2007 NARL Annual Report

National Applied Research Laboratories

National Applied Research Laboratories

Our Missions

- Establish R&D platforms
- Support academic research
- Promote frontier science and technology
- Foster high-tech manpower

NARL Annual Report **2007**

國家實驗研究院
National Applied Research Laboratories

2007 NARL Annual Report

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Message from the Chairman

Taiwan is not isolated from global trends. According to the United Nations, the key factors affecting globalization and societal change over the next decade will be (1) environment, (2) security, (3) economy, and (4) energy. In order to successfully sustain the operation of a nation, that nation's science and technology development must meet the demands of its future society.

In order to address the sharp increase in societal needs, the NARL is transforming itself into a more efficient and effective organization that is better prepared to meet the needs of the future. Standing true to its original mission, the NARL will develop a more competitive vision for its future and strengthen its operational mechanisms through efficient management.

In response to the Taiwanese government's requirement to develop focused areas in science and technology, in 2006, the NARL established the preparatory offices of the National Center for Ocean Research (NCOR) and the National Center for Typhoon and Flood Research (NCTFR).

The NCOR is dedicated to strengthening fundamental oceanographic research and integrating inter-disciplinary ocean science and technology development. The NCTFR, on the other hand, is focused on developing the core infrastructure to facilitate the large-scale simulation and monitoring of typhoons and floods across Taiwan. The NCTFR is also responsible for developing domestic high-resolution meteorological models.

In December 2007, the NARL Board of Trustees officially endorsed the NCOR and the NCTFR preparatory offices. Pending approval by the National Science Council (NSC), both offices will officially begin operation shortly. We anticipate the establishment of these two offices will have a global impact on oceanography and typhoon and flood research.

In 2008, the NARL will continue to do its part in contributing to our nation's science and technology development. I sincerely encourage my predecessors and peers to offer their insight in order to make the NARL the best ever!

Chairman

Message from the President

During 2007, the NARL continued to evolve in accordance with its three main missions of service, research, and the fostering of new high-tech talent. In 2007, the NARL continued its transformation into a leading innovator. Due to the extraordinary efforts of the NARL workforce, the NARL realized many outstanding achievements in organizational development, management operation, and project advancements during 2007.

In the area of organizational development, after almost two years of planning and the laying of groundwork, the National Center for Ocean Research (NCOR) and the National Center for Typhoon & Flood Research (NCTFR) preparatory offices were officially endorsed by the NARL Board of Trustees. Pending the approval of the National Science Council (NSC), these two organizations will officially become operational early 2008. This will open a new chapter in our nation's oceanic research and typhoon/flood research. Additionally, it will elevate the NARL's capacity in environmental and disaster reduction.

Under the guidance of the NSC and the NARL Board of Trustees, the NARL fulfilled its management operation goals of strengthening operation efficiency, reducing operating cost, and synchronizing operation quality. During 2007, the NARL also reformed several of its management techniques, for example, the NARL adopted Activity-Based Costing (ABC) and the Quality Assurance Management System (ISO). These were adopted in order to enhance the efficiency of the NARL's management structure through the institutionalization and standardization of operations and to establish consistent levels of service quality.

In the area of project advancement, during 2007, the NARL initiated the horizontal integration of its individual laboratory-centered projects into five inter-laboratory projects: (1) Environment & Disaster Reduction, (2) Space Technology, (3) Biotechnology Experiment Resource Platform, (4) Leading-edge Science & Technology Information, and (5) Nano Electronics & System Technology Services. This horizontal integration will allow the NARL to maximize its project resources and competitiveness.

Looking forward to 2008, the NARL will continue to reform and innovate. Additionally, the NARL will go one step further by promoting the vertical integration of all nine laboratories to create a common operational platform for the entire NARL. The NARL will establish an operation center with a single service window in order to reduce the operation redundancy within the organization. This will help to bring about consistent and seamless operations and will allow the NARL more flexibility and more efficient use of its resources.

As a result of these efforts, the NARL will no longer be restricted by the bureaucratic process of the past. Instead, going forward, the NARL will be able to focus all its energy on collaboration, exchange of resources, and supplementing and synergizing its research capacity. Free from its prior restraints and restrictions, the NARL will once again "soar high!"

Our ultimate goal, going forward, is to transform the NARL from an applied research service provider to a leading edge technologies integrator. We will do this with the goal of bridging the gaps in the nation's innovation value chain, satisfying the NARL's societal mandate of evolving into an advanced, sustainable, and secure society, and fostering industrial development. It is my sincere hope and desire that friends and colleagues provide us guidance and support in the years to come.

President 

Organization

Board of Directors & Supervisors

Chairman	Robert Lai
Managing Director	Chien-Jen Chen, Lou-Chuang Lee, Shyi-Ming Lin , Che-Ho Wei
Director	Chenming Calvin Hu, Cheng-Yan Kao, Michael Ming-Chiao Lai, Kuen-Yao Lee, Wen-Hsiung Li, Ferng-Ching Lin, Shie-Ming Peng, Andrew H.-J. Wang, Maw-Kuen Wu, Tsung-Tsong Wu, Chao-Shioung Yeh
Executive Supervisor	Wen-Hsiung Huang
Supervisor	Shaw-Liang Cheng, Wen-Ji Hwang, John Yu

President	Jer-Nan Juang
Vice President	Yeong-Her Wang, Kuang-Chong Wu

Headquarters

Planning & Evaluation Division	Director Nan-hung Ting
Business Development Division	Director Guey-Shin Chang
Administration Division	Director Kuo-Hsin Chen (acting)
Accounting & Finance Division	Director Ching-Ping Lu
Audit Division	Director Yeong-Her Wang (acting)
System Management Office	Director Ching-Yi Wu

Laboratories

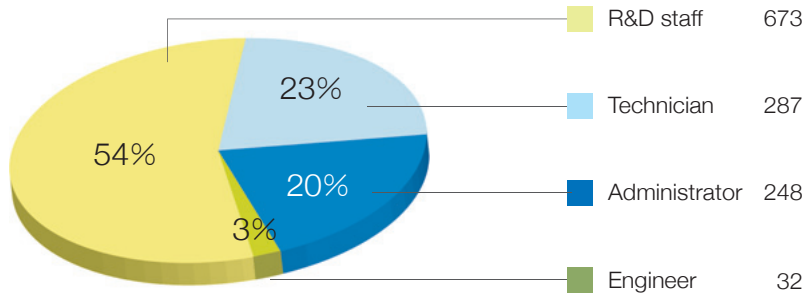
National Nano Device Laboratories (NDL)	Director General Wei-Xin Ni
National Laboratory Animal Center (NLAC)	Director General San-Chi Liang
National Center for Research on Earthquake Engineering (NCREE)	Director General Keh-Chyuan Tsai
National Space Organization (NSPO)	Director General Yeong-Her Wang (acting)
National Center for High-performance Computing (NCHC)	Director General C. Eugene Yeh
National Chip Implementation Center (CIC)	Director General Chin-Long Wey
Instrument Technology Research Center (ITRC)	Director General Chien-Jen Chen
Science & Technology Policy Research and Information Center (STPI)	Director General Pe-Cheng Wang
National Science and Technology Center for Disaster Reduction (NCDR)	Director General Liang-Chun Chen
National Center for Ocean Research (Preparatory Office)	Director General Forng-Chen Chiu
National Center for Typhoon and Flood Research (Preparatory Office)	Director General Wen-Yih Sun

(Organization structure as of December 2007)

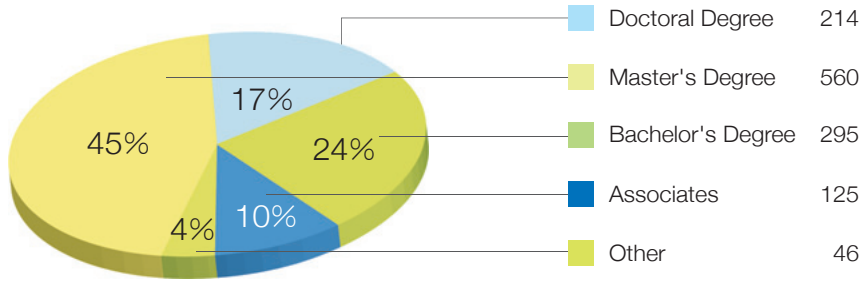
Human Resources

Number of Employee 1240

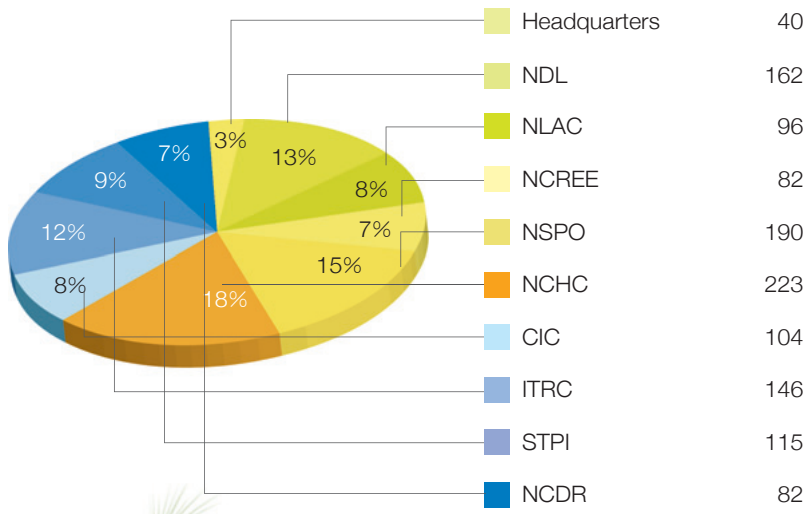
Human Resource Allocation



Education Qualification



Employees per Laboratory

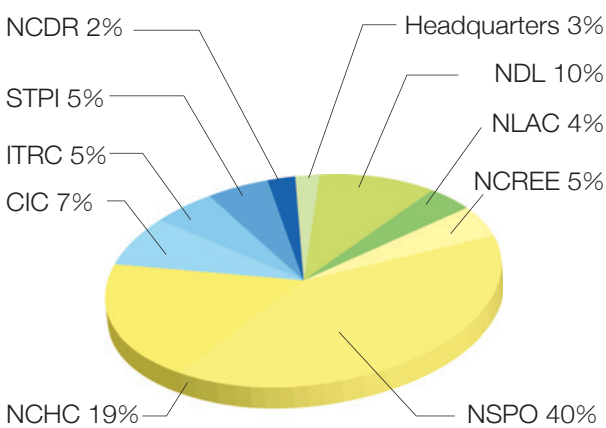


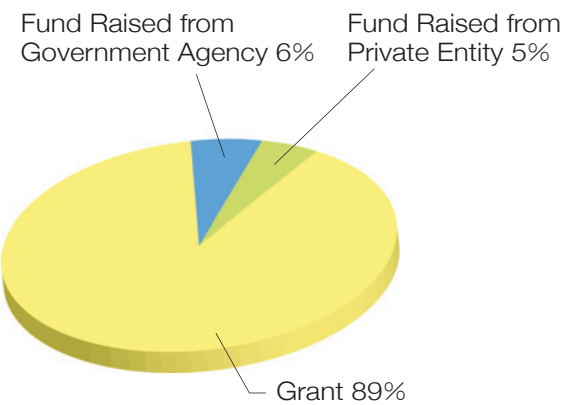
Financial Information

Revenue (FY2007)

Laboratories	($M USD)
Headquarters	5
National Nano Device Laboratories (NDL)	16
National Laboratory Animal Center (NLAC)	7
National Center for Research on Earthquake Engineering (NCREE)	8
National Space Organization (NSPO)	65
National Center for High-performance Computing (NCHC)	32
National Chip Implementation Center (CIC)	11
Instrument Technology Research Center (ITRC)	9
Science & Technology Policy Research and Information Center (STPI)	8
National Science and Technology Center for Disaster Reduction (NCDR)	4
Total	165

(Rate : $ 1 USD = 32.5 NTD)

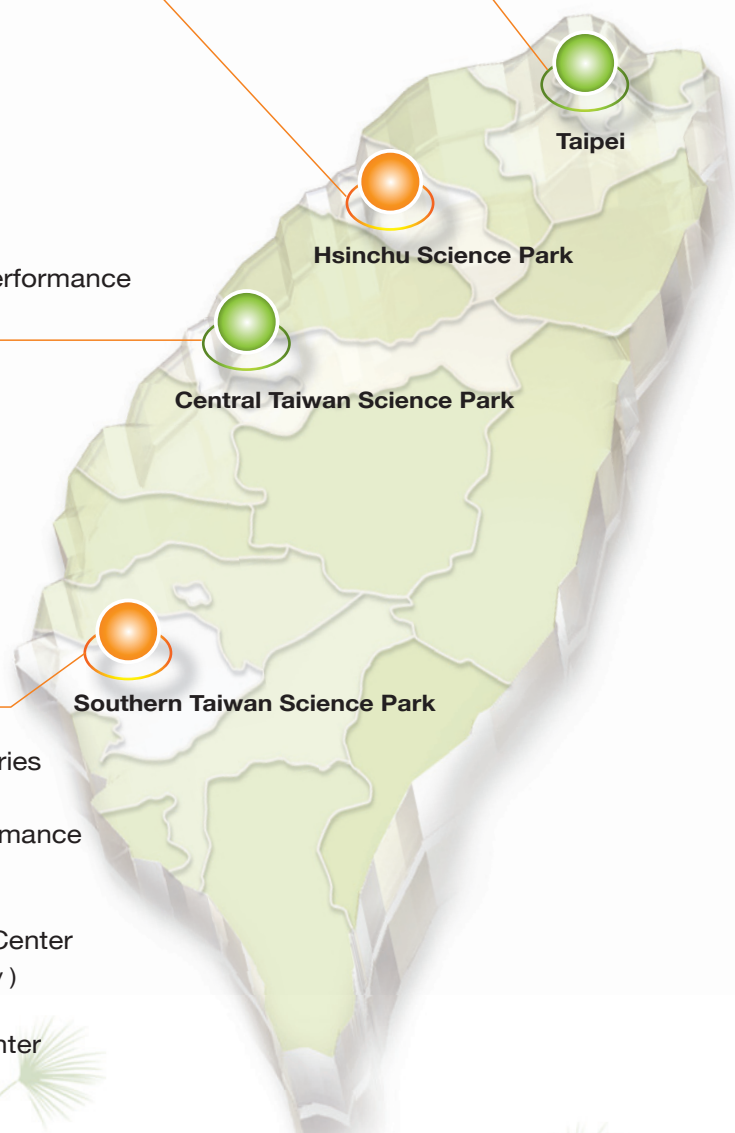




Location

- National Nano Device Laboratories
- National Space Organization
- National Center for High-performance Computing
- National Chip Implementation Center
- Instrument Technology Research Center
- National Center for Typhoon and Flood Research (Preparatory Office)

- NARL Headquarters
- National Center for Research on Earthquake Engineering
- National Laboratory Animal Center
- Science & Technology Policy Research and Information Center
- National Science and Technology Center for Disaster Reduction
- National Center for Ocean Research (Preparatory Office)



Central Taiwan Office

- National Center for High-performance Computing

Southern Taiwan Office

- National Nano Device Laboratories
- National Center for High-performance Computing
- National Chip Implementation Center (in National Cheng Kung University)
- National Laboratory Animal Center

Management and Operation of the NARL

During 2007, in order to achieve its visionary goals of elevating the organization's operational efficiency, reduce administrative costs, and maximize operational quality, the NARL implemented its new strategic development plan. This plan involves the implementation of several organizational administration improvements such as a large-scale synergistic program, activity-based costing (ABC), and quality management and information security management systems. Following the successful implementation of these plans, the NARL will become an increasingly competitive organization.

NARL 2007 Academic Cooperation Programs

Domestic	National Cheng Kung University, Taipei Medical University, National Taiwan Ocean University, Chang Gung University, Dayeh University, National Chung Hsing University
International	Ecole Normale Supérieure de Cachan, France Georgetown University Medical Center, USA The Board of Trustees of Leland Stanford Junior University, USA

Synergy of Research Programs

Compared to other research institutes in Taiwan, the greatest advantage the NARL possesses is that it brings together 11 individual research laboratories into a single organization with a wide spectrum of expertise. Each laboratory is dedicated to its own area of proficiency. For example, the individual laboratory's expert know-how includes high-performance computing and networking, space technology and exploration, oceanography, disaster reduction and mitigation, earthquake engineering, and typhoon and flood research. Its expertise also includes nano electronics development, IC chip design, precision instrument manufacturing, S&T policy and information development, and the breeding of experimental laboratory animals.

The NARL has also incorporated unique core facilities and databanks across Taiwan such as the TaiWan Advanced Research and Education Network (TWAREN) high-speed network, space environmental testing facilities, seismic testing tables, ocean research vehicles, nano-metrology and fabrication, and government research bulletins (GRB).

In order to synergize and enhance its research capability and multi-disciplinary cooperation, the NARL is preparing to implement an integrated program that meets its future challenges and mission goals. The NARL has identified five multi-disciplinary programs as primary focus of its future development. These programs are (1) environment & disaster reduction program, (2) cyber infrastructure program, (3) space technology program, (4) biotechnology laboratory resource & platform program, and (5) nano electronics & systems technology service platform program. In 2007, the NARL formulated a mid-term development plan to be implemented 2009~2012. Beginning in 2009, the entirety of the NARL's programs will be implemented using this integrated method. The synergy of the individual laboratory's core competences will elevate the NARL's R&D capabilities and enhance its global competiveness. Fig. 1 illustrates the NARL's organizational arrangement and major projects.

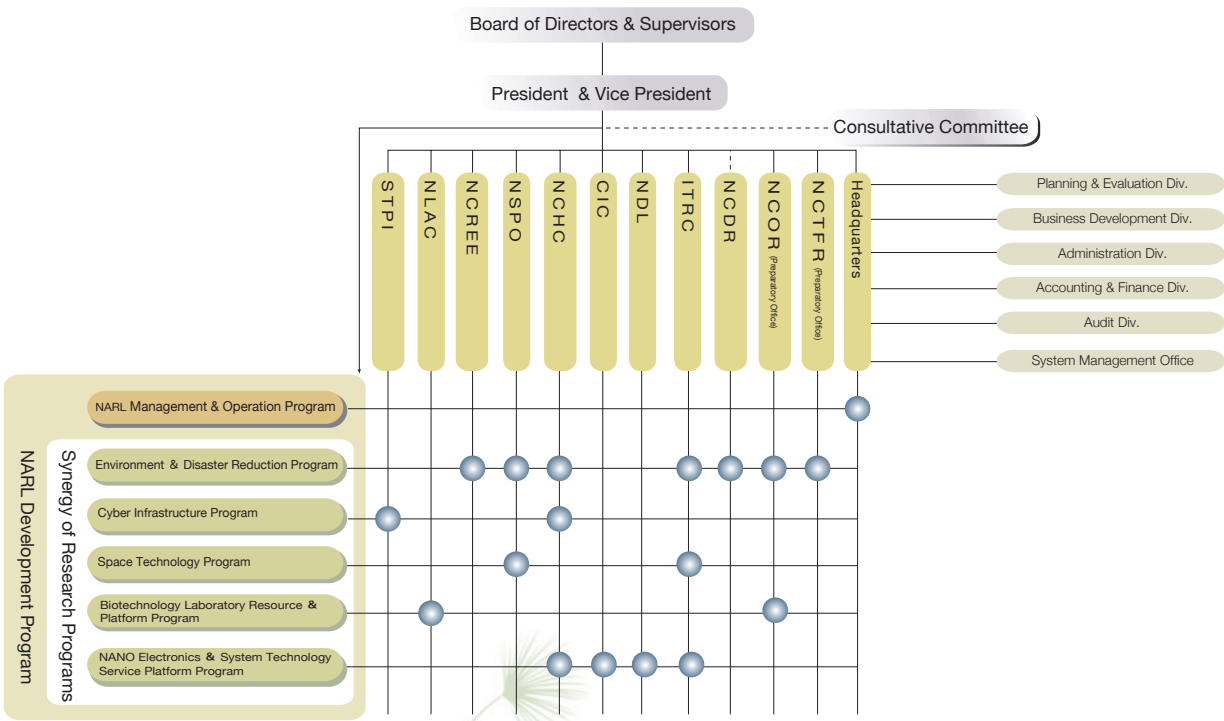


Fig. 1 The NARL's organizational arrangement and major projects laboratories versus programs.

ISO Certification Campaign

In 2007, the NARL began its Quality and Information Security Management System adoption campaign. This was done in order to improve the NARL's overall management efficiency and to adopt ISO 9001 and ISO 27001 standards and methodology across the organization. Via this consistent quality management system, the NARL hopes to establish a world-class management mechanism.

In order to meet its quality standard goals, in addition to forming a core team to implement the planning and evaluation of its ISO standards adoption, the NARL established a mechanism for internal auditing and progress review. The president of the NARL himself serves as the campaign's Chief Coordinator. All NARL laboratories and divisions are fully committed to the campaign. The Auditing Division also conducts bi-monthly meetings to review each laboratory's progress and to share experience and exchange thoughts.

The entire NARL is scheduled to pass ISO certification in 2008. The NARL expects to improve its management efficiency through the institutionalization of operations and to enhance its operational performance and raise its customer satisfaction using this world-class management and evaluation mechanism. Additionally, the NARL hopes to increase its international competitiveness, perfect its management systems, and transform itself into a research institute of international renown.

Activity-Based Costing (ABC)

Activity-Based Costing (ABC) is a method by which organization can measure their operational performance, resource consumption, and costing targets. ABC is used by the NARL to acquire proper, timely, and critical costing information. ABC is also used by the NARL to optimize distribution resources and increase operational performance. In order to cope with its transition in becoming a non-profit organization, the NARL implemented ABC in 2007.

ABC's implementation within the NARL is divided into two phases. The purpose of the first phase, completed in 2007, was to establish ABC's concepts and values in the mindset of the NARL's associates. The purpose of the second phase, set to commence early 2008, is to develop a cost model based on ABC's structural backbone: operations, cost factors, and costing targets. Both phases fully encompass the NARL headquarters as well as its 11 affiliated research laboratories. Each unit has completed development of its initial ABC model and undergone trial calculations.

The completion of the second phase will complete the establishment of ABC within the NARL. Via system calculations, the NARL will be able to acquire cost information early on, shorten the ABC cost reporting cycle, strengthen the control of ABC/M (Activity-Based Costing / Management) , and feedback to ABB (Activity-Based Budgeting). Also, the cost model created in the first phase will be able to be modified in accordance with the vertical integration of the NARL.

Once ABC is successfully implemented, it will aid the NARL's management in understanding the cause of costs and identify it's value-added/non value-added operational items. This insight will, in turn, aid the NARL's management in making the best business decisions and create a reference. From which each center can determine or modify the charges for services offered. By successfully implementing ABC, the NARL's strategic goals will be met and its maximum value will be realized.


NDL
NDL


National Nano
Device
Laboratories

History

The National Nano Device Laboratories (NDL), establishment in 1988, is administrated by the National Applied Research Laboratories (NARL). The NDL is located in the Hsinchu Science Park and, since it's inception, has greatly contributed to the development of semiconductor technology in Taiwan via the expert professional training and advanced semiconductor R&D it offers.

1988 The Executive Yuan approved the five-year "SubMicron Device Laboratory Plan" project to fund the establishment of the NDL

1992 The NDL's Cleaning Room Building became operational

1993 The NDL was renamed the "National Nano Device Laboratories" and began offering service to academia and industry

2002 The NDL's Southern Taiwan office became operational

2003 The NDL became a non-profit organization and a member laboratory of the NARL

2004 The NDL inaugurated the new Nano Electronics Research Building

Missions

The NDL is considered Taiwan's most prestigious institute for the training of semiconductor and nano technology professionals. The NDL's primary responsibilities include technical service and training and R&D in advanced nano device technologies. In recent years, semiconductor manufacturing processes have moved into the era of nano technology and quantum electronics. In response to these developing trends, the NDL has defined its research strategy and overall objectives and missions for the next decade as follows:

- Establish a world class nano device and material research environment, the focus of which will be on nano device fabrication, providing technical service to industry, and effectively managing and utilizing the lab's resources.

- Train semiconductor and nano technology professional, thus, ensuring Taiwan's edge in the international semiconductor and nano technology market. The NDL's training focuses on nanostructures including the fabrication of nano-devices, nano-bios, functional materials, nano-metrology, and high-frequency technologies.

- Preserve the future of nano device development and provide resources for nano-related R&D to include the building of a provisional nano device platform, escalating the development of nano technology in Taiwan, and maximizing resources through collaborative projects with academia and industry.

2007 Major Accomplishments

In order to help achieve its missions and goals, the NDL aggressively promotes research partnerships with local academic institutions. Based on its core technologies development of silicon semiconductor manufacturing and functional nano biomaterials, the NDL has established an integrated research platform for nano device/structure manufacturing. The platform supports research in high quality projects that promise worldwide impact. The NDL also provides a foundry service and facilities that gives domestic researchers access to fabrication and laboratory services.

In 2007, the NDL received funding in the amount of about NT $456 million (US $14.4 million) from the Taiwanese government. In 2007, the NDL employed 24 researchers which accounted for 13.1% of its total staff. Their responsibilities include organizing research projects, process technology R&D, and academic research. Also in 2007, the NDL established three R&D platforms : Nano fabrication R&D platform, Nano device R&D platform, and Nano devices & chip systems integration R&D platform.

A. Technical Services

The technical services offered by the NDL during 2007 included in-house operating services, foundry services, and lab. training services. These services totaled 125,908 accumulated work hours in 2007, an increase of 1.6% over the previous year. The service revenue generated by the NDL in 2007, including paper money, was NT $443 million (US $14 million), an increase of 10.7% over the previous year.

Also in July 2007, the NDL implemented an online proposal application that is used by academia to easily submit proposals. The total number of qualified proposals processed via this online application during 2007 was 149. Also, the total number of acknowledged papers that were completed by academia using the NDL's facilities and resources during 2007 was 546.

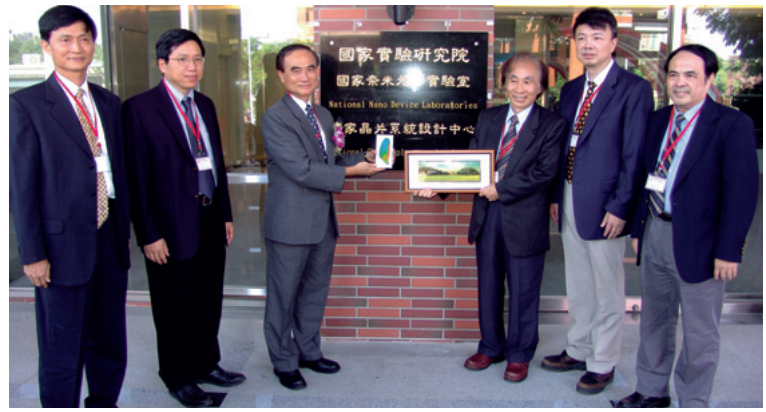


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Fig.1 The Nano Metrology Lab acquired ISO 17025:2005 certification in 2007.

Fig.2 The Equipment Move-in Opening Ceremony for the NDL/NCKU was jointly hosted by NCKU's President Lai, M. C. (third from left) and NARL's President Juang, J. N. (third from right).

During 2007, the Nano Metrology Laboratory received ISO 17025:2005 certification (Fig.1). The Nano Core-facility Line, the High-frequency Laboratory, and the Nano Metrology Laboratory all received ISO 9001:2000 certification during 2007 as well. Also, a joint-research project entitled "Nano Energy and Solar Cells" was agreed upon and signed by the NDL and National Cheng Kung University (NCKU) in January of 2008. NCKU offered space on the 8th floor of its Chi-Mei building for the NDL to setup its equipment in. The opening ceremony for the NDL's equipment move-in was held in October of 2007 (Fig.2). This was a significant step towards integrating and strengthening the NDL's core-facilities in South Taiwan.

B. Training

The NDL organizes various nano device-related technical training courses throughout the year. In 2007, the number of technical training course participants was 6,066, this being a 15% increase over the previous year's participants. Also, during 2007, there were 278 theses and dissertations published based on research using NDL's facilities and resources. Additionally, the 14th Symposium on Nano Device Technology (SNDT 2007) accepted 166 papers and hosted 181 attendants.

C. R&D Achievements

The NDL's advanced nano-device technology R&D team published 128 SCI international journal papers in 2007, a 13% growth over the previous year. Of the 128 SCI papers, 47 were graded with indexes of impact factor about 3. Additionally, the NDL acquired nine patents during 2007. In order to strengthen international collaboration, the NDL also signed 12 letters of intent with 12 different organizations located in six different countries respectively.

1. Developed sub-50nm research service platform of I-line and e-beam mix-match processes

- Developed Si-based high-speed GaAs MESFET devices.
- Developed high-quality thin Ge epitaxial layers on Si substrate for the 22nm node MOSFET transistors.
- Developed single-Si nano-wire MOSFETs, this, provides a foundation for research on high-sensitivity nano-wire bio-detectors.
- Developed opto-electronic diodes using Si-O nano-structural materials; this enhances the light-trapping efficiency of solar cells.

2. Executed large-scale application-oriented R&D and developed cutting edgetechnologies

- The NDL collaborated with the USA's Veeco Inc. to develop an exclusive electrical scan-probe microscope that does not require optical perturbation.
- The NDL initiated the "Nano-energy and Solar Cells Joint Research Program" with NCKU.
- The NDL established a solar cell optoelectronic R&D platform for the optoelectronics industry in southern Taiwan.

Educational Outreach

In order to enhance the training of Taiwan's (also known as silicon island) high-tech IC industry, the NDL has been organizing various semiconductor training courses since 1994. Participants in these training courses come to gain a deeper understanding of the various IC process in a short period of time, after which, they are fully prepared to perform semiconductor research and/or manufacturing in the fields of academia or industry. These courses include the "IC Process Technology Training Class" that consists primarily of process subjects. Another course offered is the "IC Equipment Training Class" that teaches participants to operate various pieces of semiconductor-related equipment.

In 2007, the NDL added two more advanced training courses to their repertoire, those being the "Semiconductor Material Characterization Technologies" and the "High Frequency Measurement Technologies" courses. The NDL also offers process and equipment manufacturer engineering certification in the "Semiconductor College Program" which is organized by the Bureau of Industry. By successfully completing the certification courses, participants are acknowledged by the semiconductor industry as "certified." These training programs help to ease the workforce shortage that exists in Taiwan's semiconductor and nano-related industry and, at the same time, strengthen Taiwan's competitiveness in the worldwide chip manufacturing market.

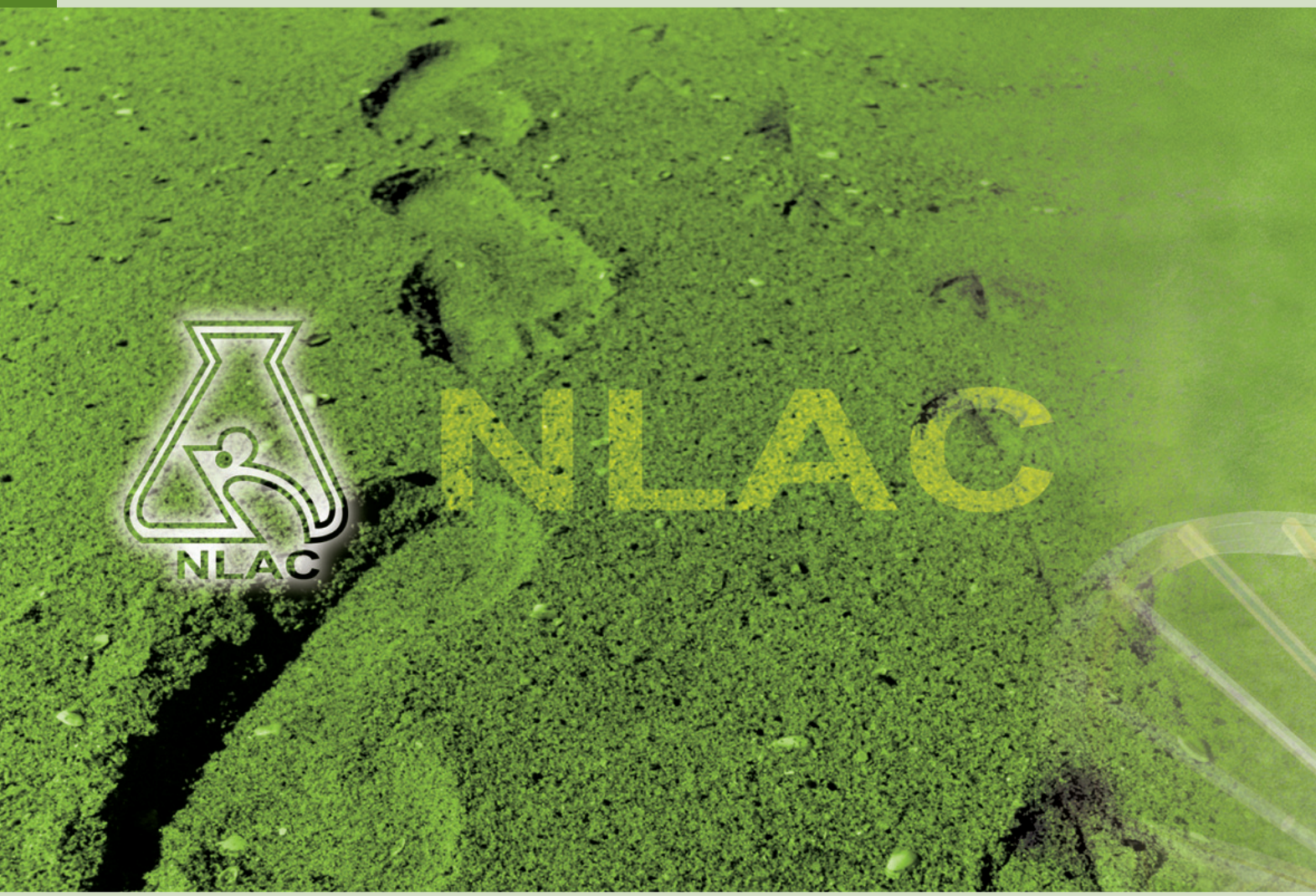
As an important part of its educational outreach program, the NDL produced two publications in 2007—the "Nano Communication" and the NDL "Newsletter". The "Nano Communication" is primarily for presenting professional paper abstracts. It has been published for the past 14 years and delivers results and professional nano-related techniques. "The Nano Communication" also highlights the outcomes of various joint collaborative programs. The NDL's "Newsletter" publication primarily focuses on professors, students, and people in the field of industry. The NDL published its first issue of the "Newsletter" in October 2006 as an aid to help users acquire real-time facilities information while in the lab. Readers of NDL's "Newsletter" include the interested public, professors, students, legislators, and manufacturers.

These two publications not only provide the readers with information of new nano technologies and services but they also provide an important interactive channel between the NDL and its users through announcements of activities and patent information.

Also, as part of its educational outreach program and in order to help popularize nano technology among universities, research organizations, and industry, the NDL welcomes the public to visit and tour its laboratories and facilities. In 2007, the NDL had a total of 2,838 domestic and foreign visitors.

Vision

Nano-scale device research has become one of the key factors in tomorrow's technology development. In order to provide local academia with a superior research environment, the NDL's vision is to unite research in nano devices, nano manufacturing, nano structures, and system-on-chip integration. Also, the NDL will continue to build a high quality foundation for research and training and establish a visionary laboratory for nano-related research within Taiwan and beyond.


NLAC
NLAC


National
Laboratory
Animal
Center

History

The National Laboratory Animal Center (NLAC), located on the campus of Academia Sinica in Nankang, Taipei, was founded by the National Science Council (NSC), Executive Yuan, in 1993. In June 2003, the NLAC became part of the National Applied Research Laboratories (NARL). The NLAC is a non-profit organization that currently employs 105 full-time employees, most of whom are biomedical or biotechnology professionals. Under the Director General are the Vice Directors, the Administration Division, Animal Breeding Division, Research and Development Division, and Planning Division.

1986 The establishment of a national laboratory animal research and breeding center was proposed at the NSC's 3rd National Science and Technology Meeting

1988 The Executive Yuan approved the funding of the National Laboratory Animal Breeding and Research Center

1994 The National Laboratory Animal Breeding and Research Center began operating under the supervision of the NSC

2003 The National Laboratory Animal Breeding and Research Center became a non-profit organization and a member laboratory of the NARL and was renamed the National Laboratory Animal Center

Missions

The NLAC is the foremost supplier of specific pathogen free (SPF) laboratory animals in Taiwan. The NLAC provides animals for biomedical research and pharmaceutical exploration. The NLAC's primary missions are to：

- Provide SPF laboratory rodents for biomedical research in Taiwan.
- Provide laboratory animal disease diagnostic and embryo cryopreservation services.
- Establish a national repository for specific mice models.
- Provide public training programs and certification courses on laboratory animal sciences including animal care, management and research.

2007 Major Accomplishments

A. Full Accreditation by AAALAC International

In pursuit of the accreditation by the Association for Assessment and Accreditation of Laboratory Animal Care International (AAALAC International), during 2007, the NLAC elevated its level of animal care and management systems, improved its software and hardware facilities, and established veterinarian daily rounds. These improvements amounted to a total of 82 standard operation procedures (SOP) being adopted by the NLAC. In June 2007, the NLAC was awarded full accreditation by the AAALAC International.

This accreditation certifies that the NLAC is properly equipped with adequate animal use and management facilities and procedures. Furthermore, this accreditation certifies that the NLAC has met and even exceeded the worldwide standard for laboratory animal management systems. This accreditation sets a good example for other animal laboratories in Taiwan. The NLAC will continue to promote its animal laboratory quality assurance system, encourage other animal laboratories to raise their standard of husbandry and, ultimately, elevate national biomedical research quality and global competitiveness. (Figs.1 and 2)

B. National Laboratory Animal Center in Tainan

The National Laboratory Animal Center in Tainan (NLAC Tainan) in the Southern Taiwan Science Park (STSP) was completed in December 2007. It will receive final inspection in March 2008 and will be inaugurated in April of the same year (Fig 3). The number of NLAC Tainan's staff has steadily increased since October 2007. Recently, 15 new employees were employed to work at the NLAC Tainan, all of whom completed the required professional educational and developmental training courses.

Fig.1 Joint press conference for AAALAC full accreditation in June 2007

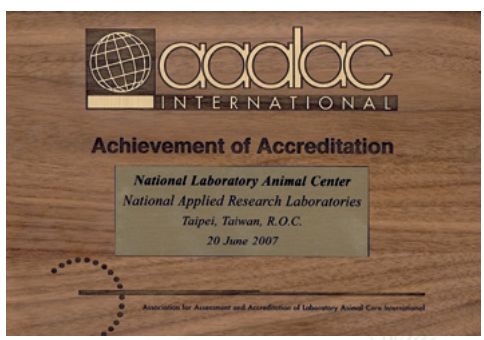


Fig. 2 AAALAC Accreditation

Fig.3 The National Laboratory Animal Center in Tainan was completed in December 2007

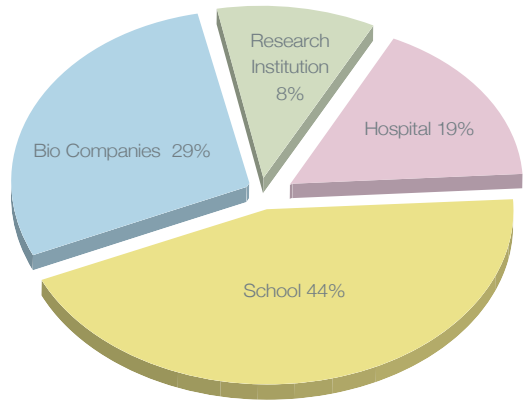


Fig.4 2007 Sales Volume

To address Taiwan's lack of domestic laboratory animal professionals, the NLAC actively promotes laboratory animal training courses and encourages the education of humane laboratory animal care and use. The NLAC Tainan is the professional development center for laboratory animal sciences in southern Taiwan. The NLAC Tainan actively promotes the southern Taiwan Biomedical Science Park in becoming the biomedical R&D industry infrastructure of southern Taiwan. The NLAC Tainan supplies a steady supply of quality laboratory animals for southern Taiwan and laboratory animal breeding, quarantine, and professional development. It is expected that southern Taiwan will evolve into a "green silicon island" by building a southern biotechnology town in collaboration with research institutions such as National Cheng Kung University (NCKU), Kaohsiung Medical University (KMU), the STSP, and the Luju Biomedical Science Park.

C. Provisioning of Laboratory Animals

The NLAC's SPF laboratory animal production volume for 2007 was 120,000 animals that generated an annual sales volume of NT 124,227 (US $3,764.00). The number of received orders during 2007 was 5,955 from nearly 1,000 customers that came from 118 organizations such as schools, hospitals, research institutes, and biotech companies across Taiwan. (Fig. 4)

Beginning in late 2005, the NLAC began importing various mice strains of diabetic and other disease models for quarantine, breeding, and propagation. These model mice help the NLAC fulfill the need of domestic biotechnology research institutes for quality, diverse, specific non-commercial laboratory animals. During 2007, 4,502 new laboratory animal strains were given to 61 researchers for testing. (Fig. 5) The results were very encouraging. In the future, the NLAC will continue importing quality animals and develop breeding and nurturing techniques for genetically engineered animals. This will help the NLAC to further explore, publicize, and promote new strains of animals for domestic research.

D. Laboratory Animal Quality Control

The NLAC routinely monitors its animal's health status to ensure quality standards in animal care and to assure that these standards are maintained according to SPF conditions. The health-monitoring program includes serology, microbiology, parasitology, and pathology. The NLAC has also elevated animal quality by applying polymerase chain reaction (PCR) to set up fast testing of Pneumocystis carnini, Helicobacter spp., Clostridium piliforme (Tyzzer's disease), Giardiasis, and other pathogens

that cannot be diagnosed using conventional techniques. The NLAC employs current diagnostic techniques to detect 20 different viruses, 12 bacteria, and 10 internal and external parasites and protozoans in mice, rats, and hamsters. The results of the NLAC's quarterly health monitoring are as follows: (Table 1)

Table 1 Animals in Quarterly Health Monitoring

Animals in Quarterly Health Monitoring	Rats	Mice	Hamsters	Total
2007 The First Quarter	372	548	8	928
2007 The Second Quarter	76	166	10	252
2007 The Third Quarter	72	139	10	221
2007 The Fourth Quarter	45	135	10	190

In order to raise the domestic biotechnology R&D standard and credibility of animal quality, the NLAC also provides external health and genetic monitoring services. 2007 saw a vast increase in the number and volume of external health monitoring for mice and rats over previous years. In fact, the growth of external health monitoring in 2007 was 122%. The total revenue for these services during 2007 was NT 2,886,000 (US $87,454.00). In the future, the NLAC will enhance and promote these services as well as maintain service quality.

During 2007, the NLAC became ISO 9001:2000 certified and received laboratory accreditation from the Taiwan Accreditation Foundation (TAF). The NLAC will continue to maintain consistent quality services and improve its service techniques in order to provide the best quality service for Taiwan's biomedical community.

E. The NLAC's Mice Reproduction Service Officially Available to the Public

The Cryopreservation Laboratory (CL) is one of the essential resources for the establishment of the National Repository of Laboratory Mice. This laboratory helped resolve the NLAC's insufficient animal breeding space issue, and integrate and distribute animal resources for academic exchange.

In 2007, the CL officially began its public mice reproduction service including embryo cryopreservation, sperm cryopreservation, relevant animal purification, and re-derivation. During 2007, 26 such service cases were implemented, of which 15,474 were cryopreserved embryos and 3 were animal re-derivations. Once official reproduction service became available, the number of NLAC cryopreserved embryos was enormous as compared with prior years. This growth indicates that domestic industry, academic, and research institutions have an urgent need for the embryo cryopreservation services offered by the NLAC. (Fig. 6)

F. Micro Satellite-based Monitoring System for Genetic Monitoring

During 2007, the NLAC established a genetic monitoring system for inbred mice using MIT markers, the results of which were presented in the paper, “Development of Micro Satellite-based Monitoring System for the Genetic Quality Control of Inbred Mice” at the Chinese-Taipei Society for Laboratory Animal

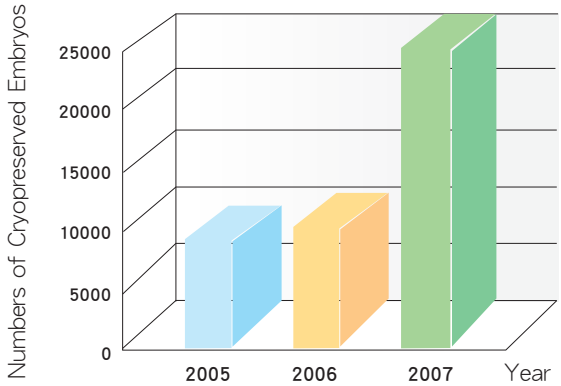


Fig.6 Compariosn Graph of Numbers of Cryopreserved Embryos in 2005-2007

Fig.5 B6.V-Lep^{ob}/ JNarl mouse carrying the gene for obesity

Sciences (CSLAS) 2007 Annual Meeting. The NLAC will replace its current biomarker testing system with the Micro Satellite-based Monitoring System for routine genetic quality control. This will result in more rapid and accurate genetic quality control that will, in turn, result in better laboratory animal welfare.

G. Production and Application of Germfree Mice

"Germfree" is the highest quality level of laboratory animal in which there are no detectable microorganisms. However, due to the absence of microbial stimuli, germfree animals are unable to secrete certain enzymes or synthesize essential vitamins (e.g. Vitamin K and B12) that results in different physiological conditions than "normal" animals. The NLAC currently maintains three such germfree strains of mice: BALB/cByJNarl, C57BL/6JNarl, and Tac: (SW). The NLAC utilizes cesarean section for the re-derivation of contaminated animals and breeds colonies for the purpose of propagation.

In addition to the germfree mice, the NLAC established two strains of germfree rats, SD and NIH-*Whn*, and one gnotobiotic NIH-*Whn* during 2007(Fig. 7). This achievement was awarded third prize at the 2007 NARL Award for Outstanding Contributions to Science and Technology.

Currently the germfree animals have been provided to the NLAC's academic co-operative partners. In 2007, the NLAC's germfree team was awarded the Healthy Food Research & Development three-year (i.e. 2007~2009) project which is a cross-ministry objective-oriented research project conducted by the NSC, the Council of Agricultural (COA), and the Department of Health, Executive Yuan. For this project, the team used its germfree animal model to evaluate the functions of probiotics. The project was divided into four sub-projects. The NLAC, the Food Industry Research and Development Institute (FIRDI), Fu-Jen University, Chung San Medical University, the Institute of BioAgriculture Sciences, Academia Sinica, and the Chinese Culture University were all participants in the project. In August 2006, a press conference was held to highlight the results of the NLAC's germfree animals project.

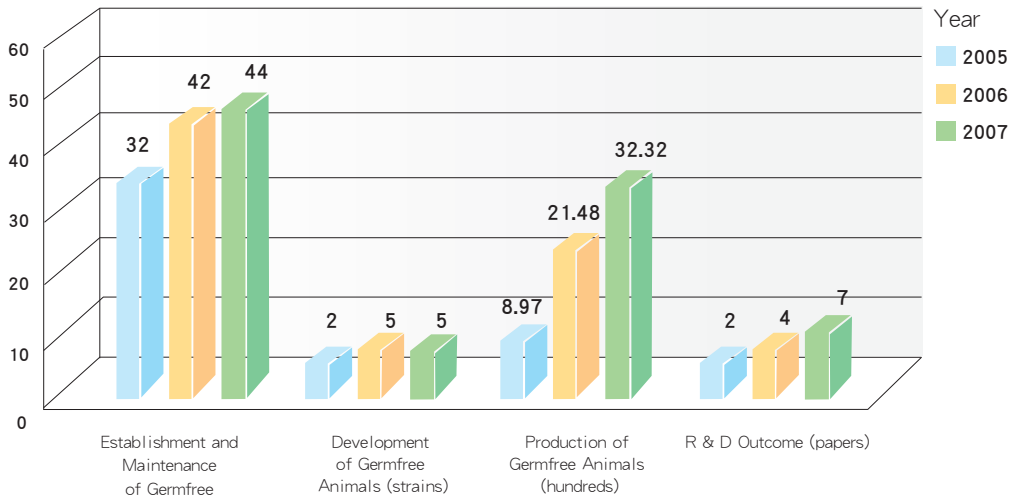


Fig.7 Comparison Graph of Germfree Animals Production and Application 2005~2007

Educational Outreach

Each year, the NLAC is commissioned by the Executive Yuan's COA to conduct training courses on the humane care and use of laboratory animals. These courses help laboratory animal care professionals understand the essence of laboratory animal welfare and the implementation of the Animal Protection Act that includes laboratory animal care and management, animal facility management, fundamental experimental techniques, and environmental care and emergency management. During 2007, course attendees came from over 200 animal laboratories and 19 municipal and county animal quarantine offices around Taiwan.

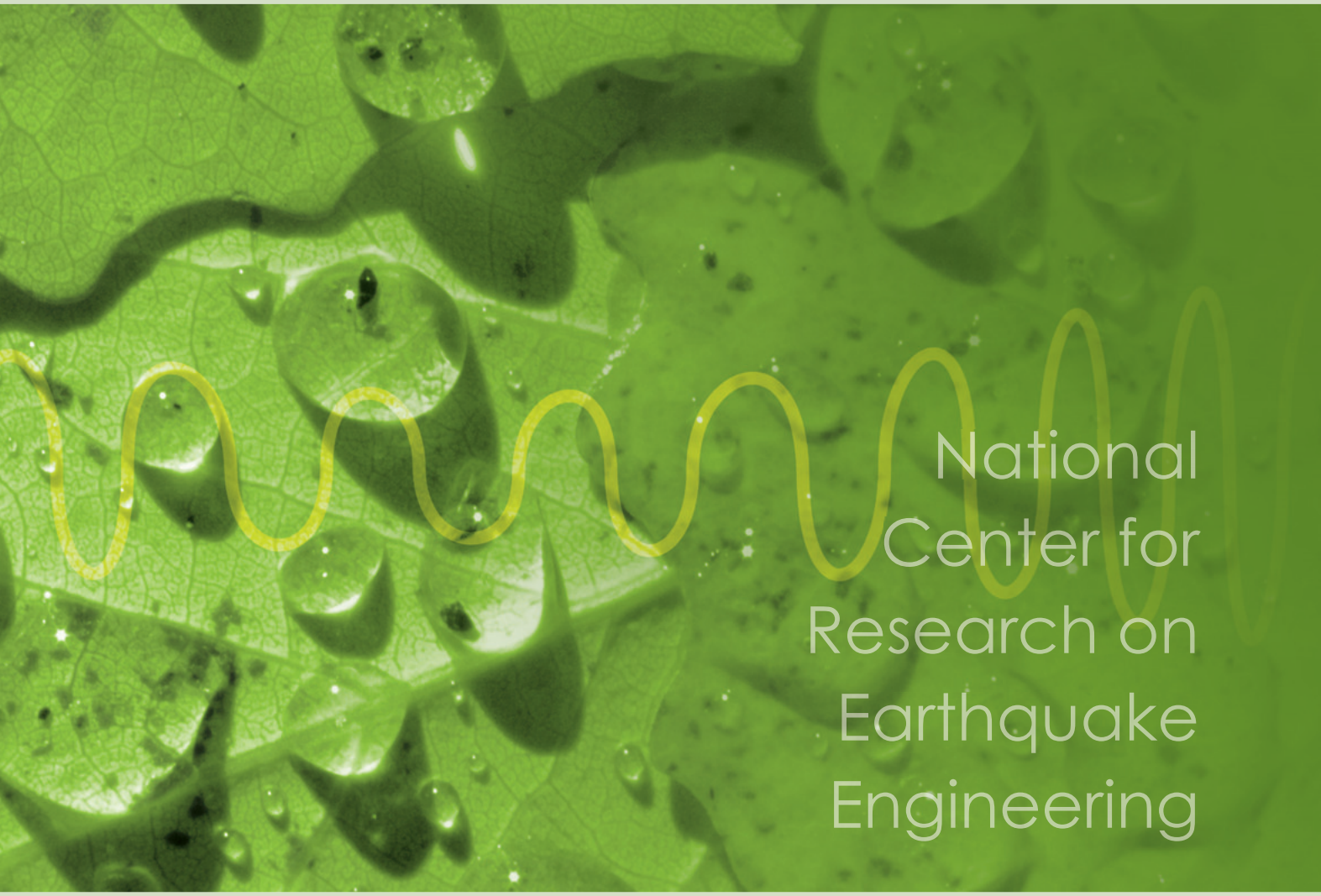
Also in 2007, two terms of training courses were held. The first term took place from 7/14~7/15 at Kaohsiung Medical University. The first term consisted of 352 accepted applicants, 311 actual attendees, 301 examined attendees, and, by the end of the course, 266 certified attendees. The second term took place from 10/4~10/5 at Academia Sinica. The second term consisted of 206 accepted applicants, 192 actual attendees, 190 examined attendees, and, at the end of the course, 170 were certified. In total, the two terms resulted in 436 certifications.

Vision

The NLAC's vision is to become an international-caliber compact “Jackson Lab” animal laboratory providing balanced production of high-quality genetically specific laboratory animal strains, technical services, and professional development. The NLAC's vision includes evolving into a:

- Diverse, rare, and valuable laboratory animal resource center.
- National Laboratory animal foundation preservation center.
- National Laboratory animal health diagnostic center.
- National Laboratory animal technical services and professional development center.
- International laboratory animal collaboration center.


NCREE
NCREE


National
Center for
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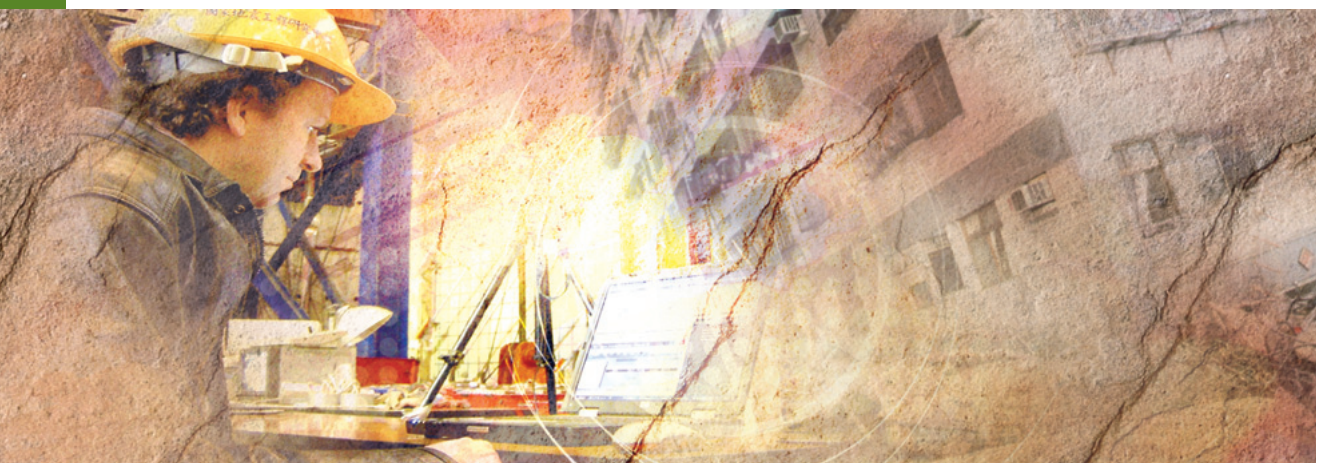


History

The National Center for Research on Earthquake Engineering (NCREE) was established in 1990 by Taiwan's National Science Council (NSC) on the campus of National Taiwan University (NTU). The NCREE was established to promote research and development on earthquake disaster-prevention technology. The NCREE's state-of-the-art facility is a world-class seismic simulation laboratory capable of conducting large and full-scale static and dynamic seismic experiments. In 2003, the NCREE transformed into a non-profit organization and became one of the nine research-based institutes under the NSC's National Applied Research Laboratories (NARL).

1989 The Executive Yuan approved the establishment of a preparatory office for the NCREE

1990 The first NCREE office opened its doors on the NTU campus under a project contract with the NSC

1992 A seismic experimental park was developed on the campus of the National Ilan Institute of Agriculture and Technology

1993 The construction project for the NCREE's main building, including a large-scale laboratory, was initiated

1997 The construction of the tri-axial seismic shaking table facility was completed
The NTU office was moved into the newly constructed headquarters building

1998 The inauguration ceremony for the newly constructed headquarters building and the large-scale structural laboratory was held

2003 The NCREE became a non-profit organization and a member laboratory of the NARL

2006 The construction of the laboratory extension began

2007 The construction of the laboratory extension was completed

Missions

With the goal of stimulating theoretical and applied research on earthquake engineering, the NCREE unites researchers and engineers to solve important issues in seismic engineering using numerical and experimental methods. The missions of the NCREE include:

- To plan, integrate, promote, and implement multidisciplinary research projects on earthquake engineering
- To improve the experimental technology in large-scale structural laboratories as well as to provide services and execute related experiments
- To collect, distribute, and promote research information and findings in the fields of earthquake engineering
- To revise the region-dependent seismic design codes of civil infrastructure systems and engineered structures in Taiwan
- To assess various earthquake-induced losses using computational simulations
- To support and participate in major civil tasks such as earthquake reconnaissance and international collaborations

2007 Major Accomplishments

A. Research

1. The Development of Performance-based Seismic Design Methods to Enhance the Seismic Capacity of Civil Structures

In 2007, the NCREE called a total of three meetings of the Research and Development Committee for Seismic Design Codes in an attempt to solve the problems associated with the current seismic design codes for buildings in Taiwan. Four revised provisions and recommendations were made by the committee that are now under official review.

In 2007, the NCREE also completed the Design Examples and Suggested Modifications to the Base-isolation and Energy Dispassion Systems in the Current Seismic Design Code for Buildings in Taiwan project for the Architecture and Building Research Institute, Ministry of the Interior. Also during 2007, the NCREE completed its Seismic Design Code for Highway Bridges in Taiwan project for the Ministry of Transportation and Communications. The results of these projects have had a significant impact on the development of seismic design code in Taiwan.

2. The Development of Technologies on Seismic Evaluation and Retrofitting to Upgrade the Seismic Performance of Existing Civil Engineering Structures

During 2007, the NCREE conducted research, in coordination with the Ministry of Education, on the seismic evaluation and retrofitting of school buildings in Taiwan. The out-of-plane behavior of partition brick walls and the shear behavior of short columns were studied for the establishment and verification of the seismic evaluation methods. In a collaboration with the US and Mexico, in-situ pushover tests of the Guan-Miao Elementary school building in Tainan were conducted to verify the method of seismic retrofitting (Fig.1). The results of this project were compiled in a reference handbook for the

Fig.1 In-situ tests (in collaboration with USA and Mexico) of school buildings at Guan-Miao Elementary School in Tainan

Fig.2 Segmental pre-cast bridge column system possessing high energy-dissipation capability and low residual displacement

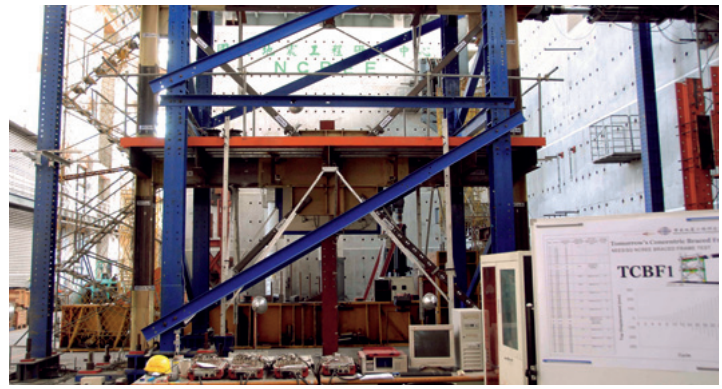


Fig.3 A concentrically braced frame with innovated gusset plate details

engineering community. Also, a web site was established to collect the results of seismic evaluation and retrofitting of Taiwan's school buildings. The data collected from this study has proven extremely helpful to Taiwan's building engineers.

Also during 2007, the NCREE developed a next-generation method of bridge construction-segmental pre-cast post-tensioned bridge columns (Fig. 2). This new method of construction is used to help minimize the ecological impact that bridges have in metropolitan areas. Functional rubber bearing systems were integrated into the displacement-based seismic design of this system as well.

3. The Development of TELES Applications for Earthquake Emergency Response and Risk Management

In order to help enhance the seismic preparedness and emergency management of Taiwan's public and private sectors, the NCREE created specialized software called the Taiwan Earthquake Loss Estimation System (TELES) that is used to assess seismic risk. The TELES system greatly improves the accuracy of early seismic loss estimations utilizing data from Taiwan's Central Weather Bureau. The NCREE proposed using TELES to develop a restoration model that analyzes the serviceability of power systems damaged by earthquakes.

Also during 2007, the NCREE began developing a Web-GIS internet-based GUI and query system to monitor Taiwan's transportation networks and earthquake damage data management system. Also in 2007, the NCREE transferred early estimation technology to the Taiwan Residential Earthquake Insurance Fund (TREIF) to help it establish its early claim estimation and message dispatch system.

4. The Development of Innovative Seismic Technologies to Deliver Sustainable Structural Systems

This project is a collaborative research program between the NCREE and the NSC Integrated Program for Hazards Mitigation. The focus of this collaboration, that also includes the US, is on the development of viscous and shape memory alloy (SMA) dampers to reduce seismic risk in structures. One of the highlights of this research is the mid-story isolation technique. This technique received much recognition for its applicability to buildings built in highly populated urban areas.

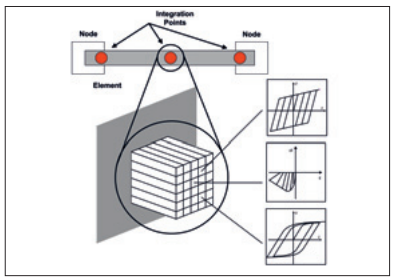
During 2007, the NCREE preformed R&D in the field of innovative seismic technologies including a building structure system that uses steel plate shear walls (SPSW). This study verified that SPSW provide excellent seismic performance results by reducing the overall weight of the steel used in the construction of the building. Also during 2007, the NCREE joined a collaborative project with Japan, the US, and Canada to develop capacity of concentrically braced frames that utilize innovated gusset plate details. (Fig. 3)

Regarding structural control and system identification, during 2007, the NCREE cooperated with US researchers to develop two semi-active control applications—a floor isolation system and a torsional-coupled structure. The NCREE also worked with the same researcher to develop a semi-active control decentralized structural system that utilizes wireless sensing.

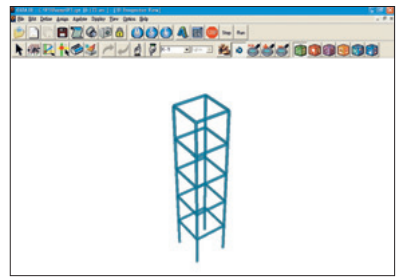
5. The Establishment of an Experimental Environment to Advance Numerical Simulation Technology

During 2007, the NCREE successfully conducted 29 experiments utilizing its reaction wall and strong floor system and 33 experiments utilizing its tri-axial earthquake simulator testing system. Also, during 2007, the Internet-based Simulations for Earthquake Engineering (ISEE) software was developed to corresponds with the Network for Earthquake Engineering Simulation (NEES) that was developed by the US. In addition, the next-generation high-performance structural analysis software (Fig. 4) realized an increase of seven functions in 2007, thus, making it significantly more efficient. The NCREE licensed the software to seven different companies during 2007 also.

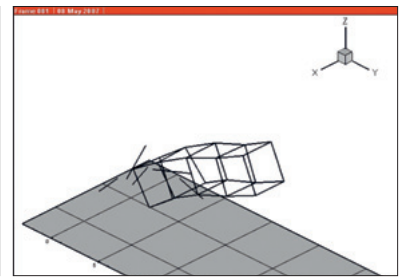
Finally, the world-class Multi-axial Testing System (MATS) (Fig.5) was established during 2007. MATS is used to test both the isolation system components and the high-strength of structural elements.



PISA3D analysis of fiber section



Simulation using vector form intrinsic finite (V-5)



Collapse analysis of a frame structure

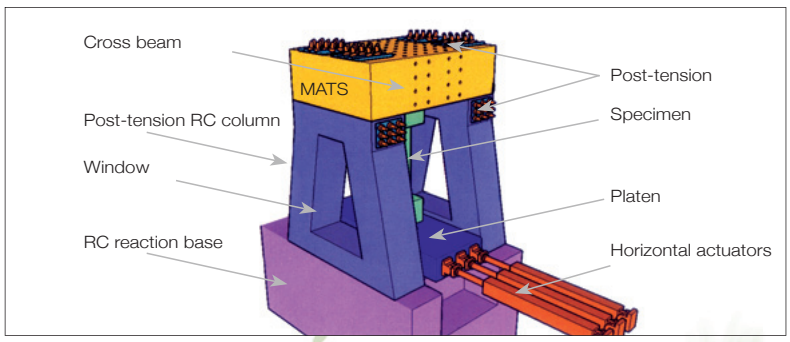


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Fig.4 The promotion of next-generation high-performance structural analysis softwares

Fig.5 Multi-axial Testing System (MATS)

6. The Establishment of the Earthquake Engineering Knowledge Databank for Sharing and Promoting Research Findings

In 2007, two new functions, the NCREE membership application and the online experiment request system, were added to the NCREE's website. Also, in the near future, a cross-language information retrieval instrument for earthquake engineering will be developed to help globalize NCREE's knowledge and experience. In order to effectively collect and organize the NCREE's experiment data, the NCREE's Data Center collected and organized their existing experiment data.

Also during 2007, the engineering geological data from 49 strong motion stations in Taiwan was used to build a strong motion engineering geological database. This brings the total number of strong motion stations in Taiwan to 383. The geological data collected from the strong motion stations is available on the NCREE's website. Researchers world-wide are able to view this data using the NCREE website portal.

7. The Integration of Earthquake Engineering and Earth Science to Facilitate the Transformation of Basic Research into Practical Applications

Up until 2007, the NCREE conducted dense micro-tremor measurements in Taiwan's three major Science Parks located in Hsinchu, Tainan, and Taichung from which site-specific resonance frequency maps were made. In order to determine the rupture characteristics of suspected seismogenic zones near the Hsinchu and Tainan Science Parks, the NCREE continued to monitor the micro-earthquake activity using 34 broadband seismometers. Two geochemical gas monitoring stations located near the Hsin-Cheng and Hsin-Hua faults were used to study the earthquake's precursor. The results of the monitoring stations showed that up to 60% of all earthquake incidences have a precursor. During 2007, the data, including response spectrums from many Taiwan strong motion stations (TSMIP), was analyzed in order to modify the seismic design code for the Taipei Basin. A corner frequency micro-zonation map of the Taipei Basin was also proposed for this purpose.

8. The Intensification of Research on Geotechnical Earthquake Engineering and the Implementation of Seismic Design on Foundations of Structures

For this project, a method that utilizes distributed plastic hinges was proposed for the pushover analysis of a pile-soil system. For this experiment, pushover and shaking table tests were conducted on a single steel pile to evaluate existing pile foundation design methods in ground that is susceptible to liquefaction. Additional forced vibration tests on the classrooms were conducted as well. The results of these experiments will be used to build a base model for soil-structure interaction analysis.

B. NCREE 2007 Patents

The NCREE, in its goal to strengthen research in the field of earthquake engineering, obtained "The system and method to measure the over weigh and over speeding on road using the optical displacement sensor" domestic model patent during 2007.

Educational Outreach

A. The APEC-IDEERS Competition 2007

The Introducing and Demonstrating Earthquake Engineering Research in Schools (IDEERS) competition was introduced to Taiwan in 2001 and has since become an annual event in commemoration of the 1999 Chi-Chi earthquake. This year, the content and rules of the competition changed so that more participants could be accommodated. Once again, the Asia Pacific Economic Cooperation (APEC) approved the IDEERS competition as one of their official educational events.

Students from Singapore, Hong Kong, New Zealand, Malaysia, Australia, Indonesia, Japan, Belize, and several foreign high school students from Taiwan were invited to join the competition and enhance their earthquake awareness and fundamental knowledge of earthquake engineering. In addition, a graduate student symposium was held to provide opportunities for Taiwanese and international graduate students to share their knowledge on earthquake engineering research.

B. International Training Program (ITP) for Seismic Design of Structures

The ITP invited 42 practicing engineers and researchers from 13 countries in Southeast Asia and Latin America to gather for the purpose of improving seismic design in developing countries. This gathering also helped to create a new channel for strengthening Taiwan's international diplomatic connections.

C. The Design of the Educational Content for the 921 Earthquake Museum, National Museum of Natural Science.

The museum opened on September 21st, 2007. The content for the 3rd stage included:

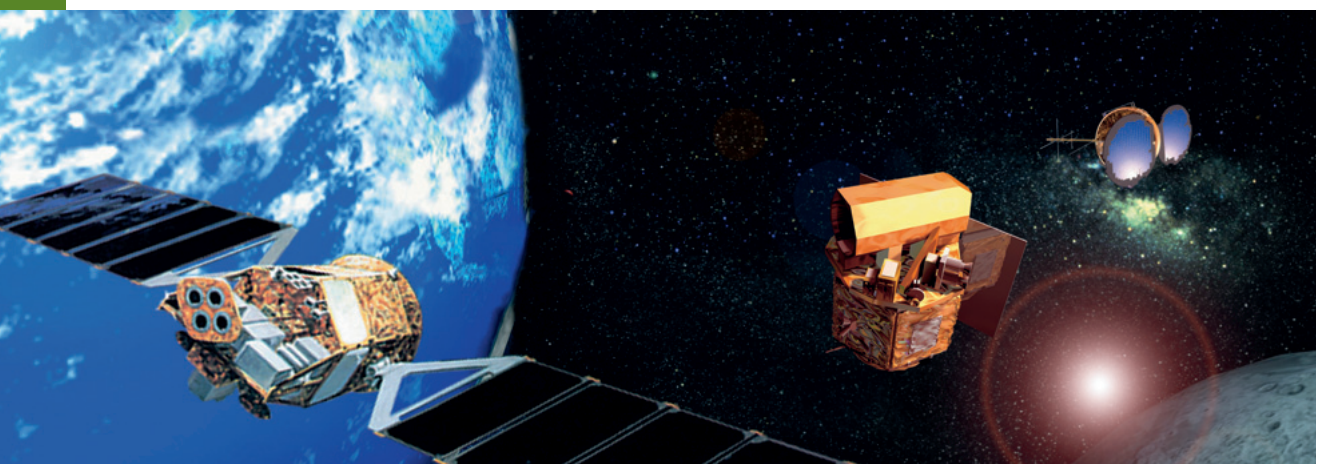
1. Home building and construction safety.
2. Advanced technology integrated into earthquake— resistant buildings.
3. Urban city life- Demonstrates how the infrastructure (e.g. nuclear power plants, MRT system, gas pipeline, etc.) perform during an earthquake. The content introduces the general public to the threat earthquakes pose to their daily lives.
4. International and domestic conferences and workshops— There were 17 international and domestic conferences and workshops administered by the NCREE during 2007. There were a total of 2,536 participants in these conferences and workshops.

Vision

The NCREE is a model research institute possessing outstanding experimental facilities, world-class technical competence, and unparalleled earthquake-related databases. The NCREE brings together local researchers and encourages international collaborations for pre-earthquake preparedness, emergency response, and post-earthquake recovery.


NSPO


National
Space
Organization



History

The National Space Organization (NSPO), Taiwan's national-level space organization, was established in October 1991 by the Executive Yuan and initially charged with carrying out the first stage of the 15-year "Space Technology Long Term Development Program." The NSPO's primary mission is to develop Taiwan's space technology infrastructure as well as competitive resources that can be offered for sale to the international space market. In December 2002, a National Science Council (NSC) committee approved the second stage of the space program that extended it from 2004 to 2018.

1991	Established the National Space Program Office (NSPO) following the approval of the Space Technology Long Term Development Program by the Executive Yuan
1994	The NSPO's offices were centralized in the Hsinchu Science Park
1999	Successfully launched FORMOSAT-1 at Florida's Kennedy Space Center
2002	The Second Stage Space Program received approval
2003	The NSPO became a non-profit organization and a member laboratory of the NARL
2004	Successfully launched FORMOSAT-2 at California's Vandenberg Air Force Base
2005	The National Space Program Office (NSPO) was renamed National Space Organization (NSPO)
2006	Successfully launched FORMOSAT-3 at California's Vandenberg Air Force Base

Missions

The primary focus of the Second Stage Space Program is on the development of a satellite program. The goals of this undertaking are to promote the transfer of space-related technology from academic research to industrial use, facilitate the development of domestically designed satellites, and pioneer cutting-edge scientific research on satellite applications.

The NSPO's primary mission objectives include:

- Developing self-reliant satellite technology by consolidating R&D from private industry, academia, research institutes, and government agencies
- Participating in large-scale international space projects
- Promoting commercial opportunities in satellite applications
- Fulfilling Taiwan's national space program-related goals

2007 Major Accomplishments

A. The FORMOSAT-3 Constellation Gains International Attention as its Data is Used by Weather Centers Worldwide for Global Weather Monitoring

The FORMOSAT-3 constellation was successfully launched on the 15th of April 2006, thus becoming the world's first satellite system to use refracted signals originating from Global Positioning System (GPS) for near real-time atmospheric measurements. Currently FORMOSAT-3 records an average of 1,600 profiles in a single day with a maximum of up to 2,200 profiles daily (Fig.1). Recently, FORMOSAT-3 currently received accolades as being one of the most accurate and stable thermometers in space.

Already 42 countries and over 600 users have subscribed to FORMOSAT-3's real-time meteorology data for global weather monitoring. This extends to weather centers in the United States, England, France, Canada, Spain, Denmark, Japan, South Korea, and India. In June 2007 at the annual space conference in Geneva, the World Meteorological Organization (WMO) acknowledged the importance of FORMOSAT-3 as a major stepping-stone for the future development of real-time weather monitoring and predictive systems.

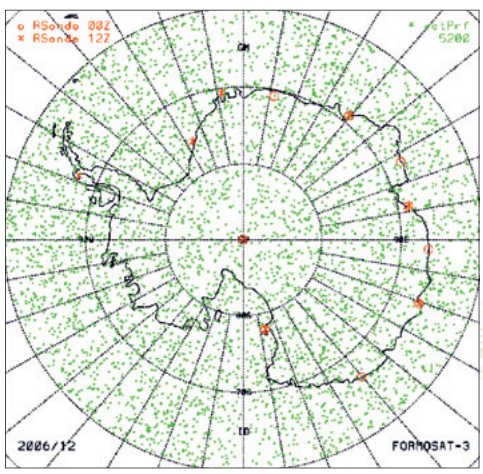


Fig. 1 GPS RO observation by FORMOSAT-3 (·), ground-based observation over (◦) Antarctic area.

B. FORMOSAT-2 Image Data Used for Global Environmental Monitoring and Emergency Disaster Rescue Support

Global warming and the resulting change in climate are increasingly important issues in today's environmentally aware society. FORMOSAT-2 is able to study these effects in great detail. Taking advantage of its highly manoeuvrable design and unique mission orbit, FORMOSAT-2 was recently able to capture high-resolution images of the Arctic region and Antarctica. In a collaborative research effort, images of ice sheets over Alaska, Canada, and Greenland were submitted to the 2007 International Polar Year (IPY) program for research into global warming. Additionally, FORMOSAT-2's Digital Elevation Model (DEM) capability creates enhanced 3-D images that help researchers better differentiate pattern changes between satellite images.

In 2007, FORMOSAT-2's emergency support mission to monitor disaster stricken regions increased by 64% from the year prior. This is a clear indication of the increasing responsibility placed on the NSPO to respond to emergency events in a timely and effective manner. The NSPO continues to work closely with the "International Charter on Space and Major Disasters" to monitor regions in Asia, North America, Central America, and Europe so that humanitarian assistance can be provided to affected areas in the shortest amount of time possible.

A total of 157 images were taken as a result of 23 emergency callouts last year. This included the earthquakes in Afghanistan (04/07~04/15), stranded ships off the coast of Newfoundland, Canada (04/23~04/30), earthquakes in the Solomon Islands (04/04~04/12), the Greek forest fires (07/17~10/03), earthquakes in Peru (08/17~08/30), hurricane Dean in Mexico (08/23~08/30), the massive 8.2 earthquake in Indonesia (09/14~10/03), flooding in Nicaragua (10/20~11/14), California forest fires (11/02~11/14), and flooding in Mexico (11/03~11/09).

On the domestic front, rescue authorities are able to receive up-to-date information quickly and accurately as satellite images are updated frequently and with extensive geographic coverage. For example, typhoon SEPAT, which devastated the southern regions of Taiwan in 2007, was continuously monitored by NSPO after receiving an emergency notification from the National Science and Technology Center for Disaster Reduction (NCDR) and the Disaster Prevention Research Centre of National Cheng Kung University (NCKU). For two weeks, the entire south of Taiwan was surveyed continuously to assist local authorities with their damage evaluation and re-building efforts.

C. Sounding Rocket-6 Successfully Launched

Taiwan's Sounding Rocket-6 was successfully launched on the 13th of September 2007 from the Chui-Peng launch site in southern Taiwan (Fig.2). The Sounding Rocket-6 launch initiated two separate experiments--a mono propellant experiment by NCKU and a recoverable payload capsule experiment by National Central University (NCU). This research is a major step forward and significant development in Taiwan's space technology program.

D. International Science Research Projects

The GPS Scientific Application Research Center (GPS-ARC) was jointly established by the NSPO and NCU in 2007 to carry out FORMOSAT-3 scientific missions and to analyze scientific data for research and application purposes. To that end, the center brings together researchers and scientists from around Taiwan to participate in the planning and development of future scientific missions and research in GPS technology.

Fig.2 Sounding Rocket-6 Successfully Launched on September 13, 2007

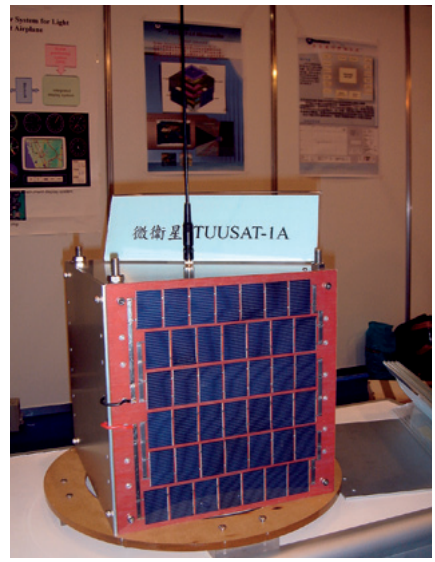


Fig.3 TUUSAT-1A EDM

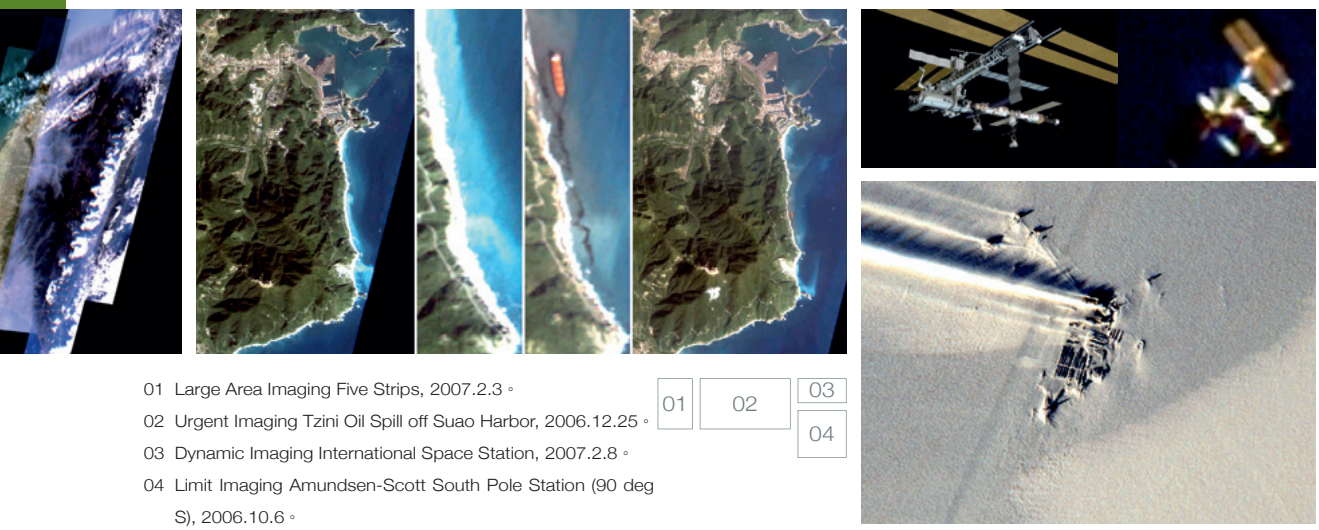
The NSPO continues to perform scientific experiments using the FORMOSAT-2 and FORMOSAT-3 satellites and is involved in an international collaborative research program on the gamma-ray telescope and geomagnetic substorms. The NSPO is also participating in the worldwide Alpha-Magnetic Spectrometer (AMS-02) development program and is currently assisting Italian counterparts in the design, analysis, and manufacturing of a thermal control system.

E. Remote Sensing Satellite Program

The Remote Sensing Satellite is the first domestically designed satellite carrying self-developed remote sensing instrumentation and scientific payloads. The goal of this project is to continue the services provided by FORMOSAT-2 and continue to receive the economic benefits that come from international collaboration. In 2007, the NSPO completed design audits on all systems and subsystems of the Remote Sensing Satellite and created Elegant Bread-Board models for both the Command and Data Management Unit (CDMU) and the Power Control and Distribution Unit (PCDU). Also in 2007, the NSPO created a prototype for scientific payloads, planned for the remote sensing instrument development, and achieved key technological advances for both the flight software and the Electrical Ground Support Equipment (EGSE).

F. Micro-satellite Program

The critical design of the experimental micro-satellite was completed in 2007(Fig. 3). The purpose of the development program was to encourage the active participation of academic institutes in the research of satellite-related technologies. Two renowned Taiwanese universities are currently taking part in the program, each implementing their own miniaturised satellite system and subsystems. Once completed, they will be the first independently produced micro-satellites in Taiwan.



01 Large Area Imaging Five Strips, 2007.2.3。
02 Urgent Imaging Tzini Oil Spill off Suao Harbor, 2006.12.25。
03 Dynamic Imaging International Space Station, 2007.2.8。
04 Limit Imaging Amundsen-Scott South Pole Station (90 deg S), 2006.10.6。

Fig.4 The highly manoeuvrable design and sun-synchronous orbit of FORMOSAT-2

G. Improvement of FORMOSAT-2 Image Processing Capability

The FORMOSAT-2 image processing capability continues to evolve and improve for operator control and processing efficiency. By December 2007, the NSPO had processed 2,178,440 seconds of image data covering a total area of 339,836,640 square kilometers. This is approximately 226% of the earth's entire surface area or 8,832 times the size of Taiwan. In addition to operating under normal operating conditions, the NSPO is able to utilize the highly manoeuvrable design and sun-synchronous orbit of FORMOSAT-2 for special imaging requirements. These include large area imaging, urgent imaging, dynamic imaging, limit imaging (Fig. 4). The dynamic object-tracking feature enabled FORMOSAT-2 to capture images of the International Space Station back in early 2007 that was verified soon after using advanced image processing techniques.

Educational Outreach

A. FORMOSAT-2 Educational Program

Imparting earth science and geography knowledge to students has never been so important as it is now especially when considering today's climate of globilazation and increased concerns over the environment. In order to raise public awareness of Taiwan's unique landscape as well as countries around the world, the NSPO distributes free satellite images that schools can use to illustrate textbooks. The NSPO also provides a range of educational products and services for the general public. These include calendars, exhibitions, and television documentaries.

The FORMOSAT-2 educational outreach program successfully came to a close on the 5th of July 2007. As a result of this program, several special topic articles were featured in the "Young Newton" scientific magazine. In addition, the NSPO also hosted the astro-camp school program, participated in on-air radio interviews, and provided training courses for teachers and instructors.

B. FORMOSAT-3 Creative Software Design Competition

In the interest of promoting the education and understanding of Taiwan's national space technology and science programs, the NSPO, in collaboration with the NSC, hosted the FORMOSAT-3 Creative Software Design Competition on the 1st of May, 2007. The competition attracted 35 teams nation-wide consisting of over 120 applicants from high schools and colleges. After five months of hard work, each team demonstrated tremendous talent and creativity as they showcased their unique and innovative designs that featured FORMOSAT-3 as part of a computer game.

Vision

Over the past fifteen years, the NSPO has established a solid foundation and infrastructure for Taiwan's space program. Going forward, the NSPO will continue to support Taiwan in its quest to become a leading space technology provider and major contributor to the international space community.


NCHC
NCHC


National
Center for
High-Performance
Computing

History

The National Center for High-Performance Computing (NCHC) is Taiwan's only complete high-performance computing center. The NCHC provides domestic academia and industry with high-performance computing-related services including research and education. To achieve its vision of becoming a world-class supercomputing center, the NCHC recently obtained ISO 9001:2000 Quality Management Certification and ISO 27001:2005 Security Information Management Certification as well as "Technology Efficiency" certification from Taiwan's National Science Council (NSC).

1988 Taiwan's NSC expressed interest in building a high-performance computing (HPC) laboratory

1989 The NSC and Ministry of Education (MOE) formed a committee to conduct a feasibility study on building a HPC laboratory

1991 Taiwan's Executive Yuan approved the NCHC development plan

1993 The new building in the Hsinchu Science Park was completed

2003 The NCHC evolved into a non-profit (i.e. incorporated) organization under the National Applied Research Laboratories (NARL)

2005 The NCHC received ISO 9001:2000 Quality Management Certification

2006 The NCHC received the NSC's "Technology Efficiency" certification

The NCHC received ISO 27001:2005 Information Security Management Certification

2007 The NCHC placed in the top 35 supercomputers worldwide on the Top500 list

Missions

The NCHC's missions include :

- Providing the best environment for domestic R&D in HPC and networking applications.
- Offering high quality HPC and network application research services and fostering technology discovery and innovation.
- Educating specialists in HPC and network application technology.

2007 Major Accomplishments

A. Core Facility Service Achievements

Establishing a high quality HPC environment is the NCHC's primary mission. In 2007, the NCHC finished the construction of a computing mainframe that raised the center's total computing power to 33.5 teraflops (TF). With its 24.6 TF of raw computing power, the newly constructed mainframe catapulted Taiwan into the top 50 ranking of the TOP500 supercomputers (http://www.top500.org/) worldwide. This major increase in computing power will greatly increase Taiwan's research capability and facilitate scientific breakthroughs. In 2007, the NCHC's supercomputers users published a total of 377 SCI and EI papers and 114 symposium papers.

Table 1 Usage statistics for the past 3 years

Year	Tflops	# of cases	# of accounts	Total SRUs available (million)	SRUs used (million)
2005	4.7	766	3,215	388.34	349.28
2006	8.4	796	3,124	796.62	570.70
2007	33.5	745	3,061	1361.92	935.23

B. Academic Research Network Service Report

The NCHC continues to create network-related services and conduct research in high-efficiency network monitoring systems in order to provide a more complete service for academic research. The NCHC also constructed a fiber-optics network laboratory to act as a driver for Taiwan's advanced network technology development. In 2007, the Taiwan Advanced Research and Education Network (TWAREN) became a member of the Global Lambda Integrated Facility (GLIF), thus, formalizing Taiwan's connection to the international community. This membership will lead to collaborations with international institutions and the importing of advanced networking technologies. In September, 2007, the NCHC also finished the construction of the GLIF Open LightPath Exchange (GOLE), thus, allowing neighboring countries to connect to other international networks through the NCHC.

C. Service-oriented Research Results

In 2007, the NCHC strengthened its core services and, at the same time, spearheaded environmental research and other research related to improving daily living. Major service-oriented research achievements in 2007 include the following:

01 02

Fig.1 As a result of his work with the ECO Grid project, the NCHC's Dr. Fang Pang Lin received the Executive Yuan's 2006 Notable Contribution to Technology award in April, 2007. The award bestows the highest honor on individuals with outstanding technological contributions to society.

Fig.2 The NCHC's Director Eugene Yeh (2nd from the left), Professor Ann-shyn Chiang (4th from the right), and Dr. Tim Tully (3rd from the left) of the Cold Spring Harbor Laboratory. The three institutions signed a cooperative agreement on the Fruit Fly Brain Nervous System project May, 2007.

1. ECO Grid Results Gain Acclaim: The NCHC's Dr. Fang Pang Lin Wins the the Notable Contribution To Technology Award

The ECO Grid project creates a major impact on the sustainability of our environment by applying information management and computing analysis to the world's most important ecological sites. Due to this project, the NCHC became part of the core steering committee in both the Global Lake Ecological Observatory Network (GLEON) and the Coral Reef Environmental Observatory Network (CREON) and plays an ever-increasing important role in international ecological research (Fig. 1).

2. Technical Assistance to the Fruit Fly Brain Nervous System Project

The NCHC integrated a 3D bio-imaging knowledge database and display system to support National Tsing Hua University's (NTHU) Brain Research Center's Fruit Fly Central Nervous System project. Together, the NCHC and NTHU created the world's first 3D Fruit Fly Brain gene expression database. The project also enabled an important discovery by Dr. Chiang Ann-shyn on the mechanics of the brain's neuro-pathways. His research was published in the science journal "Cell." In the publication, he thanked the NCHC twice for its assistance with the project. Because this is the first time a Taiwanese research team has been published in "Cell," the project gained domestic and international attention (Fig. 2).

3. DRBL and Clonezilla Gain Popularity

The NCHC developed two open source-based software programs during 2007—Diskless Remote Boot in Linux (DRBL) and Clonezilla. Using just a single server, the software can change

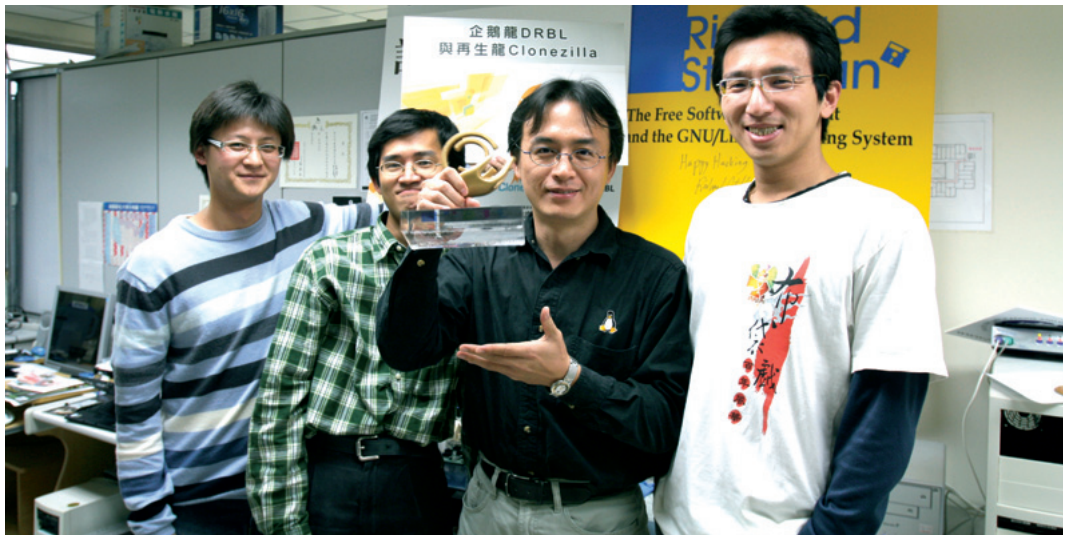


Fig.3 DRBL, a software developed by the NCHC's Open Source Software Laboratory, won the Public Sector Applications Award at the Libre Software Meeting in France.

a classroom full of computers into an open source environment complete with system backup, restore, and disaster recovery capabilities. Since 2007, the software have been downloaded more than 90,000 times. The savings for domestic education institutions in 2007 is estimated at US $3.4 million. DRBL also won the first place in France's International Software Competition. The DRBL and Clonezilla's development team was invited to France, Indonesia, and the Philippines to give presentations and set up training sessions. This "diplomacy through technology" introduces Taiwan's open source software development capability to the world (Fig. 3).

D. Large Scale Computer Modeling Research Results

The NCHC's large scale computer modeling research focus during 2007 was on the software and environment required to conduct modeling. In particular, the NCHC focused on modeling energy computation and medical imaging.

1. Renewable Energy Computational Simulation

The NCHC, National Sun Yat-sen University (NSYSU), National Chiao Tung University (NCTU), and the Institute of Nuclear Energy Research have been collaborating for several years now. One of the NSYSU's research projects resulted in the ability to predict the response rate of formic and oxalic acid. The research also explored the adsorption configurations and energetics of BClx on TiO2 anatase and rutile surfaces. These results are a major breakthrough in their respective fields. The collaboration with Dr. Ming-Chang Lin of Academia Sinica in the computation modeling of renewable energy is the NCHC's first step towards further energy research.

2. Medical Imaging Computation and Application

During 2007, the NCHC assisted Chang Gung University in the development of a software program to aid in the reconstruction of damaged craniums due to head injuries. The software

Fig.4 During 2007, science camps were held by the NCHC to encourage scientific pursuit in future generations

enables surgeons to perform more precise surgical operations thereby increasing the quality of care. Testing of the software was completed in 2007 and the NCHC transfered the technology to area hospitals.

Also during 2007, the NCHC collaborated with the Biotechnology Park and National Taiwan University to use virtual reality and image processing technology to create medical images of the brain and nervous pathways. This new technology has pushed the medical research of the brain to the next level.

Educational Outreach

A. Education

During 2007, in order to build a proper foundation for Taiwan's next generation HPC professionals, the NCHC held the following courses and programs:

- 174 professional training courses resulting in 4,459 individual course registrations and 135 symposiums and lectures with 7,885 individual symposiums/lectures registrations.
- Held the Matrix NCHC '07 in which matrix computing was the theme. The event taught students how to utilize HPC in problem solving.
- Held six science camps for middle and high-school students. One hundred and seven students participated in the camps. The camps were held to help nurture future HPC specialists (Fig. 4).
- The workshop, Strengthening Corporate Responsibility to Society, directed by NCHC's Science Volunteer group, was accepted at a symposium held by the World Alliance for Citizen Participation (CIVICUS). The workshop helped to extend scientific volunteerism to the world.
- Released Co-Life Multi-point interactive video conferencing software. In 2007, the software enabled education exchange by connecting 160 institutions so that they could conduct 33 classes. There were more than 4,166 participants.

Fig.5 2007 Southeast Asia gained the support of the USA's National Science Foundation (NSF) and PRAGMA. Attendees included the PRAGMA chairman, Dr. Peter Arzberger. Presentations were given by senior PRAGMA members.

B. Important Symposiums

◆ 8/27~8/31

Participated in the 24th Asia-Pacific Advanced Network (APAN) meeting. The NCHC promoted TWAREN, fiber-optics technology, and its wireless campus networking projects at the event. The center also actively sought out opportunities for international collaboration.

◆ 11/10~11/16

Attended the Supercomputing Conference, SC07. Exhibited research results from HPC, networking, storage, and application software.

◆ 12/3~12/7

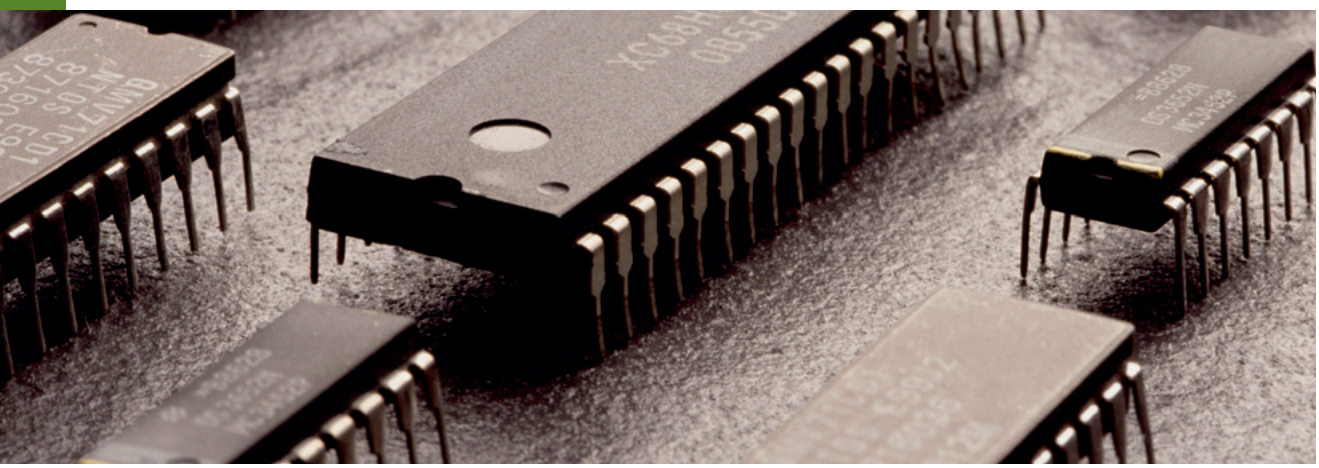
Hosted the second annual Southeast Asia International Joint Research and Training Program in High-performance Computing Applications and Networking Technology in conjunction with the Pacific Rim Application and Grid Middleware Assembly (PRAGMA). The NCHC used this event to publicize research results from HPC and Grid research to southeast Asian countries. The event was also used to cement international collaborative agreements (Fig. 5).

Vision

Building a quality HPC and networking environment is a long-term work in progress. By following governmental mandates and carefully listening to the needs of academia and industry, the NCHC will continue to increase the quality of its HPC, networking, and storage services. Also, through research and education of the various services it provides, the NCHC hopes to achieve its vision of becoming an


CIC
CIC


National
Chip
Implementation
Center



History

Taiwan's National Science Council (NSC) initiated the Chip Implementation Center project (a.k.a. the CIC project) in 1992 as a result of its Fourth National Science and Technology Conference. The CIC is currently a non-profit organization under the supervision of the National Applied Research Laboratories (NARL). The goal of the CIC project is to establish a national research and service center for IC design. In order to realize its vision of making Taiwan a leading global IC design center, the CIC devotes itself to cultivating domestic IC design manpower and upgrading IC design technology within Taiwan.

1992 The CIC Project was initiated by the NSC

1993 The CIC Project Office was established in the Hsinchu Science Park

1997 The CIC was inaugurated

1999 The CIC Project Office relocated to Prosperity Road I in the Hsinchu Science Park

2002 The CIC South region branch office was established in the Tainan Science Park

2003 The CIC became a non-profit organization and a member laboratory of the NARL

2004 The CIC office relocated to the Nanoelectronics Research Building in the Hsinchu Science Park

2007 The South region branch office relocated to the Chi-Mei Building in NCKU, Tainan

Missions

The primary missions of the CIC are to train and expand Taiwan's IC/System design human resources and to upgrade IC/System design technologies.

2007 Major Accomplishments

A. Integrating and Developing the IC/System Design Environment

In order to meet the demands of academic research and industrial development, the CIC provides various Electronic Design Automation (EDA) tools that have been widely adopted by local academia and industry. By integrating these tools into design flows, the CIC aims to establish a complete IC/System design environment.

In 2007, the CIC offered EDA tools from 22 different world-class vendors (Table 1). This included the introduction of ten new EDA tools in the 2007 lineup. Also during 2007, the CIC integrated and updated several design flows including Electronic System Level (ESL), Cell-Based IC, Platform-based SoC, Full-Custom IC, FPGA, Mixed-Signal IC, RF/MM IC, MEMS, and IC measurement. The CIC also introduced various standard cell and SIP libraries for academic use during 2007 including Artisan TSMC 0.13μm CMOS Cell library, Artisan TSMC 0.13μm CMOS Metro Cell library, Artisan TSMC 0.13μm Power Manager Kit, Faraday UMC 90nm CMOS Cell library, and ARM PrimeCell.

The CIC aims to establish a SoC/SIP design and verification environment with Multi-Project SoC (MP-SoC) for resource sharing and cost reduction. MP-SoC integrates heterogeneous SoC projects onto a single chip with shared CPU, DSP Core, memory, on-chip bus, and DMA. In 2006, the CIC collaborated with four academic research groups to design the first MP-SoC chip known as MP-SoC I. The MP-SoC I was taped out using the TSMC 0.13μm CMOS generic logic process. The chip is able to operate at a 100 MHz clock rate with a power supply of 1.2V.

Table 1 EDA Vendors used by the CIC

Vendor	Vendor
Altera	Mentor Graphics
Agilent	Monta Vista
Ansoft	National Instrument
ARM	Parasoft
Aptix	SpringSoft
Cadence	Synchronicity
CoWare	Synopsys
Dolphin Integration	SynTest
Green Hill	TI
Intel	TransEDA
Magma	Xilinx

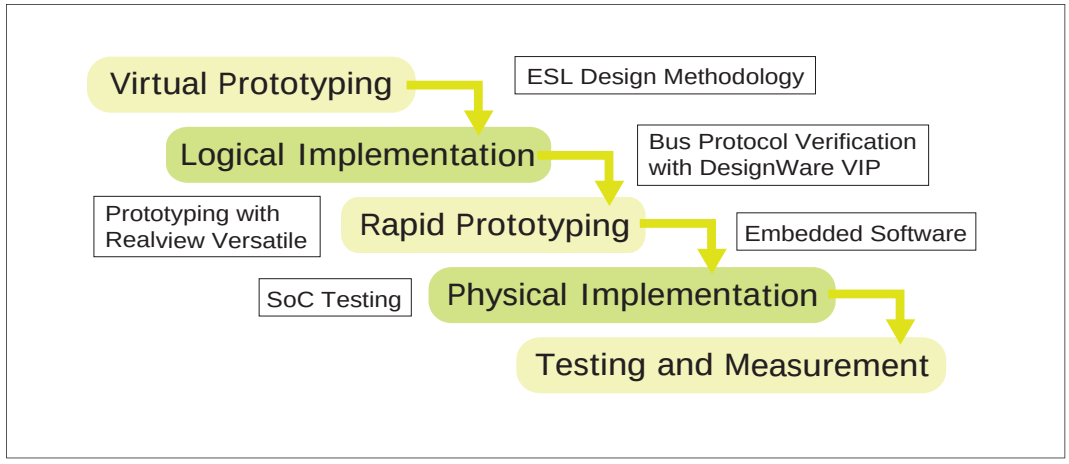


Fig.1 MP-SoC II design flow and key techonologies.

In 2007, the CIC collaborated with 11 academic research groups on 11 different SoC-based projects to design the second generation MP-SoC chip. The MP-SoC II chip's design was more complex than the previous version. Several new technologies such as ESL design flow, bus protocol verification, SoC testing, and embedded software were utilized for this project. Fig.1 shows the MP-SoC II chip's design flow and key technologies used. Fig.2 shows the MP-SoC II ESL's virtual platform. The MP-SoC II layout was completed in 2007 and will be taped out to the TSMC foundry in January, 2008. Fig. 3 illustrates the MP-SoC layout.

Because of it's ever-increasing role in IC design development, the CIC focused primarily on providing the research environment and promoting technology for embedded system designs during 2007. The CIC offers technical consultation services and design service support for embedded software development such as operating system porting, device driver, user applications, and embedded hardware platforms such as TI-DaVinci DVEVM and ARM-Versatile EB on both single core and dual-core architectures. By the end of 2007, the CIC had introduced the domestic self-designed embedded system platform to academia (Figs. 4~7) and will begin offer training courses and technical consulting on these platforms in early 2008. The purpose of these training classes is to

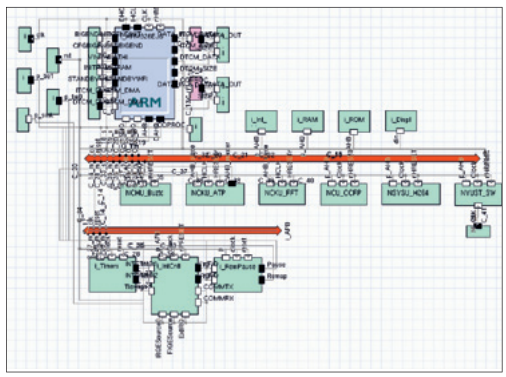


Fig.2 MP-SoC II ESL virtual platform

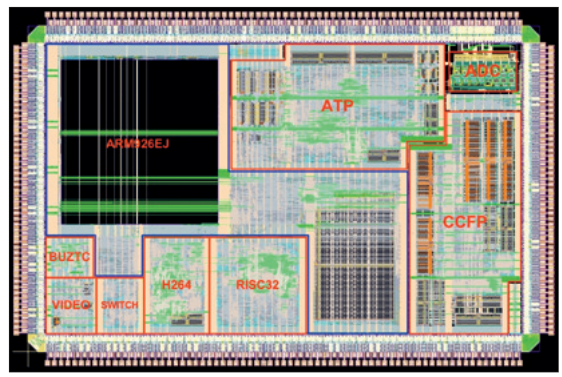


Fig.3 MP-SoC II layout

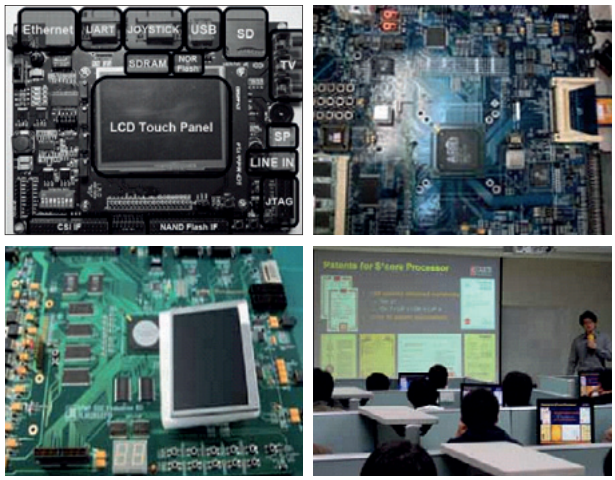


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Fig.4 SunPlus S+Core-SPCE3200 platform
Fig.5 ANDES Leopard platform
Fig.6 ITRI PAC-PMP platform
Fig.7 Platform-related training course

educate students in domestic self-designed embedded system platforms and to help support the local IC industry in Taiwan. The CIC will soon begin offering the classes Hardware-Dependent Software (HDS), Bootloader, and Linux Device Driver.

B. Providing Chip Fabrication and Measurement Services

In order to meet the demands of the IC design industry and encourage growth in IC design human resources, during 2007, the CIC introduced several advanced processes to domestic foundries and provided services for prototyping IC fabrication. In 2007, several process environments were established including UMC 90nm MS CMOS, TSMC 0.13μm MS/RF CMOS, TSMC 0.13μm Logic/MS CMOS, TSMC 0.18μm 1P6M CMOS, TSMC 0.35μm 2P4M CMOS, TSMC 0.35μm SiGe BiCMOS, WIN 0.15μm PHEMT GaAs, TSMC 0.35μm CMOS MEMS, and TSMC 0.18μm CMOS MEMS. The CIC also provided the design rules, model files, EDA verification environments, and training courses on its website.

In 2007, 469 papers were published by the CIC's academic partners in the fields of IC/SoC design. The number of such published papers has steadily increased over the years. This illustrates the CIC's academic partner's remarkable progress in both the quality and quantity of R&D.

Regarding services for industry and research institutes, the CIC uses the Multi-Project Chip (MPC) approach by integrating multiple IC design projects onto a single chip and then entrusts foundries with its manufacturing. This is done in order to share resources and reduce costs. The CIC continued offering advanced process fabrication services to research projects funded by the NSC. These services alleviated the inconvenience and uncertainty associated with direct contact between designers and foundries.

The CIC offers its IC design and fabrication services free of charge to university professors whose proposals are approved by the NSC. A total of 1,721 ICs were fabricated in 2007 including 1,468 advanced chips and 253 educational chips. The chips were designed by 1,965 students under the supervision of 1,680 professors (Fig. 8).

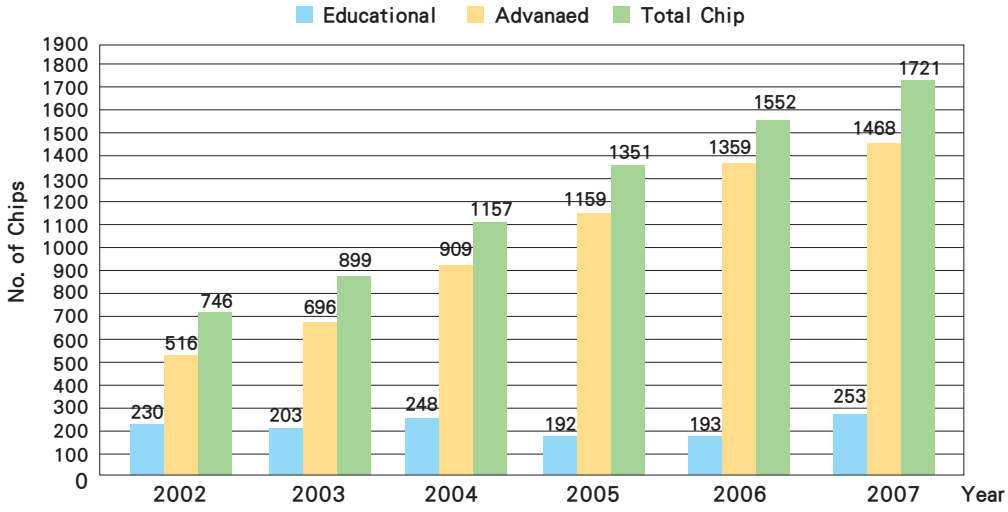

Fig.8 2007 taped out chips

The CIC provides a full range of basic IC measurement services including those for digital, analog, mixed-signal, RF, and MEMS. The CIC's measurement facilities and testing equipment include a wafer probe station, RF IC measurement system, Load-Pull measurement system, high frequency S-parameter, noise figure measurement system, signal source analyzer, and a wireless communication measurement system. During 2007, academic partners accessed facilities 1,218 times. 159 of the 1,218 incidences involved use of the Agilent 93000 SoC test system.

High-performance heterogeneous SoCs have recently become a hot topic in IC design. CMOS MEMS and System-in-Package (SiP) are the two major research topics in the CIC's heterogeneous SoCs platform development. The CIC has been developing 0.35μm CMOS MEMS technology since 2002. Since then, the CIC has implemented more than 300 chips for RF and sensor applications. The CIC released the 0.18μm 1P6M CMOS MEMS process in September of 2006 and, in so doing, began offering high performance devices for RF applications.

During 2007, 12 CMOS MEMS inductors, based on foundry device libraries, were integrated into the CIC's design skills. Information extracted from the designs as well as device models are available in

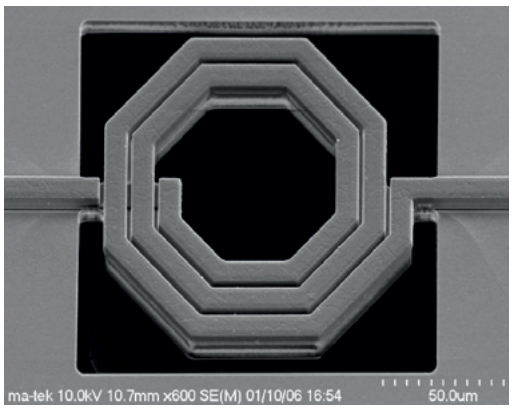

Fig.9 (a) The SEM of CMOS MEMS inductor

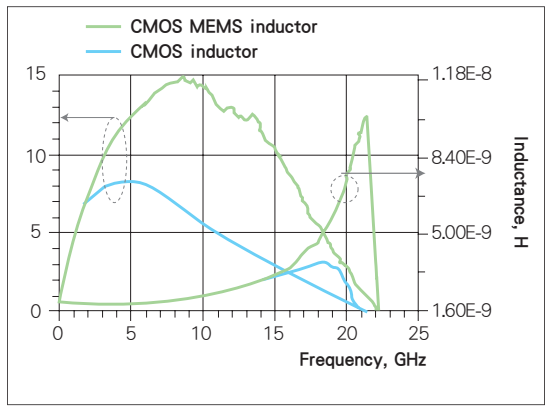

Fig.9 (b) the measured Q factor and inductance for CMOS and CMOS MEMS inductors

the CIC's design handbook. Fig.9 (a) shows the SEM of CMOS MEMS inductor with hollow silicon substrate where the vertical and lateral etchings are around 80μm and 50μm respectively. Both measured inductance and Q factor were extracted as illustrated in Fig.9 (b) where the FQ,max of CMOS MEMS inductor shifts from 4 GHz to 8.5 GHz and the Qmax increases from 8 to 15 resulting in an increase of 88% in Qmax. The CIC's CMOS MEMS process is one of the most advanced platforms in the world and contributes to the development of hetero-material integration.

In 2006, the ACX's LTCC technology was utilized as the MCM-C platform in the SiP project. The first MCM-C MPW test run encompassed ten designers and 17 designs.

C. Promoting Technological Exchange and Cooperation

The continued cultivation of IT manpower is one of the CIC's major missions. To this end, the CIC conducts training courses on full custom IC design, cell-based IC design, FPGA design, IC testing, RF/MMIC design, and SoC/IP design. Most of the training courses are taught by CIC engineers. In 2007, the CIC offered 44 training courses in the above seven categories. The courses were made up of 183 individual classes with a total of 8,419 attendees (Fig.10).

The CIC offers e-learning courses based on the Economical, Effective, and Efficient (i.e. 3E) strategy. These courses provide the opportunity for life-long education without the limitations of time and space. During 2007, the following seven courses were offered by the CIC: HSPICE, Full-Custom IC Design Concepts, VHDL, RF CMOS IC Design, From Plan to Closure, What is Verification Process Automation?, Introduction to the Mixed-Signal Design Environment, Demo Based on PLL Design, Novas' Verdi Debug System, Laker, MMIC design, HW/SW Co-Verification with Seamless CVE, and ADS-Circuit.

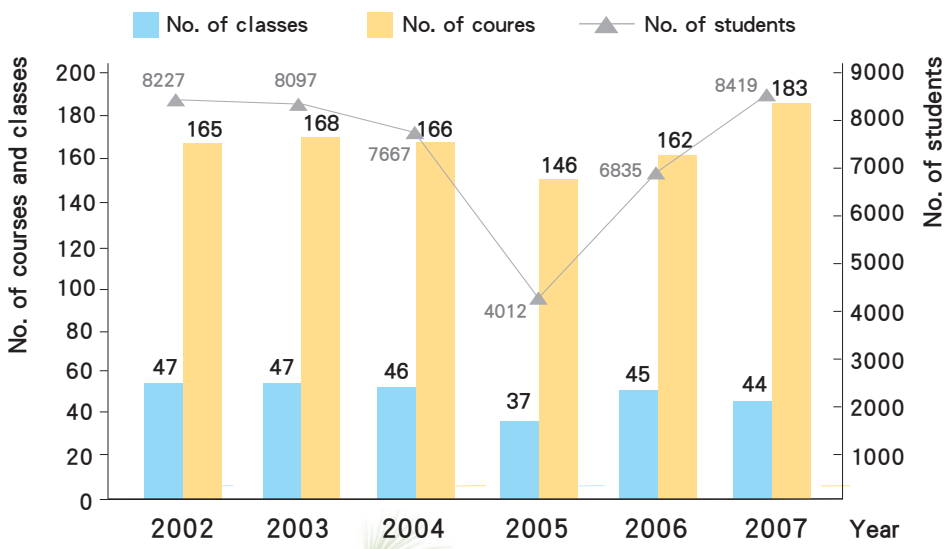

Fig.10 The CIC 2007's courses, classes, and students

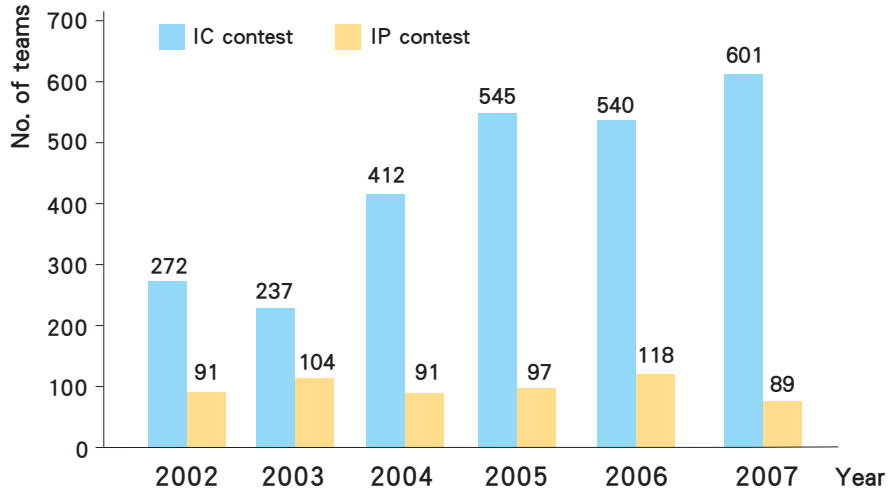

Fig.11 IC and IP contest statistics

In 2007, the CIC jointly organized the IC design contest with National Cheng Kung University (NCKU) and the SIP design contest with National Chung Hsing University (NCHU) to both encourage local academia to engage in IC/SIP design and to encourage Taiwan's overall growth in design technology. The IC design contest involved 601 teams with a total of 1,202 participants. Eighty-nine teams participated in the SIP design contest. These contests have evolved to become the two major IC design-based competitions for all of Taiwan's academia (Fig.11). The CIC also hosted the 2007 Multi-Project Chip Workshop in May of 2007 to demonstrate outstanding IC designs, increase the value of academic research, and further promote cooperation between universities and industry. During this event, Taiwan's leading designers presented their research results in workshops.

Regarding technology introduction and achievement recognition, in addition to maintaining close contact with international research institutes, the CIC also hosts numerous visits from both international and domestic researchers and engineers each year. The CIC uses views these visits as opportunities to create additional research collaborations and knowledge exchange. During 2007, the CIC signed Memorandums of Understandings (MOU) with Japan's VLSI Design and Education Center (VDEC), France's Circuits Multi-Projects (CMP), and Belgium's IMEC. In order to promote IC design concepts to colleges and high schools nationwide, the CIC also gives tours to students as part of their IT summer camp schedule.

Technology innovation and intellectual property rights are indispensable assets in global industrial competition. They are also the prerequisites for Taiwan to become a so-called “Green Silicon Island.” The engineers at the CIC are encouraged to apply for patents and to seek outside business opportunities. In 2007, three patents were granted to the CIC including one USA “invention patent” and two Taiwan “new patents.” Additionally, the CIC has two CMOS process technology-related patents pending.

Fig.12 The CIC's South region office relocated to the Chi-Mei Building on the NCKU campus in Tainan, Taiwan.

D. Driving Research in Southern Taiwan

In order to strengthen the IC/System design environment in southern Taiwan, provide academia with convenient IC measurement services, and cultivate IT manpower, the CIC relocated its South region office to the Chi-Mei building on the NCKU campus (Fig.12). The new office provides an ideal environment for RF power and analog measurements. To provide more design and measurement services and drive research in southern Taiwan. The new office's focus is on biochip integration and the establishment of heterogeneous chip measurement environments.

Vision

The CIC's major objectives are both service and service-oriented research. The center provides IC/System design, fabrication, measurement services, and training to academia, industry, and research institutes. The CIC also offers service-oriented research in order to develop a complete design and measurement environment as well as continuously upgrade its service quality. As a national laboratory, the center spares no effort to meet the demands of Taiwan's national science and technology programs and industrial development. The CIC will continue to strive to be a leader in the global IC community and realize its vision of becoming a world-class research and service center for IC/System design.


ITRC

Instrument Technology Research Center

History

Instruments are the foundation of a nation's industrial advancement and technology development. Because precision instruments are so important to scientific and industrial development, Taiwan's National Science Council (NSC), Executive Yuan, restructured the Scientific Data and Instrument Center (SDIC) to establish the Precision Instrument Development Center (PIDC) in January 1974. The purpose of the restructuring was to establish specialized techniques and develop self-manufacturing capacities for precision instruments.

In January 1987, the PIDC moved to its current location in the Hsinchu Science Park then, in January 2005, the PDIC became one of the nine laboratories under the National Applied Research Laboratories (NARL) and was renamed the Instrument Technology Research Center (ITRC). The ITRC continues to grow and evolve in order to best serve Taiwan's specialized instruments community.

1968 Taiwan's NSC established the SDIC at the National Tsing Hua University (NTHU)

1974 The SDIC was restructured into the PIDC

1987 The PIDC moved to its current location in the Hsinchu Science Park

2003 The PIDC received the "Outstanding Organization" award in Taiwan's governmental technology organization evaluation

2004 The PIDC received the "Honor of Excellence" award in the Technology Category of the Executive Yuan's "Institutional Established Participation and Suggestion System"

2005 The PIDC became a non-profit organization and a member laboratory of the NARL and was renamed the ITRC

2007 The ITRC was awarded the gold medal for the "Illuminated Close-up Photograph Apparatus" and the "Unpowered Micro Fluidic Biochip" at the National Invention and Creation Awards ceremony

Fig.1 ISIS and FUHSI

Fig.2 Atomic Layer Deposition System

Missions

Since its inception over 30 years ago, the ITRC has focused on developing diverse core technologies such as remote sensing, vacuum technology, nanotechnology, and opto-electro-mechanical system integration. In particular, the ITRC's opto-electro-mechanical system integration is widely acclaimed in the field of precision instruments. The ITRC is an increasingly important player in the development of precision instruments in Taiwan. The ITRC's primary missions are to :

- Develop precision instruments and related applications
- Provide repair, training, and information services for precision instruments
- Participate in government projects and support government research

Major Accomplishments

In recent years, the ITRC has been actively integrating its resources with the goal of developing truly advanced and innovative instrument systems. The ITRC's 2007 achievements were as follows :

A. Instrument System Innovations and Industrial Technology Advancements

The technology innovation and advancements made by the ITRC during 2007 (Table 1) included a microscope auto focusing system, a hyper-spectral imager (FUHSI) for use in farming, an intelligent spectral imaging system (ISIS) (Fig.1), a near-infrared spectrometer, a small double-beam biochemical testing system, an atomic layer deposition system (Fig.2), and an optical film thickness monitoring system.

Also during 2007, the ITRC successfully developed both 4-inch and 8-inch atomic layer deposition systems and transferred the technology to local industry in Taiwan. This is the first such system solely developed in Taiwan. It is economically priced, highly customizable, and easy to maintain. It has been predicted that this new technology will become the mainstream and, as a result, Taiwan's ALD will no longer be controlled by foreign companies. The success of this system has contributed significantly to the success of Taiwan's vacuum-related technology industry.

Table 1 ITRC's 2007 Important Innovations and Advancements

System	Field
VCDi-II	Remote Sensing Technology
ISIS	
FUHSI	
LED Brightness Measuring	
Feedback System-HOPE	
Near Infrared Spectrometer	
ALD Optical Film Thickness Monitoring System	Vacuum and Thin Film Technology
Electron-beam Gun	
Evaporation Method with Ion-assisted Deposition	
Pulse Laser Deposition System	
Molding Tester	
II-VI & III-V Material Etching System	Nano / Medical Technology
Double-beam Biomedical Testing System	
Mini-type Multi-function Biochemical Detector	
Lotus Effect Texture Chip System (developed with Prof. Jing Tang Yang of NTHU)	
Mini-type Immunity Quick Test Platform (developed with Prof Chou Chun Shan of Taipei Medical University)	
Microscope Auto Focus System	Optomechatronics Technology
Interference Decenter Instrument	
Multi-function CO_2 Laser Cutting System	
Photo-optical Imaging Molding	
Micro Astigmatism Path System (developed with Professor Ing Shouh Hwang of Academia Sinica)	

Table 2 ITRC's 2007 Patent Applications

Patent Title	Country	Type
Suspended SAW Devices	USA	Invention
One Shot Bipolar Wave Generating Method and Apparatus	USA	Invention
Tunable Dispersive Optical System	USA	Invention
Component of Composite Plate used in Heat Emissions Pump	ROC	Invention
Method and Apparatus for Automatic Compensation Adjustment of Optical Components Polishing	ROC	Invention
Method and Apparatus of Contact less High Voltage Measurement	ROC	Invention
Scrollable Fiber Light Display	ROC	Invention
Method of Manufacturing Self-adjusting Micro Lens	ROC	Invention
Directional Device of the Compass Chariot	ROC	Invention
Device for Liquid Droplet Detection	ROC	Invention
Detecting Apparatus for Cold Cathode Lamp	ROC	Invention
Method for Displaying Focusing Status and System Thereof	ROC	Invention
Method and Apparatus of Fluid Sequence Control	ROC	Invention
Method and Instrument for Measuring Decenter and Tilt of Lens by Interferometer	ROC	Invention
Plasma Process Chamber Leak Instant Micro Detector	ROC	Utility
Far Infrared Pack	ROC	Utility
Far Infrared Immobilization Device	ROC	Utility

B. Key Components and Technology R&D

In 2007, the ITRC successfully developed key industry components such as the InGaAs short-wave infrared rays module, an Area CCD camera module, a solar concentrator zoned lens component molding, Bi-Conic components, Flyeye components, a large diameter rear-silvered mirror, B1 and B2 band pass filters, far infrared base material, a micro immunity detection chip, and the molecular biochip.

Among the aforementioned achievements, the ITRC's Flyeye components are essential to the making of mini projectors. Also, B1 and B2 band pass filters are important optical components in the development of space borne CMOS image sensors whereas micro immunity detection chips and molecular biochip processes are key to Taiwan's biotechnology industry.

C. Patents and Technical Papers

The granting of patent rights and the publishing of technical papers and engineering reports are important to innovation and R&D. The ITRC's 2007 patents, technical papers, and reports included the following :

1. Patents

The ITRC applied for 39 domestic and international patents in 2007 (Table 2). Seventeen of them have been granted-three in the US and fourteen in Taiwan. Among them, 14 were new inventions created by the ITRC. These new patents serve to demonstrate the ITRC's strength in original product development.

2. Technical Papers

The ITRC published a total of 147 technical papers and reports in 2007 in 40 journals and 118 conferences both domestically and internationally. The ITRC also published 34 SCI papers in 2007 in internationally renowned journals such as the Journal of Applied Physics and Nano Letter. Furthermore, in order to pass down its knowledge and technology, the ITRC completed 65 volumes of technical reports in the fields of remote sensing technology, vacuum technology, Nano technology, and opto-electro-mechanical systems integration.

D. ISO 17025 Certified Laboratory

In order to ensure laboratory quality, the ITRC established a national calibration and testing laboratory. The ITRC applies these calibration capabilities to each measurement system. In 2007, the ITRC's Thin Film Standard Laboratory's reflectivity calibration and Opto-electric Standard Laboratory's chromometer correction each received TAF certification and began providing services to industry. Also, the ITRC is expected to become certified for atomic force microscope measurement and Optical MTF measurements in early 2008.

E. Technology Service and Promotion

In order to provide service to Taiwan's high-tech industry, the ITRC has established a one-stop technical service window for the manufacturing, maintenance, testing, research, technology transfer, consultation, and professional training of its instruments. Furthermore, the ITRC also conducts information seminars, press conferences, and major exhibitions worldwide. The goal of the ITRC is to promote the results of its research to the world.

Table 3 ITRC's 2007 International Competition Awards

Competition	Name of Technology
National Invention and Creation Award	Illuminated Close-up Photograph Apparatus—Gold Medal Flat Luminant Visual Inspection Device—Silver Medal
Taipei International Invention Show	Method and Apparatus for Droplet Control (developed with Professor Jingtang Yang of NTHU) —Gold Medal Device for Liquid Droplet Detection—Gold Medal One Shot Bipolar Wave Generating Method and Apparatus—Gold Medal Driver for Amplifying Operating Voltage—Gold Medal
Nuremberg International Invention Exhibition (Fig.3)	Microscope Auto focusing System— Silver Medal Method and Apparatus for Droplet Control (developed with Professor Jingtang Yang of NTHU) —Silver Medal
National Innovation Award (Fig.4)	Unpowered Micro fluidic Biochip (developed with Professor Jingtang Yang of NTHU) —Best Innovation

03 Fig.3 Award winner in the Nuremberg International Invention Award

04 Fig.4 Award winner in the National Innovation Award

1. Promotional Events

◆ International Conferences

The ITRC held the International IEEE/LEOS Optical Microsystems and Nanophotonics Conference during 2007. The chairman of the conference was Professor Jer Liang Andrew Yeh of NTHU's Institute of Nanoengineering and Microsystems. The conference, in which 98 papers representing 15 countries were presented, took place in Hualien, Taiwan from 08/12~08/16. In addition to knowledge exchange, attendees were able to experience the beauty of Taiwan's eastern region and its indigenous culture. The event was extremely successful in promoting Taiwan's academic and cultural achievements to the world!

◆ Instrument Technology Promotion Seminar

In order to provide the public with an understanding of ITRC-produced technology, the ITRC conducted a series of instrument technology promotion seminars on 08/30, 09/05, and 09/19 in the Central (Taichung) and Southern (Tainan) Taiwan Science Parks and National Taiwan University. Wenke Yang, the Director of the Central Taiwan Science Park, Chunwei Chen, Director of the Southern Taiwan Science Park, and Yungzhuang Wang, Director of the Department of Planning and Evaluation at the NSC, were invited to the event to share their expertise. The event also allowed professionals from various fields to directly communicate with each other.

◆ Exhibitions and Competitions

In order to improve international awareness of the ITRC's inventions and achievements, the ITRC participated in several exhibitions during 2007 such as OPTO Taiwan and the Taipei, Taichung, and Tainan Industrial Automation Exhibitions. Also during 2007, the ITRC participated in the Taipei International Invention Show & Technomart /National Invention and Creation Award, the 59th Annual Nuremberg International Invention Exhibition, and the National Innovation Award (Table 3).

At the Taipei International Invention Show & Technomart, the ITRC's close-up photograph apparatus and flat luminant visual inspection device won the gold and silver medals, respectively.

Also at the competition, the ITRC's method and apparatus for droplet control, device for liquid droplet detection, one-shot bipolar wave generating method and apparatus, and driver for amplifying operating voltage, all won gold medals. Never in the history of this event has the ITRC received so many awards!

At the National Innovation Award, the unpowered micro fluidic biochip, a joint project of the ITRC and Professor Jing Tang Yang of NTHU's Department of Power Mechanical Engineering, received the best innovation award in the academic research division. The ITRC's outstanding performance was not only a testament to its innovation, but also showed that it has made significant contributions to Taiwan's high-tech industry.

◆ Press Conferences

In order to facilitate the development of Taiwan's industry and transfer of technology, the ITRC held the Hyper-spectral Imager press conference on 04/25. FUHSI and ISIS were unveiled at the event. FUHSI and ISIS are used in researching precision agriculture, water monitoring, and non-indigenous species. This new technology has become an important tool for Taiwan's agriculture science and ecological monitoring.

On 12/19, the ITRC held another press conference to promote the completion of its atomic layer deposition (ALD) technology. The step coverage and thickness uniformity of the ITRC's ALD are on par with that of the international standard but cost two thirds less. The success of the ALD is an important milestone in Taiwan's journey toward next-generation semiconductor devices.

2. Commissioned Instrument Manufacturing, Repair, and Calibration

The ITRC actively promotes their technical consultation and assistant systems services in order to improve instrumentation efficiency. The ITRC has provided instrument manufacturing services (Table 4) for important academic research such as National Chiao Tung University's (NCTU) metal-organic chemical vapor deposition control system, National Sun Yat-Sen University's (NSYSU) X-ray diffractometer specimen turning mechanism and control software, and National Chung Hsing University's (NCHU) short-wave infrared hyper-spectral imager. During 2007, the ITRC assistance in 2,090 cases for industry and academia. This demonstrates the ITRC's significant contribution to the research and development of instruments in Taiwan.

3. Technology Transfers and Commissioned Research

Some of the ITRC's technology transfers during 2007 included the micro sensor component technology and signal generator with single step and continuous wave output. Also, the ITRC is continueign to promote technology such as the multifunction bio-chemical testing system, free radical detectors, liquid precursor oxides in ALD, and optical film thickness monitoring systems. It is expected that by early 2008, the signing for liquid precursor oxides in ALD will be completed. Also during 2007, the ITRC participated in several joint research projects including the optical system for CO_2 laser application in art glass cutting, grain flaw detection modules, and light guide plate modules.

F. Training

1. Professional Training

The ITRC provides professional skill training courses that emphasize both theory and practice. These courses cover the fields of engineering, optoelectronic technology, vacuum technology,

Table 4 ITRC 2007 Support Provided to Academia

Name of Institution	Program Title
National Chiao Tung University	High Voltage Amplifier
	Metal-organic Chemical Vapor Deposition Control System
	Design and Manufacturing of Vacuum Coating Chamber
	Electric Current Circuit
	Voltage Generation on a Piezoelectric Actuated Positioning Table
National Sun Yat-sen University	X-ray Diffractometer Specimen Turning Mechanism and Control Software
	Low Temperature Physics Vacuum Instrument
	Low Temperature Electromagnetic Property Measurement Module
	Low Temperature Vacuum Signal Adaptor
	Low Temperature Electromagnetic Property Measurement Module
	Scanning Probe
National Chung Hsing University	Heat Pipe
	High Voltage Pulse Generator
	Short-wave infrared Hyper-spectral imager
National Taiwan University	Sirius Optical Calibration System
Ching Yun University	Micro Imprint Formation Machine Component
De Lin Institute of Technology	Power Amplifier
National Formosa University	Cat's Eye Reflector
National Cheng Kung University	Aluminum Cylindrical V-groove
National Kaohsiung First University of Science and	Mirror Molding

micro electro-mechanical technology, as well as the application and maintenance of instruments. A total of 27 classes were conducted in 2007 with a total of 916 trainees/attendees.

2. Basic R&D Training

The ITRC actively promotes the participation of graduate students in research projects in order to educate Taiwan's future high-tech industry leaders. In 2007, 87 graduate students from 15 universities were selected by the ITRC to participate in ITRC-initiated research projects that resulted in their receiving masters or PhD degrees.

3. International Cooperation

Over the past several years, the ITRC has hosted the International Scientific Instrument Technology Workshop in order to assist other nations with the development of their instrument technology development. In 2007, 21 professionals from Thailand, Indonesia, Vietnam, and other countries participated in these training courses. “Diplomacy of Science and Technology” is seamlessly promoted by the ITRC via these workshops.

G. Integration of Instrument Resources

The ITRC has established the most comprehensive instrument information database in the nation. The database contains information that has been compiled over the past ten years on the 17,881 instruments purchased by 584 organizations nationwide with a net value of over one million NTD. This database enables the ITRC to quickly obtain information on instrument resource distribution and determine domestic market needs. It is also an important reference tool for research projects and policy formation.

Educational Outreach

A. Instrument Specific Books

A proper understanding of an instrument's operation and maintenance requirements is necessary in order to get maiximum use of it. To this end, the ITRC published six issues of "Instruments Today" in 2007. The contents of this publication covered topics such as biosensors, nanoparticles, fiber lasers, atomic layer deposition and its applications, physical structures of polymers, and hyper-spectral imager.

The precision manufacturing of optical components is the cornerstone of opto-electro-mechanical systems integration. Therefore, for the last two years, the ITRC has brought together more than 50 local industry and the academic experts and scholars to write the "Precision Manufacturing & Inspection of Optical Components." The book has 17 chapters and more than 600 pages and covers topics such as optical systems, basic optical design, properties of optical material, and the international optical drafting standard. The book also describes, in great detail, the manufacturing and inspection of optical components, introduces their applications, and discusses the future of the industry. The book is an invaluable source of knowledge for researchers in academia and the industry.

B. Basic Science Education

One of ITRC's main focuses is on the improvement of basic science education. In 2007, the ITRC and the Fubon Cultural and Educational Foundation held several science camps for junior and senior high school students. Students who participated in the Applied Science Camp for Future Leaders in Science and Technology and the Science Camp for Happy Lives learned about physics, chemistry, biology, optoelectronics, nanotechnology, and medicine. One hundred thirty-six junior and senior high students participated in the camps. The ITRC donated funds to cover the fees for 20 students whom otherwise would not have been able to attend due to financial limitation.

As part of its promotion of science technology, the ITRC also hosts guest tours of its facility. In 2007, a total of 2,244 visitors visited the ITRC.

Vision

Precision instruments are the foundation of the high-tech industry's past and future development. Given the continued breakthroughs in academic research and high-tech industry, various innovative instruments have emerged and systems have become more complicated. Looking forward to an even more competitive future, the ITRC will hold strong to its self-requirement of "Sustainable Management and the Continuous Pursuit of Excellence." The ITRC will continue to play a key role in national research and as a supplier of precision instruments and technology services to Taiwan's high tech industry.


STPI


Science &
Technology Policy
Research and
Information Center

History

"A sound sci-tech policy helps to lead and guide a nation's sci-tech-related development and guarantees its success."

The primary role of the Science & Technology Policy Research and Information Center (STPI) is to improve the quality of the nation's Sci-Tech information services by developing and providing outstanding sci-tech policy support and fostering programs for innovation and creativity. To this end, the STPI develops and implements well established formulas that provide professional support for Taiwan's sci-tech policy development needs.

1974 The establishment of the Science and Technology Information Center (STIC) was approved by the National Science Council (NSC), Executive Yuan

1986 Commissioned by the NSC, the STIC established the Science & Technology Information Retrieval Network (STICNET)

1998 The STIC began providing its online Government Research Bulletin (GRB) information retrieval service

The STIC established the CONsortium on Core Electronic Resources (CONCERT) in Taiwan

1999 The STIC began offering its Nationwide Document Delivery Service (NDDS) service

2000 The STIC established its Policy Research, Information Analysis, and Survey & Statistics divisions

2005 The STIC became a non-profit organization and a member laboratory of the NARL and was renamed the STPI

The STPI implemented the Information and Communications Safety Management System (ISMS) and received ISO BS-7799 certification

2006 The STPI was awarded Intellectual Property Management Services (IP1) and Intellectual Property Value Added Services (IP2) certification by Taiwan's Industrial Development Bureau, Ministry of Economic Affairs

2007 The STPI received Information and Communications Safety Management System ISO 27001: 2005 certification

Missions

The STPI is to establish a Sci-Tech database for use by Taiwan's industrial, governmental, and academic circles. Also, the STPI studies, analyzes, and forms Sci-Tech policy utilizing international and domestic Sci-Tech databases. The STPI seeks to support the government's Sci-Tech decision-making system and academic R&D as well as promote international communication and cooperation. This is done through licensing, developing, and enhancing the core Sci-Tech information strategies such as marshaling, analyzing, determing, and presenting.

The primary mission of the STPI is to support the governmen's decision-making system. The STPI's responsibilities include studying the developmental trends within the Sci-Tech domain, analyzing and determining the "change-in-demand" trend within Sci-Tech policy, collecting and building databases related to Sci-Tech R&D resources and policy, and providing innovative and forward thinking Sci-Tech planning and strategy.

To improve Taiwan's overall Sci-Tech research environment, the STPI has taken on the additional mission of supporting academic research and development. The STPI introducess and integrates new domestic research information resources and expands the sharing of technology, results, and advanced knowledge.

In support of promoting international exchange and cooperation, the STPI is constantly strengthening and expanding exchange and collaboration with Sci-Tech policy research institutions in foreign countries. The STPI actively participates in international activities such as collaborative research and promotes business development as well as Taiwan's achievements in Sci-Tech.

2007 Major Accomplishments

A. Sci-Tech Policy Research

The STPI's 2007 focus was on surveying and applying the latest Sci-Tech developmental trends including the inter-disciplinary outcome evaluation methodology of technology convergence trend, energy technology, and Nano and biotech fields. The STPI assisted the NSC in planning, deliberating, and managing its Life Science in the Government Sci-Tech Program. The STPI also assisted Taiwan's Council of Agriculture (COA) in executing its national agriculture development strategy plan.

During 2007, the STPI has published over 50 papers, 12 research and technology reports, 10 analysis and planning reports, 3 statistical analysis reports, and the Yearbook of Science and Technology, Taiwan ROC 2007. Also during 2007, the STPI has held 33 symposiums, 2 forums, and actively promoted international Sci-Tech cooperative research.

1. Sci-Tech Policy Planning Management Research

The STPI's three major areas of focus during 2007 were:

- Technology convergence trends and science technology policy planning— The focus of this research was on analyzing the Nano development plan and developing strategies to promote the plan in the US, E.U., China, and beyond. This research was also used to develop comparative strategies for promoting expansion of the technology convergence trend in Taiwan.

- A study on the energy technology policies of representative countries— The focus of this research was on analyzing policy and technology trends regarding wind and ocean energy. This research will be used as a reference for planning similar energy technologies for use in Taiwan.

◆ Performance-based mechanism for R&D resource allocation— This research applied both quantity and quality analysis methodologies to calculate how governmental investment affects enterprise R&D financial investments. Also, this research examined the policy that could motivate civil R&D investment from the aspect of international benchmark and domestic development uniqueness.

2. Sci-Tech Policy Development Strategy Methodology Research

The goal of this project is to apply integrated core competences and establish research models for Sci-Tech strategic planning. Also, the project aims to forecast future Sci-Tech developmental trends and assess global R&D competitiveness in emerging fields. The results of this project will help government and enterprise obtain optimal R&D resource allocations and competitive portfolios.

During 2007, the project produced the following results:

◆ Assisted the NSC and Executive Yuan Steering Committee on Taiwan's energy policy and Sci-Tech development strategy.

◆ Executed strategic planning and promotion for industry clustering and developed the Hsinchu Biomedical Park and the Stanford-Taiwan Biomedical Fellowship Program (commissioned by the NSC).

◆ Analyzed developmental trends in the fields of nanotechnology and functional food industries.

◆ Executed the Research of Agriculture Technology Foresight Planning project (commissioned by Taiwan's Council of Agriculture).

◆ Participated in the Feasibility Assessment of Next-generation Smart Grid and Power Grid Management Systems (executed by the NARL).

◆ Held an international workshop and a seminar on Technology Foresight.

3. R&D Programs Evaluation Methodology Research

The focus of this research was on the development of inter-disciplinary outcome evaluation methodologies and the comparison of R&D program evaluation models. In developing the evaluation methodology, the STPI researched the outcome indicator of the Sci-Tech project aspects using Bibliometric Analysis, Patent Analysis, and Data Envelopment Analysis, and finished two projects in title of Trend Analysis of Carbon Nanotube Research and Observation of Patent Activity in Asian Countries. Also, the Formation of Goals & Development of Outcome Indicator of Science & Technology Programs used the evaluation models and indicator systems from Korea, the E.U., and the US. The direction of the research is illustrated in Fig. 1.

The STPI also entrusted the Center for International Science and Technology Policy (CISTP) at George Washington University to execute the Analysis of Outcome Evaluations of R&D Programs in the U.S. and the E.U.: Research Network Indicators project. Additionally, the STPI is developing new impact evaluation methodologies in various inter-disciplinary research methodologies.

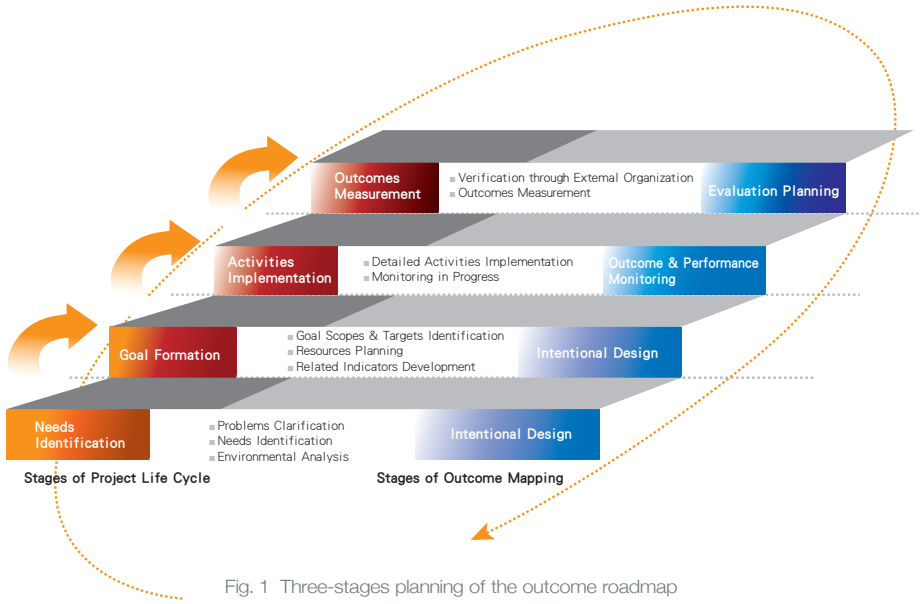

Fig. 1 Three-stages planning of the outcome roadmap

B. Sci-Tech Information Services

In order to provide high quality Sci-Tech information services and help researchers perform their research as efficiently as possible, the STPI offers a wide array of licensed software under CONsortium on Core Electronic Resources in Taiwan (CONCERT) program. CONCERT combines with NDDS, a self-building R&D databases, and the REAL system, to create the Governmental Academic Information Integrated Resources Services platform of governmental academic information resources (Fig. 2). The STPI worked hard in 2007 to offer its customers the utmost in capability and security. Due to this endeavor, the STPI received Information and Communications Safety Management System ISO 27001: 2005 certification in 2007.

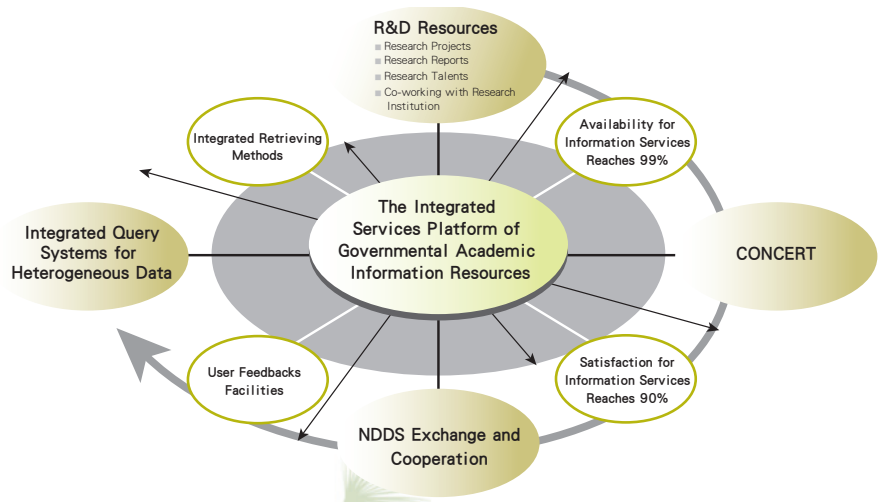

Fig. 2 The governmental academic information integrated resources services platform

1. The Construction and Activation of R&D Resources Databases

As of 2007, in order to support Sci-Tech policy research and quality as well as to enhance information services, the STPI's Information Resources Division maintained 12 databases including the Government Research Bulletin (GRB), the database of National Profiles of Human Resources in Science and Technology (NPHRST), and the DataBase of Research and Innovation Capacity (DBRIC). The STPI's Information Resources Division also published three statistical reports during 2007 to demonstrate the importance of these databases showcase the current status of R&D resources in Taiwan.

2. CONsortium on Core Electronic Resources in Taiwan (CONCERT)

With the goal of facilitating and improving academic research and development in Taiwan, the CONsortium on Core Electronic Resources in Taiwan (CONCERT) effectively licenses international and domestic electronic resources. To date, there are a total of 207 CONCERT participants from 169 universities in Taiwan. During 2007, 37 systems, 108 databases, and 11,000 online electronic journals were negotiated. The total number of licensees obtained during 2007 was 2,142. The STPI's electronic information resources have become the major source of reference information for academic researchers nationwide. In 2007, the CONCERT reached an overall user satisfaction rating of 97.1%.

3. Nationwide Document Delivery Service (NDDS)

The STPI also provides the Nationwide Document Delivery Service System (NDDS) for Taiwan's academic research information environment. The STPI has provided the NDDS service since 2000. The NDDS facilitates information sharing among Taiwan's academic libraries. The NDDS also allows users to send requests to photocopy journals and reserve books online. By utilizing the NDDS, libraries in Taiwan are able to realize a significant cost savings in terms of budget and labor. The total number of the libraries NDDS in 2007 was 433. Also, there were over 150,000 approved users during the same year with requests for the NDDS service totaling 160,000.

Educational Outreach

As part of its educational outreach program, in 2007, the STPI hosted the International Seminar on Technology Foresight, the CONCERT Conference, and two Information and Communication Security seminars. Between these four events, there were a total of 695 attendees. In addition, five CONCERT and NDDS user meetings were held with a total of 339 attendees. The STPI also held 132 training sessions during 2007 with a total of 3,512 attendees. The total number of participants for STPI-hosted events during 2007 exceeded 4,000. The list of STPI's 2007 publications is shown in Table 1.

Table 1 The STPI's 2007 publications

Publication	Publication Date
Sci-Tech Policy Review	Bimonthly
Sci-Tech Policy Review (English version)	Semi-Annually
Yearbook of Science and Technology Taiwan ROC 2007	December, 2007
Yearbook of Science and Technology Taiwan ROC 2006 (English version)	December, 2007
Formation of Goals & Development of Outcome Indicator of Science & Technology Programs	December, 2007
2006 NDDS Annual Report	October, 2007
Statistical Report on DataBase of Research and Innovation Capacity 2006 (Universities & Research Institutions Only)	October, 2007
Statistical Report on National Profiles of Human Research in Science and Technology 2006 (Ph.D. Level Only)	October, 2007
Statistical Report of Government Research Bulletin 2006	October, 2007
A Study of Current Policies on Sci-Tech Talents of Selected Countries	October, 2007
Current and Future Technological Development for Taiwanese Functional Food	June, 2007
2006 CONCERT Annual Report	May, 2007

Vision

The STPI's vision is to continue strengthening its capability of accessing database resources and to improve its services and the level of support it provides to Taiwan's Sci-Tech policy makers. Additionally, in order to improve Taiwan's overall Sci-Tech competitiveness, the STPI will continue to develop the environment and construction of academic research information.


NCDR
CDR


National
Science and Technology
Center for
Disaster Reduction

History

Taiwan, famous for its beauty and hospitality, is also well known for its recurrent natural disasters. Because Taiwan is located near the conjunctions of the Pacific and Philippine Sea tectonic plates, there is a higher potential occurrence of natural disasters such as typhoon, flood, debris flow, landslide, and drought. These natural disasters often cause serious economic hardship and occasionally even loss of life.

Disaster mitigation, preparedness, response and recovery have become of primary focus to Taiwan's government. The National Science and Technology Center for Disaster Reduction (NCDR) works hand-in-hand with the local governments to discover solutions to natural and man-made disasters. These solutions help to ensure a safe Taiwan by addressing issues such as technology research, system management, policy, and legislature as they apply to disaster mitigation, preparedness, response and recovery.

1997 The 138th Committee Meeting of the National Science Council (NSC) approved the National Science and Technology Program for Hazard Mitigation (NAPHM) and the establishment of the program office

2001 The 6th National Science and Technology Conference convened and established the NCDR to develop, promote, and evaluate disaster technology, implement applications, and promote technology transfer

2003 The minister of the NSC convened the Executive Yuan's Technical Advisory Committee to formally establish the NCDR

Missions

The NCDR provides a solid foundation for the sustainable development of disaster management and the reduction of casualty and property loss. The primary missions of the NCDR are to:

- Perform R&D
- Supply technical support
- Implement applications
- Maintain database and information exchange platform on disasters
- Provide an advisory function for policy-making regarding disaster prevention

The NCDR's major functions are to:

- Coordinate, plan, and implement disaster reduction and emergency response technology-related R&D
- Deploy disaster reduction and response technologies to support actual field tasks
- Promote R&D and apply those results to the disaster reduction and emergency response system
- Additional implementation and design for tasks related to disaster reduction and emergency response

2007 Major Accomplishments

Since its establishment, the NCDR has carried out the horizontal and vertical integration of government, academia, and industry with the goal of accumulating and aggregating national technology developments in natural disaster. This is done so as to ensure a safer living environment for all of Taiwan's citizens. The major accomplishments of the NCDR, especially in technology development and policy promotion during 2007, are as follows:

A. Conclusion and Demonstration of the National Science and Technology Program for Hazard Mitigation (NAPHM)

In its eight-year history, the NAPAM has achieved many outstanding research results. In early 2007, the NCDR hosted the annual NAPHM conference that was designed to provide a comprehensive vision of innovation and development on disaster reduction in Taiwan. During the conference, government ministries, academic institutions, and industry gathered together to map out the NAPHM's future.

B. Assisting the Government in Policy Making

In an attempt to prevent technological hazards and mitigate losses from natural disasters, the Disaster Prevention and Response Act, declared on July 19th 2000, was designed to define the NCDR's tri-level framework (i.e. the cabinet, the county/city, and township levels) of disaster prevention and emergency response. In order to ensure that local governments adhere to the disaster prevention and preparedness policies and procedures, the National Disaster Prevention and Response Council (NDPPC) performs its annual evaluation via written inquiries and formal on-site inspections. The NCDR consistently provides assistance to all 25 local governments on annual evaluation regarding their disaster-related preparedness. These annual evaluations have been conducted with participation of the NCDR since 2003. The evaluations are designed to identify the local areas disaster prevention and preparedness strengths and weaknesses. Improvements in the regional plan of disaster reduction and emergency response, the identification of potential disasters, and measures taken in the event of an emergency were all laid out in 2007.

C. Information and Decision Support Platform

Natural hazards are defined as random acts of nature symbolized by extremes in physical processes. Although it is almost impossible to avoid the occurrence of such disasters and completely recoup the damage caused by them, the risks and suffering they cause can be minimized by developing suitable strategies for disaster management. Such strategies include the development of early warning systems, realization of pre-disaster developmental plans, implementation of disaster preparedness and emergency response, mobilization of relief resources, and assisting in re-habilitation and post-disaster recovery.

The general process of emergency management involves real-time disaster information collection, simulation, interpretation, analysis, prediction, visualization, and decision support. Monitoring systems must be installed to collect the real time data before, during, and after the disaster. Databases and numerical models must be employed to generate the most appropriate tendency forecast in preparing for and response to emergency. Advances in information technology such as the Internet, Geographic Information Systems (GIS), remote sensing, and satellite imagery form a 3-D solution tool in the planning and implementation of disaster management.

The Information Division of the NCDR has developed a Decision Support System for Emergency Response (DSSER) specifically to address the hazards associated with typhoons. This system is based on the Web-GIS framework in that the disaster-related information can be distributed via the Internet. The DSSER is designed to integrate real-time monitoring data, dynamic hazard models, and GUIs to provide disaster management decision support tools for emergency response. The results of analysis and warning messages are delivered to decision makers at the Central Emergency Operation Center (CEOC) and help them make the right decisions in the event of an emergency.

D. Increase Disaster Analysis Accuracy

Supporting the government before, during, and after a natural disaster is the NCDR's primary function. As an example, during typhoon season, the NCDR is staffed 24/7/365 to support the Central Emergency Operation Center (CEOC) (Fig.1). The NCDR also collaborates with other governmental agencies including the Water Resource Agency, the Central Weather Bureau, and the Water Conservation Bureau in order to predict and, when they take place, help mitigate possible damage done by typhoons, landslides, and other natural disasters.

Fig.1 The CEOC operation's headquarters

E. Yearly Evaluation of Local Governments

The NCDR supports local governments by emphasizing disaster preparedness and mitigation. This program provides local government a reference for preventative planning and mitigation.

F. Facilitating a "Community-based" Disaster Management Program

The NCDR cooperates with governmental sectors to promote its "community-based" disaster management program to the public by designing teaching materials that are used to increase disaster resilience in communities. During 2007, the focus of the program was to deliberate the experimental projects of 12 communities and identify obstacles that the community dwellers might encounter. Based on these findings and conclusions, the NCDR made recommendations for enhancing the "community-based" disaster management program.

Educational Outreach

During 2007, the NCDR dedicated itself to promoting the concept of disaster prevention and preparedness to the public via various programs such as conferences and activities. The NCDR's 2007 promotional efforts focused on the following three categories:

A. "Community-based" Disaster Management Training Program

Recent catastrophic disasters have underscored the necessity of enhancing the public's disaster readiness. The United Nations and its member countries recognize the necessity of community involvement in reducing the effects of hazards whether they are natural or man-made. Accordingly, in 1998, the NCDR implemented five pilot studies on community-based disaster management. In 2005, the NCDR developed a training course to help communities throughout Taiwan implement their own community-based disaster management program.

In 2007, the NCDR conducted a total of 15 training courses, programs, seminars, and workshop to assist both local governmental and non-governmental organizations deal with disaster preparedness. There were more than 700 attendees among these 15 programs. The programs did much to help develop active partnerships between the public and private sectors.

B. Disaster Mitigation Personnel Training and Education Plan

In order to improve disaster reduction awareness and education, during 2007, the NCDR assisted the Program Planning Office administer the Personnel Training Leading Program for the Education of Disaster Reduction. The primary goals of this program were to instill the concept of disaster reduction, increase the safety of students and teachers on campus, and to prepare shelters for local residents in the event of an emergency.

C. International Collaborations

The NCDR actively seeks out international collaborations for the purposes of promoting disaster prevention and mitigation. Over the past few years, the NCDR has dedicated itself to communicating with the world and promoting its disaster prevention and hazard mitigation technology and achievements. Some of the NCDR's critical international collaborative activities in 2007 included the following:

Fig.2 The International Training Workshop on Typhoon and Flood Disaster Reduction

1. The International Training Workshop on Typhoon and Flood Disaster Reduction 05/07~05/11 (Fig.2)

The primary focus of the International Training Workshop on Typhoon and Flood Disaster Reduction was on hazard mitigation with an emphasis on typhoon-related disasters. During the conference, attendees from developing Asian and Latin American countries shared their experiences with government officials and engineers.

2. Taiwan/Japan Workshop on the Earthquake Early Warning System 09/03~09/04

The focus of the Taiwan/Japan Workshop on the Earthquake Early Warning System was on introducing the earthquake early warning (EEW) system that was developed in Japan. The EEW system has successfully been applied to residential buildings, hospitals, electronic facilities, and semiconductor factories in Japan. The workshop was held in order to explore ways in which the EEW system might be used in Taiwan.

3. The Second International Conference on Urban Disaster Reduction 11/27~11/29

The focus of the Second International Conference on Urban Disaster Reduction (ICUDR) (Fig.3) was on large-scale disaster management of both natural and man-made disasters. In total, there were about 300 attendees representing 18 different countries attending the event. Also, there were 192 mitigation, preparedness, response, and recovery-related papers presented at the conference. The conference helped to further build closer collaborations among global disaster reduction-based societies.

Fig.3 The former president of Academia Sinica, Dr. Yuan-Tseh Lee, delivered a keynote speech on the opening day of the Second International Conference on Urban Disaster Reduction, Nov.27~29,2007.

Vision

Along with the growth of the global economy has come industrial development and, as a consequence, global warming and climate change. These, in turn, seemingly cause natural disasters to occur more frequently and in larger magnitude and intensity. For these reasons, disaster mitigation is an extremely important topic that demands the world's attention!

Disaster reduction is an long-term ongoing task that, in order to be effective, must be based on solid research and technology. Disaster mitigation counter-measures involve a wide-range of analysis including vulnerability evaluation, land use planning, standard formulation, program drafting, organizational build-up, technology application development, education of the general public, taxation, and insurance.

We must synchronize Taiwan's national development in disaster mitigation with that of the rest of the world and share our experience in solving existing or potential disaster-related issues. Through our long-term endeavor, it is our hope that the safety of Taiwan's citizens can be assured and that nature will be well preserved.

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Publishing Date : June 2008