VI. CENTRAL INTERDEPARTMENTAL AND DEPARTMENTAL RESEARCH UNITS

To support and extend research based in academic departments, the University has established a number of research institutes and centers. Institutes promote and facilitate broad interdisciplinary research collaboration, while centers tend to be more focused. Such units advance the complementary research interests of a group of faculty and research staff, normally across traditional disciplinary boundaries.

Together with disciplinary research in academic departments, the following specialized research units provide both postgraduate and undergraduate students with opportunities to participate in leading-edge fundamental and applied research.

Research Institutes

Each research institute is managed by a Director who is responsible for programs, projects, facilities and personnel. Faculty, staff, students and visitors should contact the director if they wish to become involved in a particular program.

Advanced Manufacturing Institute

The mission of the Advanced Manufacturing Institute (AMI) is to enhance the competitiveness of manufacturing enterprise in Hong Kong. By building a synergy among the existing strengths in Automation Technology, Design Technology and Systems Integration Technology in the University and by leveraging on the unique location of Hong Kong in an area of rapid industrialization, the University is well positioned to be a major international center in global manufacturing.

The AMI's research outcomes will directly benefit Hong Kong economy through the upgrading of its manufacturing industry. This includes transferring research results to local industry, spinning off appropriate projects as stand-alone business ventures, and providing better trained manufacturing professionals.

Areas of Focus

The scope of AMI encompasses the planning, design, implementation and operation of the manufacturing industry from marketing to delivery. Research and development of AMI focus on:

- Automation Technology (including Motion Control, Sensor, Actuator, Instrumentation and Rapid Prototyping),
- Design Technology (CAD/CAM, Concurrent Engineering, Human Modeling, Design Modeling and Virtual Reality Technology), and
- System Integration Technology (Mass Customization, Supply Chain Management, System Engineering, and Environment Policy Compliance).

These technologies are key elements of modern manufacturing systems. In order to achieve world class manufacturing, all three elements above need to be strengthened.

Research Programs and Projects

Manufacturing automation technology programs include rapid prototyping/tooling, manufacturing process control, grinding technology, multi-fingered robotic hands and manipulation, special-purpose robots, robotic vision and sensing systems, fuzzy control systems, non-linear and robust control techniques for mechatronic applications, motor drive and control systems, transportation automation, industrial motion control applications.

Design technology programs include manufacturing system design, modeling and simulation for business process engineering, computer-aided design, human modeling, finite element modeling, reliability modeling of electronic packaging, design for supply chain management, concurrent engineering, design knowledge management systems, process design, CAD for quality and manufacturability.

System integration technology programs of manufacturing include mass customization, supply chain, integrating human factor, organization and technology, CAD/CAM integration systems, computer-aided process planning, computer integrated manufacturing system, quality control and measurement technology, management for new product development.

Biotechnology Research Institute

Globally, biotechnology continues to represent one of the most rapidly growing industries as a result of its propensity to provide innovative and state-of-the-art solutions to many complex issues facing the future well-being of the world and its population. As we enter the 21st Century, exciting and historical breakthroughs in basic and applied research await us just over the horizon. These critical advancements and their immediate applications to the medical, agricultural, food, energy and environmental sciences will ensure the continued outgrowth of the biotechnology industry. Noting the rapid pace by which biotechnology products are being developed, the future growth and expansion of this industry will most assuredly have a profound impact on the future health and well-being of humankind, as well as the world's economy. In light of these developments, many countries have begun to recognize the importance of building-up their existing biotechnology base. From its inception, HKUST has made development and advancement of biotechnology one of the primary research initiatives of its faculty. With intuitiveness, HKUST in 1990 established the Biotechnology Research Institute (BRI) using a generous donation of $130 million from the Hong Kong Jockey Club.

The mission of the BRI is to assist Hong Kong in developing a strong biotechnology industry through recruitment of outstanding and motivated faculty, training of professionals, expansion and continued development of state-of-the-art research facilities, support of basic and applied research in relevant areas of science, and further development and enhancement of promising biotechnology products. Additionally, the Institute has assumed a committed and supportive role for the development of enabling technologies, such as DNA array and integrated biochips, which are key capabilities vital to establishing a globally competitive biotechnology industry in Hong Kong. The focus of BRI research and development interests and expertise include :

Traditional Chinese Medicine (TCM)

- to provide scientific verification of the effects of TCM
- to discover lead compounds for new drug development
- to evaluate the efficacy and safety of TCM
- to develop methods and protocols for TCM quality assurance and reformulation

Neuro-Proteins

- to discover novel neuro-proteins and elucidate their cellular functions and molecular interactions
- to identify potential therapeutic and diagnostic approaches to neuro-diseases

Protein Engineering and Design

- to elucidate the pathways of protein folding and the structural basis of protein stability so that therapeutically useful proteins with improved properties can be designed.

Plant Biotechnology

- to produce transgenic crop plants that can better withstand the environmental stresses inherent to this region, and bring about improvements to the agricultural economy of the region.

Additionally, BRI actively sponsors several research facilities essential for conducting cutting-edge biotechnology research:

- Plant Growth Facility
- Fermentation Facility
- Microscopy Facility
- Nuclear Magnetic Resonance Facility (500 MHz & 750 MHz)
- Animal Care Facility
- High-Throughput Drug Screening Facility
- Molecular Biology Facility
- Genechip Facility
- Combinatorial Chemistry Facility

Currently, BRI maintains worldwide affiliations with universities, research institutes and industrial entities, as well as serving as a supporting institution for the newly formed International Molecular Biology Network for Asia and the Pacific Rim (IMBN).

BRI's web site address: *(http://www.ust.hk/~bri)*

Europe Institute

The mission of the Europe Institute - an umbrella organization focused on science, technology, and management - is to promote academic exchange and R&D collaboration with European universities, research institutes, and corporations. It provides a foothold for European institutions seeking to establish a strong, long-term presence in China or East Asia - especially in academic research, applied R&D work, technology-based manufacturing, and the service industry.

Two national centers are formed under the Institute: the German Center and the French Center. Activities of these Centers include:

- faculty collaboration involving short-term visits
- long-term collaborative research projects
- student exchange, particularly at the graduate level
- collaboration on contract research and R&D projects

Europe Institute's Website : http://www.ust.hk/ei

Hongkong Telecom Institute of Information Technology

This Institute was founded with a grant of $65 million from Hong Kong Telecommunication Limited. The concept of the Institute is based on the recognition that in future there will be no economic development, no industry or commerce, no service or manufacturing capability of any significance without the full utilization of telecommunication and information technology. All Schools at the University are involved in the research activities of this Institute. At present, the Institute is sponsoring five major research programs, namely lightwave technology, network technology, wireless communication, video technology, and human language technology.

Undergraduate scholarships and postgraduate research assistantships are also offered through the Institute, and certain members of the academic faculty are designated as Institute Fellows.

Institute for Environment and Sustainable Development

Hong Kong has made the improvement of its environment a high priority to ensure sound future development. HKUST has contributed to this effort over the past years through its Institute for Environment and Sustainable Development and through the collaborative efforts of the staff and students in the participating departments. Over 40 projects have been carried out for a total funding of over $35 million in collaboration with governments and industries in Hong Kong, China and Southeast Asia. The projects cover air and water pollution, marine coastal zone management, cleaner production for Hong Kong and China's industries, eco-labelling for Hong Kong, remote sensing and environmental GIS studies, to name but a few.

The change of name to "Institute of Environment and Sustainable Development" (IESD) as of 1 April 1997 is deliberate. It emphasizes that the philosophy of the Institute is to support development necessary for a growing population and an increasing standard of living, but to ensure as much as possible that such development is carried out in a "substainable" way, that is, in harmony with our environment.

IESD, in collaboration with the Department of Chemical Engineering has started a newly funded project by the Hong Kong Jockey Club to build Mobile Real-time Air Monitoring Platform (MAP). This is an advanced system for the measurement of gaseous air pollutants, volatile organic compounds, and various aerosols properties and compositions while in transit. MAP will be important in understanding the dynamics and mechanisms of atmospheric pollution. In collaboration with the Departments of Biology and Chemical Engineering, a program in bioaerosols has been initiated. Bioaerosols are of primary importance in Hong Kong because of the high temperature and humidity in the summer.

The Pearl River Estuary Pollution (PREPP) is a joint project between HKUST's IESD and CCAR (Center for Coastal and Atmospheric Research) and several partner institutions in the Mainland. Its objectives are to improve our scientific knowledge of the physical, chemical and biological ecosystem of the estuary.

Institute of Integrated Microsystems

The Institute of Integrated Microsystems (IIMS) was established in January 2001. It is a new initiative based on the prior success of the Institute of Microsystems (IMS), which was active from 1994 to 2000.

The main objective of IIMS is to coordinate the frontier research across campus on micro-sciences and micro and nano technologies. Involving about 40 faculty in both the School of Engineering and School of Science at HKUST, the current activities include micro and nano fabrication technology and applications of MEMS, MOEMS, various types of sensors, actuators, and bio-chips; micro and nano tribology, micro-heat transfer, micro-dynamics, thin films and ER fluids, micro-fuel cells, micro machining and micro-assembly, packaging and bio-chips.

IIMS is enhancing the infrastructure for the fabrication and characterization of micro and nano systems at HKUST. It will facilitate interdisciplinary projects, and promote interaction with local industries and collaboration with institutions in the Chinese Mainland and overseas.

Institute of Nano Science and Technology

Mission
The Institute of Nano Science and Technology (INST) aims to pursue world-class fundamental research in the area of nanostructured materials, to create critical interdisciplinary opportunities, to train human resources, and to partner with local and regional industry for technology transfer of research results.

Goals

- To forge a multidisciplinary collaborative team, and through the synergism of materials synthesis, experiment/characterization, and theory/simulation, to generate new knowledge in the physics and chemistry of nanostructured materials and their attendant properties, with an eye toward industrial applications.
- To strengthen scientific interactions with other local research groups and top research groups around the world in nanostructured materials.
- To educate students in the science and technology of nanostructured materials, and to disseminate the most up-to-date discoveries and their implications to the general public.

Research Programs

Nanostructured materials constitute a field of immense diversity. In order to be effective in obtaining the best results with limited resources, INST intends to focus its research in the following three areas of existing strength.

(a) Ordered nanostructures

At HKUST, we have successfully fabricated the world's smallest carbon nanotube arrays by means of using zeolite crystals as templates. We are also the world's first to discover room-temperature UV lasing from zinc oxide nanocrystal arrays. With the additional support of INST, organized efforts will be mounted to study the fascinating electrical and optical properties of quantum wires as represented by the 4.2-Angstrom carbon nanotubes, and to understand the role of strong electron-electron correlation in the measured characteristics. We also intend to fabricate, by using either the atomic force microscope or the chemical means, ordered two dimensional nanostructures. These structures are expected to exhibit exotic physical characteristics such as the Giant Hall effect, which could have potential applications.

(b) Composites and polymeric systems

A new type of materials systems, consisting of multiply-coated microspheres ranging from 0.5 micron to 50 microns in diameter, was conceived and successfully fabricated at HKUST. These microspheres exhibit not only record-setting electrorheological yield strength under an applied field, but can also form mesocrystals that undergo field-induced structural transitions. Future directions include the realization of photonic crystals by using these coated spheres, and fabrication of coated microrods for application in electrorheological fluids. In polymeric systems, polymers with biomemetic nanostructures were successfully synthesized. We would like to explore the use of these polymers as templates for the formation of novel materials. In addition, we intend to pursue the study of polymers in nanosized confined spaces, a topic that can yield potentially significant insight into polymer dynamics that deviate from th bulk.

(c) Semiconductor heterostructures
A new type of UV detector, using zinc sulfide heterostructures, was successfully demonstrated. This UV detector exhibits not only superior performance, but also lower cost of production. It is now in the commercialization stage. Fundamental questions, such as the role of the isoelectronic center and band-bending, are to be addressed in future research. In III-V semiconductor systems, a new and unified framework has been proposed to explain and predict the current oscillation behavior observed in the vertical electrical transport of the GaAs/A1As superlattice system. Based on the phenomenon of negative differential resistance, the theoretical framework allows the possibility of chaotic oscillations. Such possibility, as well as their physical and technological implications, will constitute part of the research program to be pursued under INST.

In all the research programs, the synergy of theory/simulation, experimentation/characterization, and material synthesis will be the basic driving force that insures their progress and eventual success.

Shenzhen Institute

Hong Kong and Shenzhen will become a twin-city and the core of a great metropolis in South China. It is only natural for a university designed to enhance the economic and social development of Hong Kong and its region to contribute to the building of a strong partnership across the border.

Funded mainly by the Shenzhen Municipal Government, and under the banner of "Peking University (PKU) - Hong Kong University of Science and Technology (HKUST) Academic Alliance", a base has been established in Shenzhen's High-Tech Industrial Park to offer executive education programs, house applied R&D projects, and incubate technology enterprises. Also, a "Shenzhen PKU-HKUST Medical Center" is being built, and a multi-partner law program is being planned. These peripheral activities round out HKUST's very focused core programs in teaching, research, and public service.

This Shenzhen Institute coordinates HKUST's participation in all these activities.

Sino Software Research Institute

The Sino Software Research Institute (SSRI), established in July 1992 with a $20 million grant from the Sino Land Co., Ltd., has the dual aims of supporting software research that can lead to practical applications, and providing assistance in transforming those applications into useful products.

The Institute sees its primary role as that of a catalyst, helping software research projects reach the critical phase in which ideas may be translated into prototypes that can be evaluated using large-scale trails. The Institute also encourages development efforts in areas that are relevant to the economic and social development of Hong Kong. One such project is the "Hong Kong SuperNet", which has made full Internet access available to the public, an important step towards maintaining Hong Kong's status as a regional communications center.

Beyond its interest in software research and development, the SSRI also provides technical and consultative help to local businesses as they seek to implement the latest software technologies. As part of this effort, the Institute sponsors conferences, workshops, seminars and lectures on software topics related to the needs of businesses and public institutions. Examples are the 16th IEEE International Conference on Distributed Computing Systems and the 10th International World Wide Web Conference which were held in Hong Kong in May 1996 and May 2001 respectively. Both are flagship conferences in the areas.

Transportation Institute

Hong Kong must continually upgrade its transportation services and infrastructure to maintain mobility of people and freight. The Transportation Institute is making a contribution through human resource development and R & D partnerships. Its mission is to become an acclaimed world-class Institute, offering education, training and research programs to international standards of excellence while, at the same time, providing services to the transportation industry in Hong Kong and the region. In consideration of needs and opportunities, the Transportation Institute is strategically focusing on systems engineering and technology aspects of:

- passenger transportation systems (urban, regional and international)
- freight systems and logistics (regional and international)
- economics of transportation (passenger and freight)

Research Centers

Center for Asian Financial Markets

The Center for Asian Financial Markets is formed to develop a data and knowledge base on Asian financial markets to facilitate research and the dissemination of knowledge and expertise. It will also provide an academic interface with government and business. Activities will include publications, provisions of expertise, development of new data and teaching materials, a bi-annual newsletter, a working paper series, seminars and public lectures, executive education, consulting services, and contract research.

Center for Cultural Studies

The Center aims at achieving the following objectives:

- bring more cohesion to the interdisciplinary nature of the Humanities and Social Science programs;
- stimulate research and intellectual discussions from a global perspective through conferences, workshops and seminars;
- serve as a regional impetus for contemporary cultural and social criticism in Hong Kong and other Asian societies;
- bring visibility to our program, attract prominent scholars, and facilitate future efforts in obtaining funding for scholarly activities; and
- provide intellectual underpinnings for the University's artistic and cultural life.

Center for Economic Development

Formally established in 1995, the Center for Economic Development promotes strong research programs concentrating on the study of economic development, particularly in the Asia-Pacific region. Emphasis is given to the study of topics such as China's economic reform and open door policy; the economic integration of Hong Kong and Pearl River Delta; the emergence of regional economies in China, in particular the region comprised of the southern coastal provinces. The Center also supports theoretical research on economic growth and transitional economies, and has been active in public policy debates in Hong Kong.

Center for Electronic Commerce

The mission of the Center is to advance the theory and practice of conducting business over an electronic media with an aim to contribute to the economic development of Hong Kong by :

- Enabling Electronic Commerce through frontier research in the integration of technology, organization, and market structure;
- Upgrading the manpower of Hong Kong through high-end executive and online programs on Electronic Commerce topics; and
- Collaborating closely with industrial partners to transfer and assist implementation of technologies and process innovations developed by the center.

Center for Energy and Thermal Systems

The mission and objectives of the Center for Energy and Thermal Systems (CETS) are: (i) to provide a state-of-the-art facility for education and training of students in energy science and technologies; (ii) to perform leading-edge research in green thermal systems for energy efficiency and conservation; and (iii) to provide certification services for energy efficiency tests of electrical appliances.

Areas of focus include: (i) Electronic cooling (heat pipes, cryogenic cooling); (ii) Air-conditioning and refrigeration (trancritical CO2 cycle, energy storage systems, compact heat exchangers, dehumidification, indoor air quality, clean room technology); (iii) Fire and waste incineration (smoldering combustion, porous combustors); and (iv) Fuel Cell.

Center for Experimental Business Research

The mission of the Center for Experimental Business Research (cEBR) is to promote the use of experimental methods in business research, expand experimental methodology through research and teaching, and apply this methodology to solve practical problems faced by firms, corporations, and governmental agencies.

The Center focuses on three main areas:

- Experimental work concerning the dialogue between experimenters and policymakers. Experiments in this category are motivated by questions raised, for example, by government agencies about the effects of new policies on some markets.
- Experimental work motivated by well-articulated formal theories.
- Experimental work motivated by interesting unexplained business phenomena.

Recent research activities include:

- Bargaining, coordination, and public good provision in experimental markets
- Strategic uncertainty in market entry games with fixed capacity
- Alternative mechanisms for reducing exploitation of uncertain resources
- Value of information in bilateral trading with alternatives
- Experimental investigation of bargaining efficiency improvement
- Sequential search with relative ranks

cEBR web page address: http://cebr.ust.hk/

Center for Medical Diagnostic Technology

The Center for Medical Diagnostic Technology (CMDT), established in February 1998, serves as a platform for interdisciplinary research in biomedical-related technologies between the School of Science and the School of Engineering. It aims to promote interaction among research groups in the two Schools and to seek partnerships with industries for the development of new and innovative micromedical devices.

Current R & D activities include:

- Biosensors: Development of electrochemical and optical sensors for rapid measurement of biochemicals in body fluids and detection of micro-organisms.
- Cell/Tissue Sensor Technology: Development of impedance spectroscopy sensors for high-throughput pharmaceutical screening of effectors in complex herbal extracts and for quality control of Traditional Chinese Medicine.
- Medical Imaging: Development of non-invasive technology for diagnosis of diseased soft tissue based on optical and ultrasound imaging.
- Medical Electronics: Development of signal acquisition and processing strategies for cost effective and portable medical instruments.

Center for Scientific Computation

Scientific Computation has grown over the past decades to become an important new approach to studying science and technology, adding to the traditional experimental and theoretical approach. It uses large scale computation to solve complex problems in science and technology. The Center is dedicated to the development and innovation of computational algorithms that are reliable, accurate and efficient, with attention to their applications. There are 39 participating faculty members from 10 academic departments. Current research programs include computational fluid dynamics, computational logistics, computational finance, parallel computation, computational hydraulics, computational chemistry and biology, simulation of complex systems, and software development.

Center for Wireless Information Technology

Wireless information technology is undoubtedly the technology of the future. It is essential for Hong Kong tertiary institutions to play a leadership role in this area of applied research and lay the foundation for future technological advancement. To meet this challenge the Center for Wireless Information Technology (CenWIT) was set up in September 1997 at HKUST. The mission of CenWIT is to establish a center for wireless information technology which:

- Performs high caliber research and development;
- Offers excellent training and education for undergraduate and graduate students;
- Provides technology transfer and consultant services for industry and government; and
- Addresses unique issues confronting the Asia Pacific region and China.

CenWIT is currently funded by several sources spanning government, industry and also HKUST. It relies on facilities in the Department of Electrical and Electronic Engineering, including the wireless communications, DSP and communication, and the video technology laboratories.

Consumer Media Center

The Consumer Media Center (CMC) is concerned with helping local industries in areas of research and development. It creates a closer link between the University and the home electronics industry. By developing or enabling new technology on a medium scale timeframe, and demonstrating the technology in a working platform, the CMC is able to transfer this technology quickly and efficiently to local companies for the development of new and exciting products, thus helping Hong Kong industry to move into heavier design oriented products. CMC is supported by the Innovation and Technology Support Program of the Hong Kong Government's Innovation and Technology Fund, company members, and the HKUST.

Hainan Center

Work of the Center focuses on Hainan Province as a base for academic research and applied R & D. The aim is to strengthen these areas of activity at the University, contribute to the economic development of Hong Kong and its region, and enhance Hong Kong's involvement in the development of Hainan. Objectives of the Center are :

- to obtain a profound understanding of the natural, social, technological, and economic conditions and prospects of Hainan; and
- to undertake applied research and executive education in : agriculture and mariculture, environmental studies, economics and managment, and other fields.

The Center has a joint laboratory in Sanya. Projects include applications of biotechnology in mariculture, introduction of modern agricultural technology, air pollution monitoring, satellite monitoring of the marine environment, executive education for government and business leaders, and joint organization of international conferences.

Hang Lung Center for Organizational Research

The mission of the Hang Lung Center for Organizational Research is to improve the practice of management in Chinese and multinational firms doing business in Greater China (i.e. Chinese Mainland, Hong Kong and Taiwan), and Chinese companies doing business globally, by conducting rigorous research and engaging in exchanges among network of business leaders and university scholars. Our vision is to be the world's center of excellence for knowledge on China-related organizational and management practices.

Our objective is to facilitate, sponsor and publish high quality research on organization and management issues within the Greater China context. We also offer workshops on modern research methods in managment. The Center represents an effort to apply the department's emphasis on rigorous academic research to addressing pressing management challenges of business and other organizations in the region. By studying critical organizational issues and discovering factors related to effective management of organizations in this context, we hope to contribute to knowledge creations as well as the economic development of the Greater China region.

Molecular Neuroscience Center

Neuroscience, the study of the brain, constitutes one of the leading areas of scientific investigation currently at the forefront of modern biomedical research. The field of neuroscience encompasses many scientific disciplines dealing with the structure, development, regeneration, function, chemistry, pharmacology and pathology of the nervous system. One of the field's major areas of scientific investigation relates to the unraveling of the processes involved in neurodegenerative diseases. By understanding the mechanisms involved in the progression of these diseases and other neuropathologies, scientists hope to identify novel molecular targets useful for the development of novel and effective therapies and diagnostics.

Established in 1999, the Molecular Neuroscience Center (MNC) has the mission to obtain international recognition as a center of excellence for its scientific contributions to the field of molecular neuroscience relating to the areas of: (i) brain function, (ii) neuropathies, and (iii) neuro-drug discovery. By establishing basic research collaborations among its team scientists, as well as with other leading international neuroscientists, the Center aims to provide a vehicle for strong scientific exchange and ultimately to attract new pharmaceutical ventures to Hong Kong.

The research activities of the MNC are being directed at the use of molecular biological approaches to investigate various neuronal processes including: (i) neuronal differentiation and cell cycle regulation, (ii) synapse development and regeneration, (iii) cellular signal transduction in neurons, (iv) neurodegenerative diseases, and (v) learning and memory.

The Center also investigates the structure-function relationships of neuroproteins that are found to play critical roles in these neurobiological processes. Furthermore, the MNC scientists are developing strategies for screening and/or designing potential neuro-drug candidates.

Currently, the Center is comprised of multidisciplinary group of faculty from the Departments of Biochemistry, Biology, Chemical Engineering, Chemistry, Electrical and Electronic Engineering, Mathematics, Mechanical Engineering, and Physics.

Multimedia Technology Research Center

The Multimedia Technology Research Center (MTrec) aims to stimulate university-industry collaboration and to promote technology transfer to local industry as well as to maintain world-class academic excellence. Housed in a state-of-the-art facility with high-performance audio-visual and computing equipment, the Center is funded by several research grants from the funding agencies and industrial partners. The Center is a home of more than 40 personnel, including faculty members from the Department of Computer Science and the Department of Electrical and Electronic Engineering, research scientists, engineers, and graduate students. The Center is launching a research initiative with an emphasis on audio/video processing and communication for multimedia applications that will bring unprecedented power and versatility in information technology in Hong Kong and the region during the 21st century.

Major research projects :

- An infrastructure for MPEG-4 based interactive multimedia systems, including encoding, decoding, authoring, presentation and communication;
- High performance MPEG-2 video compression for real-time and non-real-time environments;
- H. 263 based videophone and video conferencing systems for internet communications;
- Very low-bit-rate video coding;
- Content-based modeling, indexing and presentation;
- HDTV video encoding and decoding;
- Efficient motion estimation algorithms;
- Cost effective VLSI design for video compression;
- Video transmission over the Internet, ATM, and other broadband networks;
- Mobile image/video transmission for wireless multimedia communications;
- Multimedia and Internet resource management;
- Scalable video servers;
- Watermarking for images and video;

Shui On Center for China Business and Management

The Shui On Center for China Business and Management has been established by the School of Business and Management (SBM) of the Hong Kong University of Science and Technology (HKUST) with the sponsorship of Shui On Holdings Limited. The Center aims to promote and sustain academic-business collaboration through management development programs, industry forums, applied research, and case development projects related to China business and management. The ultimate goal is to advance and disseminate our knowledge and understanding of China business and nurture top caliber China business managers and entrepreneurs with business interests in China.

South China Research Center

The South China Research Center was established in 1997 to serve as the nodal center for scholars and institutions in South China studies to exchange findings, share archival and folk documents, hold conferences and organize field research in South China.

The Center collaborates with specialists in South China studies to collect source materials that are not available in libraries or archives, to publish research aids, and to organize workshops and field-site visits. Its newsletter, published quarterly and on the World Wide Web Home Page, promote intellectual dialogues and exchanges.

The Center provides a research environment and training programs for undergraduate and postgraduate students. It also acts as a resource center for teachers, students and the public to explore the teaching and learning of the history, culture and society of Hong Kong and South China.

Survey Research Center

Established in 1999, the Survey Research Center promotes and coordinates survey research projects in Hong Kong and the Chinese Mainland. Its long-term goal is to serve as an international forum for scholarly debates and exchanges based on survey and other researches on Chinese societies. Current activities include a summer research practicum program for graduate students in the School of Humanities and Social Science, a survey data archive on Chinese societies, collaborative research with Zhongshan University to study social change and regional development in Hong Kong and Guangdong, and a short-term training program offered to young survey researchers from the Chinese mainland.

Center for Coastal and Atmospheric Research

The Center for Coastal and Atmospheric Research is more than a place to collect the existing relevant facilities and to get together faculties and researchers with common interests in coastal and atmospheric research. The main objective is to develop additional capabilities based on the existing strength. The Center strives to achieve the following specific objectives:

- To facilitate the generation of high quality and interdisciplinary research by bringing together collaborators from various internal and external units and disciplines.
- To develop science application at the highest quality for the benefit of society.
- To act as a focal point for HKUST for relevant external matters.
- To provide leading-edge infrastructure support for field data collection, data communication and analysis relevant to the research and development tasks.
- To seek institutional and external support for manpower, equipment and general expenses.

Major research activities will include, but not limited to, the following:

- Coastal environmental studies
- Large scale modeling for coastal water and estuaries
- Coastal engineering
- Meteorology and society: aviation meteorology, real-time application for coastal and atmospheric research
- Study and modeling of atmospheric dispersion and air quality
- Coastal and atmospheric research data center for remote sensing, radar meteorology, analysis and data assimilation
- Numerical simulation and prediction of regional and local circulation
- Marine natural products and marine ecotoxicology

Cooperative Nasopharyngeal Carcinoma Research Center

The Cooperative Nasopharyngeal Carcinoma Research Center is supported by the Research Grants Council (RGC) Central Allocation for Group Research. Its members are from the Hong Kong University of Science and Technology, the Chinese University of Hong Kong, and the Hong Kong Baptist University. The objectives of the Center are to enhance our understanding of fundamental aspects of nasopharyngeal carcinoma (NPC) development and treatment. Joint projects will be focused on understanding the molecular genetic basis of NPC development, the development of novel molecular diagnostic assays for detection and management of NPC patients, and the development of photodynamic therapeutic drugs as an alternative modality for treatment.

Cooperative Research Center for Soluble Receptor Biology

The establishment of the Cooperative Research Center for Soluble Receptor Biology is to develop cutting-edge technologies for soluble receptor related biomedical sciences, and translate basic research into medical applications. As receptors are mediators of cellular signal transduction and targets of therapeutic compounds, they are of especial interest in life sciences. Recombinant soluble receptors and their antibodies to be generated by the Center will serve as potentially important diagnostic and therapeutic agents, as well as useful research tools. The Center will facilitate the translation of biological research output into industrial applications, thereby benefiting Hong Kong biotechnology related industries.

High-Throughput Drug Screening Center for Traditional Chinese Medicine

The Biotechnology Research Institute's High-Throughput Drug Screening Center for Traditional Chinese Medicine (TCM) is supported by the Innovation and Technology Fund and matching industrial funds. Established in late 1999, the Center utilizes state-of-the art technologies and drug screening platforms for the identification of biologically active compounds from TCM. The build-up of an integrated high-throughput drug screening capability will offer regional and international biotechnology and pharmaceutical companies the opportunity to tap into the therapeutic wealth of TCM. Furthermore, the Center will perform in-house screening projects to identify novel lead compounds for the treatment of neuro-related diseases including stroke, pain, epilepsy and a number of neurodegenerative diseases. Currently the Center has a number of ongoing, high profile collaborations with major biopharmaceutical companies in areas of high impact. These strategic partnerships provide the Center's researchers with international forums which facilitate the exchange of scientific knowledge as well as technology generation. As a result, the Center engages in critical activities that are essential for maintaining its international competitiveness.

Hong Kong Bioinformatics Center

With an initial funding support from the Hong Kong Government Industry Department, the Hong Kong Bioinformatics Center was established in 1997 jointly by the Department of Biochemistry, HKUST, and the Chinese University of Hong Kong. The Center provides the computational equipment and technical expertise necessary to make available to the Hong Kong biotechnology community the molecular biology and biotechnology oriented databases and bioinformatics software that are essential to the continued development of cutting-edge biotechnologies. The Center is a member of the Asia Pacific Bioinformatics Network (APBioNet). The establishment of the Center will be proven to contribute to life science and biotechnology advancement in Hong Kong, thereby allowing Hong Kong to take its proper place in the region and in the world. A specialized database developed by the bioinformatics team at HKUST was featured in the Science, 11 February 2000.

Active Matrix Organic Light Emitting Diode Displays Cooperative Research Center

Though Hong Kong has a thriving display industry involving both production and usage of displays, most of the products are low-end and the industry needs technology upgrades to remain competitive. Among an array of potential contenders, organic light emitting diode (OLED) has been heralded as the display technology of the future. The Active Matrix Organic Light Emitting Diode Displays Cooperative Research Center is established with funding support from the Research Grants Council to (1) perform research in OLED technology, (2) perform research in related low temperature thin-film transistor technology and (3) work with local display manufacturers to produce proto-type active matrix OLED displays. This will form the basis for further investments in active matrix OLED manufacturing in Hong Kong.

Advanced Cement-Based Building Products Cooperative Research Center

This Cooperative Research Center (CRC) has been established to develop innovative cement-based building products such as functional building components and the light-weight, heat resistant, and acoustically insulating wall panels. One major objective of the CRC is to build up a close relationship with local industries through exchanging the expertise of the Center (new products development) with the experience of the industry partners (matured management and manufacture mode). Under such a close cooperation, the products developed in this CRC will be very practical and ready for mass production. Thus, the results of this CRC will be of significant benefit both to Hong Kong generally and to the building industries in particular.

Postgraduate research assistantships are offered through the funds of the Center. The research assistants will be trained not only with academic merits but also industrial experiences.

Advanced Composite Materials for Infrastructure Repair Cooperative Research Center

This Cooperative Research Center is funded by the Research Grants Council and an industrial partner (Lit Cheong Group Ltd). The objective of this CRC study is to establish an engineering knowledge base in advanced composite materials for infrastructure repair. The aims are to develop new repair technologies using advanced composite materials and to set design guidelines for concrete structure repair. This project will involve collaboration among universities, industry and government.

In this CRC study, we will focus on the repair design and application procedures. The materials system can be application specific. Carbon will be the reinforced fibers with epoxy resin being the matrix. We will investigate beams and columns. Efforts will also be made to establish a quality assurance policy for using composite materials in onsite repair of infrastructures. Advice will be sought from related government departments such as the Buildings Department, the Highways Department, the Housing Department and the Architectural Services Department. Training courses or seminars will also be organized to facilitate knowledge transfer to the end users.

Advanced Electronic Packaging and Assembly Cooperative Research Center

The Advanced Electronic Packaging and Assembly Cooperative Research Center (AEPACK CRC) is supported by the Research Grant Council (RGC) CRC Program and matched by industrial funds. The objective of the Center is to develop advanced electronic packaging and assembly (EPACK) technologies that benefit Hong Kong electronic industries. The current focus of the Center is to develop low-cost flip-chip on printed circuit board (FCOB) technology for single and multi-chip packages. FCOB technology enables electronic manufacturers to produce smaller electronic devices, such as wireless handset and personal digital assistant, with higher performance and better reliability.

ATM/IP Telephony Solution Cooperative Research Center

In the future, communications network infrastructure will have to support diverse services. Two technologies, namely Asynchronous Transfer Mode (ATM) and the Internet Protocol (IP), hold potential promise. The ATM/IP Telephony Solution Cooperative Research Center aims to conduct timely research and prototyping with industry participation on the support of voice/telephone communications over ATM and IP. The major objectives of the Center are two-fold: (i) to develop a step-by-step voice-over ATM and IP solution, which can provide service quality by taking advantage of their respective unique strengths; (ii) to create a prototype based on the proposed techniques in partnership with industry. In addition, technology transfer will be considered as the project progresses.

This project is a multidisciplinary one. Our team consists of five professors from the Departments of Electrical and Electronic Engineering and Computer Science of HKUST, and a few engineers from China Motion Telecom.

Automation Technology Cooperative Research Center

The Automation Technology Cooperative Research Center is dedicated to research and development of technologies for manufacturing and industrial automation. Its goal is to become an internationally reputed center encompassing basic research on fundamental theory of automation systems, development of new technologies and products for industrial automation, and the promotion of applications of new technologies for manufacturing industries in the region.

Center for Display Research

The Center for Display Research (CDR) was established by the Hong Kong Government Industry Department at HKUST in August of 1994. The goal of CDR is to provide basic research support for the local Liquid Crystal Display (LCD) industry. So far, funding support of CDR has reached HK$30 million. Most of the funding was used to establish a unique LCD laboratory with active matrix fabrication capabilities. CDR concentrates on many areas of display research such as thin-film-transistor materials and devices, circuit design, new display schemes, optical-system design, microfabrication technology, liquid-crystal material development, and chip-on-glass packaging technology. Many faculty members from the Departments of Electrical and Electronic Engineering, Physics and Chemistry are involved in CDR. They have collectively published over 200 journal papers and applied for 15 US patents during the past 3 years. Several technologies have been transferred successfully to local industry.

Construction Research Center

The growth boom in Hong Kong and most of Asia is supported by the construction sector. The Construction Research Center is established with the following objectives: firstly, to develop technically sound innovative design and construction methods that will reduce time and cost of construction without sacrificing quality and safety, and secondly to stimulate University and industry collaboration and accelerate technology transfer with a three-way co-operation between University, government and industry in construction research project. The Center expects to generate gradual industrial support to become financially self-sufficient in the near future. Phase I of the Center is focused on the Geotechnical Centrifuge Modeling. Strategies include: (i) a start-up project, (ii) setting up a research consortium, and (iii) the establishment of a training scheme for graduate students and young practitioners.

Cyberspace Center

The Cyberspace Center was established in March 1996 with a grant from the Hong Kong Government Industry Department. The Center aims to help local industries and businesses to make effective use of the Internet in improving their competitiveness in the world market. To support this goal, the Center provides services in terms of promotion and training, and participates in research and development with the objective of transferring the technology to local industry.

Services include conducting seminars and workshops, developing handbooks, and maintaining websites on various current Internet technologies such as network security, e-commerce, mobile e-commerce, smart card technology, and mobile phone technologies.

Our current projects include smart card over the Internet for authentication, and PKI-secure infrastructure and applications for mobile commerce in both mobile phone and wireless PDA environments.

Internet Switching Technology Center

The Internet Switching Technology Center is funded by the Research Grants Council (RGC) Cooperative Research Centers (CRC) program and matched industrial funds. The goal of the Center is to develop the key switching technology for the future Internet. The current focus of the Center is to develop a switching fabric chipset that can be used for routers and switches. Another focus is to develop an optical crossconnect for multiple-wavelength-division (WDM) transmission facilities.

Semiconductor Product Analysis and Design Enhancement Center

The Semiconductor Product Analysis and Design Enhancement (SPADE) Center is playing a vital role in building the basic infrastructure to support local semiconductor companies as well as to help attract non-local semiconductor companies to establish design and development offices in Hong Kong. The SPADE Center is providing services to these companies. It analyzes their designs and products when their silicon prototypes are available in the form of silicon wafers or silicon dies. Design and product errors are debugged, corrected, and optimized, such that high value semiconductor products are produced.

The total funding for the establishment of the Center, including equipment and manpower needed to run the Center, is approximately HK$15 million under the sponsorship of the Innovation and Technology Fund (ITF), complemented by HK$2.4 million of support from more than 20 local semiconductor companies.

Applied Technology Center

One of the objectives of the University is to assist in the economic and social development of Hong Kong. Too often, there is a gap between the results of academic research and an opportunity that industry recognizes, accepts and can use for commercial benefit.

The Applied Technology Center is intented to facilitate the process by which technology is transferred across the interface between the University and industry. The staff of the Center provide project management and technical skills and draw upon both the human and physical resources of the University and funding opportunities to develop and add value to the results of research that have commercial potential for Hong Kong. Technology will be transferred both to enhance existing businesses and to assist new start-up companies.

Central Research Facilities

Advanced Engineering Materials Facility

Established in 1994, the Advanced Engineering Materials Facility is a multi-disciplinary central research facility located at Hong Kong University of Science and Technology. Its mission is to provide state-of-the-art research equipment and technical expertise for HKUST as well as Hong Kong industries to develop advanced engineering materials technology and their applications. Research areas of the Facility include processing, microstructural design and new materials development, non-destructive testing and failure analysis, applied mechanics and testing methodology.

The Facility engages in the training of graduate students and researchers in advanced materials technology, and in international exchanges. It also organizes seminars, workshops and conferences to disseminate knowledge of recent developments in the latest materials technology to the industry.

Animal Care Facility

Animal Care Facility (ACF) is located on the seventh floor of the Laboratory Wing occupying a total area of about 600 square meters. It is a facility for breeding conventionally reared laboratory animals and holding of these animals for experiments. The air-conditioned Facility contains ten animal holding rooms, an operation theater, a quarantine room, a nude mice room, a procedure room, a cage washing room, a bedding dispensing room and a diet store. ACF provides professional and humane handling of animals selected for biomedical research activities at HKUST. The animals held in ACF are receiving the highest standard of health care and compassionate treatment, and all the experimental protocols on animals are approved by the Animal Care Advisory Committee of the University. ACF supplies and maintains several common strains of mice, rats, rabbits, chicks. ACF's technical staff are well trained and they are prepared to provide support and advice to researchers on their animal experiments including surgery, drug administration, antigen immunization and antibody production.

CLP Power Wind/Wave Tunnel Facility

The Wind/Wave Tunnel Facility was established with a substantial donation from CLP Power Co Limited. Its mission is to provide a physical modeling capability to Hong Kong for designing tall buildings and bridges against wind induced vibrations; prediction of air pollutant dispersion in complex terrains and studies of wind/wave effects on off-shore structures.

The tunnel consists of two main sections: high speed and low speed sections. The high speed section will be used for wind engineering work. The maximum wind speed attainable is 25 m/s. The dimensions of the test section are 29.2m x 3m x 2m (length x height x width) with computer controlled turntable and roughness elements. The low speed section is to be used for atmospheric dispersion studies and bridge model tests. The dimensions are 41m x 5m x 4m. The lowest steady wind speed attainable is less than 1 m/s. By raising the tunnel floor of the low speed section, the tunnel is converted to a wind-wave facility. The water tank has the same length and width as the low speed section while the water depth is 3m. Wave makers will be installed. An up-to-date array of flow velocity, pressure, force, concentration and wave measurement equipment are available. With a long test section the behavior of a neutral atmospheric boundary layer wind can be accurately simulated.

The Facility will also be used to train undergraduate and postgraduate students for use of physical modeling techniques in the field of wind, environmental and off-shore engineering. Fundamental research on generic (as opposed to site specific) problems in the above areas will also be engaged by faculty and PG students. Workshops and seminars will be organized to train practising engineers in using physical modeling to assist their planning and development of infrastructures.

Design and Manufacturing Services Facility

The role of the centrally based Design and Manufacturing Services Facility (DMSF) is to provide technical expertise and support for research and teaching related areas.

The Facility focuses on multidisciplinary and application-oriented research programs that will create impact on the design and manufacturing industries in Hong Kong and the neighboring regions. It provides stimulus for collaboration and interaction between HKUST, local industries and international bodies.

The Facility maintains a range of state-of-the-art equipment to promote research in the area of design and manufacturing. These include measurement equipment such as Co-ordinate Measuring Machine (CMM), Nano Indenter, three-dimensional profiler and three-dimensional laser scanning system. The Facility has a number of Computer Numerical Control (CNC) machines, rapid prototyping machine, robots and computer aided design systems for providing a platform for CAD/CAM integration. It has a strong capability in Computer-Aided-Engineering with a full range of analysis and simulation software. The Facility is also actively moving into the area of electronic packaging and has the basic equipment for BGA and flip-chip prototyping. The Facility also supports the repair and maintenance of sophisticated scientific instruments. It fabricates special mechanical parts/systems and special purpose electronic circuits for both teaching and research activities.

Geotechnical Centrifuge Facility

The Geotechnical Centrifuge Facility (GCF) is a unique facility in Hong Kong. It is built and established partly through funding by a UGC Central Allocation Grant and partly through funding from the University. Therefore, this Facility is dedicated to serve not only the University but also the geotechnical community at large in Hong Kong.

Centrifuge modeling is a powerful research tool to study geotechnical problems such as rain-induced landslides, consolidation settlement of reclaimed land, pollutant transport in porous media, tunneling, deep excavation, liquefaction, and many other soil-structure interaction problems under both static and dynamic loading conditions.

The geotechnical centrifuge has a rotating arm of approximately 9 meters in diameter, and is capable of creating an elevated gravity field 150 times that of the Earth's gravity. Geotechnical structures are built in model boxes with maximum dimensions of 1.5m x 1.5m on plan, and 1.0m high. The maximum payload capacity of the model package is 400 g-ton. The centrifuge is equipped with a bi-axial (2-D) shaking table so that models can be tested dynamically in-flight to model various seismic events. This 2-D shaking table is a unique feature and it is the only one in the world. In addition, a state-of-the-art 4-axis robotic manipulator is developed to simulate various construction activities inflight. With our advanced data acquisition system, test data can be transmitted to any part of the world via internet at almost real time.

Demands from the industry (oil companies, major consulting firms, etc.) and government departments such as the Geotechnical Engineering Office are anticipated to take advantage of the newest and the unique geotechnical centrifuge to perform basic and applied research. It is also expected that this Facility will be visited by researchers from all over the world to conduct state-of-the-art research.

Glassblowing Facility

The Glassblowing Facility (GBF) is a central facility to provide glassblowing services to all units of the University. The services offered include design, fabrication and repairing of glassware and custom apparatus. In addition, technical advice on the design of special glass apparatus pertaining to research projects is provided by the glassblowers. A good stock of common glassware, glass and quartz tubings and spare-parts, which can be checked out by all users of the University, is maintained at the GBF.

The GBF is equipped with a range of equipment and tools and has a capability for glassblowing at temperature up to 3000˚C. These include temperature-programmed annealing ovens, grinding mills, belt linishers, diamond sanders and glassblowing lathes with various types of burners.

Liquid Helium Facility

The Facility is established by the University to provide liquid helium to academics and research units to obtain low temperature environments (4˚K and below) that are required for research and/or operation of specialized equipment. The Facility has a state-of-the-art computer controlled helium liquefier module equipped with a built-in automatic purification system and two compressors. It has a total liquefying capacity of 240 litres of liquid helium per day without using liquid nitrogen for pre-cooling (480 litres with pre-cooling). The Facility also operates a helium gas recovery system for retrieving helium boil-off from user's instruments for recycling.

Materials Characterization and Preparation Facility

The Materials Characterization and Preparation Facility (MCPF) is a central facility for the synthesis, characterization, and testing of new and advanced materials. MCPF houses and operates a wide range of state-of-the-art, sophisticated instrumentation that have wide usage in materials related research. The Facility also organizes workshops on new advances in characterization and preparation techniques and/or instrumentation and conducts training sessions. The mission of the Facility is to serve academics in all the science and engineering departments as well as researchers in research centers by providing them with access to materials preparation/analytical techniques that are not available in their own laboratories. Normally, job requests from users are carried out by the Facility's own staff. However, some facilities are accessible to qualified users who have been certified and authorized by the Facility's senior staff. By arrangement, the services provided by MCPF are also available to researchers from other Hong Kong tertiary institutions, government departments, industrial and commercial sectors.

The Facility occupies about 4,000 square meters of specialized laboratories. Instrumentation is available for various types of thermal, spectroscopic, electrical, and magnetic characterization, and for the preparation of materials by sputtering and evaporation. Equipment for microanalysis includes a field emission scanning electron microscope, a dedicated high-resolution transmission electron microscope, atomic force microscope, magnetic force microscope, imaging SIMS systems for surface and depth profiling analysis, and a multi-technique surface analysis system (XPS, Auger, SIMS, etc.) These are supported by more standard types of electron-beam analytical instrumentation. A complete list of the equipment available in MCPF can be found in its Website, http://www.mcpf.ust.hk .

Microelectronics Fabrication Facility

The Microelectronics Fabrication Facility (MFF) of the Hong Kong University of Science and Technology (HKUST) is the first microfabrication laboratory established at a tertiary institution in Hong Kong. The mission of MFF is to provide facilities for the faculty and students of HKUST to conduct teaching, research and industrial services. Currently, there are about 80 projects covering the following areas: Micro-Electro-Mechanical systems (MEMS), flat panel displays, biochip, advanced Ultra-large Scale Integrated (ULSI) circuit devices and technologies, RF and power integrated circuits, advanced electronic packaging, nanoscience and technology, sensors and actuators.

The Facility had been planned in two phases. Phase I laboratory provides about 247 square meters with Class 1000 clean room. Since April 1997, the technical capabilities of the MFF has been further upgraded with completion of its Phase II laboratory, which occupies an area of 750 square meters with some sections providing Class 100 environment. A complete 4" silicon wafer processing line has been installed, which provides photolithography, thermal diffusion, thin-film deposition, drv/wet etching, metallization, implantation and mask making service. These also include a E-beam Direct Write System which facilitates sub-quarter-micron patterning and enables nanostructure research. The new laboratory will also provide support to the newly established Center for Display Research. With the additional capabilities and capacity, MFF has extended its service to other tertiary institutions and the private sector through various technical collaborations.

Plant Growth Facility

The Plant Growth Facility provides support for various research project using plants or components derived from plants. It will be used for growing and conditioning of whole plants, tissues or cells in research as well as teaching.

The Facility has twelve environmental chambers of various sizes and an open area for outdoor planting. The environmental chambers are equipped with sophisticated control and regulation systems, which can provide a range of plant growth environments to meet the critical requirement of different research projects. The open area is made up of five 6.4 x 10 square meters space with benching to accommodate outdoor planting.

Overall, the Facility will serve areas of research and teaching in plant biotechnology, plant diversity, plant physiology, botany, environmental studies, and ecology.