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Second Phase of Space Program to Begin in 2004

The National Science Council (NSC), Executive Yuan, passed the "Second Phase National Space Program" at the 159th council meeting, held on December 30, 2002, and also approved the results of the 2001 Survey of National Science and Technology Activities.

The ROC's space program has already achieved satisfying, tangible results. To further improve the nation's ability to apply space technology, the NSC has now drawn up a roadmap for the second phase of the space program, which aims to expand the country's space industry, develop small satellites and micro-satellites, and apply space nanotechnology.

More than eleven years have gone by since the ROC's First Phase National Space Program got underway in October 1991. Thanks to a team effort on the part of industry, universities, research organizations, and the National Space Program Office (NSPO), our country has established a space technology development framework and accumulated an impressive list of space technology achievements. For instance, the ROCSAT-1 satellite – the ROC's first satellite – was successfully launched on January 27, 1999, and is still operating normally in orbit and continues to perform its mission. The ROCSAT-2 and ROCSAT-3/COSMIC (Constellation Observing System for Meteorology, Ionosphere and Climate) satellite programs are proceeding according to the First Phase Space Program plan, which is anticipated to be accomplished on schedule by 2006.

The first phase of the space program has given the nation a space technology capability and completed the infrastructure needed for space missions. The established satellite Integration and Testing facilities and ground station system are now able to take on satellite projects either commissioned by other domestic agencies or through joint international ventures. The NSPO has formulated the "Second Phase Space Technology Development Plan," which is to extend from 2004 to 2018, in hope of raising the ROC's space technology to the highest international standards. Simultaneously during this phase the NSPO plans to expand the nation's space industry, satellite application capability, and space facilities, implement satellite programs, advance space research, and develop a sustainable space technology industry.

Taking into consideration the nation's existing facilities and international development trends, it is felt that the mainstream of future efforts will consist of small satellites and micro-satellites. The NSPO consequently plans to organize joint space technology teams involving industry, schools, and research organizations for the purpose of independently designing and manufacturing satellites in Taiwan. While maintaining a core technology team, the NSPO will gradually transfer its technical know-how to relevant private firms, which will continue to increase the number of spacecraft components produced domestically. The academic community will assume active responsibility for the design and manufacturing of pico-satellites, nano-satellites, or even micro-satellites with the technical support provided by NSPO. The joint program has the goal of technology upgrading, education outreach, and manpower training.

The NSC has conducted yearly the "Survey of National Science and Technology Activity" since 1981 for the purpose of regularly tracking the R&D activities of industry, government, schools, and research organizations. This survey has provided a clear picture of the state of high-tech research and development in Taiwan, while giving the government a factual basis for its technology policy and resource planning work. The most recent survey put nationwide research and development spending in 2001 (excluding defense R&D) at NT$205 billion, which represented an increase of NT$7.4 billion over 2000. This R&D spending also accounted for 2.16% of GDP for the year. The annual growth rate of R&D spending in the ROC – which has averaged 7.0% over the last five years – has been higher than that of

the US, Japan, Germany, or France, displaying Taiwan's strong commitment to research. But since Taiwan's private sector has spent relatively less on R&D than its counterparts in many of the world's leading nations, the government in the future must do more to encourage private R&D investment.

A total of 10,635 journal papers published by Taiwan's researchers and scientists were cited in SCI in 2001, which was an increase over 2000 and sufficient to propel Taiwan up two notches from 19th to 17th in the world. While the 5,103 papers cited in EI was similarly up from 2000, Taiwan's rank remained steady at tenth. A total of 5,376 US patent applications made by Taiwanese applicants (not including new design patents) were approved in 2001, giving Taiwan a world rank of fourth.

Furthermore, Taiwan's sci-tech development statistics were added to the OECD (Organization for Economic Cooperation and Development) technology statistics database in December 2001, and have been published in the OECD's Main Science and Technology Indicators (MSTI). Besides underscoring the ROC's active participation in international affairs, this also illustrates the importance the world places on our technology data.

Four Scientists Presented 2002 Outstanding Achievement in Sci-Tech Award

The Executive Yuan (Cabinet) presented the 2002 Outstanding Achievement in Sci-Tech Award to four distinguished scientists on the evening of January 3, 2003. This year's recipients were Dr. Ting Gan of the Institute of Nuclear Energy Research, Atomic Energy Council, Dr. Li Paul Jen-kuei of the Institute of Linguistic Study, Academia Sinica, Dr. Chen Sheng-jin, a professor at the National Taiwan University of Science and Technology and President of the Taiwan Construction Research Institute, and Dr. Hwang Deng-fwu, Chairman of the Dept. of Food Science at National Ocean University. The Outstanding Achievement in Sci-Tech Award activity has been held for 26 years thus far, and a cumulative total of 167 awards have been given to outstanding scientists and technical personnel. During the awards ceremony, Executive Yuan Premier Yu Shyi-kun emphasized that technology underpins the nation's economic development, and high-quality manpower is essential to technological innovation. Of course knowledge workers will play a crucial role in the knowledge economy age. Premier Yu expressed hope that Taiwan's technical personnel would continue to engage in innovative R&D and help raise the country's industrial competitiveness.

Among this year's award winners, Dr. Ting Gan – a former vice president of the Institute of Nuclear Energy Research – was honored for his hard work in promoting Taiwan as an Asia-Pacific medical isotope and nuclear medicine R&D and manufacturing center. Known as the "Father of Nuclear Medicine in Taiwan," Dr. Ting oversaw, planned, and implemented the establishment of core facilities and key technology in connection with radioisotopes and radiopharmaceuticals, helped build Taiwan's first cyclotron and isotope research laboratory, and promoted the production of isotopes. As a result of his efforts, many types of radiopharmaceuticals, medical isotopes, and nuclear drug products have been developed in Taiwan.

While the selection process for these awards favors natural science and high-tech manpower, and there had been no winners in the social sciences for a number of years, this year Dr. Li Paul Jen-kuei broke this trend for his outstanding research on the Austronesian languages. After spending 30 years laboring in obscurity surveying and researching the Formosan aboriginal languages, Dr. Li succeeded in making research on the Austronesian languages one of Taiwan's most impressive contributions to the international

academic community. Dr. Li's focus on the aboriginal languages of Taiwan, and his deep concern for Taiwan's indigenous Austronesian peoples, has earned the profound respect of the island's aboriginal residents.

Dr. Chen Sheng-jin is the inventor of the "Ductile Steel Beam to Column System." This system offers seismic resistance ductility more than three times that of conventional connector systems, as well as the advantages of easy installation and low cost. It is considered a major breakthrough in steel structure design and construction. The technology has already received numerous patents, including those of the European Union. The "Taipei 101" building, currently under construction, employs Dr. Chen's system. In addition, Dr. Chen has provided this technology free of charge for use in reconstruction of buildings damaged by the 921 Chi-Chi Earthquake.

Known as Taiwan's "Living Dictionary of Toxic Fish and Shellfish," Dr. Hwang Deng-fwu is a respected authority on toxic fish and shellfish. He has studied toxic marine organisms from the time he returned to Taiwan from overseas in 1988, and has spent more than a decade researching the chemical composition, sources, and seasonal changes of toxic fish and shellfish in Taiwan. During a past oyster poisoning incident, he proved that the safety of "green oysters" cannot be determined solely from their copper content. He also oversaw the compilation and publication of the "Illustrated Book of Toxic Fish and Shellfish in Taiwan" on behalf of the Department of Health and Fisheries Administration.

Asia Pacific Microsystems and PIDC Sign Optical MEMS Pact

Asia Pacific Microsystems, Inc. and the NSC's Precision Instrument Development Center (PIDC) signed a commissioned research contract on January 10th at the PIDC building in the Hsinchu Science-based Industrial Park. In the signing ceremony, which was witnessed by NSC Vice Chair Dr. Shieh Ching-jyh, Asia Pacific Microsystems' CEO Dr. Lin Min-shyong, former executive vice president of the Industrial Technology Research Institute, and PIDC Director General Dr. Chen Chien-jen represented their respective organizations. The two parties have pledged to cooperatively develop key optical micro-electromechanical system (MEMS) devices, accelerating the development of a MEMS industry in Taiwan and capturing a share of international markets.

PIDC has devoted much of its recent efforts to the development of nano-system and microsystem process technology. It has acquired and developed inductively coupled plasma (ICP) reactive ion etching systems and is able to perform high aspect ratio micro-machining of silicon. After significant technical breakthroughs in 2002, PIDC is now able to produce mirror surface structures with a depth of 60 μm and sidewall roughness of 10 nm on silicon chips. PIDC has also developed concave micro-gratings, an important technical advance noticed in Taiwan and abroad.

Part of PIDC's mission is to achieve technology diffusion and improvement by promoting the application of new technology by industry, academia, and research organizations. PIDC has consequently drafted regulations governing acceptance of commissioned research and approval by the NSC. PIDC's other services include providing specialized technical skills and facilities, helping research organizations or public/private businesses to develop key products, planning future technology development directions, training technical specialists, and acquiring special or cutting-edge technology.

Asia Pacific Microsystems, Inc. is the first manufacturer in Taiwan to commit itself to optical communication MEMS R&D and production. The company specializes in the integrated design and manufacture of MEMS elements and wafer process foundry services. Asia Pacific is interested in PIDC's advanced deep silicon etching fabrication technology, and feels that this technology, in conjunction with its existing optical communications and RF MEMS and sensor mod-

ule design, production, packaging, and testing capabilities, will enable it to expand its optical MEMS product market. Asia Pacific has therefore commissioned PIDC to perform preliminary research on the development of optical MEMS devices using a high aspect ratio deep silicon etching fabrication process.

Both parties have expressed their high regard for this cooperative project. The project also highlights the government policy of encouraging cooperation with businesses and research organizations, which is geared to effectively pairing the R&D findings of research organizations with industry's market-oriented product ideas. It is hoped that the current effort will help reinforce the MEMS industry take root in Taiwan and gain a foothold in international markets.

Projected Hsinchu SIP Turnover May Top NT$900 Billion in 2003

The Hsinchu Science-based Industrial Park (SIP) looks for ward to a revival during 2003. The SIP's turnover fell by 29% in 2001 – the first drop since the SIP was established. But while it was estimated that turnover would barely surpass NT$700 billion and register only slight growth in 2002, the forecast for 2003 is bright and turnover is expected to near NT$900 billion.

The high-tech economy peaked in 2000. During that year the turnover of firms in the Hsinchu SIP hit an all-time high of NT$929.2 billion, a rise of 42.58% over 1999. But economic conditions deteriorated rapidly in 2001, and the repercussions of the 911 terrorist attacks impacted the global economy. The six leading industries of the Hsinchu SIP, namely semiconductors, computers and peripherals, communications, optoelectronics, precision machinery, and biotechnology, generated turnover of only NT$661.3 billion in 2001, which was the first year ever in which the SIP turnover posted negative growth.

Hsinchu Science-based Industrial Park Administration Director General Dr. James J. Lee points out that the SIP has already begun recovering from the dark days of 2001, and enjoyed a bit of growth in 2002. Firms in the Hsinchu SIP employed over 102,000 persons during the peak year of 2000. This number fell to 96,000 in 2001, and rebounded slightly to 98,000 in 2002, keeping pace with turnover growth. Dr. Lee is confident about the SIP's prospects in 2003, and feels that turnover may increase by 20%, or even 30%, over 2002.

As in the past, the semiconductor industry will continue to be the SIP's economic locomotive in 2003. Foreign research organizations have variously forecast that the global semiconductor industry will grow by approximately 20% in 2003, said Dr. Lee, and the optoelectronics and communications industry will continue to flourish as well. Since the semiconductor industry has always accounted for more than 50% of Hsinchu SIP's output, the SIP as a whole has a good chance of growing by 20% in 2003.

As more and more high-tech companies move production to China, the Hsinchu SIP must adapt by redefining its role and placing more emphasis on research and development. The trend towards role transformation will be even more obvious in 2003. The SIP Administration is currently making plans to develop a nearby army base recently released by the Ministry of National Defense as an R&D center. It is hoped that a dozen or more companies will establish their R&D headquarters in this area. The SIP Administration is also planning an SOC zone where major international high-tech companies can set up R&D facilities. These plans are expected to start yielding results from the first quarter of 2003.

In short, 2003 will be a year of recovery and growth for the Hsinchu SIP. It will also see some of the most obvious changes seen thus far, as firms continue their globalization and transfer of production to China. On the plus side, companies possessing strong R&D capability will plant the seeds of future competitiveness in the SIP. It follows that promoting R&D will be the SIP's paramount task in 2003.

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