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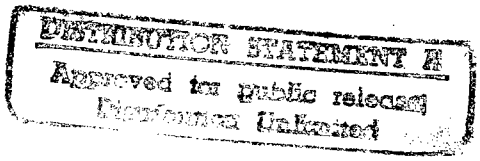

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Science & Technology
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State Council's Research Report on Status of Perfecting New, High-Tech Industrial Development Zones

93FE0287A Beijing RENMIN RIBAO in Chinese 25 Nov 92 p 3

[Article by the Research Office of the State Council]

[Text] Editor's Note—In this report by the Research Office of the State Council, a systematic analysis is given for China's progress, accomplishments, and remaining problems in new, high-tech industrial development zones. Suggestions were made for ways to further perfect policies and formulate development strategies. This report should serve as a useful reference for all those concerned with the development of new, high-tech industries and the construction of new, high-tech development zones. The original report was more than 10,000 characters long; an abbreviated version is published here.

New high-tech industrial development zones are new entities which emerged in China's reform. Together with economic zones and economic technology development zones, the high-tech development zones formed a new vista in China's economic development. Today China's new, high-tech development zones are still in their infancy. At this time it is particularly important to understand its strategic significance and to adopt the correct direction and effective policies so that we may proceed at a faster pace and to bring along the development of new, high technologies.

I. New, High-Tech Development Zones Are a Necessary Choice for Achieving China's Strategic Goals of Modernization

Science and technology is the primary productive force. Today's economic competition more and more exhibits itself as a competition in new, high technology. Many countries pay great attention to the research and development of high technology and to the competition in new, high-tech industries. Data shows that the gross value of production of new, high-tech products in the world has exceeded 1 trillion U.S. dollars, which accounts for 17 percent of the production value of the entire manufacturing industry in the world. In the United States the value of production of high technology has exceeded 20 percent of the production value of the entire manufacturing industry. The export value for high-tech products in the United States accounted for more than 40 percent of the entire output value of manufactured goods. New and high technology has become a powerful driving force for socialist economic development. The size of a country's high-tech industry has become an indication of that country's integrated national power. It is noteworthy that many countries have made the building of new, high-tech development zones one of the key steps in their development of high technology. The commercialization and industrialization of high technology require large investment and suffer from high risk; special support is therefore needed. By selecting a good location, carrying out an incentive policy, and nurturing a good environment, we can promote the development and commercialization of high, new-tech results and help the high, new-tech industry to grow and to overcome difficulties.

In the last 10 years or so, international economic competition intensified and various types of science cities and research parks rapidly emerged on the world scene. By the end of 1989, there were more than 500 development zones in the world with 80 percent in Western developed countries, 141 in the United States, 40 in the UK, 60 in France, 70 in Germany, 28 in Japan and 23 in Australia. Some developing nations are also actively building high-tech development zones. The building of high-tech zones has become a world trend in the industrialization of new technology.

We in China now face the historical task of realizing the second step development strategic goals by the end of this century. In order to maintain an average growth rate of 8 to 9 percent per annum for the GNP and catapult the economy to a new plateau, we must create a new avenue of high mobility and efficiency. High-tech industries must be developed with vigor in order to readjust and to reorganize the economy, so that the industrial structure and traditional industries can be reformed and elevated. Whether the Chinese economy can develop quickly and better in the 1990's, to a large degree, depends on the speed of growth of China's high technology. In the long term, China wants to reach the level of an intermediately developed nation by the middle of the next century and basically achieve modernization. To reach this goal, the support of a strong high and new technologies and its associated industries is essential. With a firm grasp of the current and future situation, Comrade Deng Xiaoping specifically proposed the direction of "develop high technology and achieve industrialization." He stressed that China must develop its own high technology and play a role in the world of high technology. This was an extremely important policy in China's economic development.

China's ability to develop new and high-tech results and convert such results into products is still very weak. High and new technologies still account for only a small fraction of China's industry. A pressing task in China is to accelerate the development of high, new-tech zones and to promote the development of high and new technologies and industry. Based on the reality in China, there are also two special reasons for building development zones. One is that the market economy in China is still not mature, and there is no incentive for enterprises to innovate and compete. Scientific research lacks an internal mechanism to combine with economy and high, new-tech research is seriously out of step with the commercialization and industrialization of research results. Under these conditions, the development of high, new-tech industries is not only risky, but also lacks the driving force. To overcome these difficulties we need to first create a market economy environment by establishing development zones and give enterprises in the

development zone certain preferential treatment. The other reason is that high and new technologies need high investment, but China's financial resources are extremely scarce in comparison with developed nations. It is therefore more important for China to put these limited resources together through the construction of development zones to focus on supporting a number of high, new-tech industries.

China has only a short history of building development zones, but some encouraging prospects are already visible. Statistics show that, at the end of 1991, there were 3,400 new-tech enterprises in 27 state high, new-tech zones. These enterprises employed 138,000 people including 67,000 S&T staff and produced 3,900 high, new-tech products. In 1991, the total income from technology, industry and trade was 8.73 billion yuan, the total value of production was 7.12 billion yuan, the total amount of tax revenue was 1.61 billion yuan, and the export total was 710 million yuan. These figures represent increases of 45.1 percent, 62.6 percent, 114.7 percent, and 51.1 percent respectively over the 1990 level. The per capita income created was 63,000 yuan. Enterprises with a sales volume greater than 10 million yuan number 159. Within a very short period of time the development zones have already played an active role in China's economic development.

First, the development zones have promoted the conversion of new, high-tech results. For example, the Beijing development zone completed 1,287 research projects and new products in the 4-year period from 1988 to 1991; 120 of the new products have become major products. While insisting on self-reliance as the main theme in research and development, the development zones have also paid attention to importing and digesting foreign technology for secondary development and for designing new, high-tech products needed by the domestic and international markets. Almost half of the 120 major products developed by the Beijing development zone were developed through secondary development.

Second, the development zones promoted the reform of traditional industries and the development of the local economy. Many development zones put emphasis on the development of special local businesses. This has allowed the development zone to introduce new and high technologies into traditional industries and to establish their own superiority. For example, the Chengdu development zone stressed bioengineering products to make use of local economic and S&T superiorities and the Shenyang development zone actively participated in the reform of old industrial bases and worked hard to develop new materials and electromechanical products. By collaborating with old industries, the development zones have given old industries new life. It is easy to envision that, with more development, the development zones will lead to new growth and will elevate China's national economic development.

Third, the development zones have provided useful inspiration and experience for the deepening of reform. In order to explore a way to combine technology and economy, planning and market, to make full use of the technical staff, and to liberate and develop productivity to the maximum level, the development zones are actively conducting reforms in their property rights system, distribution system, personnel system, management system and operation mechanisms, which in turn stimulate the reform and development of financial systems and social security and service systems. The reforms thus provided the enterprises an operation mechanism of raising their own capital, forming their own groups, running the business on their own, being responsible for their own profit or loss, developing their own business and voluntarily restricting their action. This has provided useful inspiration for our exploration to establish a new socialist system of market economy. In addition, state-operated medium and large enterprises have built plants in the development zones and research institutes and universities have practiced "one institute, two systems" or "one university, two systems" policy by establishing enterprises in the development zones. These activities have promoted technology reform in enterprises and stimulated educational reform.

Although China's development zones are in their infancy, with proper policy guidance, they are fully capable of becoming bases for commercialization, industrialization and internationalization of new and high, new-tech results. They can also become technological sources for reforming traditional industries, experimental zones for deepening the reform, demonstration zones for combining commercial product economy and science and technology, and important windows to the outside world.

II. Deepen Reform, Perfect Policy, and Speed Up the Development of New, High-Tech Industrial Development Zones

Foreign experience shows that it takes 10-20 years to establish a development zone. To develop China's high, new-tech development zones in time, we must make an overall plan as early as possible.

Today there are two key problems that affect the development of the high, new-tech zones. First the market economy system and operation mechanism have not been fully established in the development zones. Second, universities and research institutes, and large and medium enterprises, have not fully played their role as a major force for the development of high and new technologies and high, new-tech industries.

The first problem showed itself in the following four areas. First, planning and marketing have not been properly combined and well operated in the allocation of resources. Enterprises in the development zones are basically outside the state budget and plan, they cannot be supported through the normal channels for their production data and capital for large-scale production. In the meantime, the production element market is not yet mature enough for the enterprises to obtain the necessary data and capital on

a steady basis. Second, some of the enterprises in the development zones, especially the publicly-owned enterprises, have not been fully converted. The ownership and management operation of some enterprises have not been separated; the ambiguous relationship between rights and responsibilities has hampered the vitality of the enterprises. Third, the reform of some development zones' management system has yet to make the necessary progress. The problem of too much government involvement still remains. In the meantime the government lacks a uniform plan or guideline for the construction of development zones. Some development zones are not adequately linked to the needs in national and local economic development plans and there exists a duplication problem in product structure. In addition, many development zones' management organizations lack the ability to organize and coordinate the service for the enterprises. Authoritative, capable, and efficient administrative organizations are yet to be formed. Some enterprises also lack a scientific and democratic management system and their activities are somewhat blind and unguided. Fourth, venture capital system and social security system needed in market economic development are yet to be formed. New and high-tech enterprises developed a large number of new products but very few of them reached the stage of large-scale production. The main problem was a lack of capital; without capital the manufacturing technology and facilities for large-scale production cannot be established.

The second problem involves the big picture of China's policy and direction for development zones. The main objective of building development zones is to rely on our own science and technology capabilities in the development of new, high-tech industries, but as of now very few science and technology personnel participate in the construction of development zones. Channels for personnel and intelligence exchange and for development cooperation have not been effective between development zones and research institutes, universities, and large and medium enterprises. The advantages of China's science and technology ranks are its superiority in personnel, intelligence and technology, especially in universities and colleges; these advantages have not played a role in the development zones. This may be attributed to two reasons. On the one hand some deeply rooted problems in science and technology system and education system reform have not been resolved. There has not been a mechanism by which science and technology, education, and economy can be combined. Some universities and research institutes still lack the initiative for facing the economic development and participating in the construction of the development zones. They also do not have an effective scheme to encourage the personnel to pursue a diversified path. On the other hand, the development zones also do not have an effective system to attract entrepreneurial technical personnel and to pick up the research results from research institutes and universities. As for large and medium enterprises, since the conversion of their management system has not been completed, they too lack an internal incentive for participating in the construction of development zones and for upgrading their own technology and products.

To solve these two problems we need to further liberate our thought, change our concept, improve our understanding of the significance of building development zones and developing new and high-tech industries. We must speed up the pace for development zones' reform based on the needs in establishing a socialist market economic system. In the meantime we must perfect the pertinent policies as soon as possible in order to create a better condition for the reform and construction of development zones. Based on our studies we recommend efforts in the following eight areas.

1. Focus on Implementation of Stockholding System Reform and Accelerate the Conversion of Enterprise Management Mechanism

As experimental zones for reform and openness, the high, new-tech development zones should lead the overall reform to meet the needs in establishing a socialist market economic system and form an operation mechanism based on market operation. To do so we must work on the key issue of converting enterprise management system so that the enterprises may become full-fledged, independent, self-responsible legal entities. In China's development zones, a large number of the enterprises are run by government departments and commissions, research institutes of the Chinese Academy of Sciences, universities, and state-owned large and medium enterprises. Whether these publicly-owned or collectively-owned enterprises can be vitalized has a direct impact on the development of China's new and high technologies and new, high-tech industries. In recent years CAS practiced "separation of rights" and self-reliance principles for its enterprises in the development zones. The enterprises are responsible for their own profits and losses. This has promoted the conversion of the management mechanism of enterprises. For the majority of the enterprises in the development zones, however, the conversion problem is still not resolved.

As a form of business organization, the stockholding system is an effective means for rapid conversion of the enterprise management mechanism. By practicing the stockholding system, the enterprises can broaden their sources of capital, raise production capital, and clearly define the property rights relationship, especially for collectively-owned enterprises in development zones without an administrative unit. Different new and high-tech enterprises should take the form of companies, enterprises, and limited corporations based on some local experience on converting to the stockholding system. Existing enterprises will be given 2 to 3 years to complete the conversion, but new enterprises should adopt the stockholding system from the very beginning. For qualified new and high-tech enterprises qualified for

the stockholding system, the state regulation should consider letting them sell their stocks on the market first.

2. Reform the Management System of the Development Zones According to the Principles of "Separation of Politics and Enterprises" and "Small Organizations Performing Big Services"

New, high-tech industrial development zones are S&T "special zones." The government and its various departments should change their functions and delegate more power to the enterprises in the spirit of treating special matters with special approaches. Today the emphasis should be on the integrated management of the development zones. The zones should be given a certain degree of authority to approve projects, manage import and export and personnel. The functions of commerce, tax, bank, and customs departments should be coordinated in the development zones.

China's high, new-tech industrial development zones are different from its special economic zones and economic technology development zones; they are not an administrative district. The management organizations in high, new-tech development zones only manage the high, new-tech enterprises in the zones. Such management should be of professional management caliber. In the initial phase of the development zones, especially when the new economic system and operating mechanisms are still incomplete, it is necessary to strengthen the management organizations of the development zones. As market economy becomes more established and mature, the macroscopic economic management functions should be gradually strengthened so that management by industry can be practiced. In the long term, the development zones are likely to pursue a direction of multi-level, high-tech economic consortium.

3. Market System in the Development Zones Should Be Quickly Developed

Building a market system is an important step in establishing a new economic system and operating mechanism. We must build, develop, and perfect the production data market, technical commodity market, finance market, stock market, personnel service market, and information market in the development zone. We should also link them up with other domestic markets so that the production elements may be developed rationally. To form a sound market environment, a complete set of market rules must also be established and perfected. The market rules of the development zones should conform to international practices so that the Chinese market may link up with the international market for the promotion of internationalization of high technology.

In today's situation when both systems coexist and the market growth is still immature, we should consider allocating a portion of the state funding to development zones and invest according to the market situation in order to provide the production data urgently needed by new, high-tech enterprises. Production data urgently needed for must-have projects should be guaranteed by including them into the state plan.

4. Establish a Venture Investment Mechanism and Build a Social Security and Service System

The development of high, new-tech results and the industrialization of new, high technology cannot do without a venture investment system. Avenues for raising venture capital should be developed by various means. Possible ways include the formation of venture capital companies by financial institutes and insurance organizations, the formation of high, new-tech venture capital foundations with support from various sectors of society, the establishment of low interest loan programs by banks for the development of new, high technologies. In addition, we may also consider allowing foreign financial institutes to form investment companies in Chinese development zones.

The governments at various levels should first consider forming social security and service systems for the development zones and then gradually building up unemployment insurance, medical insurance, annuity insurance, housing funds systems, and incorporating them into local socialization management. To provide comprehensive service for the development zones, we should also form general or professional consulting service organizations, law offices, and accounting offices.

5. Speed Up the Reform of Science and Technology and Education Systems; Properly Channel the Human Resources

The elements of reform are to intimately integrate science and technology and education with economy, to establish an effective dynamic mechanism to direct the flow of human resources and intelligence, and to encourage a fraction of research and teaching personnel to enter the main arena of economic development through various avenues. The experience of "one institute, two systems" and "one university, two systems" should be further promoted so that research institutes and universities may actively participate in the construction of the development zones. While maintaining an outstanding basic research team, research institutes and universities should liberate a majority of their research staff and encourage them to develop new and high technologies and to establish high-tech enterprises. While ensuring the teaching function, colleges and universities should also encourage some teachers to engage in direct construction of development zones or to develop research results on campus. Universities should establish a collaboration relationship with the development zones, systematically arrange research and development activities in the zones for instructors and graduate students so that teaching and R&D can be promoted at the same time. In the meantime, new disciplines should be developed to train new and high-tech specialists in order to meet the economic development needs.

To promote the exchange of personnel and intelligence, a more flexible policy should be adopted. R&D and

teaching staff should be allowed to cooperate in research and in spare-time consulting activities. The departments, institutes, laboratories and offices in universities and research institutes should be encouraged to fully play their roles and become technology-supporting bases of new, high-tech enterprises and receive regular funding from the enterprises.

6. Development Zones Must Create an Environment That Is Attractive to Talents

Talents are key to building development zones. Without a large influx of talented people a development zone has no future. We must further liberate our thoughts and encourage the technical staff to get rich through hard work. This is a major policy in liberating the primary productive force in science and technology.

We must respect intellectual property rights and allow the S&T staff to become stockholders with their research results and patents and to enjoy the same capital gain as regular stockholders. We need to reform the wage system in new, high-tech enterprises and give them the autonomy for determining workers' wages and internal distribution under the prerequisite that growth in accumulation is greater than consumption and growth rate in labor production is greater than growth in total wages. The state may exert its control through personal income tax adjustment. Technical personnel with outstanding achievement should be lavishly rewarded and the reward should be institutionalized. The problem of technical title assessment for technical personnel in the development zones should be actively resolved. We should attract overseas students with even better conditions to return and participate in the construction of development zones. Overseas students working in high, new-tech Chinese enterprises outside China should be treated as returning overseas students.

7. Encourage and Guide Large and Medium Enterprises To Participate in the Construction of Development Zones

Large and medium enterprises in China have strong personnel, technology and economic strength, especially defense industries. But at the same time these enterprises also face a formidable task of technological renewal and product innovation. Industrial experience abroad shows that an effective means for promoting technological and product renewal is to strengthen the relationship and cooperation between industry and the development zone and to build research and development units in the zone. We can learn well from this experience. We should encourage various connections and cooperation between large and medium enterprises and development zones. Those with better conditions may also organize their technical staff to build "branch plants" in the development zone. Success in this area will undoubtedly play an important role in revitalizing large and medium enterprises.

8. Perfect the Policy for Helping Enterprises in the Development Zones

For the purpose of promoting high, new-tech industrial development, the State Council formulated a series of preferential policies and issued its Document No. 12 in March 1991. As the situation changes, regions and development zones wish that these policies can be perfected. Based on the input from different regions, more measures beyond those discussed above should be implemented. These include extending the income tax waiver period for new, high-tech enterprises, having a more preferential protective policy for high, new-tech enterprises started by universities and by military and civilian government systems, issuing bonds and low interest loans for capital construction in the development zones, and making it more convenient for management staff of high, new-tech enterprises and S&T personnel to go abroad to do business.

According to some development zones and enterprises, some of the policies formulated by the State Council were not actually implemented; the responsible departments and local governments should conduct a thorough review of the implementation of these policies.

III. Formulate a Development Strategy for China's High, New-Tech Industry Based on the Reality in China

Construction of the new, high-tech development zones and development of the high, new-tech industry are tasks that extend across the change of century. We must formulate scientific and definitive development strategies as soon as possible to ensure their healthy development.

—We need to do well in overall planning.

In China's economic development, it will take at least 40 to 50 reasonably-sized new, high-tech development zones to support the sustained rapid economic development in the 1990's; otherwise, the realization of the third step strategic goals in the next century will be affected. Today, while concentrating our efforts on existing development zones, we should also build more development zones based on the national and regional economic development needs. The goal is to have a broad distribution of new, high-tech industrial development zones in most provinces, municipalities, and regions from the coastal region to inland. We should strive to have some development zones with production values exceeding 10 billion yuan by the end of this century, and to have some international standard hot products so that the value of production of high, new-tech products may reach more than 10 percent of GNP and high, new-tech export can reach more than 8 percent of total export. If we can achieve these goals, we will have laid a sound foundation for China's favorable position in the international high, new-tech arena in the next century.

In the construction of China's development zones, the guiding principle should be to "focus on the main points, be aware of the whole situation, give full play to their superiorities, and form a few major forces."

National level development zones should shoulder the responsibility of industrializing the high-tech research results. In the last few years China implemented its "863 Program," S&T breakthrough program, and the "Torch

Plan" and generated a great deal of research results. The state development zones should gradually become bases for commercializing these high-tech results. In the present commercialization of research results, the most urgent problem is funding for intermediate testing or the front-end investment for industrialization. Without solving the funding problem, numerous research results will not be converted into productivity, which, in a sense, is a waste of investments on high-tech research programs. The state should therefore link up the efforts of building development zones and developing high, new-tech industries with above-mentioned high-tech R&D programs. Research results with good prospects and the funding for intermediate testing of such results should be given to capable development zones so the results can be industrialized.

Development zones should play the role of high-tech reach-out centers for upgrading and adjusting structures of local industries and actively participate in the reform of traditional industries. They should choose a series of competitive high, new-tech projects with fast results and large impacts on local economic development and develop the projects as quickly as possible so that they may serve as the leaders for reviving the local economy.

The construction of development zones should be closely tied to the promotion of structural adjustment of industries and the development of high-tech industries. For this reason we recommend that an overall plan for new, high-tech industrial development zones should be formulated by the state as soon as possible based on the state's enterprise policy. This plan should include the layout, number, main tasks, principle of construction, major policy and management methods and should be made a part of the overall national economic plan.

—Follow the approach of encouraging self-reliance and technology importation collaterally in developing high, new-tech industry.

China undoubtedly must rely on its own ability in high-tech development and industrialization. However, high, new-tech R&D can be better realized through international exchange, and high, new-tech industries can only grow and prosper through competition in international market. Many enterprises in development zones have done very well in secondary development by absorbing and digesting imported technology. Joint venture between Chinese and foreign capital and jointly managed enterprises in the development zones have brought us advanced technology and research information. Experience shows that China's progress in high, new-tech industrialization can be accelerated only by further opening up and keeping track of high-tech development in the world.

Participation in international competition is a necessary condition for the survival and growth of high, new-tech enterprises. Enterprise Groups such as Legend and Sitong in the Beijing development zone actively engaged in the international market and established development and sales centers, and training and maintenance stations overseas. They have begun to build plants in high-tech zones such as the Silicon Valley in the United States and actively promote their products on the international market. Local governments should help the capable enterprises in their development zones to enter the international market as soon as possible.

—Choose the right channel to implement industrialization and internationalization of high and new technologies.

China has rich resources in personnel and intelligence, which are suitable for developing technology-intensive, intelligence-intensive and labor-intensive high, new-tech industries. China is also competitive in production cost and sales price. We should therefore avoid our weaknesses and wisely choose some industries that can give full play to China's superiority as entry points to realize commercialization, industrialization and internationalization of high, new-tech products. In the meantime, some development zones with higher standards should be chosen to develop these industries by giving them special preferential policies to help their development and to help them enter the international market. We recommend that the State Council make an effort to study this problem carefully and come up with feasible plans.

—The training of management personnel is an important task that the development zones cannot do without.

Today's development zones often have the problem of management personnel quality; the lack of management knowledge by S&T personnel has impeded the development of development zones and enterprises. Local governments and development zones should establish management personnel training centers as soon as possible and systematically conduct personnel training; capable institutes and universities should also take the training responsibilities. The future of our high-tech business will be much brighter if we have a large number of technical entrepreneurs who are knowledgeable in technology, foreign language, management and business.

—Rules and regulations for the development zones should be established and perfected.

To ensure a healthy development of the zones, the legislative effort must be strengthened. Management regulations for high, new-tech industrial development zones must be formulated as soon as possible. An assessment system must also be established. Further improvements in registration, accounting, auditing and statistics systems are needed. In the meantime a bankruptcy law is also needed so that the fittest can survive.

Building new, high-tech industrial development zones and accelerating high, new-tech industrialization are important steps in implementing the instructions given by Comrade Deng Xiaoping in his tour of south China and following the spirit of the plenary session of the Central Political Bureau. These activities have an effect

on the realization of China's three-step strategic development goals, and have an impact on the world position of socialist China and the Chinese people. Governments at various levels should pay great attention to the construction of development zones, make careful studies, help the development zones solve practical problems, and promote major advances in China's high and new technologies and its high, new-tech industries.

Objectives in Five High-Tech Research Fields

93FE0361E Beijing BEIJING KEJI BAO [BEIJING SCIENCE AND TECHNOLOGY NEWS] in Chinese 12 Dec 92 p 3

[Article by Huang Xu [7806 2485]: [No Title]

[Text] China's "863" high and new technology research and development plan calls for the production of targeted products in the biological, information, automation, energy, and new materials fields for the breaking of new ground in key technologies and a narrowing of the distance from the world level by 2000.

The biotechnology field: Continued research on and promotion over a wide area of the growing of hybrid paddy by the two lines method; successful research and development of one or two genetically engineered vaccines and new drugs, and formation of an export capability.

The information technology field: Research and development of a computer system that has basic level intelligent behavior oriented toward intelligent applications. Two development orientations centering around construction of a optoelectronics technology center and communications and optical computing applications to advance beyond elementary technology.

The automation technology field: Building of a CIMS experimental project research center and a robot-assembly test line. Development of a number of phased target products, gaining some practical application results.

The energy technology field: A shift in the research and development stage, experimental projects being the goal.

The new materials field: Emphasis on basic research on photoelectron information materials, advanced composite materials, and modern materials.

Official Urges Overhaul of Secrecy Policy

HK2302010093 Hong Kong LIAOWANG OVERSEAS EDITION in Chinese No 8, 22 Feb 93 pp 9-11

[Report by reporter Fang Zheng [2455 2398]: "Shen Hongying, director of the State Bureau of Secrecy, Says: 'Barricades' Protecting Secrets Cannot Be Totally Removed"]

[Text]

Maintaining Secrecy and Opening Up to Outside World

China is not the only country in the world opening to the outside world. In fact, it is comparatively late in opening itself to the outside world. However, there is not a country in the world which says it has no need to maintain secrecy because of opening up to the outside world.

The United States is a country open wider to the outside world compared than many other countries. But it is very strict about security and classification management, and is stricter than China in many fields. For example, its management of documents is stricter than ours. In the security classification of documents, we put Chinese characters on the upper left corner of the document. But they differentiate different documents with different colors on the cover, where there are also classification demands, so they draw people's attention easily. They also carry out personnel management very carefully. Personnel involved in secret issues are also classified and put in different categories so they can handle different classifications with the approval of the relevant authorities. Those who are not on the relevant list cannot be involved in the business of that specific classification. In the United States, vetting of secret personnel is also very strict and careful. For example, they even find out what their hobbies and habits are. If someone gets drunk often, he will be used with caution.

Moreover, polygraphs are used for certain personnel after a general investigation. The secrecy situation at some defense enterprises is also rather good. All of these enterprises have a deputy general manager in charge of security and confidential work. The manager is usually called a security deputy general manager. There are also complete sets of internal security and secrecy regulations and systems and classes on secrecy.

The former Yugoslavia was also a country wide open to the outside world. As it had signed mutual visa exemption agreements with many countries, its citizens could visit most countries with their passports. Visas were necessary only for a very small number of countries. However, their secrecy work was also very strict. Confidential personnel from important government organs were assigned by the Ministry of the Interior and were not under the personnel management of the relevant organs. All offices were examined every night to see whether documents were left on desks, whether drawers were locked, and whether doors and windows were closed.

In the former Yugoslavia, only two government organs had security guards at the gates: The Ministry of National Defense and the Ministry of the Interior. There were no security guards at the gate of any other departments, including that of the Party Central Committee. But does this mean that people could come and go freely? No. If someone wanted to enter a party or government organ, the reception room would call the person who was being visited by telephone first, and after the call had

finished, the caller would be escorted by the person who had been visited on leaving the organ. Outwardly, controls were rather loose, but internally management was strict.

By citing these examples, I seek to explain that there are no contradictions between opening up to the outside world and secrecy work. Only when there is a strict management inside can we open up better to the outside. Strict internal management is for the purpose of opening better and more courageously to the outside. If we do not have strict internal management, will things not be in a muddle when the doors are opened?

In future, China will be opened even wider to the outside world. Thus, we are required to exercise stricter internal secrecy management. If we do a better job in this field, better and more favorable conditions will be created for opening up to the outside world.

Mao Zedong said long ago that we must clean our rooms for our guests. To clean our rooms refers to many things, including exercising good management in the field of maintaining secrecy. If we do not have good internal management, it will be very difficult to really open up our country to the outside world. Just as Qiao Shi pointed out recently, the more we carry out reform and open up our country to the outside world, the more it is necessary to strengthen our work in maintaining secrecy. Under the current situation of further expanding the scale of openness, work to maintain secrecy can only be strengthened rather than weakened.

"Secrecy Box" Is Reduced by One Scale and Reinforced by One Grade

Under the new situation of reform and opening up, it is necessary to make an accurate distinction between secret and nonsecret. This is the foundation of the work to maintain secrecy.

Judging from the concrete range of secrecy at present, we find that problems still exist in our work, such as the wider range of secrecy and higher grade of secrecy. In reality, this means a weakening rather than strengthening of this work. When the "secrecy box" is too big and swells, there can only be more unfavorable factors for our work to maintain secrecy.

First, people's sense of secrecy will be weakened. When there are too many secrets or if there are secrets everywhere, people can easily forget to maintain vigilance. Just as in the issuance of banknotes, if too many are issued money will be devalued. If many things that should not be regarded as secrets are regarded as such, people's sense of secrecy will naturally be weakened rather than strengthened.

Second, the strict management of real secrets will be affected. If the range of secrets is too broad and too wide, it is usually difficult to carry out the management system more strictly. Thus, lower demands will be set on the overall management of the work to maintain secrecy, and real secrets could not be really protected.

Third, the work of opening to the outside world will be affected. When foreigners come to China to do business or invest, and when we want to introduce talent and funds to our country, we have to introduce our own situation to the foreigners. It is natural and reasonable that investors should know something about the investment environment. But if the range of our secrecy is too wide and things which could be opened are regarded as secrets, then our openness, our efforts to introduce foreign funds, and our economic development will certainly be affected.

Some days ago I told a reporter that our country's "secrecy box" should be reduced by one scale. In order to strengthen the work of maintaining secrecy, things that are not in the classified category and should not be maintained as secret should be removed from the "secrecy box." But while doing so, it is also necessary to "reinforce the secrecy box by one grade."

In my opinion, to "reinforce the secrecy box by one grade" is of practical significance at present. In China, the policy of taking class struggle as the key link has been changed into taking economic construction as the central task, and the situation of closing the country to international intercourse has been changed into one of reform and opening up. Under this situation, some people have really slackened their vigilance, and think that because the country has been opened to the outside world, there are no more secrets to protect.

At present, as has been proved by the hard facts of divulging secrets and stealing secret information, we cannot say that there are no more secrets to protect and that the work to maintain secrecy is no longer necessary. Instead, it is even more necessary to further strengthen this work under the new situation of reform and opening up. Therefore, while the "secrecy box" is being "reduced by one scale," it is also necessary to improve and reinforce it.

Under the new situation of reform and opening up, there are many new situations and new problems in our work to maintain secrecy. Old methods do not suit the new situation. We must have new methods.

Introducing Foreign Capital and Keeping Secrets From Foreigners

Only when the meaning of state secrets is clearly defined, will we be able to ensure that what should be kept secret is kept secret and what can be released is released. This question was elaborated on by the late Premier Zhou Enlai in 1953. He noted that one must not treat all information indiscriminately and thus keep everything secret, but rather treat different sorts of information in different ways. In 1965, when listening to a briefing on the technological revolution, Chairman Mao Zedong pointed out that secrets protection work should be viewed from two aspects; in other words, what should be

kept secret should be kept secret and what should be released to the public should be released.

These days, we see two erroneous tendencies in the actual work of protecting secrets.

The first tendency is that some comrades are very nervous when dealing with foreigners. They dare not talk of what should be talked of and dare not release information which should be released. They always ask for permission from one superior or another before talking about something with foreigners. They keep asking for instructions from the relevant department in Beijing although they have already obtained permission from the local authorities, which they believe is not enough to protect themselves. They keep consulting with one department after another. However, after consulting every department, the chance to run cooperative projects with foreign partners may already have gone.

The other tendency is that some people just fail to keep vigilance. They talk irresponsibly and without reservation. They never conceal major points, let alone minor points; and they always disclose more than enough. To persuade potential investors, they simply ignore strategy and tell the other party everything.

In dealing with foreigners, whenever the issue concerns state secrets or classified matters, the principle of reasonable, legal, and moderate procedures should be observed. Reasonable means the information should be indeed necessary for running the cooperative project or exchange program; legal means that the secrecy law and other relevant laws, ordinances, and regulations should be abided by; and moderate means exercising control based on a comparison between the pros and cons. Only this way of handling things is good for our intercourse with foreigners and will ensure that classified information is not leaked.

Given the Backward State of Science and Technology in China, Is It Still Necessary To Keep Secrets in This Regard?

With regard to the necessity of keeping secrets in the field of science and technology, some foreign scientists object to it. For instance, a U.S. science policy analyst called John Owen [4766 5060 2962 2429] maintains that the protection of secrets does great harm to science and technology. U.S. sociologist Rosy Neil [5012 6007 1143 1422] has said that the protection of secrets is dangerous to science and technology, since it lowers the productive forces and damages the image of scientists.

Science and technology is the heritage of human civilization, which should be shared by all mankind. However, the world today is full of keen competition, and the grim reality of thefts of scientific and technological secrets indicates that the wish to "share" the fruit is merely a naive dream. So long as there is competition in the world and national interests and group interests exist, there will be a need for the protection of scientific and technological secrets. Nowadays, science and technology have an influence on the economic, political, and military fields, as well as every area of social life. Scientific and technological capacity can sometimes be transformed into economic force, military power, and political capital very quickly. Every country is making unremitting efforts to protect its own scientific and technological secrets in the comprehensive national strength competition.

Some erroneous views are spreading among our people as well. For instance, some people believe that we do not need to keep secrets since China is backward in science and technology; others hold that the protection of secrets may hinder exchanges and cooperation with foreign countries, and so on.

In my opinion, although China lags behind in terms of overall scientific and technological standards, this does not mean that we lag in every field. As a matter of fact, we have reached pretty advanced levels in certain areas, and we even lead in some. Secrets in those fields where we have achieved an advanced standard or lead others need to be kept. In the next place, we need to keep secrets in those fields monopolized by us. Perhaps these are not advanced things, but they are exclusive to us, and others have no knowledge of them. This is particularly so when it comes to technical know-how. The technique may not be complicated and can be learned very easily, but others just do not know about it. Also, some secrets that were left to us by our ancestors must be kept. Finally, we need to maintain our bargaining power. Something we keep may not be very advanced, or may even be rather backward. Even if it is, we still need to keep it secret from our rivals.

International exchanges and cooperation in science and technology has now become an important feature of contemporary scientific and technological development. This being the case, exchanges and cooperation between countries is constantly expanding. Europe's Eureka Program, for instance, involves 165 projects run by 19 countries. Thus, it can be seen that international cooperation has become a trend.

China has made very rapid progress in cooperation and exchanges in science and technology with foreign countries too. The point is, the development of science and technology needs cooperation and exchanges as well the protection of secrets. How are we going to solve this paradox? Can we do both things—promote exchanges while keeping secrets when necessary?

As I see it, exchanges and the protection of secrets contradict each other but can go along with each other as well. Why is this so? When we say it is necessary to promote exchanges between countries in the field of science and technology, this statement is generally based on two preconditions: first is the actual strength, as exchanges can only be achieved when both sides have some real potential; second, the exchange must be mutually beneficial, as nobody will do anything that causes a

loss to himself. The protection of secrets really requires us to handle these two problems properly. With regard to the first problem, we need to display our strength, but we must show everything we have. If you fail to show your strength, others will exchange with you. Therefore, you have to show something after all to convince them that exchanges with you will be beneficial to them. But if you show too much, you will have nothing to exchange and you are likely to suffer losses in the deal. Then you will not achieve your ultimate aim. This is the crucial point of protecting secrets—how to ensure that both sides benefit from the exchange.

If we keep the doors completely closed and simply refuse exchanges with others, we will not be able to develop science and technology; but if we pay no attention to protection and tell everything, others will take advantage and will develop their science and technology, probably leaving us no benefit at all. In this sense, protection and exchange can definitely go along with each other.

By and large, China is marching toward a socialist market economy, and toward this end all feudal barriers should be broken. But the means to protect secrets, "road blocks" to protect state security and national interests, cannot all be removed.

Journal Discusses Protecting State Secrets

HK0503025293 Hong Kong LIAOWANG OVERSEAS EDITION in Chinese No 8, 22 Feb 93 pp 6-8

[Article by Fang Jinyu [2455 6651 3768]: "Latest Report From China's Secrets Protection Front"]

[Excerpts] As the 14th CPC Congress was about to open in Beijing on 5 October 1992, a Hong Kong newspaper published the error-free full text of a "top secret" congress document.

The State Security Department took immediate action and ascertained the details of the case: The classified document was stolen by a 30-year-old reporter called W from a certain central level press agency in Beijing. After getting a copy of the document, he asked his wife to hand it over to the Hong Kong newspaper. It was not the first time W sold "classified information" but it is the last time he will receive a reward for information betraying his personal and national dignity. He was arrested by the state security organs.

The latest report from China's secret protection front indicates that there are cases of divulging and stealing secrets every year, every month, and even every week in China.

A Shocking Report

A Xinjiang County magistrate was on his way back after attending the regional party congress in June 1992. His car, which was parked at a guesthouse, had its window broken by a thief and the documents were stolen. The documents included 14 confidential documents (Chinese classified documents are divided into three grades: "Top secret," "secret," and "confidential"). The briefcase was later thrown away by the thief and the documents recovered; the confidential documents had been out of security control for 6 hours.

According to regulations, the magistrate should have carried the documents with him.

Influenced by the wave of "enlarged editions" and "detailed descriptions" in press circles, a provincial newspaper published a "Description of Armed Police" in its weekend supplement one day in 1992. The situation regarding the province's state strategic reserves and the distribution of police forces were made "public."

According to regulations, reporters are not allowed to know such classified information and, even if they are aware of it, they should not make it public.

The following incidents were more serious:

—In the 1980's, a regimental officer offered details of the training at and photographs from China's submarine base and quick response troops to the enemy agents.

—In the 1980's, a state official, in return for small favors, disclosed details to foreign pressmen of the CPC Central Committee Political Bureau meeting to discuss China's foreign policy.

For this reason, the CPC Central Committee issued a circular on strengthening secret protection work in 1990. In China's capital, Beijing, however, this problem has not yet been resolved in a small number of departments, where secret protection work is still a weak link. In a small number of departments with large numbers of state secrets and arduous tasks in protecting these secrets, there was noone specially assigned to take charge of the work.

Statistics are also alarming: In the third quarter of 1992, departments in all localities reported 48 cases of divulging secrets, of which 42 cases involved the provinces, municipalities, or autonomous regions and six involved central organs. A total of 202 state-level classified documents were divulged, including six top secret, 117 confidential, and 79 secret papers.

Mainland media has many reports about the gratifying achievements in China's reform and opening up. However, the press has rarely carried articles about maintaining state secrecy in recent years. [passage omitted]

The Tree May Crave Calm But the Wind Will Not Drop

"The tree may crave calm, but the wind will not drop," a saying abused during the "Great Cultural Revolution," is rather suitable to the struggle between secret stealing and anti-secret stealing today. When the wind of foreign information agencies bugging Chinese secrets has not dropped, how can the tree of China's struggle against eavesdropping calm down?

The latest State Secret Protection Bureau report states: Since China introduced reform and opening up, organizations abroad have never slackened their efforts to collect Chinese political and military information. Currently, foreign espionage activities have spread to the political, economic, military, scientific, and technological fields.

The computer systems in the information agencies of some countries have stored the data from a large number of Chinese "stool-pigeons." The management of the "stool-pigeons" is "scientific" and they are divided in light of their professions and political attitudes. Some are regarded as officials for maintaining normal contacts, some can obtain information, and some can expand their ties through tacit understandings. Data from these people are "cataloged." In the course of, or prior to, a major event in China, if a piece of information is to be verified, they only have to make a few telephone calls or send some invitation cards. For instance, if some Chinese economic information is to be verified, a number of economists or government officials in charge of economic work are invited to dinner. The problem is resolved after a few rounds of toasts.

As in the past, those invited should continue to attend normal receptions and banquets. Contacts and exchanges can strengthen friendship between countries. However, is it not necessary for the Chinese participants to heighten their vigilance while eating?

There is another fact which cannot be neglected: Despite the further development of dialogue, cooperation, and contacts between countries in the future, competition and struggles between them will also become more acute. Because economic strength is the foundation of the competition, the economic, scientific, and technological information has become increasingly the focus of "pursuit" for information agencies worldwide. The 1990 "State Security Strategy" of a Western power pointed out: Economic information is the top priority of our information work. The report appealed: Some 20 countries in the world are now stepping up their collection of our economic information. Our country is suffering an annual loss of billions of dollars from economic secret divulgence. For this reason, they proposed the following principle: Trace the high-tech of others to protect our own high-tech.

An information official from a Southeast Asian country said openly: Our economic development has benefited from the acquisition of economic, scientific, and technological information. The slogan of a large commercial firm in that country is: "Information is life and money."

Can the struggle against secret divulgence "crave calm" on the economic, scientific, and technological front in China, which is situated in such a "big world structure"?

Defensive Line Can Easily Be Broken From Within

There is an ancient saying: "Worms breed only when things have already started to rot."

In our current struggle against secret divulgence, the saying can be translated as: Enemy agents will focus their "offensive" on our internal ranks because the defensive line can easily be broken from within.

Undoubtedly, the rapid development of modern science and technology has indeed equipped the spies with "field glasses" and "informed sources." Nevertheless, spy satellites, reconnaissance aircraft, electronic equipment, and other hardware cannot be used at one's will. As some foreign information experts have said: Although we can obtain a lot of information by means of sophisticated technology and equipment, we cannot know what they are thinking. We can only rely on the "undercover agents [ding zi 6857 1311]" planted to obtain "high-grade" information.

Take another example. U.S. spy satellites are operating every day in space. When the Iraqi troops invaded Kuwait, however, it seems that the satellites did not "accomplish" their tasks. When the Gulf war broke out, the allied forces continued bombing for more than 30 days. To assess the loss caused by the allied bombing of Iraqi troops, however, they had to rely on the "undercover agents" planted by Israeli secret agencies in Iraq.

Naturally, foreign secret agencies will try by every means to plant their "undercover agents" in China's internal ranks. While visiting his relatives abroad, a provincial department level official revealed his intention to stay abroad. Informed of this, a secret agency immediately contacted him and encouraged him to defect. As a result, the official was dragged into the mire. Upon his return home, he received the order: "Lie low for a long time and wait for the opportune moment to go into action." Later, the "undercover agent" was apprehended by Chinese state security organs. Nonetheless, innumerable facts at home have proved that such "undercover agents" have caused immense damage within our ranks.

Our friendly people probably do not know that foreign secret agencies have changed their methods of seeking, creating, and planting "undercover agents" in China in recent years. Take encouraging defection for example. Rudeness and threats were usually applied to defectors in the past but now the methods have changed and become more ingenious. For example, they try by every means to find out more about the would-be defectors, including their personal experiences, performance, style, hobbies, social relations, families, incomes, and even privacy. By seizing upon a person's weakness, they gradually entrap him, unconsciously, without hurting his feelings, until he cannot extricate himself.

Here is another example. The offices of some large foreign companies in China often send the senior Chinese employees and officers from their economic departments to study abroad. Overtly, they are training professional backbone and management officers for us. In fact, they are training secret agents for their own country.

These countries lavishly entertain the Chinese trainees, offering a small banquet every 3 days and a big one every

5 days as well as a lot of petty cash. When they return home, they receive gifts such as color television sets. Before their departure, the agents do not have much to say. They simply present a visiting card, with the remarks: "Keep in touch."

After a period of time following their return, the agents call back: "Mr XX, I am currently engaged in researching a topic and I need your help on certain information." And so on and so forth.

There is a famous Chinese saying: After eating with and accepting things from others, you always feel you owe them something. To protect state secrets, it is necessary to guard the defensive line within our ranks and in our mind.

What Should Be Done in the Years Ahead?

The struggle between stealing and protecting secrets is one of the oldest forms of war in human history and this will continue to be the case in the years to come.

The situation of struggle facing the Chinese people is extremely grim. Although China's security departments are working day and night and the secret protection departments have taken precautions at all times, a foreign information officer said: The information obtained in the past by sending 10 to 20 agents can now easily be achieved by making Chinese friends and ideologically disarming them. A foreign newspaper has commented: Beijing, a modern metropolis, has gradually become a paradise for secret agents. An ex-ambassador from a Western country said openly before his departure: It is now the golden era for us to collect information in China.

Is this not enough to warn the naive and friendly Chinese people?

Protecting state secrets is the "sacred" mission entrusted by the Constitution to every Chinese citizen!

Only by mobilizing millions upon millions of people to build up an iron wall can China strive for the initiative and win victory in the struggle and the smokeless war against secret divulgence!

What should we do and what can we do?

First, we should change in light of the enemy moves.

Foreign secret agencies have been active in collecting information in China. Take a Western power for example. In view of the increasing number of Chinese visiting the country to conduct research, continue their studies, and meet relatives, a secret agency put an advertisement in the press, encouraging the Chinese to defect: "We hope to contact personnel who are engaged in security work or who are sent here to collect information; people connected with China's state security information are particularly welcome." It was unprecedented in the history of that country to publish such an advertisement.

"We should change in light of the enemy moves." Is it necessary to improve and transform China's secret protection work and struggle against secret divulgence? We should strictly protect China's state secrets. If the situation of the struggle against secret divulgence and the progress of the secret protection work are further made public, we will be able to mobilize more people in heightening their vigilance and joining the important work.

Second, if the enemy remains unchanged, we should follow suit.

Despite the changes in strategy applied by foreign secret agencies, the secret divulgence report indicates that the "bait" they use to "fish" remains more or less the same. Although the methods include "applying for visas," "offering school fees for children to study abroad," and "offering handsome pay for part-time jobs," the essential remains the same: Money and women.

"If the enemy remains unchanged, we should follow suit." How should we strengthen education among all the people? This is a pressing current topic.

Third, ensure the key issues.

An ancient Chinese military strategy says: "Hurting one finger is better than hurting 10" and "seize upon one point and ignore the overall picture." This refers to offensive but what about defensive? If we open our hands, we can see 10 fingers. Is it possible to include everything into the scope of secrets and protect them all? What happens if the 10 fingers are folded into two fists?

The State Secret Protection Bureau director clearly pointed out: In the years ahead, the scope of China's "secret protection" will be further reduced.

Fourth, strengthen propaganda.

Propaganda work is an old topic but propaganda work on secret protection seems to be a new one. China's media usually publicizes: "It is a pleasure to meet friends coming from afar." However, the following is seldom mentioned: Eavesdroppers also come from afar.

China will continue to open its door to the outside world, vigorously expand tourism, and develop economic and technological exchanges with other countries on a large scale. While sounding the alarm, we should not be panic stricken. Nevertheless, we should continue to conduct education in maintaining secrecy as soon as possible among all the Chinese people. If education in maintaining secrecy is only conducted among people who have grown up and have access to state secrets, such "rudimentary education" will be too late.

Maintaining China's state secrets is related to the interests of the whole Chinese nation. It is also the bounden duty of every Chinese citizen.

State Science and Technology Commission Profiled

93FE0361A Beijing RENMIN RIBAO in Chinese 27 Dec 92 p 5

[Article by State Science Commission Office: "Introduction to State Science and Technology Commission"]

[Text] The State Science and Technology Commission is the State Council functional unit in overall charge of science and technology nationwide. Its main functions are: to study and analyze major scientific and technical problems to spur economic and social development, organizing the formulation of science and technology development strategies, plans, policies, and regulations; to study and define scientific and technical development priorities for development of the national economy, organizing the formulation of long-range plans for the development of national science and technology, coordinating with the State Planning Commission in drawing up intermediate and long range scientific and technical development programs and plans, drawing up annual plans on the basis of State Planning Commission-proposed overall guidance (including the projects to be emphasized and total expenditures), and being responsible for organizing their implementation and managing the distribution of funds once the State Planning Commission has decided on the overall balance; to study, in conjunction with departments concerned, the formulation of plans, policies and measures for reform of the science and technology system nationwide, organizing tasks that give impetus to the reform of the national science and technology system, and studying and proposing a rational structure and distribution for scientific and technical organs nationwide; to use comprehensively, in conjunction with departments concerned, the fiscal, credit, and tax revenue levers and methods, as well as the funds and powers that the science commission directly controls for overall regulation and control of scientific and technical work performance; to guide and coordinate the scientific work of all units under the State Council, and of all provinces, autonomous regions, directly administered municipalities, and cites having province-level economic decision making authority, coordinating with units concerned in spurring the technological progress of all vocations and industries; to study and propose policies and measures for basic research, applied research, and technology development, as well as the industrialization and commercialization of such research and development; to be in charge of managing technology market work; to coordinate, in conjunction with departments concerned, China's international scientific and technical cooperation and exchange policies, being responsible for managing external scientific and technical cooperation, directing scientific and technical organizations stationed abroad, and being responsible for the selection, assignment and management of science and technology cadres in China's foreign embassies and consulates; and managing scientific and technical information work throughout the country. In recent years, the State Science and Technology Commission has divided the country's scientific and technical work into three levels for action. First is orientation toward the main battlefield of economic construction to raise the level of industrial and agricultural production rapidly, and to spur technological progress in traditional industries. It has particularly organized the implementation of plans for tackling scientific and technical problems (joint State Science and Technology Commission and State Planning Commission organization and implementation), bumper harvest plans (Ministry of Agriculture organization and implementation), Spark Plans (State Science and Technology Commission organization and implementation), plans for the selective promotion of national science and technology achievements (State Science and Technology Commission organization and implementation), and Prairie Fire Plans (State Education Commission organization and implementation). Second is keeping track of the trend of development of science and technology throughout the world, selection of limited goals, concentration of energies on tackling difficult problems, and the development of high and new technologies and associated industries. Concentration on the organization and implementation of high technology development plans and torch plans aimed at translating high technology achievements into industries as quickly as possible, and to approve the establishment throughout the entire country of a number of high and new technology industry development zones. Third is supporting and increasing basic research and the application of basic research. Special emphasis is given to the organization and implementation of major and crucial national basic research projects and plans, i.e., climbing program.

Electronics Industry to Focus on Three Major Projects

93FE0361C Beijing KEJI BAO [BEIJING SCIENCE AND TECHNOLOGY NEWS] in Chinese 12 Dec 92 p 3

[Article by Guan Xuli [7070 2485 7787]: "Basic Construction of China's Electronics Industry To Focus on Three Main Projects"]

[Text] For the next several years, the emphasis in the basic construction of China's electronics industry will be on three major projects as follows:

1. Integrated Circuit Project. In keeping with the principle of centralized construction and focusing on the breaking of new grounds, various backbone enterprises are to be built during the Eighth 5-Year Plan in the development of a 2-3 micron industrial production capacity while simultaneously putting into effect a "megabyte plan" for the development of a 0.8 - 1.0 micron industrial production capacity, thereby becoming able to produce general purpose and application-specific integrated circuits for megabyte storage devices, 32 bit microcomputer central processing units (cpu), and digital and high resolution color videos.

2. Computer and Software Project. Orientation primarily toward application, emphasis going to the building of major microcomputer, printer, floppy disc drive, and software enterprises, efforts directed toward achieving the economies of scale. Attention is to be focused on the development of applied systems equipment and technology needed for the transformation of the energy, communications, construction materials, and metallurgy industries, and for the key areas of finance and banking, cultural and education, and national defense. By 1995, output of microcomputers of all types is to reach 400,000 units; output of mainframe, mid-sized and minicomputers is to reach 1,500 units, more than 60 percent of the domestic market for microcomputers being supplied. Output value of software is to reach 1 billion yuan, and output of various kinds of systems software, support software, and application software is to reach 20,000 units.

3. Communications Project. During the Eighth 5-Year Plan, emphasis is to be placed on the development of digital stored-program-controlled [SPC] switches and portable communications. The emphasis on SPC switches is to be on the building of two SPC switch production bases for bureau use, and the transformation of three to five digital PABX production enterprises in the fashioning of a production capacity of 4.5 million lines per year that will provide the technical equipment needed to provide more than 2 percent of the country's population with telephone service by 1995. In the transmission equipment field, the emphasis is to be on the development of optical fiber communications, production of optical fiber terminals reaching 24,000 units each year with optical cables in use over a 50,000 kilometer area. In the portable communications field, emphasis is to be on the development of small area manufacture of radio communications, building research and development centers and six production bases to form a production capacity of 600,000 units per year to provide equipment for both public and dedicated networks. Emphasis is to be on the development of three types of fax machines and multi-functional electronic telephones. In the fax machine field, a 300,000 unit production capacity is to be developed. A 15 million unit telephone production capacity is to be developed.

Twelve Major Technical Equipment Projects To Be Developed During Eighth 5-Year Plan

93FE0361D Beijing BEIJING KEJI BAO [BEIJING SCIENCE AND TECHNOLOGY NEWS] in Chinese 12 Dec 92 p 3

[Article by Fun Zuli [7070 2485 2787]: "China to Develop 12 Major Technical Equipment Projects During the Eighth 5-Year Plan"]

[Text] China has decided that it will develop 12 major state technical equipment projects during the Eighth 5-Year Plan for the purpose of bringing the level of the country's complete plant technology to the advanced world level of the 1980's, and to bring the indigenous production rate for this equipment to more than 80 percent.

These 12 development projects are as follows: 20 million ton large open-pit mining equipment; 2. large thermal power generation equipment; 3. 500,000 volt ultra-high voltage electrical transmission and transformer equipment; 4. Datong-Qinhuangdao super-heavy weight coal cars / ocean transportation serial equipment; 5. 300,000 ton ethylene equipment; 6. large chemical fertilizer equipment; 7. large coal mine chemical equipment; 8. research on Three Gorges Dam equipment and large hydropower equipment; 9. Desert region petroleum extraction equipment; 10. Air transportation control series equipment; 11. special stand-alone units and universal technologies; and 12. large metallurgy technology.

Development of the foregoing projects will be conducted at key state construction projects including the Three Gorges hydropower project, the Baoshan Iron and Steel Mill project, the second phase of the Datong-Qinhuangdao railroad project, the Dexing Copper Mine and the Tarim oil field project.

War Industries Switch to Civilian Production

93FE0362A Beijing RENMIN RIBAO OVERSEAS EDITION in Chinese 21 Dec 92 p 2

[Article by Correspondent Jia Yong [6328 3057] and Reporter Liu Cheng [0491 4453]: "China's War Industries Readjust Development Strategy. Manifold Increase in Well-Known and Premium Products. Good Prospects For International Cooperation on High and New Technologies"]

[Text]Xinhuashe, Beijing— Their eyes on the market, China's war industries are readjusting their development strategy to stake out a solid position for themselves in domestic and foreign competition. Production of well-known and premium products has increased several fold over the years, and prospects are good for international cooperation in the high and new technology fields.

The correspondent learned from the Chinese Society for the Peaceful Uses of War Industries Technology that China's war industries have built 475 civilian goods production lines, the output of their civilian goods accounting for 76 percent of their total output value. Thanks to major changes in the make-up of war industry products and technology, their ability to compete in the market has steadily increased. Civilian goods that they have developed are already making a mark in hundreds of industries and fields including communications, energy, transportation, light industry, textiles, medical treatment and health care, and project construction. Their products are being sold in more than 20 countries on five continents. International cooperation is moving into the high and new technology field, remarkable returns being obtained from hundreds of high technology industries and high technology joint ventures.

Smooth progress in changing from military to civilian work results from having geared business concerns toward markets from the very beginning, allowing them to find the road to survival and development through competition. Except for some important ordnance for which the state institutes command style plans, the plants themselves are free to work on all else. The nuclear industry system's application and development of nuclear technology for civilian use has spawned one new product. The military electronics industry has formed a large civilian electronics group that has developed a series of hot-selling high technology civilian products. The shipbuilding industry has actively taken on the task of designing and building key pieces of equipment for key state projects, producing more than 1,000 non-ship products and more than 80 kinds of products of major importance to more than 20 industries and fields including spaceflight, electric power, petroleum, and chemicals. Ships products and electrical and mechanical products have carved out a place for themselves in international markets. Ordnance industries have broken down all sector and industry boundary lines to establish more than 10 economic partnerships for motorcycles, electric refrigerators, mini and heavy motor vehicles, and cameras. The mini motor vehicles that they produce for civilian use account for one-sixth of the national total. More than 100 premium quality civilian products of industries in remote locations, where a substantial number of war industries are located, have entered the international market.

Information from the quarters concerned shows that since China's war industries instituted a strategy for shifting from military to civilian production, 30,000 items of technology have been transferred to civilian use, and more than 1,000 difficult civilian technology problems tackled. Civilian product output value increases by 20 percent each year, and the taxes and profits from this production increase tremendously with each passing year. In addition, war industries have established and perfected a body of internal operation, self-limitation, and development mechanisms that are in keeping with a commodity economy.

New Integrated Circuit Design Group in Shenzhen

93FE0362B Beijing KEJI RIBAO [SCIENCE AND TECHNOLOGY DAILY] in Chinese 14 Dec 92 p 1

[Article by Correspondent Zhang Xiaoyuan [1728 2556 0626]: "Shenzhen Sets Up Integrated Circuit Designing Group"]

[Text] Shenzhen, 12 December—China's first application-specific integrated circuit (ASIC) open design group was established yesterday in Shenzhen. This is a new kind of organization that has emerged in the upgrading and updating of China's electronics industry.

An expert at the Shenzhen Municipal Science and Technology Bureau said that the swift development of the world's information industry today means that ASICs play an increasingly important role in electronics industries. It is expected that by 1993 ASICs will account for 21 percent of the world's integrated circuit market having an output value of $12.5 billion.

Reportedly ASICs are characterized by high performance, a high degree of integration, high reliability, and high secrecy, as well as by small bulk and light weight, which means a very great increase in performance and an enormous decrease in cost of machines equipped with ASIC electronics. The development cycle is markedly shorter, and product market competitiveness is higher.

Currently Shenzhen has more than 10 concerns that have set up ASIC design laboratories (or centers) where more than 120 specialists are directly engaged in the designing of ASICs, and in which 30.65 million yuan has been invested. Sixty-nine different ASIC products are currently being marketed, and they are playing a major role in the electronic information, communications, and electromechanical integration fields.

Reportedly the newly established Shenzhen open type ASIC design group is made up of numerous ASIC design laboratories (or centers). The first members came from nine enterprises such as the Saige Research and Development Institute, and the members themselves invested in the group and operate it themselves. It has both products of its own, and it engages in close mutual cooperation with others, accepting outside design tasks and the training of personnel.

Applied Surface Physics Laboratory at Fudan University

93FE0362C Shanghai WEN HUI BAO in Chinese 25 Dec 92 p 3

[Article: "Key National Applied Surface Physics Laboratory Established at Fudan University"]

[Text] Another national level scientific research base—the key National Applied Surface Physics Laboratory—has been established at Fudan University in this city. On 24 December, the State Planning Commission authorized the State Education Commission to accept it formally following examination.

In 1990, the State Planning Commission decided to establish a key state laboratory using Fudan University's surface physic laboratory as the foundation in order to emphasize research on surface science problems having to do with the development of new-model semiconductor devices and materials. Three years ago, simultaneous with the laboratory's new construction and expansion of a number of large devices and pieces of equipment including its silicon molecular beam epitaxy system, its opto-electronic energy spectroscopes and its Rahman spectroscopes, it continued to obtain advanced results at the international level in its research on germanium/silicon superlattices, porous silicon-emitted visible light, and the surface purification of III-V group semiconductors under leadership of Professor Xie Xide

[6200 1585 1795] and the laboratory director, Professor Wang Xun [3769 6598]. A research paper on porous silicon emitted light was recently published in *Physics Review Newsletter,* the most authoritative publication in international physics. Two of the young professors in the laboratory were awarded the title "All-China holders of doctorates and masters degrees making outstanding contributions." The two have become implementers of the Shanghai Municipal Science Commission "Venus Plan."

World-Class Telephone Network For Shanghai

93FE0362D Shanghai WEN HUI BAO in Chinese 22 Nov 92 p 1

[Article by Correspondents Zheng Wei [6774 5588] and Zhang Ping [1728 1677]: "Shanghai's Communications Development Goals For the Rest of the Century Set. One of the Largest Communication Centers on the Western Rim of the Pacific To Be Built. Total Telephone Capacity to Reach Between 5.5 and 6 Million Lines By 2000."]

[Text] The correspondents learned from the Shanghai telephone switchover network-entry command center, which has an installed capacity of 1 million lines, that over the next 8 years communications in Shanghai are to be built to the standard of a first rate world city. A concrete design for a "high technology, high level, and high speed system has been decided upon. The development goal is for Shanghai to have one of the largest communications centers on the Pacific rim by the year 2000.

The director of the Shanghai Posts and Telecommunications Bureau, Xu Zhichao [1776 1807 6389], and deputy bureau director Cheng Xiyuan [4453 6932 0337] told the correspondent that in the final 8 years of this century, development of Shanghai's communications will aim for the top world standard. An effort will be made to add telephone exchanges for between 400,000 and 700,000 lines each year to speed up the development of communications. The specific conception is for a total installed telephone capacity of between 2 million and 2.5 million lines throughout the city by 1995, 25,000 international stored-program-controlled [SPC] switch equipment terminals, 100,000 domestic SPC equipment terminals, 100,000 portable telephones, and 350,00 wireless-pager telephones. This network's exchanges will be more than 95 percent digitized, the number of digits in Shanghai network telephone numbers increasing to eight.

Bureau director Xu Zhichao said that in the future development of Shanghai's communications, Pudong's communications will be built to a more advanced and higher level than the downtown area of Puxi. During the Eighth 5-Year Plan, networking and optical fiber will be used mostly in three development zones having an installed capacity of 350,000 lines. During the Ninth 5-Year Plan, installed telephone capacity will reach 1 million lines, a telecommunications information center being built in the Lujiazui financial and trading district, and experimental integrated services digital network (ISDN) and intelligent professional test network (IN) built. From 2000 to 2020, bringing ISDN into general use will be the main emphasis, an information center built, optical cables brought into general use, and personal communications networks (PCN) developed, every effort made to attain the top world standard for the period.

First Economic and S&T Information Center Established in Beijing

93FE0362E Shanghai WEN HUI BAO in Chinese 12 Nov 92 p 1

[Article by Beijing Correspondent Lu Zhengming [7120 2973 2494]: "Founding of Beijing Jinghua Economic and Scientific and Technical Information Center, the First Comprehensive, Multi-Function Information Exchange Location"]

[Text] Beijing, 11 November—Founding of China's first comprehensive, multi-purpose information exchange—the Beijing Jinghua Economic, Scientific, and Technical Center—was announced in Beijing today. This center was jointly founded by the central government and Beijing municipal economic, scientific and technical, news, and cultural units to satisfy needs in the building of a socialist market economy system.

Reportedly this center will obtain information from all ministries and commissions of the central government, all departments concerned, all large academic institutions, and other sources of information from various places throughout the country and abroad. It will screen for high quality information having great practical value. Using the central exchange's on-site large screen computerized display equipment, it will disseminate information about market trends, supply and demand, commodity prices, business conditions, and technology market conditions. It will be a high performance system that provides broad coverage and reports quickly. Because of the unlimited growth and shared used of information, as well as its regenerative and learning nature, the center will provide multi-functional market demand information services, science and technology development and transfer services, administration and management consulting services, business and trade negotiation and proxy services, and brokerage services. It will organize economic, scientific and technical, and cultural exchange activities emphasizing the entire process of obtaining good economic returns after information is made available to the market. In this connection, and with support from national industrial and commercial executive and administrative departments, the Beijing Huajing Economic, Scientific and Technical Commerce and Trade Center was simultaneously founded, thereby enabling the information center to construct an integrated economic, scientific and technical, and cultural commercial trade entity that provides information

and consultation, business and trade management, scientific and technical development, brokerage services and exchange activities.

New Precision Laser Beam Processing Laboratory in Shanghai

93FE0362F Shanghai WEN HUI BAO in Chinese 14 Dec 92 p 3

[Article by Correspondent Qian Weihua [6929 4850 5478]: "Key Laser Beam Precision Processing Laboratory Founded in Shanghai"]

[Text] China's first laser beam precision processing laboratory—the Key Shanghai Municipal Laser Beam Precision Processing Laboratory—was founded a few days ago in Shanghai.

Laser beam precision processing is a high and new technology that promises to have broad application in the fields of microelectronics, precision machinery, precision optics, and optical disc manufacture. The Shanghai Laser Technology Institute was the earliest in China to do research in this field. The municipal science committee allocated 1 million yuan to the third research laboratory in that institute to construct China's first key laboratory in this specialized technology.

In using projects to support construction during the period of construction, the Shanghai Municipal Laser Beam Precision Processing Key Laboratory has scored several major achievements that include application for a national patent, and six national, provincial, and municipal ministry-level scientific and technical progress awards second class or higher.

70/30 Ratio Set by CAS for Science Job Switch

40101005A Beijing CHINA DAILY in English 8 Mar 93 p 3

[Article by Cai Yan, staff reporter]

[Text] The Chinese Academy of Sciences (CAS)—entering its third phase of reform—will require 70 percent of its scientists and technicians to switch from jobs in basic research to ones with an applied application.

The CAS reform outline calls for trimming the basic research staff over the next 5 to 10 years to 30 percent of the total. The rest will go into applied science and profit-making institutions.

The outline was submitted to the State Council last June and has just been approved.

The three-to-seven ratio, said CAS spokesman Guo Chuanjie, will guarantee that the academy retains a top notch group of scientists for basic research. Meanwhile, the transfer of scientific findings into production will be speeded up.

This was described as exciting news for CAS's basic research staff as it promises preferential policies and pecuniary back-up for this type of research.

The outline also contains measures to inspire CAS's fundamental research staff.

These include: strengthening international academic cooperation; absorbing excellent overseas Chinese students; introducing a merit-based assessment of basic-research laboratories and founding a young experts' team, to which the academy promises all-out assistance.

By contrast, those falling into the applied science category will be largely on their own.

Institutes devoted to applied science can take the form of engineering centres, joint-venture enterprises and conglomerates, the outline stated.

As a trial, CAS will set up seven or eight shareholding companies. The academy will also assign support to selected profit-making high-tech companies.

It is expected that a group of key enterprises will emerge, each to produce an annual output value of more than 100 million yuan ($17.5 million) in a few years.

Guo Chuanjie said co-operation will be enhanced, through CAS's 29 branches nationwide, to assist provinces, autonomous regions and municipalities to better fuse research with production.

He described the present stage of reform as "overall, systematic and comprehensive" because it will be coupled with changes in personnel, distribution and insurance within the CAS.

Hi-Tech Research Gets Sales Power

40101005B Beijing CHINA DAILY (Economics and Business) in English 13 Mar 93 p 2

[Article by Wang Yong, staff reporter]

[Text] China yesterday approved 100 academies and research institutes for foreign trade rights in a landmark move to promote its high-tech exports.

The government is expecting those institutes, whose research results have been frittered away in many cases because of isolation from commercial markets, to help push China into the world's top-10 trading nations.

Analysts said China plans to increase its annual exports to at least $100 billion in the next few years.

But what is unsettling for policy masterminds is that the bulk of China's exports has been in textile and light industry products and relatively unsophisticated machinery and electronics items.

High-tech products have made up less than 5 per cent of the country's total annual exports. That proportion in developed nations is around 30-40 percent.

Song Jian, a State Councilor and head of the State Science and Technology Commission, said in Beijing yesterday that China hopes to raise the proportion to about 10 percent in the near future.

"China's fundamental advantage (in exports) lies in its high scientific and technological development calibre, which is far from being tapped," he said.

The 10-million-plus researchers produce 25,000 high-tech results each year, but a number of them have been left in pigeon holes.

"The potential is there... And we've made a good start today to this effect," Song said.

The 100 academies and research institutes come from 28 ministries, including aerospace, nuclear power, metallurgy, chemicals, textiles, electronics, ship-building, water conservancy, automation, petroleum and armaments industries.

Notably, 35 are military units.

Ding Henggao, head of the Commission of Science, Technology and Industry for National Defence, said those institutes will promote civil production by the military sector.

Civil products accounted for about 70 percent of the industrial output by the military system last year.

Ding said the military system contributed about 10 percent of China's total machinery and electronics exports last year.

"We urge our aerospace, atomic power and electronics institutes to gear up production of civil products in the years to come," he said.

Analysts said China's military factories are turning out more civil products for export because of the shrinking demand for arms.

The output value of civil products by the military system has increased at an annual rate of 20 percent since 1980.

Song Jian revealed that the country's overall high-tech exports rose by an average of 32 percent between 1986 and 1991, riding on the nation's 3,000-plus high-tech enterprises and 52 national high-tech development zones.

But even so, China's high-tech imports have outweighed exports in the past few years, causing huge deficits in the sector, he said.

And China promises to further increase its high-tech imports toward the end of the century as the national economy soars upward.

China's policy-makers fear, however, the country's exports won't enjoy sustained growth if its own high-tech sectors fail to become money spinners.

Greater Emphasis on Security Work in Xinjiang Province Urged

93FE0361B Urumqi XINJIANG RIBAO in Chinese 29 Oct 92 p 1

[Article by Correspondent He Ruilan [0149 3843 5695]: "Zhang Fusen [1728 4395 2773] Emphasizes at Autonomous Region Security Work Conference That the More Reform and Opening to the Outside World, the Greater the Need to Improve Security"]

[Text] Urumqi. Xinjiang Autonomous Region CPC Deputy General Secretary Zhang Fusen stressed at the recently convened autonomous region security work conference that security committees at all levels must fully realize the extreme importance of security work under the new circumstances. He said that inasmuch as Xinjiang is located on the frontier of the motherland, now that reform and opening to the world has entered a new stage, the more reform and opening to the outside world, the greater the need to improve security.

Zhang Fusen said that close attention to, and intensification of, security work effectively preserve's the Party's and the country's secrets. It has a direct bearing on smooth progress in the four modernizations, and in reform and opening to the outside world, and has a bearing on national security and social stability as well. The serious situation being faced today in security work must be sufficiently appreciated, a high degree of vigilance maintained against the surreptitious sabotage perpetrated by hostile forces.

Comrade Zhang Fusen said that security work must resolutely carry out the party's basic line of taking economic construction as the centerpiece, adhere to the four basic principles, and persevere in reform and opening to the outside world. It must have as its point of departure maintenance of the nation's basic rights and interests, persevere in highlighting key points, and actively be on guard, both protecting state secrets and assisting plans for all tasks, take the initiative in serving economic construction, and serve reform and opening to the outside world.

Comrade Zhang Fusen emphasized that CPC committees at all levels must improve leadership of security work. Security work encompasses the overall situation. It requires two combinations, namely security units and professional units in combination, and specialized functions and concurrent functions in combination. It must be centrally directed by party committees. CPC committees at all levels must regularly analyze the state of security work, and study and solve problems and difficulties in security work. In no case may security work be accorded an important position in words, but relegated to a secondary position and rushed to completion in action. Major disclosures of secrets must be personally attended to. Units supporting security work and enforcement units are to handle those who divulge secrets according to law. Security

organs must be established and improved to create the necessary conditions for the smooth performance of security work. Autonomous region CPC committee standing committee member and autonomous region deputy chairman Wang Yuequan [3769 2867 3123], and autonomous region CPC committee security committee chairman Jin Jixun [6855 4764 8113] made speeches at the meeting.

The conference read decisions of the State Security Bureau on the commendation of advanced collectives and advanced workers in nationwide security work. Nine advanced collectives in Xinjiang Province, including the Changji Zhou Security committee, and 16 advanced personnel including Zhou Songzhen [0719 2646 3791] received commendations and awards.

China To Launch 20 Satellites Before End of Century

93FE0464A Xian SHAANXI RIBAO in Chinese
14 Feb 93 p 4

[Article by reporter Xu Jingyao [1776 0099 6460] and correspondent Yu Hongguo [0060 4767 0948]]

[Text] Beijing, 13 Feb (XINHUA)—The director of the China Academy of Space Technology, Qi Faren, announced today that before the end of this century, China will launch approximately 20 application satellites, and will engage in the research and development of manned spaceflight technologies.

Between now and the year 2000, China's main satellite development goal is to accelerate the development of a family of communications and broadcasting satellites, navigation and positioning satellites, and scientific experiment satellites; such satellites are required to meet the needs of developing China's economy and modernizing China's defense systems, and to enhance China's ability to participate in international cooperation and to compete on the international market. This goal will be accomplished in two phases. In the first phase, which coincides with the period of the "Eighth 5-Year Plan," application satellites designated as high-priority projects by the State will be developed and launched. In 1993 and 1994, the current plan is to launch scientific experiment satellites, first- and second-generation recoverable satellites, and high-capacity, long-life communications and broadcasting satellites, thereby raising the state-of-the-art of China's satellite technology to a higher level. In the second phase, efforts will be accelerated to develop new communications and broadcasting satellites, navigation and positioning satellites, and disaster-relief satellites; it is expected that by the late 1990's, a mature system of application satellites will be established. In order to meet the wide range of requirements imposed by China's urgent needs in education, cultural development, transportation, communications, environment, disaster prevention, and resource exploration, it is important to concentrate our efforts on increasing the number of satellite product types, improving satellite performance, extending satellite design life, and developing different means of information transfer.

In accordance with the national guidelines on long-range development of science and technology, China is currently conducting technical and economic feasibility studies on manned spaceflight; it is our hope to achieve major breakthroughs in this area in order to improve China's status in the world's high-technology community.

China is also undergoing a transitional stage from an importing nation of satellite technology to an exporting nation, and from a state of merely participating in academic exchanges to a state of technical and economic cooperation. The cooperative efforts include designing, building and jointly developing geostationary communications satellites, recoverable satellites, weather satellites and earth-resource satellites, as well as key satellite components for foreign users and users in Taiwan. In addition, China is providing services of launching and recovering satellite payloads, conducting large-scale experiments in space, and designing and building large satellite ground systems. In the meantime, China will also strive to absorb foreign technical expertise and investments for the purpose of developing its space technology and expanding its application systems.

Breakthrough in Space Microgravity Research

93FE0464B Xian SHAANXI RIBAO in Chinese
15 Feb 93 p 4

[Article by reporter Xu Jingyao [1776 0079 6460] and correspondent Liu Zhiqing [2692 5347 3237]]

[Text] Beijing, 14 Feb (XINHUA)—A rice seedling produces three grain sprouts, a green pepper weighs 350 grams—these are miracles made possible by space experiments conducted on China's recoverable satellites. In recent years, major breakthroughs have been achieved in China's space microgravity research program; in a number of research areas, China is considered to be the world leader. Currently, China has completed over 300 experiments on its satellites, all of which have been successfully recovered. This has provided an excellent environment for domestic and foreign users to conduct scientific experiments in space.

Conducting scientific experiments under space microgravity conditions not only has practical significance in terms of developing new materials, synthesizing new drugs, and improving traditional farming techniques, it also provides important scientific data for future space exploration by China's astronauts.

FM-80 Low-Altitude Air Defense Missile System Detailed

93FE0319B Beijing ZHONGGUO HANGTIAN [AEROSPACE CHINA] in Chinese
No 12, Dec 92 pp 25-27, 31

[Article by Yang Cunfu [2799 1317 1381] and Chen Guoxin [7115 0948 2450] of the Beijing General Institute of Electronic Engineering: "China's FM-80 Air Defense Missile System"]

[Text]

Abstract

This paper gives a brief description of the FM-80 low-altitude and ultra-low-altitude air defense missile system. In particular, the main functions, the components, the tactical specifications, the operating modes and combat procedures, as well as the unique features and defensive capabilities of the system are described in detail. In addition, the direction of future development of the FM-80 is also discussed.

I. Introduction

The FM-80 (Fei Meng-80) is an all-weather, low-altitude and ultra-low-altitude air defense system developed by China's Chang Feng Technology and Industrial Group. It has the capability of defending against high-speed airplanes, armed helicopters, surface-to-air missiles and cruise missiles. Its primary mission is to defend strategic locations such as airports, harbors, oil fields, transportation centers, troop concentration areas and key military bases; it can also operate in conjunction with other air defense missiles and anti-aircraft guns to form an integrated air defense system.

The FM-80 is a modular weapon system which can be modified according to user needs into a field mobile system, a semi-field mobile system, or an integrated artillery weapon system. The system can potentially be further developed and improved to defend against the ever-increasing airborne threat; the improved versions of the system will be used for ship-borne air defense and ground-based anti-missile defense.

In recent international exhibits here and abroad, the FM-80 has generated a great deal of interest from the defense community.

II. System Components

1. Main Components

The FM-80 weapon system consists of the combat unit and the support and maintenance unit. A basic combat unit, also called a combat detachment, contains the equipment described below; a combat company, which consists of three to five basic combat units, is equipped with one support unit.

(1) Components of a combat detachment include:

- The search and command system (located on a box trailer-car) (one)
- The launch and guidance systems (located on a box trailer-car) (three)
- The optical aiming device (one)
- The 40-kW power station (four)
- The tube-loaded missiles (12) (each launch and guidance system is equipped with four missiles)

(2) Components of a support unit include: the electronic repair vehicle, the mechanical repair vehicle, the calibration vehicle, the electronic parts vehicle, the missile test vehicle, the missile test control vehicle, the shipping and packing vehicle, the missile transport vehicle, and the power supply vehicle.

Pictures of the search and command system and the launch and guidance system are shown in Figure 1 and Figure 2 respectively [photographs not reproduced].

2. Main Functions and Components of the Combat Unit

(1) The search and command system

The search and command system consists of the pulse-doppler radar, the data-processing and display system, the inter-vehicle data transmission and voice communications system, the radio communications equipment and the target identification unit.

The primary function of the search and command system is to perform the tasks of target search, target acquisition, target identification and threat assessment, and to assign the target to the different launch and guidance systems. The search radar of the system is an S-band coherent pulse-doppler radar which has the capability of detecting moving targets under clutter conditions; it also has good interference-rejection capability. The system can perform track-while-scan and deliver target information to three different launch and guidance systems. It is carried on one of the box trailer-cars.

(2) The launch and guidance system

The FM-80 launch and guidance system consists of the Ku-band monopulse radar, the television tracking system, the infrared position indicator, the data processing and display system, the inter-vehicle data transmission and voice communications system, four missile launchers, and the missile sequencer.

The main function of the launch and guidance system is to receive target information from the search and command system, and to perform the tasks of target acquisition and tracking, and launching the missiles. The infrared position indicator is used during the initial stage of guidance until the missile enters the main radar beam; then it is guided by the radar until it intercepts the target.

The Ku-band monopulse radar is a high-precision tracking and guidance radar which has frequency-diversity or frequency-hopping capability. The television tracking system can perform automatic target tracking, which greatly enhances the interference-rejection capability and the ultra-low-altitude target-tracking capability of the weapon system.

All the equipment of the launch and guidance system is also carried on a box trailer-car which weighs 11 tons and can travel at a speed of 50 km/hr.

(3) The optical aiming device

The optical aiming device, which is located near the launch and guidance systems, is used for manual target acquisition. In case the search and command system is jammed by the enemy or fails for other reasons, the aiming device is used to assign targets for the launch and guidance systems.

(4) The 40-kW power station

The 40-kW power station is primarily used to supply electric power for the search and command system and the launch and guidance system.

(5) The FM-80 missiles are loaded in launch tubes which also serve the functions of storing, transporting and launching the missiles.

The FM-80 missile has a canard-type aerodynamic design; both the four forward canards and the four fixed fins in the rear are arranged in a cross-shaped configuration. The missile is equipped with an autopilot, a remote-control transponder, a proximity fuse, a solid-propellant rocket engine, and a safety mechanism, as well as onboard batteries, converters, and electric cables. The missile has a focused high-energy fragmentation warhead and a multi-step fusing device; it is designed to destroy targets effectively at any point in the air space.

III. Key Tactical and Technical Performance Parameters

1. Target

- Target types: high-speed aircraft, armed helicopters, surface-to-air missiles and cruise missiles
- Maximum target velocity: 400 m/s
- Target radar cross section: 1 m^2

2. Kill Zone

- Maximum kill radius: 8.5 km at a target velocity of 400 m/s; 10.0 km at a target velocity of 300 m/s; 12.0 km for an armored helicopter
- Minimum kill radius: 500 m
- Maximum combat ceiling: 5.5 km
- Minimum combat ceiling: 30 m

3. Single-Shot Kill Probability

$P_{sskp} \geq 0.8$ inside most part of the kill zone

4. Combat Response Time of the Weapon System: 6-10 sec

5. Guidance System

The guidance system is an integrated infrared, television and radar system and implements full-range radio command guidance technique.

6. Interference-Rejection Capability

The system has good suppression capability against passive and active interference, ground clutter and weather-induced clutter.

7. Launch Mode

Four tilted launch tubes are used to launch the missiles in a single-shot mode or salvo mode; the time separation between two salvo launches is 3 sec.

8. Multiple Target Intercept and Multiple Launch Capability

- The three launch and guidance systems can engage three different targets approaching from the same direction or from three different directions.
- One launch and guidance system can launch four missiles to intercept enemy targets attacking in a single wave or in four different waves.

9. Mobility

- The system can be transported by air, by sea or by rail.
- The system is highly mobile and can travel at a speed of 50 km/hr.

10. Combat Environment and Maintenance Procedures

- Combat environment

The system can operate at 2,000 m above sea level and over a temperature range of -40 to +60°C; it can also operate under the conditions of high wind, sand, rain or snow.

- Maintenance procedures

The system has four levels of maintenance: the 1st and 2nd levels are field maintenance, the 3rd level is base maintenance, and the 4th level is factory maintenance. The mean-time-to-repair (MTTR) is 30 min.

IV. Modes of Operation and Engagement Procedure

1. Modes of Operation

The FM-80 weapon system uses the three-point guidance law or the improved three-point guidance law to steer its missiles toward the target.

The system has three modes of operation:

(1) The radar mode of operation is designed to intercept medium-altitude or low-altitude targets;

(2) The composite television and radar mode of operation is designed to intercept low-altitude and ultra-low-altitude targets; in this mode, the television system automatically tracks the target, and the radar measures the range and angular offset of the missile;

(3) The manual mode of operation is designed to manually track the target by the operator using the television system.

During an engagement, one of the three modes of operation is selected by the operator based on combat conditions.

2. Engagement Procedure

When the search and command system receives an order to engage in combat, the search radar begins searching the sky for a potential threat, and initiates the target track-while-scan mode; once a target has been identified and a threat assessment has been made, it assigns the targets to the launch and guidance systems. When the launch and guidance system receives the target information from the search and command system, it initiates the automatic radar or television target-tracking mode, and as soon as the launch conditions are satisfied, a

missile is launched. After leaving the launcher, the missile enters the field-of-view of the infrared position indicator, which uses the infrared angular offset information to guide the missile into the radar beam, and hands over the target to the radar. After hand-off, the missile is guided by the radar using the measured angular offset information between the missile and the target. As the missile approaches the target, the onboard proximity fuse detonates the warhead to destroy the target.

V. Unique Features of the FM-80 System

The FM-80 is an all-weather, low-altitude and ultra-low-altitude air defense system. By incorporating many advanced technologies, the system has acquired the following unique features:

(1) Fast response: the shortest response time is 6 sec;

(2) Good low-altitude and ultra-low-altitude performance: the system has the capability to intercept targets below 30 m;

(3) High guidance accuracy and high kill probability: the single-shot kill probability in most parts of the kill zone is greater than 80 percent;

(4) High mobility, high degree of automation, and ease of operation and maintenance.

In comparing the FM-80 with similar air defense missiles developed by other countries in terms of all-weather capability, system response time, combat zone, and defense capability against multiple targets, it is superior to the U.S. "Chaparral" missile, the British "Rapier" missile, and the joint German-French "Roland" missile; its overall performance is comparable to that of the improved "Sidewinder" missile (built by France) and the "Roland" missile.

VI. Defensive Capability

The FM-80 weapon system can be used to defend fixed target or temporary targets.

1. Fixed-Target Defense

Fixed targets refer to critical facilities, strategic points and strategic regions. A strategic point is a small ground facility whose area can be regarded as a point relative to the total area protected by the weapon system. A strategic region is a region that contains a certain number of strategic points; typically, the strategic regions are distributed over a wide area (20-50 km^2).

The strategic points and strategic regions may be:

- Military facilities and ammunition depots;
- Military headquarters and industrial complexes;
- Tactical and strategic air bases;
- Harbors, oil fields and bridges;
- Strategic or tactical communication and command centers.

Figure 3 shows a deployed combat detachment in a typical point-defense configuration. Regional defense can be achieved by deploying additional combat detachments outside the protected area.

2. Temporary-Target Defense

Temporary-target defense refers to the air defense of troops or equipment that is temporarily congregated in an area during a battle.

VII. Future Development of the FM-80 System

In modern warfare, the important issues facing a close-range low-altitude air defense missile system are: increasing the system response time, improving the

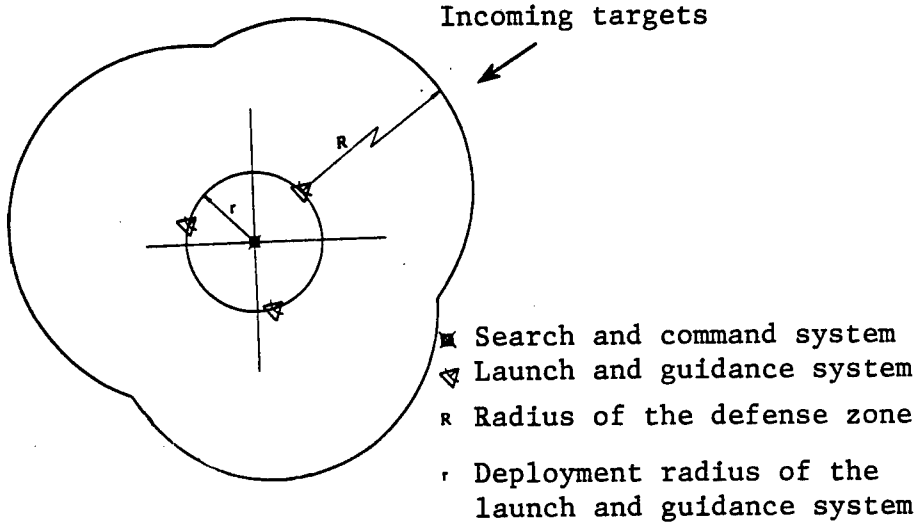

Figure 3. A Typical Strategic Point-Defense Configuration

ultra-low-altitude performance, and improving the intercept capability and interference-rejection capability against high-speed, high-mobility targets. Therefore, the following improvements will be incorporated in the future FM-80 system:

1. A Ku-band and millimeter-wave radar will be used for tracking and guidance; the millimeter-wave radar will provide higher tracking accuracy and better interference-rejection capability, thereby improving ultra-low-altitude performance.

2. The performance of the television tracking system will be improved and infrared imaging sensors or laser tracking devices will be used to provide a third tracking and guidance system. The resulting multi-sensor tracking and guidance system provides enhanced flexibility in a complex combat environment.

3. Efforts will be made to increase the missile velocity and mobility, and to incorporate optimal control and guidance laws.

4. The multi-target tracking and intercept capabilities of the FM-80 system will be improved.

Protein Crystal Growth Experiments in Space Described

93FE0319A Beijing ZHONGGUO HANGTIAN [AEROSPACE CHINA] in Chinese No 12, Dec 92 pp 4-6

[Article by Gui Lulu [2710 3873 3873], Shi Ke [1597 3784], Wang Yaoping [3769 5069 5493], Chen Shizhi [7115 0013 5347], Han Qing [7281 7230], Hu Yonglin [5170 3057 2651], Niu Xiutian [3662 4423 3944], Shen Fuling [3088 4395 5376], Xu Wei [1776 5633], and Bi Ruchang [3968 3067 2490] of the Chinese Academy of Sciences, Institute of Biophysics: "Protein Crystal Growth Experiments in Space Described"]

[Text] Abstract: The growth of biological macromolecule crystals has both theoretical and practical significance. The microgravity environment in space provides the ideal conditions for studying the complicated process of protein crystallization and for growing high-quality protein crystals. In August 1992, a series of crystallization experiments involving 10 different proteins were carried out on the Chinese-built recoverable satellite FSW-2. Preliminary results show that six of the proteins were crystallized in space; in particular, samples of the acidic phospholipase A2 and lysozyme crystals grown in space are shown to be of better quality than those produced by control experiments on the ground. Analysis of the experimental results is in progress.

The basic functions of biological macromolecules such as proteins and nucleic acids are closely related to the three-dimensional spatial structure of the tens of thousands of atoms contained in the molecules. Therefore, understanding the structures of these molecules is essential for exploring the secrets of life at the molecular level. On the other hand, the development of molecular biotechnologies such as protein engineering, rational drug design and vaccine synthesis are also based on the three-dimensional structures of proteins and nucleic acids. Unfortunately, measuring the three-dimensional structures of these biological macromolecules is a very difficult task. In particular, for large macromolecules, the commonly used single-crystal diffraction method is often limited by the growth nodes of the crystals; the speed and accuracy of structural measurement depends on the efficiency of crystallization. Biological macromolecules are different from ordinary molecules in that their crystallization is a multi-parameter process which depends on many physical, chemical and biological factors. Because of the importance and difficulty of growing biological macromolecules, an increasing number of research scientists are concentrating their efforts in this area. The microgravity conditions in space provide an ideal environment for studying the complicated process of protein crystallization and for growing high-quality single crystals. Microgravity can eliminate or mitigate the gravity-induced effects such as convection, precipitation, and wall effect; as a result, the delicate process of protein crystallization can take place in a state of homogeneous conditions with little disturbance. In the early 1980's, experimental results of growing crystals in space were first reported by West German scientists.[1] Subsequently, the United States, many Western European countries, the former Soviet Union and Japan also initiated similar research in their laboratories. Many protein crystallization experiments were conducted on the U.S. space shuttle, the Soviet space station and other recoverable spacecraft, and promising results were obtained.[2] However, the current success rate is still quite low, and current research is still at the preliminary stage where the main efforts are concentrated on identifying the key factors of the crystallization process, optimizing the crystallization technique, and improving the hardware used for growing crystals. In this country, the Protein Crystal Research Office of the Institute of Biophysics first undertook the task of growing protein crystals under microgravity conditions. Its main objective is to take advantage of the favorable conditions in space to study the effect of microgravity on protein crystallization and to develop reliable techniques and procedures for growing high-quality biological macromolecule crystals. In August 1988, the INTOSPACE Co. of West Germany conducted a protein crystallization experiment in space using one of China's recoverable satellites;[3] on the same flight, the Institute of Biophysics also participated in the experiment by providing its own protein samples.[4] As interest in this research grew, scientists from the Biology Department and Chemistry Department of Beijing University and from the Biology Department of the University of Science and Technology of China also joined the research team; their contributions included preparing the experiments and supplying part of the protein samples. In this paper, the experiments of growing protein crystals in space conducted by the Chinese research team using their own equipment are described.

In order to examine the effects of microgravity on protein crystallization, an experiment was conducted on China's recoverable satellite FSW-2 between 9 August and 25 August 1992. The key parameters of this experiment are presented in Table 1. In this study, a relatively simple and robust gas-phase diffusion method was used; the equipment used in this experiment was developed by the Shanghai Institute of Technical Physics of the Chinese Academy of Sciences in accordance with the information and specifications provided by the Institute of Biophysics. A total of 48 samples prepared from 10 different proteins were used in the experiment. These proteins included the snake-venom acidic phospholipase A2 and the bleeding toxin, both of which can be used for drug design; the insulin mutant, the ribosome inactive proteins (variola protein and protein of bitter gourd seeds) and spotted-goose hemoglobin which can be used in protein engineering; the bacteria-resistant polypeptide and lysozyme; the protein A of canavaline and the synthesized suppressing agent and trypsin compound which are primarily used for investigating the test procedures and hardware. The crystallization tubes that contain the 48 samples were operated synchronously via remote control along the satellite orbit; the total time of crystallization in space lasted 13 days and 4 hours. Within 3 days after the satellite was recovered, microscopic observations and photographic records of the recovered samples were made. Preliminary analysis results show that six of the proteins (the acidic phospholipase A2, the lysozyme, the hemoglobin, the variola protein, the snake-venom bleeding toxin and the protein A of canavaline) were successfully crystallized in space; the calculated rate of crystallization based on the sample size was 52 percent. By applying statistical analysis to the data and comparing with data obtained from ground experiments, the following preliminary conclusions can be drawn:

1. The crystal samples grown in space are limited to those produced in ground experiments.

2. Some of the space-grown protein crystals such as the acidic phospholipase A2 and the lysozyme crystals are clearly of better quality than those produced in ground experiments; the space-grown crystals are larger in size and more homogeneous in shape; pictures of the two space-grown enzyme crystals are shown in Figure 1 and Figure 2 [photographs not reproduced].

3. Preliminary examination of the samples shows that a significant portion of the space-grown crystals are larger and more homogeneous than those produced in ground experiments; the production rate of space-grown crystals is higher; and the degree of accumulation between crystals is lower.

4. For proteins which are difficult to crystallize on the ground, the results of crystallization in space are also rather poor. Of course, the crystallization technique and the equipment used in this experiment will also affect the results to some degree. Furthermore, the effects of certain protein characteristics and the preparation agent must also be considered; however, the correlation between these factors and microgravity may be nonexistent or very weak.

Table 1. Key Parameters of the Experiment

Launch vehicle	Long March LM-2D
Space vehicle	FSW-2 satellite
Launch point	Jiuquan Launch Center
Impact point	Sichuan Province
Payload weight	16 kg
Payload volume	0.018 m^3
Microgravity level	$< 10^{-4}$ g
Crystallization time	13 days 4 hours
Crystallization temperature	18.5 +/- 0.5°C
Number of samples	48

Further analysis of the experimental results is still in progress, but there is sufficient evidence from preliminary analysis that the microgravity environment in space clearly provides favorable conditions for growing protein crystals. By optimizing the crystallization software and hardware, it is possible to grow high-quality biological macromolecule single crystals. This result is consistent with the conclusions reached by other researchers.[3,5] The growth of protein crystals depends on many factors including the technique and procedure used for crystallization. The tubular crystallization technique used in our experiment has produced a crystal growth rate similar to that with other techniques, and has produced large crystals which are difficult to produce using other techniques. However, because of the complexity of the crystallization process and the need to explore multidisciplinary correlations, further space experiments and long-range studies are required to achieve our goals.

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Fudan University Completes C_{60} Research Project

93P60199A Beijing ZHONGGUO KEXUE BAO [CHINESE SCIENCE NEWS] in Chinese 1 Mar 93 p 2

[Article by Huang Xin [7806 6580]: "Fudan University Completes C_{60} Preparation, Separation, and Research Project; Reaches International Advanced Level"]

[Summary] Fudan University physicists and chemists have realized another major high-tech achievement, with the formal expert certification of their study entitled "C_{60} Preparation, Separation, and Research," which has reached internationally advanced levels. The Fudan scientists introduced the C_{60} into a high polymer material, and thus have prepared a new functional material. The Fudan University-developed water soluble C_{60} inclusion compound has a solubility 400 percent higher than reported abroad, at a price only one-fifth that of the foreign-made material. In collaboration with colleagues at the CAS Shanghai Institute of Nuclear Research, the Fudan scientists were the first to observe the C_{60} absorption band in the vicinity of 640 nm.

Crystal Whiskers for Tough Ceramic Engines

40100070A Beijing CHINA DAILY in English 18 Mar 93 p 5

[Article by Li Xing: "Crystal Whiskers Grow Tough Ceramic Engines"; first paragraph is CHINA DAILY introduction]

[Excerpts] A car that consumes about 15 litres of gas in 100 kilometres could be driven for an additional 100 kilometres if a gas turbine made of ceramic material were installed, scientists say.

The things Li Jianbao studies are tiny, less than 0.01 centimetres long.

The shape and structure of the so called crystal whiskers can be identified and examined only under an electronic microscope.

Although the whiskers are small, their synthesization into ceramics for industrial purposes will usher in an age of new engines that preserve energy, save the ozone layer and protect the environment.

In the past five years, Li, a 34-year-old professor at Qinghua (Tsinghua) University, has come up with a number of new raw materials and new methods to synthesize crystal whiskers.

His achievements have won high acclaim among his colleagues at home and abroad.

Ceramic material is known for its endurance of heat.

Burn it in 1,000 or more degrees Centigrade, it turns red but still maintains its shape and strength, unlike other materials like steel and alloy, which bend when heat reaches over 700 to 800 degrees.

But common ceramic material breaks easily.

Still ceramics' heat endurance is tempting. Engines made of ceramics could burn gas at higher temperatures and thus be more efficient than conventional engines made of alloy.

According to calculations by scientists, a car that consumes about 15 litres of gas in only 100 kilometres, could be driven for 100 kilometres more if a gas turbine made of ceramic material were installed, Li explained.

The hurdle in the production of ceramic engines is how to make ceramics as tough as steel and alloy.

The solution is simple. Construction technicians long ago worked out the way to embed steel rods in concrete, to give it tensile strength. Likewise, some tougher material could be mixed into ceramic material to improve ceramics' toughness and strength.

The "rods" embedded in ceramics have also been identified. These are non-organic single crystalline fibres, or crystal whiskers, of which silicon carbide is often used.

Li began to take interest in crystal whiskers when he was studying at the Tokyo University. He was lured because of the great promises the new ceramic materials hold.

As soon as he got his PhD degree in engineering in 1988, he returned home, where he felt he could launch his own research and share the research achievements with his countrymen. "In any engineering research project abroad, I was working for my boss and had no chance to share the patent with him," Li said.

His belief in the potential of new ceramic materials was quickly acknowledged by Qinghua University and the State. Soon after he put forward his project proposals, he won a research grant from the China National Natural Sciences Foundation. Since then, he has been given the directorship for five national scientific research projects.

And Li has lived up to the expectations. In 1991, he synthesized a new ceramic material by adding the whisker into silicon nitride ceramic material, which made it 50 per cent tougher. "If you drop it on the floor, it just doesn't break," Li said.

The new whisker-reinforced ceramic has been used to make cutting tools, which are tougher and harder than other similar tools made of ceramics.

While developing reinforced ceramics with new crystal whiskers, Li has formulated his own theories about synthesizing reinforced ceramics.

He is the first in the world to propose a search for the meeting point at which the crystal whiskers (a new type of whisker called "alpha-phase" silicon whisker) could be synthesized well to make the new material tough.

His theories have led him to develop a number of new ceramics over the years, including one published recently

in the Journal of American Ceramic Society and Journal of Japan Ceramic Society. [passage omitted]

As a State-financed student abroad, Li was required to continue his previous major, a more theoretical basic study into crystal chemistry.

When arriving in Japan in 1985, he soon found that engineering would be more suitable for him.

"I'm tired of exploring and explaining things that already exist in nature, as in basic sciences," he said. "In engineering, I can create something that may not exist on earth, and be my own master."

His achievements and research efforts have won him many honours and support.

Of the researchers who obtained the first Young Scientists Research Grant from the China National Natural Sciences Foundation last month, Li Jianbao is the youngest. [passage omitted]

Reports on Fuzzy Control Technologies

Shanghai Invests in Fuzzy Product Development

93P60195A Shanghai JIEFANG RIBAO in Chinese 24 Feb 93 p 7

[Article by Shen Keqiao [3088 0344 0829] and Hong Jianjun [3163 1696 6511]: "Fuzzy Control: Hot New S&T Topic; Shanghai Has Invested 1.3 Million Yuan in New Fuzzy Product Development"]

[Summary] The currently most advanced intelligent automated control technology—fuzzy control—has begun to make inroads into this municipality's industrial systems, and some industries have realized specific advances. This information was revealed by a Shanghai Economic Commission official at the recently convened Fuzzy Technology Symposium. After giving a brief definition of fuzzy technologies in modern intelligent control systems, this official noted that the topic has been an area of intense competition worldwide, with Japan having so far developed over 200 varieties of fuzzy-technology-based products, including washing machines, refrigerators, and air conditioners; in the United States, fuzzy technologies are being widely applied in the space industry. Our municipality has also paid significant attention to this new field by including fuzzy technology in the 10 major general technologies targeted for priority development. In recent years, the municipality has invested 1.3 million yuan in development of fuzzy washing machines, fuzzy air conditioners, and fuzzy high-grade sound systems. In addition, the technology has been applied in a number of process control systems, for accurate and stable control of parameters such as temperature, pressure, flow, speed, and displacement—with benefits not obtainable via traditional automated control methods. The Shanghai Instruments & Electronics [Plant's] Staff and Workers College has set up Shanghai's first company specializing in fuzzy technology development and applications promotion: the "Shanghai Aifusi [1947 4395 2448] Fuzzy S&T Development Co.," which has developed a series of fuzzy general-purpose controllers.

University Institute's Products Certified

93P60195B Beijing ZHONGGUO KEXUE BAO [CHINESE SCIENCE NEWS] in Chinese 3 Mar 93 p 2

[Article by Li Xiao [2621 5135]: "North China Industrial University Unveils Fuzzy Control Product Series"]

[Summary] Following upon its development of fuzzy controllers for kilns, ovens, and automobile anti-collision systems, North China Industrial University's Computer Applications Institute recently announced its development of the "FC-1C air conditioner fuzzy controller," the "FC-1D color TV fuzzy controller," and the "FC-1E refrigerator/freezer fuzzy controller," which passed ministry-level technical appraisal a few days ago. These controllers are being incorporated into the Wanbao KCC-22 air conditioner, the Xiangxuehai refrigerator/freezer, and the Mudan 21 remote-control color TV. The new controllers provide temperature control, surge protection, short-time power-off protection, and other intelligent functions.

Shenzhen Firm, U.S. Firm To Jointly Develop Neural Net, Fuzzy Control Systems

93P60188A Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 6, 17 Feb 93 p 2

[Unattributed article: "Zhonghang Computer Corp. Develops Neural Network Systems"]

[Summary] The Shenzhen firm Zhonghang [0022 5300] Computer Corp. and the U.S. firm Xi-lei [phonetic] Co. are now cooperating on completing an ONSPEC integrated management/control software package, and with various domestic research organizations are jointly developing artificial neural network controllers and fuzzy controllers. These control systems will incorporate parallel processing technologies and can handle large quantities of analog data associated with nonlinear dynamic states in various processes.

Convex Minisupercomputers Find Favor in China

93P60188B Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 6, 17 Feb 93 p 3

[Article by Liang Yu [5328 3768] and Hai Ying [3189 5391]: "Convex Minisupercomputers Find Favor in Domestic Market"]

[Summary] As a follow-up to the "Vector Computer Development and Paluck Applications Symposium" jointly held by the U.S. firm Convex Computer Corp., the Hong Kong Geotech Co., and Huarun [5478 3387] Machinery Ltd. in Beijing at the end of last year, these reporters interviewed Convex Chairman of the Board/Governor Robert J. Paluck. He indicated that since 1988, when the first Convex minisupercomputers entered the China market, 10 units have been installed in various petroleum, meteorological, manufacturing and chemical engineering firms in China. One of the main reasons for the popularity of Convex computers, he said, is that Convex has marketed over 1,200 varieties of applications software, three times as many as Cray has marketed for its supercomputers. Accumulated world sales output of Convex minisupercomputers is now over 1,200 units, compared to only a few hundred Cray supercomputers.

With regard to the prospects for cooperation between Convex and China, Chairman Paluck remarked that China has a huge future market potential, and that while the highest-performance machines have been COCOM-restricted in the past, improving bilateral relations will inevitably lead to changes in the future. Recently, the China National Petroleum Corporation and Convex reached a contractual agreement in which both parties would cooperatively establish a seismological data processing center in Singapore, and Mr. Paluck believes

there are many applications software areas for cooperation between his firm and China. Asked to evaluate the recently developed Galaxy-II [parallel] supercomputer, Mr. Paluck remarked that he was impressed with China's ability to independently write an operating system for that machine, and that the Chinese supercomputer development community should link up with the rest of the world as part of the current prevailing worldwide trend of "We are among you; you are among us."

Logical Neural Net Printed Chinese-Character Recognition System Certified

93P60188C Beijing ZHONGGUO DIANZI BAO [CHINA ELECTRONICS NEWS] in Chinese 19 Feb 93 p 3

[Article by Peng Jianhua [1756 1696 5478]: "Machine Recognition of Chinese Characters Achieved in Nanjing"]

[Summary] A State 863 Plan High-Tech research project entitled "Logical Neural Network Printed-Chinese-Character Recognition System" and completed by the Pattern Recognition Group in the Nanjing Aeronautical Engineering Institute's Computer Department recently passed technical appraisal. This world-class achievement has resulted in a neural-net-based system implemented with all digital hardware. The system, consisting of a microcomputer with appropriate additional hardware and software, can recognize 4,000 different printed characters with a tested accuracy exceeding 99 percent for specimen pages and 95 percent for actual documents; recognition speed is 1 character per second.

Kuai Yitong 863A Intelligent English-Chinese MTS on Market

93P60188D Beijing KEJI RIBAO [SCIENCE AND TECHNOLOGY DAILY] in Chinese 24 Feb 93 p 1

[Article by Han Yuqi [7281 3768 3825] and Wang Jianmin [3769 1017 2404]: "'863 Kuai Yitong' on Domestic, Foreign Markets"]

[Summary] The 863 Plan high-tech project "Intelligent English-Chinese [Machine] Translation System (Kuai Yitong 863A)" developed by young Chinese Ph.D. Chen Zhaoxiong and wholesale distributed by the Shenzhen Sangxia [2718 1115] Computer Co. is now on the domestic and foreign markets. It set a record of 1,000 units sold abroad in 1 day, constituting a monthly output value of HK$40 million. This intelligent MTS, developed with an investment of only 440,000 RMB by Chen and his partner the Hong Kong Quanzhi [2938 2535 "Sense"] Group, consists of hardware and some software designed and manufactured in Hong Kong and sentence translation software provided by the Chinese side.

Database-Aided Design Tool Unveiled in Nanjing

93P60188E Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 7, 24 Feb 93 p 13

[Article by Zhang Mingliang [1728 2494 0081]: "Advanced Database-Aided Design Tool Unveiled in Nanjing"]

[Summary] A domestic state-of-the-art database-aided design tool (DBADT) has been jointly developed by Southeast University and Nanjing High-Level Specialized Institute for Dynamics, and moreover has been certified by a group of experts to meet advanced international standards for such products. Database-aided design in large information systems has been an important worldwide topic recently, and this DBADT has been specifically written to be run on the popular SUN workstations. The complete system includes database concept design, logic design, and physical design functions.

Applications Software Automatic Generation System Certified

93P60188F Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 7, 24 Feb 93 p 13

[Article by Zhang Mingliang [1728 2494 0081]: "Southeast University Develops Applications Software Automatic Generation System"]

[Summary] The applications software automatic generation system (ASAGS) developed by Southeast University Computer Dept. software engineers passed ministry-level appraisal in Nanjing on 17 January. This ASAGS, which runs on a SUN workstations, generates target programs which can be ported to other environments. It has numerous functions, including applications requirements description, applications program generation, data dictionary management, knowledge-base management, and source-methods support.

CIMS Experimental Project Completed

93P60200A Beijing KEJI RIBAO [SCIENCE AND TECHNOLOGY DAILY] in Chinese 3 Mar 93 p 1

[Article by Han Yuqi [7281 3768 3825]: "Computer Integrated Manufacturing System Experimental Project Construction Completed"]

[Summary] Construction for the 863 Plan priority task State CIMS Experimental Project was recently completed at Qinghua University. This is the nation's first CIMS experimental project, and on 2 March it passed the acceptance check organized by 10 groups including the State S&T Commission, the State Planning Commission, the State Education Commission, and MMEI. The project consists of construction of an integrated large experimental base for research on CIMS, and was funded by a government investment of 27 million yuan. The technical equipment and methods for this project have already seen application in 10 plants nationwide. The appraisal experts certified this project to late eighties international standards.

First-Phase Engineering for State Optoelectronics Technology Center Passes Acceptance Check

93P60194A Beijing RENMIN RIBAO OVERSEAS EDITION in Chinese 10 Mar 93 p 1

[Article by Kong Xiaoning [1313 2556 1337]: "State Optoelectronics Technology Center Passes Acceptance Check"]

[Summary] Beijing, 9 March—The 30-million-yuan first-phase engineering for the 863 Plan key investment project State Optoelectronics Technology Center passed State S&T Commission-organized acceptance check today. This project, begun in August 1988 and technically supervised by the CAS Institute of Semiconductors and by Qinghua University, has resulted in construction of process lines for fabrication of quantum-well optoelectronic devices, growth of nanoscale quantum-well materials, and micromachining. Over 50 fabrication technologies have already been developed, and quantum-well diode lasers have been trial-manufactured. The center will provide services to and be open to all Chinese scientists, especially those involved in 64 critical optoelectronics research projects nationwide.

Warship Phased Array Radar Project Advances

93P60187C Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 6, 17 Feb 93 p 21

[Unattributed article: "Phased Array Radar Stabilization System Measurement Accuracy Research Advances"]

[Summary] In a 1-year-old research project entitled "Study of Single-Target Measurement Accuracy in a Phased Array Radar Electronic Stabilization System for a Warship Environment" and jointly conducted by Beijing United University's Automation Engineering Institute and by MAS's Institute 23, the researchers have achieved notable advances. Specifically, they have developed single-target accurate measurement methods for a warship-borne phased array radar; with this as a foundation, they are now attacking the next step, which is to resolve all difficulties associated with a warship wobble stabilization system. Their theoretical research achievement recently passed formal technical appraisal.

The researchers tested two different schemes. The basic concept in both schemes is to filter the warship's measured values and predict the target's measured values, to solve for the deck's predicted values, and then to transform these into direction cosine coordinates on the radar array plane and thereby permit the beam to accurately indicate the target's next position. Both schemes were tested with computer simulations written in the Quick C language and run on microcomputers. The source program for one of the schemes came to almost 2,000 lines. Theoretical analysis and the computer simulations demonstrate that both schemes effectively overcome warship wobble effects and can accurately and in real time predict target dynamic states. The two research units are cooperating on further research intended to meet utilitarian requirements as quickly as possible.

13 Optoelectronics Achievements of MMEI Institute 44 Certified

93P60187B Beijing ZHONGGUO DIANZI BAO [CHINA ELECTRONICS NEWS] in Chinese 15 Feb 93 p 3

[Article by Yu Ruming [0151 3067 2494]: "MMEI Institute 44 Realizes 13 High-Tech Achievements"]

[Summary] Thirteen military and civilian-use high-tech achievements of MMEI's Institute 44, a domestic specialist in semiconductor optoelectronics technologies, passed formal technical appraisal a few days ago. The 756 x 581-bit planar array CCD, with the highest pixel density so far among domestically made CCDs, has high transfer efficiency, large dynamic range, low dark current density, and high sensitivity. The 512-bit and 2 x 512-bit high-speed CCD delay lines, with an advanced structural design, have many applications in areas such as radar, sonar, telecommunications, guidance and tracking, medical treatment, geological prospecting, and electronic countermeasures. The CCD module drive-circuit secondary integration technology will simplify planar-array CCD system structure and reduce physical volume and cost. The CCD computer-aided testing system, which can perform high-speed acquisition, display, and numerical operations on large volumes of data, is designed for testing various parameters of linear-array and planar-array visible light CCDs. The GT3254Y large-optically-sensitive-array PIN photodiode, with some performance parameters exceeding those of comparable foreign-made products, has important applications in laser transmission systems, high-speed optical signal detectors, optical receivers, and optical controllers. The GT3191Z one-dimensional position-sensing optoelectronic detector, with no "blind spots" on its light-sensitive surface, captures signals of targets with continuously changing position; it is ideal for machining of precision machinery and for various displacement and range measurements. The GLX-1 radar optical signal isolator is the first such device demonstrating long life and high reliability under the adverse conditions of a warship-borne radar system, where it was used to measure echoes and other transmitted analog and digital signals. The GDKX-1 control module is an advanced micro-computer controlled closed-circuit TV and alarm-processing integrated control system suitable for modern monitoring and management of banks, transportation, airports, warehouses, and industrial plants. These and the other achievements are examples of Institute 44's simultaneous emphasis on basic research and on economically competitive products.

Shantou STN LCD Production Line Operational

93P60187A Beijing ZHONGGUO DIANZI BAO [CHINA ELECTRONICS NEWS] in Chinese 15 Feb 93 p 1

[Article by Li Wansang [7812 8001 2718] and Xu Rongjun [6079 2837 0193]: "Shantou Ultrasonics Group Liquid Crystal Display Construction Project Completed"]

[Summary] The nation's first STN-type [supertwist-nematic] large-screen, high-density liquid crystal display (LCD) production line, constructed at a Shantou Ultrasonic Electronics Group facility, became formally operational on 3 February. This project is a US$10 million joint venture between the Shantou Group (in cooperation with the Bank of China Shantou Trust Company) and the U.S. firm Wen-de [phonetic; ?Vanda] Co. The new facility has an annual production capacity of 20,000 square meters of LCDs, with an output value of 160 million yuan and US$10 million in foreign exchange earned.

Effect of CW CO_2 Laser Conditioned Surface on Absorption, Damage Threshold of Optical Coatings

93FE0357A Shanghai ZHONGGUO JIGUANG [CHINESE JOURNAL OF LASERS] in Chinese Vol 19 No 11, Nov 92 pp 838-841

[Article by Hu Wentao [5170 2429 3447], Fan Zhengxiu [5400 2973 0208], and Liu Liming [0491 4539 2494] of Shanghai Institute of Optics and Fine Mechanics, the Chinese Academy of Sciences: "Effect of CW CO_2 Laser Conditioned Surface on Absorption, Damage Threshold of Optical Coatings"; MS received 16 Mar 92, revised 14 May 92]

[Text] **Abstract**

The effect of CO_2 laser pre-treatment on the absorption and damage threshold of optical thin films is reported. Three types of substrates, including K_9 glass, silicon and fused silica (quartz), have been investigated. The results show that the damage threshold of an 11-layer TiO_2/SiO_2 HR (high-reflectivity) coating on fused silica can be improved by the CO_2 laser treatment.

I. Introduction

Optical coatings can be damaged due to absorption. An effective way to raise the damage threshold is to minimize absorption. The damage on anti-reflective coating often occurs at the coating-to-substrate interface. If the substrate is irradiated by a laser before the coating is deposited, it might be possible to desorb the impurity adsorbed on the substrate surface, which can reduce absorption and raise the damage threshold.[1] As for HR coatings, the damage starts at the outer layer. In order to reduce absorption, the only effective method is to treat the coating itself. This paper discusses the effect of CO_2 laser irradiation on the absorption and damage threshold of 1.06 μm multi-layer dielectric HR coatings.

II. Experimental Method

An 11-layer TiO_2/SiO_2 HR coating is placed on K_9 glass, quartz and silicon-wafer substrate, respectively. Several samples were made under the same conditions on each substrate for comparison before and after pre-treatment.

The CW CO_2 laser used to irradiate the coatings operates at 10.6 μm. Its output is tunable between 0 and 1500 W. The diameter of the light spot is approximately 30 mm, similar in size to that of the specimen. The irradiation time is expressed as (x+y)*z. This represents irradiating for x seconds and stopping for y seconds for a total of z times.

The absorption is measured by a photo-thermal deflection technique."[2] Figure 1 shows the experimental setup. Since the data measured is for comparison among specimens and no absolute absorption measurement is required, calibration was omitted. The pumping and detecting light are 632.8 nm He-Ne lasers with powers rated at 50 mW and 0.8 mW, respectively.

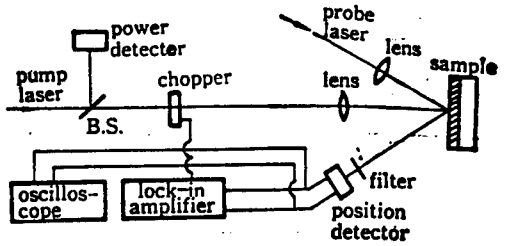

Figure 1. Experimental Setup for Absorption Testing

Figure 2 shows the experimental setup for damage resistance measurements.[3] The laser system is comprised of a Nd:YAG oscillator and a two-stage Nd:YAG amplifier. Q-switching of the oscillator is done with a LiF crystal. Mode selection is accomplished by a small-aperture grating. The output wavelength is 1.06 μm and the pulse width is 10 ns. It operates in a single-mode state. The incident light is focused on the specimen surface by an anaberrational aspherical lens. The diameter of the spot ($1/e^2$) is 100 μm. Damage to a coating may be observed in two ways. When the specimen is transparent to visible light, a microscope placed behind the specimen is used to inspect any damage to the coating. When the specimen is opaque, whether it produces fluorescence is examined on the incident side. A 1-on-1 method is used to assess the damage threshold, i.e., a specific location on the specimen surface is irradiated only once regardless of whether damage is induced or not. The damage threshold of a coating is defined as the mean of the two extremes, i.e., the average of the lowest energy to cause any damage and the highest energy not to cause any damage at all.

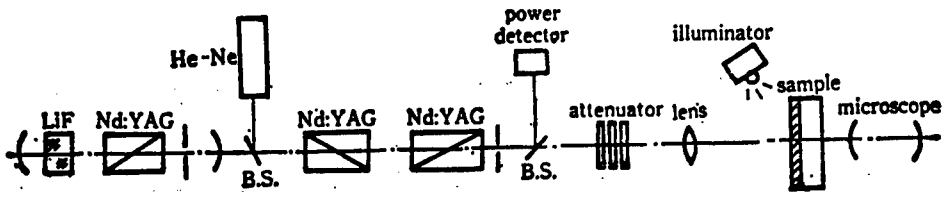

Figure 2. Experimental Setup for Damage Resistance Measurements

III. Experimental Results and Discussion

1. Glass Substrate

Nine specimens were made under identical conditions; eight of them were pre-treated by CO_2 laser irradiation at different power levels and for different durations. They were then placed on the photothermal deflection device to measure their absorption characteristics. The results are shown in Table 1. Because of the strong absorption of the 10.6 μm laser by glass, the substrate was cracked when the power density used was much lower than the damage threshold of the coating. Therefore, glass is not a suitable substrate for this experiment. No damage threshold was measured because of difficulty in handling cracked specimens.

Table 1. Damage Threshold of CO_2 Laser Conditioned Coatings on K_9 Glass Substrates

Sample number	Irradiation power (W)	Irradiation time (s)	Output signal of detector		Sample state after irradiation
			V (mV)	ΔV (μV)	
1	600	1.8	270	4.0	Substrate crack
2	500	1.8	190	1.25	Substrate crack
3	400	1.8	330	1.25	Substrate crack
4	300	4.0	285	5.0	Substrate crack
5	800	1.0	150	1.2	Substrate crack
6	500	(0.5+1.5)*10	290	0.75	Substrate crack
7	700	(0.5+9.5)*10	340	0.75	In good condition
8	1000	(0.2+9.8)*10	320	8.5	Substrate crack
9			340	20.0	In good condition

In Table 1, ΔV is the differential output signal from the quadrant detector and V is the sum of the dc output from two quadrants of the detector. The magnitude of ΔV is determined by the slope of surface deformation and V is a function of the intensity of the detecting light and the reflectance of the specimen surface. For the same substrate, ΔV/V represents relative absorption under low-frequency modulation. From the table, the values of V for specimens 1, 2, 4, 5 and 6 are much less than those of the untreated specimen, indicating a significant reduction of surface reflectance. This is because these substrates were overheated during the pre-treatment, which produced a deleterious effect on the structure of the coating. The V values for specimens 3, 7 and 8 are still close to those of the untreated samples. However, their ΔV values are lower. This suggests that the pre-treatment has reduced absorption. In addition, it is also noted that the higher the energy per continuous irradiation step, the larger the reduction in absorption becomes. This reduction in absorption may be attributed to surface purification or structural annealing by laser irradiation. Surface state changes were not studied in this work.

2. Silicon Substrate

Five specimens were prepared under identical conditions and four of them were conditioned by CO_2 laser. Relative absorption and damage thresholds for each specimen were measured. Table 2 shows the pre-treatment conditions and measured results.

Table 2. Damage Thresholds of CO_2 Laser Conditioned Coatings on Silicon Substrates

Sample number	Irradiation power (W)	Irradiation time (s)	Output signal of detector		Damage threshold (J/cm^2)
			V (mV)	ΔV (μV)	
1	1000	1.0	430	4.0	6.9
2	800	1.0	435	5.0	6.5
3	700	(1+9)*5	390	6.0	3.9
4	800	(1+9)*5	415	4.75	6.6
5			420	7.0	11.5

From Table 2, the specimen absorbs less after irradiation by the 10.6 μm laser. The higher the energy per continuous irradiation, the more apparent the reduction in absorption becomes. A comparison of pre-treated specimens shows that lower absorption corresponds to higher damage threshold. Compared to specimens 1, 2 and 4, specimen 3 has a much lower threshold. Although its absorption is not much higher than that of other specimens, it has a much lower V value. This means that its reflectance is also much lower. It also indicates that the coating structure has already been altered, resulting in a lower threshold.

Untreated specimens have higher absorption than conditioned specimens. Nevertheless, their damage thresholds are higher than those of the treated specimens. This suggests that the damage threshold of a treated specimen is constrained by other factors besides absorption. This may be because the silicon substrate does not absorb as much 10.6 μm light as the coating, and there is a temperature imbalance between the substrate and coating during pre-treatment. Factors such as internal stress upon cooling may cause the damage threshold to fall significantly.

3. Quartz Substrate

Four specimens were prepared under identical conditions and three of them were conditioned by the CO_2 laser. The absorption characteristics and damage thresholds of all four samples were determined and the results are shown in Table 3.

Table 3. Damage Thresholds of CO_2 Laser Conditioned Coatings on Fused Silica Substrates

Sample number	Irradiation power (W)	Irradiation time (s)	Output signal of detector		Damage threshold (J/cm^2)
			V (mV)	ΔV (μV)	
1	800	1.0	370	1.30	14.9
2	600	2.0	340	0.85	16.8
3	500	(1+9)*5	360	0.57	20.2
4			370	1.50	13.6

From Table 3, absorption declines after irradiation by 10.6 μm laser. Furthermore, the higher the energy of irradiation, the larger the corresponding damage threshold becomes. Moreover, it is higher than that of the untreated specimen. This suggests that CO_2 laser conditioning can raise the threshold of this set of specimens.

Comparing silicon to quartz, the difference is that the absorption of the quartz substrate is similar to that of the coating at 10.6 μm. During the treatment, the temperature rise is similar. Upon cooling, it does not induce an internal stress; on the contrary, it may eliminate some built in stress. Furthermore, the treatment reduces absorption and consequently raises the damage threshold.

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Picosecond Pulses Generated by Cascade Pulse Compression

93FE0357B Shanghai ZHONGGUO JIGUANG [CHINESE JOURNAL OF LASERS] in Chinese Vol 19 No 11, Nov 92 pp 842-846

[Article by Meng Shaoxian [1322 4801 6343], Yang Jingxin [2799 6975 2450], Qian Liejia [6929 0441 0502], and Lu Qirong [6629 0366 2837] of Shanghai Institute of Optics and Fine Mechanics, the Chinese Academy of Sciences: "Picosecond Pulses Generated by Cascade Pulse Compression"; MS received 27 Sep 90, revised 3 Jan 91]

[Excerpts] Abstract

A cascade pulse compressor is constructed by combining stimulated backward Brillouin scattering with backward Raman scattering. It has successfully converted 1.064 μm, 6 ns pulses into 630 nm, 20 ps pulses.

I. Introduction

We note that stimulated backward Brillouin scattering and backward Raman scattering not only can be used for tuning the wavelength of a laser,[1] but also for pulse compression and phase conjugation. The advantage of this compressor is that wavelength tuning, pulse-width compression and phase conjugation can be completed in one operation. The power of the light pulse produced may exceed that of the pumping light.

Compared to the conventional mode-locking method to produce picosecond or femtosecond pulses, it has the following advantages: wide tunable wavelength range, wide tunable pulse-width range, and simple structure.

In recent years, a visible-light Raman probe constructed based on nonlinear compression has been used to measure the interference pattern, schlieren and magnetic field of laser-induced plasmas and a series of significant results have been obtained.[2]

Recently, laser plasma diagnostics have been perfected by employing a Raman frequency-doubling[3] technique and a two-stage compression technique involving stimulated Brillouin scattering and Raman scattering. It is not only suitable for the diagnosis of nanosecond laser-heated plasmas but also picosecond laser-heated plasmas as well. As for the diagnostic wavelength, both visible and ultraviolet light may be used.

It was further discovered that this grating-prism compression system could also be used to compress the detecting light pulse. The principles are associated with stimulated Brillouin and stimulated Raman pulse compression. The similarities and differences of these two mechanisms are analyzed and discussed. In addition, experimental results of both compression mechanisms are presented with full analysis and discussion to follow.

II. Theoretical Analysis [passage omitted]

III. Experimental Consideration and Arrangement

In the study of laser-induced plasmas, if the heating laser pulse is less than 1 ns, it is possible to obtain a detecting pulse that is synchronous to the heating laser pulse by backward Raman scattering. Nevertheless, since the laser pulse width used in laser fusion research is 3-7 ns, a two-stage pulse compression technique is required. To this end, a tunable Q-switched dye laser is used as a switch. BDN dye is very stable and the pulse produced is very narrow. Furthermore, its spectrum is also very narrow, which makes it suitable for backward Brillouin pulse compression.

Figure 1 shows the cascade pulse compression setup.

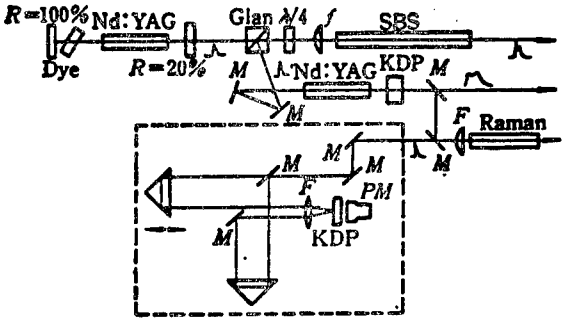

Figure 1. Experimental Setup for Cascade Pulse Compression Via Stimulated Backward Scattering

The oscillator is a Nd:YAG dye laser and the dye BDN is dissolved in 1, 2-dichloroethane. The cavity is 35 cm in length. The laser output is 6 ns wide with an energy of 80 mJ. The laser is polarized by a prism and it becomes circularly polarized by a quarter-wave plate. It is then focused at a Brillouin box that contains carbon tetrachloride. After the light is backward-Brillouin-scattered by carbon tetrachloride to the quarter-wave plate, its polarization is turned back to linear from circular and the direction of polarization is rotated by 90° relative to that of the incident light. Finally, light due to backward Brillouin scattering comes out of the polarizing prism. Relative to the incident light, the wavelength of backward Brillouin scattered light is shifted toward the longer side by 0.01 nm and the pulse width is 600-800 ps. This pulse is then amplified by Nd:YAG and turned into 532 nm green light with the aid of a type-II KDP crystal frequency-doubler. Due to phase conjugation and pulse compression, the power of amplified backward Brillouin scattering is very high and the frequency-doubling efficiency is also good.

After passing through a dichroscope, this frequency-doubled green light pulse is then focused on a Raman medium to produce 630 nm compressed backward Raman light from the dichroscope.

IV. Experimental Results and Analysis

In order to investigate the nonlinear compression process involved in this cascade compressor, a high-speed oscilloscope, streak camera and the nonlinear second-order harmonic method were simultaneously employed to take measurements.

Figure 2 shows a variety of waveforms observed by the high-speed oscilloscope at different places in the cascade compressor.

From Figure 2 one can see that the oscillator output is a 6-ns-wide pulse. A comparison of light pulse that penetrates the Brillouin box to the backward-scattered pulse shows that backward Brillouin scattering occurs after the pumping light reaches a certain threshold. Furthermore, it is abruptly amplified and compressed. After emptying out the pumping light, the pumping light that penetrates

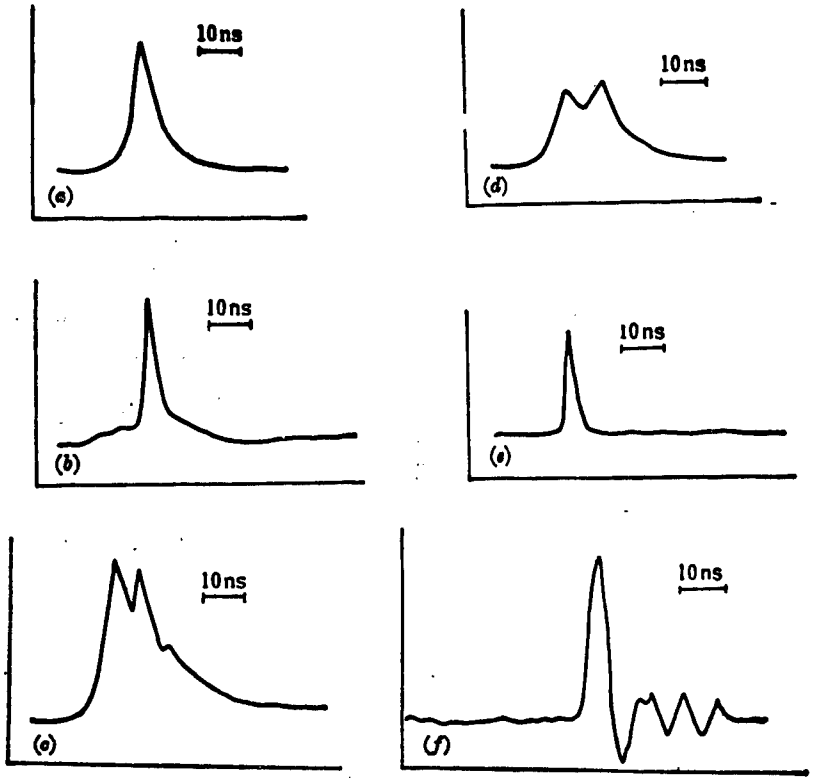

Figure 2. Waveshape of Cascade Pulse Compression at Various Places

(a) Pump Pulse; (b) Backward Brillouin pulse; (c) Transmitted laser pulse in CCl_4; (d) pulse (λ = 1064 nm) after frequency doubling; (e) Backward Raman pulse; (f) Raman pulse after compressing grating

the Brillouin box creates an indentation. In this case, the Brillouin light is very narrow and is within the resolution of the oscilloscope. After amplification and frequency doubling, this Brillouin light is used to pump the Raman medium. After frequency doubling, the remaining 1.064 μm Brillouin light is as shown in Figure 2(d). This indicates that the frequency-doubling efficiency is higher when the intensity is stronger. This causes the remaining 1.064 μm light to show a dip in the middle.

Figure 2(f) shows the waveform of the backward Raman pulse after passing through the compressing grating. The back end of it appears to be oscillating. This is caused by an increase of high-frequency components due to the short pulse width and it is not the waveform of the laser itself.

To this end, a streak camera was used to measure the waveforms of backward Brillouin scattering and backward Raman scattering. The typical waveforms are shown in Figure 3. The pulse width of backward Brillouin scattering is 380 ps and that of backward Raman scattering is 21 ps. The figure shows that both waveforms are symmetric and are approximately Gaussian.

In addition, a nonlinear type-I background-free second-order-harmonic method was used to measure the Raman

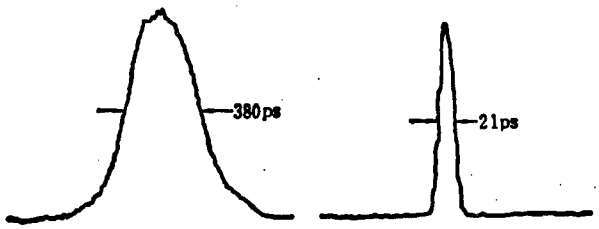

Figure 3. Streak Camera Record of the Brillouin and Raman Pulses

pulse width. The setup is shown in Figure 1. A 50 percent mirror is used to split the 630 nm light. One beam passes through a fixed right-angle prism and mirror to reach the photomultiplier. The other goes through an adjustable right-angle prism to enter the photomultiplier. The two beams are focused on a type-I KDP crystal by a lens. When both beams arrive at the same time, the second harmonic is most intense. Autocorrelation curves associated with the second harmonic can be obtained by adjusting the delay prism. In order to prevent interference from the 630 nm light, a black glass ZWB3 filter that is transparent to ultraviolet is placed in front of the photomultiplier. The photomultiplier signal is recorded by an oscilloscope.

Ethanol and DMSO were used as the Raman media. The autocorrelation curves of Raman pulse width are shown in Figure 4. The pulse width can be determined from the following equation:

$$\Delta t_p = (2\ \Delta l/\alpha c)$$

Here, l is the displacement of the adjustable prism and α is a constant related to the shape of the pulse. It was found that the Raman pulse width produced by ethanol is 27 ps and that produced by DMSO is 18 ps. If the position of the focus in the Raman medium is further fine-tuned, it is possible to obtain even shorter Raman pulses. Compared with the results obtained with the streak camera and second-harmonic measurement, they are essentially consistent.

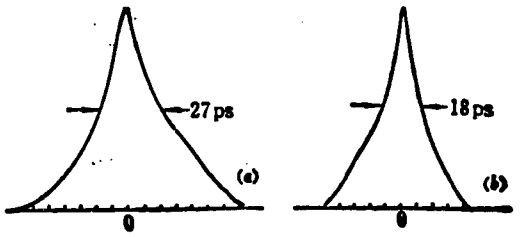

Figure 4. Autocorrelation Traces of Raman Pulse Width
(a) Ethanol; (b) DMSO

The energy of the Raman pulse was measured with a calorimeter and it was found that the energy of the 630 nm light is approximately 4 mJ. The Raman beam is approximately 4 mm in diameter. Therefore, the Raman output power is 10^8 W and the power density is 10^{10} W/cm^2. Such an intense light can be effectively frequency-doubled to 315 nm at an energy greater than 1 mJ.

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Circular-Viewing Rainbow Holography for Reconstructing Projected Object Image

93FE0357C Shanghai ZHONGGUO JIGUANG [CHINESE JOURNAL OF LASERS] in Chinese Vol 19 No 11, Nov 92 pp 857-860

[Article by Wang Dianmin [3769 0368 3046], Ha Liuzhu [0761 3177 2691], and Wang Mincao [3769 3046 5430] of the Optical Engineering Department, Beijing Institute of Technology: "Circular-Viewing Rainbow Holography for Reconstructing Projected Object Image"; MS received 18 Jan 91, revised 8 Apr 91]

[Text] **Abstract**

A circular-viewing rainbow holography to reconstruct the projected image of an object is presented. The conditions for diffraction image separation are analyzed. Two experimental optical configurations are provided and verified experimentally.

Introduction

Circular-viewing rainbow holography[1] is a novel white-light reconstruction technique. It fundamentally solves the small-viewing-angle problem associated with the reconstruction of holograms via white light. Based on the principles of circular-viewing rainbow holography, a technique to prepare a circular-viewing rainbow hologram[2,3] of an object, in particular a three-dimensional transparent object, is described.

I. Principles of Optical Configuration

From the characteristics of circular-viewing holography,[1] the optical arrangement for recording any circular-viewing hologram can be summarized as that shown in Figure 1.

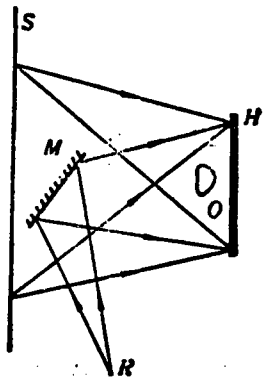

Figure 1. Recording Process of Circular-Viewing Rainbow Hologram
S—ring-shaped slit; M—reflective mirror; R—reference light point; O—object; H—holographic plate

The reconstructed conjugate of the hologram recorded, H, can be used for circular-viewing, as shown in Figure 2.

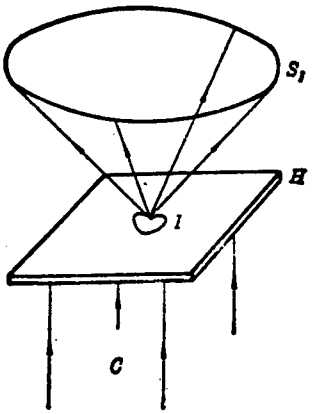

Figure 2. Reconstruction Process of Circular-Viewing Rainbow Hologram

C—illuminating wave; H—circular-viewing rainbow hologram; I—holographic image: S_I—image of ring-shaped slit S

From Figures 1 and 2, it is not difficult to see that if a ring-shaped slit is used as the light source and O is the three-dimensional object (or a two-dimensional transparent plate), the reconstructed image[3] of the projection of O can be observed as in Figure 2. Therefore, Figures 1 and 2 show the principle optical configurations to produce circular-viewing rainbow holograms.

II. Theoretical Analysis

From Figure 1, during recording of a circular-viewing rainbow hologram, the angle between the object beam and reference beam should not be too large. Therefore, the separation of reconstructed image from transmitted light becomes an issue in circular-viewing rainbow holography.

For ease of analysis, Figure 1 is simplified to Figure 3. In Figure 3, R is the cross-sectional aperture of the reference beam on the plane of the slit S and a is its radius; b is the inner radius of the ring-shaped slit S. Obviously, the condition to separate the reconstructed conjugate diffraction image from the straight light is:

$$b \geq a \qquad (1)$$

When the width of the slit, W, is taken into account, because of the halation effect produced by the slit during reconstruction,[4] the separation condition becomes:

$$b - W \geq a. \qquad (2)$$

This analysis is true in general. In order to apply it to various situations encountered in the recording of circular-viewing rainbow holograms, equation (2) is extended as follows. The separation condition for the circular-viewing rainbow reconstructed image and the transmitted light is that equation (2) must be satisfied by the cross-sectional radius a of the reconstructed wave on the image plane of the image of the ring-shaped slit S_I, the inner radius b of the reconstructed slit image and the width of the reconstructed slit image width.

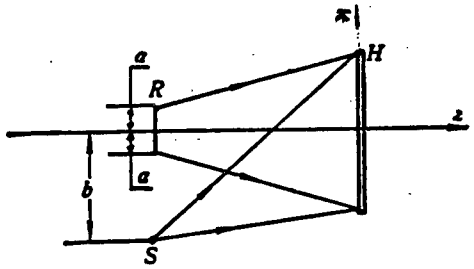

Figure 3. Simplification of Recording Process

Based on analysis similar to that used for conventional rainbow holography,[5] the maximum allowable width W of the slit can be determined:

$$W' = (l_s/l_I)\,\Delta H \qquad (3)$$

where ΔH represents the maximum blurriness permitted by the eye; l_s and l_I are the distances between the slit image and object image to the center of the interference plate, respectively; and W' is the maximum allowable slit width. W can be obtained by using the holographic imaging equation.[6]

III. Experimental Optical Arrangements and Analysis

Several experimental schemes may be used based on Figure 1. Two representative recording optical arrangements are introduced here.

3.1 Cylindrical Reflector

Different from reference 1, a cylindrical reflector is used merely to obtain a ring-shaped illumination source and there is no need to reset to reconstruct, as shown in Figure 4. There are several experimental techniques associated with Figure 4. A large-aperture spherical wave can be obtained by combining a negative lens with a relatively large aperture and a beam expander.[7] Furthermore, in order to overcome the single-channel recording problem,[2] a diffusive coating is added to the reflector. Since the reflector M is only used to provide a ring-shaped illumination source, it may be replaced by a high-reflectivity cylinder (such as a bottomless tin can). Furthermore, it may be a cylinder or a prism.

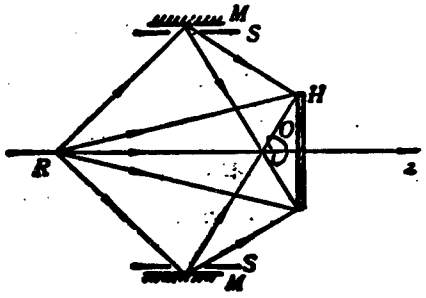

Figure 4. Recording Process of Projected-Image Rainbow Hologram

M—cylindrical reflector; S—ring-shaped slit; O—object; H—holographic plate; R—light source

It is obvious that the diameter of the slit shown in Figure 4 may be very large. Therefore, this arrangement may be used to record large-area, large-viewing-field circular-viewing rainbow holograms. There is a point worthwhile noting. The slit width W_c in this case is correlated to the W used in the theoretical analysis, as shown in Figure 5. By means of mathematics and geometry, we can derive that

$$W_c = \frac{d}{c+h} W = \frac{\sqrt{l_s^2 - c^2}}{c+h} W \qquad (4)$$

The corresponding slit inner ring radius b is:

$$b = c - W \qquad (5)$$

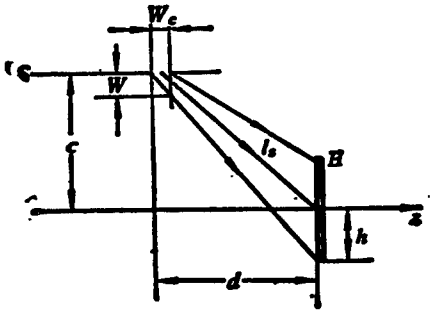

Figure 5. Equivalent Width of Slit

S—ring-shaped slit; H—holographic plate

3.2 Large-Aperture Lens

In Figure 6, L may be a large-aperture Fresnel helix lens.

Both methods can be used to produce large-area, large-viewing-field circular-viewing rainbow holograms. However, they have the following disadvantages. The object blocks the reference light so that there is no diffracted light at the center of the hologram. Nevertheless, when the object is transparent (two- or three-dimensional), this

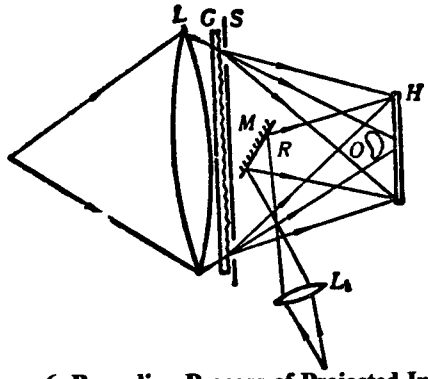

Figure 6. Recording Process of Projected-Image Rainbow Hologram

L—large-aperture lens; G—frosted glass; S—ring-shaped slit; M—mirror; L—lens; R—reference wave; O—object; H—holographic plate

drawback is eliminated. Moreover, the utilization of light energy is poor. But, since the projection hologram is recorded, the illuminating light shines directly onto the interference plate. Therefore, the exposure time is not very long.

Finally, a small wineglass was used in an experiment. The optical configuration shown in Figure 6 was employed. L is a 300-mm-aperture lens. The inner diameter of the slit is 250 mm and its width is 3 mm. The distance between the reference point and the center of the interference plate is 500 mm. The slit is 200 mm away from the plate. The wineglass is stuck to a transparent glass plate as a support for ease of handling. This also avoids the problem wherein the support might block light. Finally, a light bulb 1,000 mm away was used to reconstruct the hologram (as shown in Figure 2). The slit reconstructed image is approximately 500 mm away from the center of the hologram and the slit diameter is 620 mm. The hologram obtained is 90 x 100 mm^2 in area. The reconstruction effect is that the hologram is bright and the wineglass image is dark. However, there are many color patterns on the image. An analysis indicates that the slit illuminating light changes to different directions as it passes different parts of the glass during recording. Upon reconstruction, the diffracted light deviates from the original slit position by different degrees, thus creating the color patterns.

Our experimental results show that the reconstruction of projected image of the rainbow hologram of a transparent object produces an even more attractive visual effect than that of conventional rainbow reconstruction. This offers an effective and feasible method for the holographic display of transparent objects (such as art).

The authors wish to thank Professor Yu Meiwen [0060 5019 2429] for the direction and assistance provided.

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Domestic Development of Computer-Oriented GaAs Chips Highlighted

93P60189B Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD], No 6, 17 Feb 93, p 99

[Article by Wang Qiaoyu [3769 1564 3768] of the Shaanxi Microelectronics Institute: "Development Status of Gallium Arsenide Computers"]

[Excerpt] [Passage omitted]

3. Status of Domestic GaAs Technology

In 1989, the [CAS] Shanghai Institute of Metallurgy developed the nation's first GaAs 120-gate array circuit and GaAs high-speed frequency divider, meeting relevant key S&T project targets of the State's Seventh 5-Year Plan and overcoming various technical obstacles in GaAs IC development such as design, mask-making, ion implantation, metallization, dual-layer metal wiring, and circuit testing. This was followed by development of an all-ion-implanted planar GaAs high-speed frequency divider circuit, which has since been successfully incorporated into a 1 GHz digital frequency counter.

MAS Institute 771 has developed several GaAs circuits, such as a C-band low noise MESFET, C-band low noise HEMT, C-band power MESFET, digital VHSICs (4-input NAND gate, 4-input NOR gate, half-adder,and D flip-flop) with a master clock exceeding 500 MHz, and other circuits. Product performance indicators and reliability are now rapidly being raised.

China just took its first steps in GaAs technology only recently, and the integration level of GaAs digital circuits is still far below that of silicon devices. Various units are now actively engaged in importing equipment, training, and efforts to catch up [with advanced nations].

Shenzhen/Hong Kong VLSI International Development Project Described

93P60189A Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 6, 17 Feb 93 p 2

[Unattributed article: "Shenzhen/Hong Kong Very-Large-Scale Integrated Circuit Project Advances Smoothly"]

[Text] Groundbreaking for the Shenzhen/Hong Kong VLSI Development Plan—a project first advocated by [State Councillor and State S&T Commissioner] Song Jian in April 1990 and ratified by the State Planning Commission in July 1991—begins in March 1993. So far, the Shenzhen Saige Group, the Italian-French firm SGS-Thomson, and the U.S. firm VLSI Technology, Inc. have drawn up joint-venture plans or signed letters of intent to participate in this international project designed to boost Guangdong Province up to the level of the "four Tigers" in microelectronics technology. This US$452 million project, scheduled for completion and initial production in 1994, calls for manufacture of 0.5-0.3-micron ICs from 8-inch wafers. First-phase implementation covers construction of a 10,000-chip-per-month plant in Hong Kong, to be followed by construction of a Shenzhen plant(s) with an initial-phase output power of 200 million chip packages. These VLSI circuits will be sold in Southeast Asia, West Europe, and the United States. Centers for design of both semi-custom and full-custom chips will be located in the United States, Hong Kong, Shenzhen and other Guangdong Province cities.

Quasi-Hydrostatically Cold-Pressed $Bi_{0.8}Pb_{0.2}SrCaCu_2O_x$

40100069A Beijing WULI XUEBAO [ACTA PHYSICA SINICA] in Chinese Vol 41 No 12, Dec 92 pp 1993-2002

[English abstract of article by Wu Bingqing of State Key Laboratory for Surface Physics, CAS, Beijing 100080, Zhao Zhongxian and Yao Yushu of the National Laboratory for Superconductivity, CAS, Beijing 100080, Wang Wenkui, Jin Changqing, Liu Wei, Li Fanghua, Liu Shichao, and Liu Zhenxing of the Institute of Physics, CAS, Beijing 100080; MS received 11 Dec 91]

[Text] The effects of quasi-hydrostatic pressure treatments on Bi-system superconductors are investigated. The cold-pressing treatments seriously weaken the intergranular weaklinks and induce a large number of intragranular defects, resulting in the deterioration of the superconducting properties. A large increase in the bulk density and the orientation of the superconducting grains are also observed in the cold-pressed samples. These drastic changes of superconductivity are mainly due to the shear stress under quasi-hydrostatic pressure. The post-annealing treatments greatly enhance the weaklinks and cause the partial recovery and the agglomeration of some defects. By cold pressing-annealing method, J_c (77 K, zero field) is raised to about 1600 A/cm^2. The pressure dependence of T_c under hydrostatic pressure is also investigated and dT_c/dp is found to be 1.4 K/GPa.

Growth of 2223 Phase in $Bi_{1.92}Pb_{0.32}Sr_2Ca_{1.7}Mg_{0.3}Cu_{3.07}O_x$ Superconductor in the Process of Solid-State Reaction

40100069B Beijing WULI XUEBAO [ACTA PHYSICA SINICA] in Chinese Vol 41 No 12, Dec 92 pp 2024-2033

[English abstract of article by Chu Shaoyan, Wang Xuwei, Cheng Xianan, Li Cunjian, and Wang Junkui of the Department of Applied Mathematics and Physics, Beijing University of Aeronautics and Astronautics, Beijing 100083, Wu Qianzhang of the Institute of Physics, CAS, Beijing 100080, and Huang Jiashan of the Institute of Mineral Deposits, Chinese Academy of Geological Sciences, Beijing 100037; MS received 24 Jun 91]

[Text] Samples with nominal composition $Bi_{1.92}$ $Pb_{0.32}$ Sr_2 $Ca_{1.7}$ $Mg_{0.3}$ $Cu_{3.07}$ O_x are synthesized by solid-state reaction. The results of XRD, SEM, EDAX and ac susceptibility measurement on the bulk and the powder samples show that in the samples the 110 K and 85 K superconducting phases coexist. The 2223 phase (110 K) is considered to form at first at boundaries and in the outer region of the crystals of the 2212 phase (85 K). We also believe that the origin of the structure of 2223 phase may initially exist in the 2212 phase grains and act as certain kind of stacking fault, and the 2223 phase finally forms and grows through the intercalation of the $CaCuO_2$ layers in the crystal lattice of the 2212 phase together with climbing of dislocations. A calculation based on experimental data supports this point of view.

More on Nation's First All-Fiber-Optic 'Information Highway'

93P60193A Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 8, 3 Mar 93 p 2

[Article by Yi Maoyuan [5065 5399 6678]: "Zhongguancun Teaching and Research Demonstration Network Operational"; cf. early report in JPRS-CST-93-005, 22 Mar 93 p 42]

[Summary] Three subnets of the nation's first all-fiber-optic "information highway"—the Beijing Zhongguancun [High-Tech] Zone Teaching and Research Computer Communications Demonstration Network—recently passed the expert acceptance check organized by the S&T Department of the State Planning Commission. These three subnets are the Beijing University Campus Network, the Qinghua University Campus Network, and the Chinese Academy of Sciences (CAS) Academy Network. This project, initially conceived by the State Planning Commission in 1987 [and begun in 1990], consists of a backbone [scheduled for completion in 1995] and the three completed subnets; backbone construction is being funded by a World Bank loan and by domestic organizations, while work on the three subnets was funded by the State Planning Commission along with various other domestic authorities.

The Qinghua University Campus Network, which interconnects 18 local area networks [LANs] (in separate buildings) to form an FDDI-standard [fiber distributed data interface] fiber optic backbone and stored-program-controlled switching network, includes about 700 computers and terminals. The CAS Academy Network, which interconnects the CAS Computing Center LAN via three hubs to LANs in 19 other research units, includes 100 workstations and higher-performance machines, 50 PCs, and 500 terminals. The Beijing University Campus Network, which consists of one main network and 21 LANs, includes over 400 network-entry machines (over 20 mid-sized and minicomputers, over 40 workstations, and over 300 microcomputers); the main network is hooked up via an ORnet hub.

Ground Broken for Nation's Largest Fiber Optic Cable Production Line

93P60193B Beijing ZHONGGUO DIANZI BAO [CHINA ELECTRONICS NEWS] in Chinese 26 Feb 93 p 1

[Article by Xia Kunshan [1115 2492 1472]: "Construction Begins on Nation's Largest Fiber Optic Cable Production Line"]

[Summary] It has been learned from Henan Province electronics industry circles that on 6 February construction began on the nation's largest fiber optic cable production line—at the Zhongyuan [0022 0626] Communications Cable Group in Zhoukou City. This group, formed last year around the Zhoukou Municipal Communications Cable Plant, was able to break ground for the project in less than a half year after the decision was made—with the help of municipal and provincial authorities—to invest in fiber optic cable production. Zhongyuan signed an agreement with Finland's Nokia in December 1992 to import a US$5.2 million state-of-the-art (early 90s international standard) Nokia fiber optic cable production line. This line can make 10 different products in three main series: spandex ferrule cable, skeleton cable, and ribbon cable; annual production capacity is 10,000 kilometers.

Seven Passive Optical Devices Developed by Institute 23

93P60193C Beijing ZHONGGUO DIANZI BAO [CHINA ELECTRONICS NEWS] in Chinese 5 Mar 93 p 3

[Unattributed article: "Institute 23 Develops Seven Passive Optical Devices"]

[Summary] According to the expert appraisal organized by the Chinatron Corp. and the Shanghai Academy of Sciences, seven passive optical devices developed by MMEI's Institute 23 meet early-nineties international standards for such products, and have formally passed design finalization. Among these products, the "3 x 3 single-mode fiber coupler," which has been small-batch exported to the United States, has a uniformity indicator superior to that of foreign-made products. The "1 x 2 single-mode fiber duplex coupler," with wide applications in fiber optic cable TV, LANs, sensor systems, and test instruments, has undergone successful trials at 20 institutions and is being sold in the United States. The "2 x 2 multimode optical bypass switch" is a key device enabling link-up of fiber optic LANs with user terminals. The "SMA-type multimode single-core fiber optic cable connector" and "APT and FC single-mode fiber connectors" have many applications in optical communications, computer networking, and test equipment. Finally, the "continuously tunable single-mode optical attenuator," which provides a 60 dB attenuation, has performance superior to that of imported products at a price much lower than that of the imports.

Beijing-Hong Kong Satellite Dedicated Line Operational

93P60193D Beijing RENMIN RIBAO OVERSEAS EDITION in Chinese 12 Mar 93 p 5

[Article by Yi Zhaogong [0308 0340 0501]: "Beijing-Hong Kong Satellite High-Speed Dedicated Line Operational"]

[Summary] Beijing (XINHUA)—The first Beijing-Hong Kong 64 kbps satellite high-speed digital dedicated line became formally operational a few days ago. This dedicated line, used by the China Hewlett Packard Co., provides high-speed digital transmission (data, telephone, teletype, fax, teleconferencing, etc.) relayed via an Intelsat satellite. Beijing can now provide and receive [satellite] transmission services to and from the United States, Japan, and Hong Kong.

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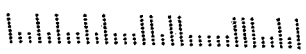

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