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Outline of American Tour by Chairman Kuo Nan-hung

Dr. Kuo Nan-hung, Chairman of the NSC, left for the New York Area of the United States on June 25 at the invitation of the Chinese American Academic and Professional Society to attend its 1993 annual meeting and give a speech, titled "Strategies for Accelerating Scientific Development." The Society presented Dr. Kuo with an award, citing Chairman Kuo's outstanding leadership and contributions to the development of science and technology in the Republic of China.

After Chairman Kuo Nan-hung attended this meeting, he toured NSC business offices in the Washington D.C., Chicago, Houston, Los Angeles and San Francisco areas. He also held get togethers with scholars and specialists in each of these areas and engaged in a full exchange of views concerning the direction of scientific and technological development in the ROC, international cooperation, business and academic cooperation, engaging the help of overseas scholars, and outer space projects. During each get together, Chairman Kuo gave concrete explanations of the major projects the NSC is presently undertaking, and that, while based on the foundation established by NSC chairmen over past administrations, adjustments and emendations must be made in response to various demands resulting from changes in time, space and the environment. The scholars with whom Dr. Kuo met also provided valuable opinions on the direction of scientific and technological development in the ROC, their willingness to participate in nation building, and their expectations regarding NSC projects.

During the course of his tour, Dr. Kuo visited a number of major scientific organizations in the D.C. area through arrangements made by Dr. Chuang Yii-der and other colleagues on the Science Division of the NSC's D.C. office. These included visits with Dr. Frederick Bernthal of the U.S. National Science Foundation (NSF); Dr. Natale H. Bellocchi, head of the American Institute in Taiwan; Dr. Arati Prabhakar,the new director of the U.S. National Institute of Standards and Technology; and Intelsat, where Dr. Kuo learned about the overall orientation and specific approaches to promoting scientific development in the United States. This should be extremely helpful in effectively promoting Sino-American scientific and technological cooperation in the days to come.

On July 5, Chairman Kuo Nan-hung made use of the San Francisco area to bring together the chairs of the Science Divisions at each of the NSC offices: Chuang Yii-der from the D.C. office, Nelson Hsiung from the Houston office, Chen Yaw-nan from the L.A. office, John H. C. Wang from the Chicago office, and Chou Jen-chang from the San Francisco office, and convened the 1993 coordination meeting of U.S. science task forces. This was the first such meeting since the groups were set up, and had clearly positive significance for promoting coordination and cooperation concerning science task force business.

Chairman Kuo Nan-hung returned to Taipei on July 7. He summarized his findings from this trip as follows:

1) Substantive promotion of international cooperation – NSC efforts to promote international cooperation in the future will stress bringing about facility-to-facility substantive exchange and cooperation. One example would be exchange and cooperation between national laboratories and university professor project bases, to allow us to fully share international facilities and research experience, and raise academic research standards. Another example might be the Advanced Manufacturing Technology Project of the U.S. NSF, involving cross-disciplinary research, which is a project integrating business and academic cooperation. The spirit and substantive content of this project could be appropriately transferred and transplanted to pertinent ROC research projects, allowing us to exchange and share Sino-American research results and experience, as well as utilize our mutual compatibility to raise research standards.

2) Invite overseas scholars to participate in appraisals of scientific and technological projects – ROC scholars who have gone to the U.S. over the years have amassed rich professional knowledge and experience. The NSC hereafter shall make use of the wisdoms of domestic and overseas professionals to help carry out appraisals of scientific and technological policies, evaluations of projects, and follow up reviews of research results. This should allow us to strive for quicker scientific and technological development on a rational basis.

3) Publish a science and technology newsletter for North America – The NSC Science Divisions in the United States are communication channels for carrying out NSC business and for serving ROC scholars in the U.S. Beyond setting up a human resources information network, there is a real need for publishing a science and technology newsletter

to allow us to maintain close and continuing contact with scholars in each region in order to further international cooperation and strengthen the utilization of the wisdom and experience of overseas scholars, so as to bring about nation building and economic development. We plan to engage the five Science Divisions to jointly publish the science and technology newsletter on a bi-monthly basis.

4) Actively promote the establishment of a science task force in Canada – In view of the highly advanced nature of scientific and technological development in Canada, our two nations have been actively initiating cooperative relations in many areas. Accordingly, the NSC Science Division in San Francisco has already established liaison channels with scientific and technological organizations of the Canadian government. We shall put that Division in charge of continuing liaison work with Canada, in anticipation that we will be able to set up a science task force in Ottawa in 1995. This will allow us to speed up scientific and technical exchange and cooperation with the North American region.

Development of the Payload Airglow Spectrograph for the ROCSAT-1 Space Project

After numerous evaluations of feasibility analysis, the Precision Instrument Development Center (PIDC) of the National Science Council, belonging to the Executive Yuan of the Republic of China, was commissioned by the National Space Program Office (NSPO) to develop a payload Airglow Spectrograph (AGS) for the space project ROCSAT-1 of the Republic of China. The instrument was developed, constructed, and tested jointly by PIDC, National Central University, and the Applied Physics Laboratory (APL) of John Hopkins University (JHU). Once the instrument is launched, it will be the only instrument among the payload instruments on the spacecraft that is chiefly made in Taiwan.

The optical components of AGS consist of a scanning telescope assembly mated to a 1/4 meter Ebert Spectrograph. A stepper motor in the telescope is used to scan across the atmosphere between 60 and 300 km with 0.5° overscan in each direction to account for possible satellite placement uncertainties. The instrument performs spectral analysis on the light detected from the atmosphere during day and night as the atmosphere responds to the solar energy input and the subsequent photochemistry. Spectral information in four different wavelength bands: 5200Å-5800Å, 6200Å-6800Å, 7300Å-7900Å, and 8300Å-8900Å in 20Å resolution is obtained simultaneously along with the following in situ remote measurements:

a. the variation distribution of temperature and density structure of the Mesosphere, Thermosphere, and Ionosphere (MTI) region, as well as the seasonal variation;

b. solar energy variation of EUV, FUV, and MUV in the MTI region;

c. measurements of the temperature, density and airglow emissions responding to gravity wave and planetary wave forcing;

d. the electron density profile in the nighttime F-region;

e. inference of the mean meridional (trans-equatorial) neutral wind;

f. tidal structures in the MTI region in the low latitude region; and

g. the spatial and temporal variability of minor species such as $O(^1D)$ and O_3. Built with high-tech data processing and inversion techniques in order to obtain more and more spectral information which has not been detected before through the application of remote sensing and measurements, the Airglow Spectrograph is one of the most important on-board instruments of the ROCSAT-1 mission, in that the interplay of chemistry, dynamics, energetics, and radiation in the MTI region can be observed.

Developing satellite-related payload instruments starting from the successful home-made Airglow Spectrograph within a short time of five months was an important step for the Precision Instrument Development Center. The successful self-designed AGS has not only been significant in achieving the required accuracy and resolution but also momentous in symbolizing the promising era of domestic aerospace instrumental technology.

The Propagation and Application of the Laser Time-of-Flight Mass Spectrometer

Since the development of surface science research has been so rapid, its application has become more and more important. In order to improve the environment of science research, support academic research and match the national goal of developing high technology industry to build the high technology of surface analysis, The Precision Instrument Development Center (PIDC) has designed and completed the research and development of the "Laser Time-of-Flight Mass Spectrometer." The Spectrometer can be

used to do element analysis of solid sample surfaces. During the development phase, PIDC has developed the capability to design and manufacture similar instruments.

In 1992, PIDC completed the research, manufacture, and testing of the "Laser Time-of-Flight Mass Spectrometer prototype" and obtained the characteristics of the whole system. Based on the experience and technology, a prototype was made into a practical instrument in 1993. The basic operational principle of the instrument is to use a laser to ionize the sample surface materials, inducing them to be vaporized or ionized, then do analysis through the mass spectrometer tube to reach the purpose of research and analysis of surface material composition. For instance, composition tests of optical thin film, impurities tests of semiconductors, research in polymers, the development of new material, etc., all can be done. The most special function of this set instrument is to monitor and observe the real time condition of sample surfaces so analyst and user can direct analysis at some sample position according to special purposes. The instrument can also do trace element analysis reaching ppb range as matching frequency stabilization dye laser.

Developing this kind of instrument is urgently necessary in Taiwan, however, commercial products have not yet been made by domestic companies. All these kinds of instruments have to be imported. The prices are very high and the maintenance of the instrument is not easy, often causing delays in research. PIDC uses the "Laser Time-of-Flight Mass Spectrometer" to test optical elements and optical thin film and will make this instrument available to universities' academic research institutes, and R&D departments of private companies to provide test services of element analysis of solid sample suraces. PIDC also accepts orders to produce this instrument for different kinds of customers, so that the research environment can be improved and the foreign exchange expenditure can be reduced.

Establishing Accredited Optical and Vacuum Standard Laboratories of Chinese National Laboratory Accreditation

In recent years, the international political and economic situation has changed significantly. Protectionism is popular and regional tradig circles, such as the European Community Union, the American Screw Law, etc. have increasingly formed. All facts show clearly the competition of politics & economics instead of force. Taiwan depends greatly on international trade and export; besides having enough competitive products, we must follow new political and economic principles. This means that assessing the quality of products must follow the international requirements. Therefore our country has established the Chinese National Laboratory Accreditation (CNLA)coinciding with the global accreditation system. CNLA accredits against ISO Guide 25, Chinese National Standard 120608, to access proficiency calibration and testing and on-site visits to laboratories of quality management. If assessed applicant laboratories follow these criteria, CNLA will openly recognize and give them certification. It also gives registration in the catalog of CNLA laboratories to inspire confidence and faithfulness.

As enterprises have accessed and developed in the international market, they have gradually suffered the competitive pressure of ISO accreditation against standards. The Precision Instrument Development Center (PIDC) has responded favorably to CNLA. PIDC will continue to keep the proficiency calibration of optics, vacuum, and electronics and also, establish traceability to standards. PIDC also joins human efforts and financial resources to preach the concepts of quality assurance, sets up the specifications of laboratory management, improves the environmental conditions of the calibrating laboratories, and trains the members of the laboratories to be qualified for their work. It will urge the laboratories to practice normally and also promote calibration levels.

The optical standard laboratory of PIDC has recently been awarded the flat calibration field of CNLA recognition (Certification No. 0090). It is the only one that can creditably produce optical flat calibration reports and offer optical technical consultant services. It provides measurements of single or dual phases of standard optical flats and smooth surface duties. The flat measuring range is outside the diameter: 10mm-100mm, flatness: 0.03W-12.5W (0.019-7.91 um). Last year, PIDC vacuum standard laboratory was awarded the vacuum pressure calibration field of CNLA recognition (Certification No. 0081). It is also the only one that can creditably produce vacuum pressure calibration reports and offer vacuum technical consultant services. It provides measurements of cold-cathode gauge, hot-cathode gauge, capacitance manometer, thermal conductivity gauge, Bourdon gauge, U-tube, etc. The pressure measurement ranges from 10-6 torr to 1 atm. PIDC electronics standard laboratory was awarded in June 1993. The certification number of CNLA is 0094. It provides measurements of direct and alternative current voltage, direct and alternative current, and resistors. Those measuring ranges are 0.1Vdc-1000Vdc, 10mA-1A, 1Vac-100Vac (60Hz, 1KHz), and 10KΩ-1MΩ.

An Introduction to Basic Research into Computer-Assisted Instruction

The use of computers is becoming more and more common in our daily lives. With progress in computer technology, the application of computers in education has an even brighter future.

The Division of Science Education of the National Science Council has continuously devoted unstinting efforts to using computers to assist students in math and science courses. From 1982 to 1985 NSC explored this direction with the implementation of a project called An Experimental Program in Computer-Assisted Education in Junior High School Math and Science Courses. Through this program, NSC developed educational methods for the reference of education authorities in the ROC.

In basic research, beginning in 1984 NSC subsidized public and private universities in conducting specific research programs. In the years since, NSC has subsidized 170 such projects. At present, NSC is actively promoting research in this area through the application of the research group method.

There are three research groups. The first is looking at computer-aided education using intelligent computers; the second the use of computer-aided education by science subject; and the third, the application of computer-aided education in junior high and elementary school.

The first research group is taking a forward-looking approach, and exploring the application of the newest information and artificial intelligence technology. This group is attempting to develop an environment where education is more convenient, interest in education is maintained longer, and the results of education are even greater.

The second research group inquired into how computer-aided education could be applied in the teaching of the different science subjects. This group approached the problem from three different directions: learning theory, education model design and human factor engineering.

The third research group sought to understand the circumstances of the implementation of computer-aided education in junior high and elementary school, and probe into the question of which methods work best.

The three research groups will separately and simultaneously enter into basic, forward-looking research that seeks to spread the application of computer-aided education. Their goal is to increase the level of achievements in computer aided education in the ROC.

Summary of Inventors Seminar

A delegation from the Inventors Association of Taiwan (IAT), led by chairman Wu An-chuan and secretary general Huer Ping-chuan, paid a call on NSC Chairman Kuo Nan-hung on the afternoon of April 4, 1993. The delegation comprised 13 inventors, including Lin Yung-wei, award winner at inventors' exhibitions in Nuremberg, Germany and Brussels, Belgium in 1992, and Geneva, Switzerland in 1993.

Chairman Kuo greeted them in a conference room of the NSC, and conducted a seminar with the assembled guests.

To ensure a frank and open discussion and a complete understanding of the research histories of the assembled inventors, the entire membership of the Science and Technology Rights and Interests Committee of the NSC was invited to attend.

The seminar was an impressive event, demonstrating the strong emphasis Chairman Kuo and NSC department heads from all levels place on the application of intellectual property rights for inventors and all others.

The seminar began with a message of welcome for the association in general and the award winners in particular from Chairman Kuo. He outlined the series of tasks involved in applying for patents and for companies involved in technology transfers, and explained that NSC was actively promoting both.

Director Hsu from Central Processing Division took over at that point and gave a more thorough explanation of the methodology, offering the hope that together they could promote the upgrading of industry, and continuously develop the strength of the nation.

Afterwards, IAT Chairman Wu introduced each of the inventors individually, and they in turn explained their inventions and how they came about. More than half the inventors spent from three to ten years on their inventions, proving that inventing is truly not an easy task. This spirit of dedication to research and development elicited an outpouring of praise from seminar participants.

Discussion between the two sides was congenial. Some of the inventors suggested that NSC could offer help for inventors from the sidelines, assisting in finding commercial applications for inventions. They further suggested that NSC could help in spreading the news of new inventions abroad, to win them a place on foreign markets.

In light of promoting the results of research into private industry, NSC is naturally happy to help do this process, but there is further work needed and better communication required in some areas. In addition, how to help inventors complete high-tech products also needs further research and discussion.

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