family. The purposes are to advance the-state-of-the-art in compiler technology, high performance computer architecture, high performance computational environment, and to enhance the education of advanced computer architectures and operating systems in China.

BACKGROUND INFORMATION

The trend in the computer industry during the past decade is to move away from proprietary architectures and systems, and to move into commodity architectures and open systems. Intel's x86 family of microprocessors has been the computing engine behind this change. Intel's x86 based systems are not only used in PC's, workstations and low-end servers, they are powering enterprise class machines these days.

During the last decade, we've experienced the migration from 16-bit word size computing into 32-bit word size computing in the PC sector. Now, as the PC industry is moving up the value chain, the need for native mode 64-bit computing is becoming overwhelming. The Itanium processor from Intel is the answer to that trend. Itanium architecture (EPIC) was originated in HP Labs in the late 1980's to early 1990's. The fundamental thesis behind the EPIC architecture is that a compiler controlled architecture is much more efficient than a hardware controlled architecture in terms of silicon utilization, and hence is a better approach to instruction level parallelism and the real estate on the chip. Therefore, the migration from deep pipelined, super-scalar RISC processor architecture to a *refined* VLIW (Very Long Instruction Word) architecture, which allows for speculative execution and software pipelining, is at hand. This product is a joint effort between Intel and HP, intended to revolutionize high speed computing for the 21st century.

However, even though new microprocessor architecture creates new opportunities, its success is dependent on the availability of underlining compilers, tools and software which take advantage of the architecture. In other words, researchers need to enhance the usage environment in order to unleash the power of the machine. Since China possesses one of the most impressive brain power in the world, we'd like to tap into that to advance the state-of-the-art in high performance computing surrounding Itanium platforms. One of the main goals of our engagement with the Chinese universities is to do just that for this new generation of computers and computer architecture.

On the other hand, Open Systems are becoming the development platform of choice for researchers world wide. The availability of Open Source software provides a powerful tool in advancing technologies for computer based teaching and research. HP Labs contributed to this trend by porting the Linux operating system on the Itanium platforms, and by making its source code available to the Open Source community.

SCHOLARLY EXCHANGE AND CONDUCT OF RESEARCH

In 2001, we collaborated with Intel to offer Itanium equipment grants to university researchers world wide, to do research and education on the new family of platforms. One of our grantees in China is the Computer Science Department of Tsinghua University. We donated 4 servers to Prof. Zhou Li-zhu and Prof. Zheng, Wei-min, for them to do research (and teaching) in compilers and in cluster computing tools and environment.

We also donated 8 servers to the Institute of Computing Technology of the Chinese Academy of Sciences, to do research in compilers. Prof. Zhang Zhao-qing, has a high powered team in this space, based on open source software.

As a second step, early this year, UR of HP started a federation (named Gelato) to develop a portal, and a Linux release for Itanium platforms, aimed at the research community. This federation will jointly enhance the quality and capability of Itanium platforms in the research community. Tsinghua University is a member of this federation. ICT is also a R&D partner of this federation. In February, we had our first Gelato federation meeting, laying out mission, charter, ground rules and areas of cooperation. Tsinghua actively participated in this meeting. This federation is also an excellent window for the faculties at Tsinghua to engage their international counterparts, and to make their research more visible in that global context.

We have plans to leverage and broaden the relationship with Tsinghua and ICT. We intend to upgrade their machines to multi-processor systems. We also intend to facilitate technical exchanges between HP Labs and the Chinese research institutes, based on the said work.

CONCLUSIONS

What we have done so far is just a pilot program. We intend to build on it a trusted and mutually beneficial partnership with the above and other universities in China. As a world leader in computing technologies, HP is not only well positioned, our commitment is from the top, our CEO. It signals a new awareness, and a new determination to be a major force in improving the engineering education and research in the international scene, such as China.

INTERNATIONAL ENGINEERING EDUCATION PARTNERSHIP WORKSHOP
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The University of Puerto Rico at Mayagüez International Collaboration Activities

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Summary

UPRM has a long tradition of teaching excellence. Established in 1911 as a Land-Grant institution, UPRM is the science & technology campus of the University of Puerto Rico system. With a faculty of about 800 members in four colleges (Engineering, Arts & Sciences, Agricultural Sciences and Business Administration) UPRM offer bachelors, masters and PhD's to more than 12,600 students, 800 of which are in the graduate programs. In academic year 1998-99, UPRM granted 1,650 bachelor, 155 master and 8 PhD degrees. UPRM's R&D activity has increased significantly over the last 10 years bringing in AY 2001-02 more than $21 million in research grants. UPRM is considered the Science, Technology, Engineering & Mathematics (STEM) Campus of the University of Puerto Rico system. According to the ASEE 1997 Engineering Workforce Commission, UPRM's College of Engineering is the 7th largest in full time undergraduate enrollment, and the largest college in the US that graduates Hispanic engineers. It also has the largest women enrollment in engineering: 38% in 1999 versus an average of 24% of the top 10 institutions with high women enrollment in engineering. According to a National Science Foundation study, of the top 25 institutions that granted PhD's in Science, Math or Engineering in the US between 1991 and 1995, 10% earned their bachelors degrees at UPRM. In 1998 the College of Engineering brought in more than $6M dollars in R&D activity. The MS and PhD programs enrollment is currently about 290 students, with hundreds of undergraduate students participating in research, coop and internship programs. Academic and R&D excellence at UPRM is evidenced by recognition of our graduates, and awards and honors given to our faculty. UPRM faculty and students are recognized locally, nationally and internationally. One of the most important elements of our mission is to promote and enhance national and international collaborations. This document presents some of these efforts.

Research & Education Collaborative Activities

A. Current Education Innovation and Technology-Related Research

- **Curriculum development focused on student learning outcomes**. For the last 7 years have worked in strong collaboration with industry on innovations in engineering & science/math education that responds to stakeholders needs, integrating practice based activities, with funds from NSF, NASA & industry (such as Microsoft, Raytheon). Ethics Across the Curriculum initiative.

- **Strategic Planning, ABET 2000 and program and student outcomes assessment.** Planning for accreditation under the new ABET criteria at the College and departmental level, assessment tools development. Currently assisting universities in Latin America to obtain their ABET substantial equivalencies.
- **Education strategies, programs & projects transfer between countries (Puerto Rico, US & Latin America).** The Learning Factory, short courses/workshops, research, faculty exchange, student/faculty internships.
- **Collaboration among disciplines with industry for curricular innovation.** Examples: The Learning Factory, Technology-Based Entrepreneurship program in conjunction with National Collegiate Innovators & Inventors Alliance, Partnership for Spatial & Computational Research.
- **Cohemis Center.** The Center for Hemispheric Cooperation in Research and Education in Engineering and Applied Science (CoHemis for short) is part of the University of Puerto Rico. founded in 1991 in a hemispheric conference-workshop sponsored by the National Science Foundation. It brought together national science and technology organization (ONCyT) delegates from 13 countries of the Americas to discuss ways to increase hemispheric collaborations in science and technology. CoHemis maintains relationships with most of the hemisphere's ONCyTs through officially designated liaisons. The mission of the CoHemis center is to promote human resources development, technology assessment, and joint applied research projects and programs with potential benefits for more than one country in the Western Hemisphere aiming to serve the needs of the Americas with the participation of engineering and science researchers faculty and graduate students from the different countries of the hemisphere. As its long range purpose, the center's mission is to become a decentralized hemispheric applied research organization in the context of the CoHemis Consortium.
- **Puerto Rico TechnoEconomic Corridor.** Alliance between government, productive sector & academia to foster economic development based on high technology clusters. R&D, curriculum development, economic incentives, infrastructure development, quality of life.
- **Microsoft Latin American Collaboration.** UPRM has become a strategic partner and become member of Microsoft's Latin American Advisory Board.

B. Areas of interest for Future International Research & Education Collaboration

- ABET accreditation/substantial equivalency.
- Consulting for engineering programs revision focused on student learning & responding to stakeholders needs.
- Workshops:
    - The Learning Factory
    - Developing an Outcomes-Based Course
    - Education Strategic Planning & Outcomes Assessment
    - Assessment Tools Development

    - Ethics Across the Curriculum
    - Creativity & Innovation
    - Integrating Students in Undergraduate Research
    - Team Building: a necessary step for successful innovation
- Faculty/student internships, courses, research collaboartion
- Program & courses sharing
- Organizing and hosting international conferences, as per ICEE 2005-6 proposal.

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Strengthening the Library Collection for Engineering Education by International Cooperation; A Proposal

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I. Reasons

1. Before China established her policy of opening to the outside world, university libraries in China did not have the opportunity to acquire many publications in Western language, including publications for engineering education.
2. Before 1978, Chinese universities were mainly teaching, rather than research, institutions. It did not require a very large Western-language collection to meet the educational needs of a four-year college in China. However, as Chinese universities have now expanded to include post-graduate education and their faculty members are actively engaged in research, they need a much larger library than before.
3. Chinese universities cannot afford to greatly increase the book acquisition funds of their libraries because of shortage of foreign exchange and budgetary restraint. Furthermore, China's participation in the Universal Copyright Convention in 1992 prohibited China from reprinting Western publications without authorization from copyright-holders and payment of royalty. Chinese libraries are compelled to purchase originals if authorized reprints are not available. Since originals are so much more expensive than reprints, the purchasing power of Chinese libraries has been drastically reduced.
4. Lack of information, out of print, and many other factors also prevent university libraries from expanding rapidly in order to meet the growing needs of their faculty and students.

The above are some of the obvious reasons that a great effort should be made to help Chinese universities strengthen their library collections. The International Engineering Education Workshop has provided us with an opportunity to establish some programs of international cooperation, which, if developed, can be quite helpful, not only to Chinese university libraries, but also to participating Western universities as well. The following is a list of some possible programs.

II. Programs

Exchange of publications -- The following types of publications may be exchanged between libraries of all participating universities:

a). University publications – including journals published by the universities or their departments. Chinese university journals are usually not widely circulated or advertised. Some are not commercialized. Therefore, although quite scholarly, many of them are not well known to Western scholars. Exchange of such journals between Chinese and Western university libraries is definitely mutually beneficial.

b) Faculty publications – exchange of publications between individual faculty members of Chinese and Western universities. Like university journals, many highly specialized faculty publications are not widely advertised and circulated.

c) Technical reports – Information about technical reports is difficult for acquisition librarians to obtain. If participants of this Workshop could exchange their technical reports, and let their libraries properly catalog and preserve those reports, it would mutually strengthen their universities' library collections and make their libraries more useful to students and faculty members.

III. Funding

Unlike research projects, which usually require a fairly large amount of funding, the implementation of this proposal needs very little funding. The major expenses are as follows:

1. Postage – International book rate is lower than the rate for normal package. But it has weight limit.
2. Acquisition of publications – University should provide its library with enough copies of its own publications for exchange purpose free of charge.
3. Salary – Exchange requires some staff time. If the library does not already have a staff member in charge of exchange, a new staff member should be added. Exchange can save a great deal of the library's acquisition funds. If the exchange programs are active and successful, the amount saved will far exceed the salary of the exchange librarian.

IV. Concluding remark

I have not discussed in this proposal problems of networking and digitalization, and their impact on library service and educational programs because I want to concentrate on the matter of developing collections of paper publications. Collection development involves many aspects of library operation and university education. Exchange of publication is just one part of library operation. I make this proposal because we have in this Workshop a unique opportunity to develop international exchange. I hope such exchange will help strengthen the international relations between Chinese and Western universities.

INTERNATIONAL ENGINEERING EDUCATION PARTNERSHIP WORKSHOP
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International Partnership in Engineerng Accreditation

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ABSTRACT

An over view of the accreditation system of USA is given, along with a brief description of the new engineering criteria of the Accreditation Board for Engineering and Technology(ABET). In view of the complexity and diversity of the practice of the accreditation system in USA and elsewhere in the world, an international accreditation system recognized by all nations is unlikely to be in place in the foreseeable future. Instead, it is suggested that bi-lateral and multi-lateral recognition of regional practices be pursued. Toward that end, international organizations such as iNEER can play an important role in promoting better understanding of each other's accreditation practices and set the stage for mutual recognition.

US ACCREDITATION SYSTEM

The ultimate purpose of any accreditation system in higher education is to serve the public interest by providing quality assurance of accredited degree programs or institutes that offer degree programs. The US accreditation system is more than 100 years. It is carried out by private, non-profit organizations. There are three different accreditors : Regional, National, and Specialized and Professional accreditors.

The regional accreditors accredit two- and four-year institutes by conducting comprehensive review of all institutional functions. There are eight regional accreditors covering six geographical regions in USA, see the attached table. The national accreditors accredit single purpose institutions, private career institutions and faith-based colleges and universities. There are 11 national accreditors. The specialized and professional accreditors accredit special programs of schools including law schools, medical schools, engineering schools and programs, and health profession programs. There are 63 such accreditors. The Accreditation Board for Engineering and Technology (ABET) accredits 2,300 programs in engineering, technology, computing, and applied sciences.

The accreditors are reviewed and "recognized" by the Council for Higher Education Accreditation (CEAH), a private national coordination body, or the United States Department of Education (USDE). Accreditation by an accreditor recognized by USDE is necessary for access to federal funds for student financial aids and other federal programs.

ABET NEW CRITERION

The prevailing practice of US accreditors is moving from a "prescriptive" approach to an "outcomes assessment" approach. A typical example is the engineering criterion of ABET. In the so-called *a*-to-*k* standard outcomes, ABET states that: Engineering Programs must demonstrate that their graduates have:

a. An ability to apply knowledge of mathematics, science and engineering appropriate to the discipline.
b. An ability to design and conduct experiments, analyze and interpret data.
c. An ability to design a system, component, or process to meet desired needs.
d. An ability to function on multi-disciplinary teams.
e. An ability to identify, formulate and solve engineering problems.
f. An understanding of professional and ethical responsibility.
g. An ability to communicate effectively.
h. The broad education necessary to understand the impact of engineering solutions in a society context.
i. A recognition o the need for, and an ability to engage in life-long learning
j. A knowledge of contemporary issues.
k. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Furthermore, each program must show evidence that an outcomes assessment plan is in place and the results of outcomes assessment have been used to improve the program

U.S. REGIONAL ACCREDITATION ORGANIZATIONS*

Organization	States and Areas	No.of Areas	No.of Institutes
Middle State Association of colleges and Schools Commission on Higher Education	Delaware, District of Columbia., Maryland, New Jersey, New York, Pennsylvania, Puerto Rico, U.S. Virgin Islands	8	490
New England Association of Schools and Colleges Commission on Institute of Higher Education	Connecticut, Maine, Massachusetts, Rhode Island, Vermont.	5	290
New England Association of Schools and Colleges Commission on Technical and	Connecticut, Maine, Massachusetts, Rhode Island, Vermont.	5	133

Career Institutions			
North Central Association of Colleges and Schools, The Higher Learning Commission	Arizona, Arkansas, Colorado, Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, New Mexico, North Dakota, Ohio, Oklahoma, South Dakota, West Virginia, Wisconsin, Wyoming, Navajo Nations.	20	975
Northwest Association of Schools, Colleges and Universities Commission on Colleges and Universities	Alaska, Idaho, Montana, Nevada, Oregon, Utah, Washington.	7	154
Southern Association of Colleges and Schools Commission on Colleges	Alabama, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, South Carolina, Tennessee, Texas, Virginia, Latin America	12	782
Western Association of Schools and Colleges Accrediting Commission for Community and Junior Colleges	California, Hawaii, Guam, Northern Mariana Islands.	4	138
Western Association of Schools and Colleges Accrediting Commission for Senior Colleges and Universities	California, Hawaii, Guam, Northern Mariana Islands.	4	148
Total		56	3,029

*Source: Council for Higher Education Accreditation (www.chea.org)

CONCLUSIONS

Knowing each other's accreditation criterion is the first step toward mutual recognition. Workshops such as this can promote international partnership on accreditation issues. The list of ABET's standard program outcomes is the required minimum. No limit is put on what a program can add to this list. There is much for US engineering educators to learn from the international community of engineering educators to enrich their programs and vise versa.

International Cooperation in Engineering Education

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Engineering education has provided upward mobility for students worldwide for many years and continues to do so. Further, engineering colleges in the U.S. have long attracted the largest number of international students of any program in the academy. International exchange in research via international graduate students, faculty exchange, worldwide conferences and international visits has been a hallmark of U.S. engineering since the 1940's. The U.S. Accreditation Board for Engineering and Technology offers engineering education reviews worldwide and a credentialing service for engineers worldwide.

The University of Florida has 45,000 students, 9,000 of them in graduate programs. It is one of the most comprehensive universities in the U.S. Its College of Engineering offers one of the largest group of degree programs in the U.S.

The faculty and graduate students of the University of Florida are engaged in virtually all aspects of engineering and science research including modern programs in nanotechnology, biotechnology and information technology. The National Science Foundation's Engineering Research Center for Particle Science & Technology is located on the University of Florida's campus. The university has over 150 research centers and institutes. International students study and do research in nearly all of them and study in all eleven departments of the College of Engineering.

The University of Florida conducts research, exchanges information, conducts joint conferences and welcomes graduate students from many of the nations of the world. A large number of graduate students from Asian nations study in virtually all University of Florida engineering and science departments.

Fellowships and research assistantships are available to international students in all departments. We welcome collaborative efforts with our international colleagues.

INTERNATIONAL ENGINEERING EDUCATION PARTNERSHIP WORKSHOP
Nanjing, China
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THE DIRECTION OF ENGINEEERING RESEARCH IN A FIRST-RATE CHINESE UNIVERSITY

--- Personal Advice from a SEU Alumnus ---

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Prologue

Historically, university education has played a major role in economic development, and thereby the wellbeing of people, in any nation. In the industrialized countries, typical functions for a major university include teaching, fundamental research, and service to the society. High quality education of young people is the foundation to build a strong nation. In science and engineering, Southeast University and its predecessors have had an impressive track record of producing world-class scientists and engineers in the past. After the second-world war, particularly during the space race between the United States and former Soviet Union after the event of Sputnik, the interest in scientific research in American universities exploded. The reputation of a university in the U.S. is often rated by its accomplishments in research. In this presentation, the speaker would like to share his personal experience with the audience regarding the direction of engineering research in general, and the field of manufacturing engineering in particular.

Research Relevant to National Needs

In the 1960's and early 1970's, engineering research at universities in America was dominated by the fields of engineering sciences. Important areas to national needs at that time such as energy, environment, and productivity were either neglected or playing a second fiddle. The National Science Foundation (NSF) took an initiative to start an exploratory program called RANN (Research Applied to National Needs) in the early 1970's. The program has yielded not only a great impact on research direction at universities, but also on the whole society at large. Today in China, these issues are still very relevant to its economic development and welfare of its people. Undoubtedly, energy plays a key role in industrialization and raising living standard, and China is making a great effort in this area. However, the challenge would be how to minimize possible negative impact on environment that is also very important to people's life. As to productivity, China today is already a major player in producing commodity goods primarily due to its low labor cost. It seems advisable that universities in China may want to commit more of their research resources on production engineering, including innovations. Such an effort would speed up the process of making China a powerhouse of producing high-tech products. It would also help the nation move into the major league of modern science and technology much sooner. This obviously would depend upon how soon the Chinese universities could compete against their peers in the world, and gain an international reputation in education and research.

Criteria for Selecting Engineering Research Topics

Engineering by nature is an applied science. A key factor for evaluating engineering research depends on how much impact it may have on industry and the society. In selecting academic research topics, the following criteria are suggested:

- Relevant to industrial and social needs
- Generic, fundamental and pre-competitive
- Advancing the state-of-the-art
- Results publishable in archival journals
- Innovation is as important as archival publication

The presentation will cover some details on each aspect including an example for the purpose of illustration.

International Engineering Education Partnership Workshop
June 1, 2002, Nanjing, China

INTERNATIONAL COLLABORATIONS IN ENGINEERING EDUCATION

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Introduction:

International collaborations play a very important role in the education of tomorrow's leaders in engineering and science. These programs will train engineers for global economy. For successful collaborations between US and Chinese Universities, the following points are to be considered:

(1) Commitment of Upper-Level Administrators and Faculty

- For successful international collaborations, we need the support and the commitment of upper-level university administration.
- We also should have enthusiastic involvement of faculty and a faculty champion for collaborative activities.
- Establishment of Joint Institutes/Research Centers in the areas of mutual interest.

(2) Educational Activities

- In most of the US universities, the graduate student population consists of 25-30% of students graduated from Chinese Universities. We need to develop collaborative programs between US and Chinese Universities in the training of these students.
- Development of the Memorandum of Understanding (MOUs) between the universities for exchange of the students and the transfer of credits from partner universities. We should encourage students to enroll for a semester in partner universities.
- Development of team-based joint senior design projects involving the students from Chinese and American Universities by using Internet for

design and fabrications of similar hardware on both sides. This collaboration will provide an opportunity for learning about design practices and codes in partner universities.

- Incorporation of guest lectures (live or internet) from partnering universities into the undergraduate courses.
- We should encourage MOUs for the transfer of undergraduate students for the last two-year curriculum to American Universities.
- Curriculum development and distance education opportunities by using Internet.

(3) Exchange of Faculty Members

- Development of partnerships based on faculty relationships. For effective collaborations we should encourage the faculty members to spend a semester/year in the partnering universities. The sabbatical and faculty development assignments are to be developed.
- Faculty members from partnering universities should be encouraged to participate in the international conferences. These meetings will provide a unique opportunity for exchanges of ideas and programs.
- Faculty from American Universities should be encouraged to travel to the partner universities and provide seminars/ guest lectures/ emerging research areas, etc.
- We should form a group of interested faculty from different universities for the development of collaborative projects with one university.

(4) Research Collaborations

- Joint research proposals to NSF/NRC and other agencies for the support of students and faculty. The NSF encourages international collaborations in various programs.
- Joint research publications between the students and faculty members
- Joint research thesis supervision of the MS/PhD. students in both countries.
- Sharing of the specialized computer software/course materials/ project reports with collaborating faculty members

- Access of sophisticated equipment utilizing Web-based arrangements.

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Examples of Conventional Cooperative Engineering Education Today

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ABSTRACT

This note describes a large mandatory co-operative education program in USA – Drexel University, and the initially practice-oriented program at Nanyang Technological University in Singapore. Such programs of integrating classroom learning with workplace experience enable the student to clarify career goal, to gain motivation for studying and to obtain financial assistance in one case, and to instill in the students the right work attitudes and professionalism in the other. The objective of this note is to recommend China to consider increased adoption of such systems, in facing the great needs of engineering graduates that exist today, and to encourage close co-operation with educational programs in US or in countries like Singapore.

INTRODUCTION

In recent years engineering schools around the world have began to undertake a comprehensive examination of their undergraduate and post-graduate education systems. To meet the new challenges in the 21st century, some of these institutions are seeking to broaden or even restructure the system. A high quality engineering education must be an inclusive one, in which the education process in integrated with research, and enabled by new-technology-based teaching and learning techniques [1]. Industry and university interaction has to play an important role. As examples of co-operative engineering education, a large mandatory co-operative education program at Drexel University and similar education program at Nanyang Technological University of Singapore are given. Conclusions are drawn and thereupon recommendations are presented.

CO-OPERATIVE ENGINEERING EDUCATION AT DREXEL UNIVERSITY

Drexel University has operated co-operative education for more than 82 years, allowing Students to alternate periods of full time study with periods of full-time professional employment. More than 1200 employers located in 34 different states and 11 foreign countries cooperate with Drexel by enabling students to acquire practical experience related to college studies through periods of paid employment[2]. A distinctive academic calendar of 4 quarters(terms) each year is operated. First year students (freshman) attend class for 3 terms (fall, winter, spring) followed by a summer vacation. This is the only Summer vacation during 4- or 5-year period working for their baccalaureate degrees. Beginning in the sophomore years, students attend classes or participate in co-op through all four terms. So are their pre-junior and junior year. All students attend class for three terms in their senior year before graduation. This is normal 5-year school program in Engineering College. In special cases, 4-year program leading to the same degree can be arranged. (The co-op period will then be reduced from 18 months to 6 months.) It should be noted international students at Drexel were able to participate in co-op through a special student work visa provided by the university. They got paid from the full-time professional employment to compensate part of their expense in U.S. To graduate from the engineering college with a B.S. degree, each student must complete 9 Drexel Co-op Units (DCUs), which are earned in two ways:

(1) Required classroom participation – 20-class hours in the fresh year and a five-class hour forum following the conclusion of the first co-op period. Three DCUs will be awarded.
(2) One DCU is awarded for each term of successfully completed co-op employment. For 5-year program in the engineering college, there will be 6-month co-op periods (6 terms) of professional employment. Six DCUs will be awarded.

The Drexel University's co-op program has been recently integrated with a new curriculum, known as (E)4 program (Enhanced Educational Experience for Engineers). This curriculum was based on the national action agenda for engineering education [3]. An important element of the new curriculum is the course integration that combines the learning of the basic sciences and mathematics with engineering topics. Other elements includes team teaching in several interwoven courses, introducing freshman hand-on laboratory(computer software and hardware), and emphasizing on design and communication courses. Integration of co-op with (E)4 new curriculum program represents a strenuous effort to engineering education reform [2].

OTHER CO-OP ENGINEERING EDUCATION IN THE UNITED STATES

The first Co-op program was introduced in 1906 at University of Cincinnati. To date 132 of the estimated 330 engineering schools offer co-op opportunities, most of which are optional. At only 8 universities is co-op mandatory. As far as total number of students are concerned, just under 12 % of engineering undergraduates are enrolled in co-op. [4]

NANYANG TECHNOLOGICAL UNIVERSITY'S (NTU) PRACTICE-ORIENTED ENGINEERING EDUCATION PROGRAM IN SINGAPORE

Initially established as Nanyang Technological Institute (NTI) in 1981, the school was specifi- cally for meeting the increased demands of Singapore's restructured economy. It encourages close interactions with industry through the students' industrial attachment program and the consultation services provided by its academic staff to local firms and industries in the engineering sector. The first batch of Bachelor of Engineering students graduated in June of 1985[1]. The features of this program are represented by in-house practical training for 2nd year students, as well as the professional training through an Industrial Attachment (IA)program of six months' duration during the third year. The 10-week in-house practical training is now emphasizing techno-preneurship. Students come up with marketable ideas complete with the business plan and people from the industry are invited to evaluate them.[5] In the curriculum structure at NTU all third year Engineering are required to undergo a 6-month compulsory IA to industry in the second semester . This IA training is graded and considered as partial fulfillment for the Bachelor of Engineering degree courses at NTU. The purposes of the IA are to supplement NTU's in-house practical professional training and instill in the students the right work attitudes and professionalism so that they could become effective and productive to their respective organizations much sooner than is usual for fresh graduates. The IA program is administered by the Industrial Attachment Steering Committee and the office of Professional Attachments.[6] Research has gone very fast. While they still strive to serve the current needs of industry, the university has its sight far in the future. This is demonstrated by the setting up of the new College of Life Sciences at the university.

CONCLUSIONS AND RECOMMENDATIONS

Clearly, there are advantages of co-op education over traditional educational program. The co-op improves undergraduate retention, lowers the drop out rate, understands more the career goals, better prepared for work and enhances students employment prospect, as well as being effective and productive to their respective organization. Furthermore, with the compensation from the co-op employment, students are more likely to support themselves.[2] It is therefore recommended that (1)Chinese government, along with industrial business communities, consider increasing the adoption of such educational systems in facing the great needs of engineering graduates that exist today; (2) Close cooperation with educational programs in US or in countries like Singapore are encouraged.

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INTERNATIONAL ENGINEERING EDUCATION PARTNERSHIP
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History of U.S.-China Cooperative Research in Heat Transfer 1982-1988

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ABSTRACT

This note deals with the background information of the engineering cooperative research project, the program of scholarly exchange and graduate research at Drexel University, Philadelphia, PA from 1982-88. Its objective is to promote and facilitate further international cooperation in engineering education and research. The project is in the area of heat transfer. It was officially recognized by the two governments and was the first of its kind between US and China since the normalization of diplomatic relations of both countries. The work prior to project approval was extremely difficult; however, once the project was started, the participants on either side were very enthusiastic resulting in an effective and productive working relationship. The project attracted dozens of researchers, including the academicians, professors and specialists from China to visit Drexel, developing a trend for cultural and scholarly exchange. It led to 43 refereed papers and 3 PhD theses. The cooperation was clearly beneficial to both countries. The principal investigators in China and U.S. were, respectively, Dr. Shao-Yen Ko, Institute of Engineering Thermophysics, Chinese Academy of Sciences and the author of this note.

BACKGROUND INFORMATION AND EARLY WORK

In 1973, Some Chinese-American scholars as a group visited China and were received by the Chinese Academy of Sciences in Beijing. Being a member of the group, the author had the chance to meet and discuss with Prof. Shao-Yen Ko on the topics of mutual interest in heat transfer. Ko earned his PhD degree in early 1950's under Prof. Max Jakob at Illinois Institute of Technology. Both Jackob and the author's teacher, Prof. E.R.G. Eckert, came to the United States from Germany at the end of the Second World War to lead the development of the field of heat transfer. With this common background, it was easy to communicate their viewpoint. The consensus was that, after many years of isolation, China needed more outside information to enhance and facilitate its research work. The concept of cooperative research emerged. However, China was then in the late stage of the cultural revolution and the people in the United States knew little or nothing about China. There would be long way to go to achieve cooperation.

Upon return to the States, the author made the trip information available to those who were interested in China's situation. With the encouragement from the National Science foundation, six famous professors in the area of heat transfer expressed the intention to visit universities in China. They were: Prof. E.R.G. Eckert (Univ. of Minnesota), Prof. Richard Goldstein (Univ. of Minnesota), Prof. James Hartnett (Univ. of Illinois, Chicago), Prof. Benjamin Gebhart (Cornell Univ., later Univ. of Pennsylvania), Prof. Thomas Irvine (State Univ. of New York at Stony Brook) and Prof. Warren Giedt (Univ. of California, Davis). On the Chinese side, however, the Institute of Engineering Thermophysics were not ready to issue the invitation because of the then political situation. Ko and his colleague kept working on the issue for the following several years. Finally, in 1979 they were given approval for sending the invitation. These six professors went to China in 3 separate trips in 1980 and 1981, visiting the Institute and a few universities in Beijing and Shanghai. They returned with positive views on the potential outcome of future cooperative research.

In this time period, a transient technique to measure fluid flow and heat transfer data in under steady flow conditions in 2 milliseconds was developed in the author' laboratory at Drexel University. With proper instrumentation, the flow could be utilized for studying film cooling problems in fluid flow boundary layers with high data acquisition speed. The film cooling method involves injection of a cold gas into the hot boundary layer along a solid surface. The surface is thus protected from overheating and burning. One important application is the cooling of the high temperature turbine blades. In Beijing, Ko and his group had studied the same problem using traditional wind-tunnel technique that could treat a variety of parameters and geometries. Thus, the study of film cooling provided both parties an ideal topic for cooperative research. Based on this, a proposal was written and submitted to National Science Foundation (NSF), Washington, D.C. Dr. Win Aung, the then program director for heat transfer at NSF, conducted the technical review process and approved the proposal.

Following this, it seemed opportune to discuss in broader terms cooperative work in engineering research and education between U.S. and China. In 1981, representatives from China and U.S. held a conference in Washington, D.C. They approved cooperation in engineering research and education as an additional item for inclusion in the general cooperative work between two countries. NSF approved the proposal. At a later time, The Chinese Academy of Sciences also approved Ko's proposal. Thus was born the first U.S.-China Cooperative Research in Engineering that lasted 6 years (1982-88).

SCHOLARLY EXCHANGE AND CONDUCT OF RESEARCH

Scholarly exchange, experimental measurements and student training were the center of interest of this cooperative project. In 1983, a heat transfer workshop was organized and held twice, once in Honolulu and the other in Xian. The purpose was to facilitating communication between researchers in U.S. and China. Many Chinese scholars visited the United States as a result of this cooperative activity. Many came to Drexel University. Several important milestones may be noted here:

(1) Prof. Shao-Xi Shi, Director, National Engine Combustion Laboratory, Tianjin University, came to Drexel several Times for exchange of ideas in the area of combustion. The visit led him to perform cooperative research with the author's colleague, Prof. N. Cernansky, for about 5 years in the late 1980's.
(2) Prof, Zhong-Hua Wu, Director, Institute of Engineering Thermophysics, Chinese Academy of Sciences, visited the author's Laboratory several times for discussion of cooperative research in connection with the present project.
(3) Prof. Xue-Jun Chen, Chairman, National Laboratory of Multiphase Flow, Xi'an Jiaotung University visited the author's laboratory a few times, suggesting joint supervision of Ph.D. student research. With the Ministry of Education's approval, he sent his Ph.D. candidate, Ming-Yuan Zhang to the author's Laboratory to perform thesis research (see below). This is historically the first case of joint supervision of Ph.D. research work by faculty members from U.S. and China.
(4) Prof. Bu-Xuan Wang , Director, Institute of Thermal Science Engineering, Tsinghua University visited the author's Laboratory to initiate better communication between the heat transfer communities in both countries. For problems in heat transfer augmentation, the visits of Prof. Chong-Fang Ma, currently Dean, Beijing Polytechnic University and Prof. Ying-Ko Tan, South China Polytechnic University, were worthy of note.

Joint research on film-cooling was carried out under the joint leadership of Ko and the author. Ko sent several research associates to participate in the author’s research group. The cooperative project allowed Ko to come Drexel several times during the six-year period. Thus, he was appointed as visiting professor at Drexel University to facilitate teaching and research. His associates, Dengying Liu, Jing-Zhong Xu, Yue-Ming Qiao, Yong-Qing Yao and Jingmei Li (Female) also visited the laboratory. Each person made one visit for 6 months or so without any overlap. They performed independent work such as measurements, design and construction, theoretical computation, etc. They had the opportunity to audit any course offered at Drexel University and visit the laboratories associated with any one of the six professors mentioned above. They were enthusiastic, hard working and productive as well as served as a liaison for both laboratories. A similar situation applied to Xin-Ran Duan of Lanzhou Railroad University who came to join the cooperative work with support of the Chinese government.

The cooperative project supported two or three graduated students at any given time working for their thesis research. Emphasis was placed on hands-on experimental measurements rather than theoretical computation. In this six years' period, the author also paid a few visits to Beijing' laboratory to monitor and understand the progress of cooperative studies. The research team produced 43 refereed papers.

DEGREE COMPLETED

The following persons completed their degree work in the author's laboratory at Drexel University under the support of the cooperative research project (1982-88):

(1) Shih-Jiun Chen, Ph.D., 1985. Dr. Chen is currently the professor and chairman of Mechanical Engineering Department at Temple University, Philadelphia PA. He continues to promote and perform cooperative engineering education and research with several universities in China.
(2) Amichai Baron, Ph.D., 1987. Dr. Baron continues to do his research work at a university in Israel.
(3) Ming-yuan Zhang, Ph.D., 1988. Dr. Zhang was jointly supervised by Prof. Xue-Jun Chen, Xi'an Jiaotung University, and the author. Zhang's thesis was first written in English and he first passed his doctoral defense in accordance with the academic procedure at Drexel University. The thesis was next translated into Chinese and he passed his thesis defense again at Xi'an Jioatung University where the doctorate degree was awarded. Dr. Zhang is now a full professor at the University, Ph.D. students supervising in a variety of research programs.

The following person received the degree later elsewhere:

(1) Yue-Ming Qiao. After the visit, he continued his study in Canada and finally earned a Ph.D. degree at the University of Toronto.

CONCLUSIONS

(1) The work prior to project approval is extremely difficult but it paved the way for numerous future cooperative projects, both in heat transfer and other disciplines.
(2) The cooperative work was productive and exciting.
(3) The cooperative work was more productive than originally anticipated, and provided an opportunity of mutual learning.
(4) The cooperative work has become an important milestone in U.S. – China scientific and engineering cooperation, especially since it was established and it flourished at the height of the Cold War.
(5) The important elements of effective and productive international cooperation in engineering education and research are, among others, common interest and strong desire to learn and work collaboratively from the outset. Do not give up once get an idea of cooperating.

INTERNATIONAL ENGINEERING EDUCATION PARTNERSHIP WORKSHOP
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CLP Holdings Limited (Hong Kong)

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INTRODUCTION

CLP has provided electric power service in Hong Kong and the New Territories for more than 100 years. In order to meet the challenges of our next century of service, CLP supports engineering education in the communities we serve, in order to maintain the human capabilities we will need for our business, and to support the creation and application of new knowledge in our service areas. Our support for institutions offering engineering education has included undergraduate scholarships, graduate fellowships, internships, conference sponsorship, research facilities, and sponsored research.

Liberalisation of energy markets in Asia have created new opportunities for Hong Kong-based CLP to diversify its portfolio through investments in energy generating capacity in the Chinese Mainland and elsewhere. We CLP Power China are leading private investors in electric power in the Chinese Mainland. We have ownership and operations interests in power generation systems in several other countries as well. We are actively involved in the transfer of technical staff, knowledge, and best practices from one country to another. With the diversification of our business, we are increasingly interested in international collaboration with leading institutions for engineering education. In our business, like so many others, we see that today's engineering education should help future technology leaders to meet the needs of a geographically diverse marketplace.

CLP Research Institute

The CLP Research Institute is conducting an outreach effort on behalf of our operating subsidiary companies: CLP Power Hong Kong, CLP Power China, and CLP Power International. The theme of this outreach is electricity for sustainable development. Engineering and technology play key roles in this theme. CLP Research Institute have established relationships with nearly 50 organisations, including several leading universities in Hong Kong, China, and the United States. We also invite experts from around the world to visit Hong Kong and share their insights.

Other CLP Research Institute projects include

- renewable energy systems

- sustainable development policy
- environmental performance benchmarking
- knowledge sharing
- future energy scenarios
- PowerZone web-based learning activity (targeted ages 13-16 years) (http://www.clpgroup.com/en/community/youth/PowerZone.asp)

THE DIRECTION OF ENGINEEERING RESEARCH IN A FIRST-RATE CHINESE UNIVERSITY

--- A personal Advice from a SEU Alumnus ---

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Prologue

Historically, university education has played a major role in economic development, and thereby the wellbeing of people, in any nation. In the industrialized countries, typical functions for a major university include teaching, fundamental research, and service to the society. High quality education of young people is the foundation to build a strong nation. In science and engineering, Southeast University and its predecessors have had an impressive track record of producing world-class scientists and engineers in the past. After the second-world war, particularly during the space race between the United States and former Soviet Union after the event of Sputnik, the interest in scientific research in American universities exploded. The reputation of a university in the U.S. is often rated by its accomplishments in research. In this presentation, the speaker would like to share his personal experience with the audience regarding the direction of engineering research in general, and the field of manufacturing engineering in particular.

Research Relevant to National Needs

In the 1960's and early 1970's, engineering research at universities in America was dominated by the fields of engineering sciences. Important areas to national needs at that time such as energy, environment, and productivity were either neglected or playing a second fiddle. The National Science Foundation (NSF) took an initiative to start an exploratory program called RANN (Research Applied to National Needs) in the early 1970's. The program has yielded not only a great impact on research direction at universities, but also on the whole society at large. Today in China, these issues are still very relevant to its economic development and welfare of its people. Undoubtedly, energy plays a key role in industrialization and raising living standard, and China is making a great effort in this area. However, the challenge would be how to minimize possible negative impact on environment that is also very important to people's life. As to productivity, China today is already a major player in producing commodity goods primarily due to its low labor cost. It seems advisable that universities in China may want to commit more of their research resources on production engineering, including innovations. Such an effort would speed up the process of making China a powerhouse of producing high-tech products. It would also help the nation move into the major league of modern science and technology much sooner. This obviously would depend upon how soon the Chinese universities could compete against their peers in the world, and gain an international reputation in education and research.

Criteria for Selecting Engineering Research Topics

Engineering by nature is an applied science. A key factor for evaluating engineering research depends on how much impact it may have on industry and the society. In selecting academic research topics, the following criteria are suggested:

- Relevant to industrial and social needs
- Generic, fundamental and pre-competitive
- Advancing the state-of-the-art
- Results publishable in archival journals
- Innovation is as important as archival publication

The presentation will cover some details on each aspect including an example for the purpose of illustration.

创造力开发是提高学生终身学习能力的有效途径

(Remaining text in Chinese not legible to MS Word)

Creativity Developing is an Effective Way to Increase Lifelong Learning Ability of Students

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Abstract

It is an important problem to increase students' ability for lifelong learning. According to the studies and practice in the past 10 years at Southeast University, we consider that creativity developing is an effective way to foster lifelong learning ability of students.

1. **1. The purpose of lifelong learning and the function of creativity developing**
2.

Generally speaking, the purpose of lifelong learning is to suit the developing needs of society. Our society is always changing and the needs of society for people are getting higher and higher. The process for meeting the needs of society should be not a negative and passive waiting, but a positive and initiative innovation. In order to increase students' ability for lifelong learning, we should make them unsatisfied with the present situation, and teach them to possess the capacity of sell-surpassing and self-perfecting.
Creativity developing means to release the creative potentialities of students and to strengthen their creativity through teaching and training. Creativity is active and dynamic. The chief function of creativity developing is to impel students surpassing themselves. Thus, creativity developing can achieve the goal of lifelong learning quite well. It is just the reason we regard it as the effective way to develop students' lifelong learning ability.

3. The necessity and possibility of creativity developing

We think creativity is more important than professional knowledge and skill throughout one's life, but creativity developing is still a week link at many universities and colleges in china nowadays. Our current evaluating criterion can hardly measure the creativity level of students. Our curriculum, contents of course and teaching methods can also hardly increase the creativity of students. Therefore, it is extremely necessary to develop students' creativity from the angle of deepening the reform in higher engineering education.

Creativity is a special kind of abilities obtaining new mental and material results through a certain thinking or behavior. The general principle of creativity tells us everyone has his/her own creativity. The recent achievements of cerebral science suggest that there exist huge potential power within man's brain. So we can affirm that it is obviously possible to develop students' creativity at universities.

3. The practice and effects of creativity developing

The main contents of our practice in creativity developing are as follows:
First, to understand the characteristics of students' thinking on the basis of investigation, find out the weak links, offer a special course namely Creative Studies, and carry out training of creative thinking.

Second, to guide students taking part in creative practice, produce creative results, participate in various competitions, and reveal their talents. We have already obtained evident effects in creativity developing.

On the one hand, many students have made great progress in creativity level. Some of them published articles in academic magazines, some of them got patent rights, some of them won different prizes in various competitions. They realized that"creativity has been increased obviously","abilities of sell-surpassing and sell-perfecting have been heightened" and "it will benefit us all our lives".

On the other hand, it received a favorable comment from the society. Many media, such as *China Education Daily, Xinhua Daily, Jiangsu TV Station, Jiangsu Educational TV Station*, etc. reported our work and experiences.

In short, the higher creativity a student possesses, the better effects he will get in his lifelong learning. We do believe that a student with growing creativity will have a bright future in the developing and changing times.