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Provisional Regulations for Export of 'State Secret Technology'

90CF0274A Beijing KEJI RIBAO [SCIENCE AND TECHNOLOGY DAILY] in Chinese 30 Dec 89 p 1

[Text] State Science and Technology Commission and State Secrecy Bureau of the People's Republic of China

Order No. 6

6 December 1989

"Provisional Regulations for the Examination and Approval of the Export of State Secret Technology" are hereby announced. They shall go into effect on 1 January 1990.

Song Jian [1345 0256], chairman of the commission Shen Hongying [3088 7703 5391], director of the bureau
Article 1. These regulations are hereby formulated to keep state science and technology secret, improve the export examination and approval system of secret state technology, protect China's technical superiority, and safeguard the proper conduct of scientific, technical, and economic cooperation and exchange with foreign nations.

Article 2. For the purpose of these regulations, "state secret technology" refers to inventions, scientific and technical achievements, and key technology which is essential to state security and interests and has been classified as confidential, secret, or top secret in accordance with relevant laws and regulations concerning secrecy. In these regulations "key technology" includes scientific and technical achievements in various stages, technical secrets, and traditional technology.

Article 3. Before a state organ, enterprise, institution, social organization, or individual provides a foreign nation with state secret technology through technology transfer, technical exchange, technical cooperation, technical assistance, technical consulting, or other method, and before it exports products or equipment containing state secret technology, it shall go through the examination-and-approval formalities as prescribed in these regulations.

When a unit owned by the whole people, a collectively owned unit, an organization, or an individual supplies a Sino-foreign joint venture, a Sino-foreign contractual joint venture, a foreign-owned enterprise, or the Chinese division of a foreign organization, it shall go through the formalities as prescribed in the preceding articles.

Article 4. The examination and approval of the export of state secret technology shall abide by the following principles: 1) safeguard state security and preserve state technical superiority and economic interests; 2) implement the nation's diplomatic line, principles, and policies; and 3) help improve the nation's international reputation and expand its scientific and technical influence.

Article 5. The export of state secret technology shall be examined and approved by the following agencies depending on the secrecy classification of the export concerned:

1) In the case of confidential technology, the unit or individual involved shall apply to the appropriate State Council ministry in charge or the science and technology commission of the relevant province, autonomous region, municipality directly administered by the central government, or municipality with the decision-making authority of a province, depending on the administrative subordination relationship. The case shall then be reported to the State Science and Technology Commission for the record.

2) In the case of secret technology, the unit or individual involved shall apply to the appropriate State Council ministry in charge or the science and technology commission of the relevant province, autonomous region, municipality directly administered by the central government, or municipality with the decision-making authority of a province, depending on the administrative subordination relationship, for its examination and approval. The case shall then be submitted to the State Science and Technology Commission for its examination and approval.

3) The export of top secret technology shall be prohibited. Where export is warranted under special circumstances, the appropriate State Council ministry in charge or the science and technology commission of the relevant province, autonomous region, municipality directly administered by the central government, or municipality with the decision-making authority of a province, shall apply to the State Science and Technology Commission. Upon examination and approval by the commission, the case shall be submitted to the State Council for its approval.

Article 6. This article pertains to civilian technology and civilian-military dual-purpose technology of the armed forces. The export of technology classified confidential shall be examined and approved by the defense department in charge and shall be reported to the State Science and Technology Commission for the record. The export of technology classified secret shall be examined and approved by the defense department in charge and shall be submitted to the State Science and Technology Commission for its examination and approval. The export of technology classified top secret shall be handled in accordance with Article 5 of these regulations.

Article 7. Applicants for permission to export state secret technology shall complete a "State Secret Technology Export Examination and Approval Application Form" in accordance with regulations and attach relevant technical data. The examination and approval agency shall make a decision and give a written reply within 30 days after receiving the application. Where a reply cannot be made on time, an explanation for the delay shall be offered.

Article 8. Where the export of state secret technology is approved, the agency in charge of examination and approval shall issue a "State Secret Technology Export Permit." People who leave the country with documents, data, and other articles containing state secret technology shall go through the exit formalities in accordance with the relevant regulations.

The unit or individual who receives permission to export state secret technology shall do so in strict accordance with the scope and contents of what has been approved and shall not enlarge the scope or alter the contents wilfully.

Article 9. The "State Secret Technology Export Examination and Approval Application Form" and the "State Secret Technology Export Permit" shall be designed by the State Science and Technology Commission centrally.

Article 10. Where state secret technology is exported without authorization in violation of these regulations, where the scope of export exceeds what has been approved, or where false representations of facts are made while applying for approval to export, with the result that state secret technology is leaked, the people involved shall be held administratively responsible. If the case is serious and constitutes a crime, the individual involved shall be held criminally responsible.

Article 11. Personnel engaged in the examination and approval of the export of state secret technology shall be devoted to their duties and enforce the law rigorously. They shall pledge to keep the confidentiality of state secret technology they are privy to. Workers who neglect their duty, practice favoritism and fraudulence, and cause the leakage of state secret technology shall be held administratively responsible. If the case is serious enough to constitute a crime, the individual involved shall be held criminally responsible.

Article 12. The "List of Controlled State Secret Technology Exports" shall be drawn up by the State Science and Technology Commission and shall be published for implementation at a time to be specified.

Article 13. The implementation of these regulations shall be supervised by the relevant science and technology commissions, secrecy bureaus, and science and technology and secrecy offices of the central agencies in charge.

Article 14. These regulations shall take effect on 1 January 1990.

Progress in High-Technology R&D Plan Reviewed

90CF0171A Beijing KEJI RIBAO [SCIENCE AND TECHNOLOGY DAILY] in Chinese 17 Nov 89 p 4

[Article by Shang Mu [1424 2606]: "Progress in China's High-Technology Research and Development Plan"]

[Text] China's high-technology research and development plan (the "863 Plan") has already been in effect for

more than 2 years. Over 100 specialization areas have been set up and have been subdivided into nearly a thousand topics, on which more than 500 organizations and nearly 10,000 scientific and technical personnel are working. In addition, about 2,000 persons are involved in 200-odd exploratory basic research projects involving new concepts and new ideas. There has been an excellent start in implementing the plan, it is running smoothly, and gratifying progress has been achieved in certain projects.

1. Further Clarification of Strategic Objectives

The rapid pace and changeability of high technology require an emphasis on near-term objectives and a focus on the rolling character of the plan. For example, in the automation field, the overall objectives in the area of CIMS (computer integrated manufacturing systems) are to establish an experimental production line by 1992, to complete the basic unit technologies needed for a demonstration production line by 1995, and to complete the demonstration line itself by the year 2000. In accordance with these general objectives, research activities have been organized at three levels. In dealing with difficult major problems related to the objectives, the main task of the next 2 years is overall evaluation work centered on the clarification of objectives.

2. Organizing Joint Breakthrough Efforts in Major Projects

Many of the topics established under the "863" Plan have interrelated mid-term and long-term goals and are highly exploratory in nature, so that it is reasonable to organize small groups to work separately on them; but in the major products to which they are geared, multidisciplinary groups should be set up for concerted breakthrough efforts. The organization of the "863-Plan" projects therefore includes both dispersed and concentrated organization. In particular, financing limitations make it necessary to concentrate personnel and resources. As a result, a beginning has been made in setting up research and development centers for certain major products, such as an optoelectronics technology center, a CIMS experimental engineering facility, and a robotics center. These centers were set up only recently; but a selective and competitive approach has been used in placing them and assigning their tasks, other experts in the fields have been invited to evaluate feasibility studies during the decision-making process, and there has been due attention to the integrated utilization of all strong points in the course of implementation, so that they are already exhibiting considerable vitality.

3. Results from International Cooperation

Extensive international cooperation is a major tendency in present-day world scientific and technological development. Opening up to the outside is especially important in the development of high technology. In the last 2 years, experts have made unremitting efforts to open channels of international cooperation and have already

achieved gratifying progress. Organizations in the United States, Japan, Sweden, the FRG, the European Community and elsewhere have expressed a desire for cooperation with China in certain high-technology products, and agreements have already been made in some areas, leading to real breakthroughs.

4. Excellent Performance on Annual Plans, Achievement of Concrete Results

At least 95 percent of planned tasks have been completed in the five areas of biotechnology, communications technology, automation, new energy sources and new materials, with unsatisfactory progress on only 5 percent of the tasks. Progress is rapid in certain projects. For example, in the biotechnology area, with the effective support of the "863 Plan", the efforts to breed new varieties of paddy rice have already yielded several dozen stable new strains with light-sensitive sterile genes, with the result that the selection of superior varieties of hybrid paddy rice has been changed from the "three-strain" to the "two-strain" approach. Hybrids obtained by the two-strain technique have given a 50-percent increase in output compared with the three-strain hybrids, and the crossing of two-strain subspecies (*indica* and *japonica*) has given a 20-percent increase in output over the three-strain method. The hybrids are scheduled for field testing on 10,000 mu of land this year, and the subspecies crosses are scheduled for small-plot tests and within 3 years will undergo nationwide fields tests on an area of 10,000 mu. This result not only is of real significance for increasing China's output of paddy rice, but also will enable paddy rice hybridization technology to remain at the world state of the art.

5. Promotion of the Search for New Concepts and New Ideas Under the High-Technology Plan

Many of the technological problems being investigated under the "863 Plan" are at the cutting edge worldwide, and in some areas there are no existing principles to provide guidance, so that we must find our own. Examples include profound research to identify mechanisms and laws governing certain key technologies and broadly applicable technologies, such as functional components, materials, structural components, processes and the like. In addition, efforts to keep up with the world state of the art under the 863 Plan are purposeful, not imitative, and their key is innovation, creating a need for creative ideas and concepts for and Chinese-style technology approaches and processes. Thus, small science and technology contingents should be organized for newly emerging research that involves unique scientific ideas, or that provides new theories and technological approaches. We have therefore allocated a specific percentage (2 percent) of the total "863-Plan" funding for the State Natural Science Fund, to be used for research into new conceptions and new ideas under the state science and technology plan. The fund will supervise these topics under project guidelines. A total of 9.81

million yuan in aid was given to 2142 projects in 1987, and 8.01 million yuan to 178 [as published] projects in 1988.

6. Conversion of "863-Plan" Preliminary Results into Commodities

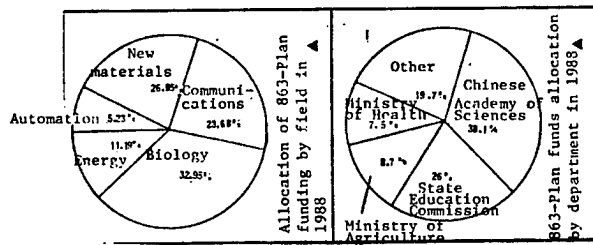
Although the "863 Plan" is a mid- and long-term research and development plan, there has been close attention to timely conversion of project results to production since its inception. This unquestionably has strengthened the ties of science with production and with research and development and has promoted comprehensive implementation of the overall objectives of the "863 Plan". The conversion of technical results obtained under the plan to commodities and the creation of high-technology industries must be considered in connection with market requirements, expenditures, intermediate testing, industrial-scale testing, and secondary development. In some fields, production units, intermediate testing units and laboratory research units are being combined into integrated research and development centers. Since the party Central Committee announced in March 1988 the policy that high-technology research and development must open to the outside world and convert its results to commodities, the State Science and Technology Commission has formulated the Torch Plan in order to promote rapid transfer of high-technology research results to industrial production. With the approval of the State Council, it has also set up the relevant high technology corporations, whose primary functions are investment in domestic and foreign high-technology and new-technology enterprises, support of the rapid conversion of results into products and commodities, and promotion of the development of high technology and new technology in China.

7. Further Clarification of "863-Plan" Activities

The management of the "863 Plan" and the system for its implementation will be made public in suitable forms. Brief reports, news bulletins and "Technology Communiques" will be published at regular intervals, and progress reports will be submitted to the departments. In order to involve qualified personnel in the "863 Plan", an 863-Plan yearbook and 863-Plan guidelines will be published.

8. Institution of an Operating Mechanism Managed by Experts

The use of expert committees in the management of the "863 Plan" is a major reform in the management of science and technology. A recent survey of the expert committees and their members indicated that this new management system involves the experts fully in decision making regarding the establishment of projects, subdivision of topics, designation of performing organizations, funding and the like; as a result, there have been few errors in designating topics and projects, implementation has been rapid, and work has been efficient, demonstrating the superiority of the expert management system. The expert-committee management system still



has certain problems: these must be solved in practice in order to improve the quality of management and improve the operations system.

Strategy for Automation Technology Formulated

90CF0171B Beijing KEJI RIBAO [SCIENCE AND TECHNOLOGY DAILY] in Chinese 17 Nov 89 p 1

[Article: "Formulation of Strategic Objectives in Automation Technology Completed"]

[Text] Drafting of the ultimate and mid-term objectives and implementation plans for the automation technology field, one of the seven fields under the High-Technology Research and Development Plan or "863 Plan," has now been completed, and a research and engineering development contingent of nearly 2,000 persons has been organized.

At a report meeting on strategic objectives in the automation technology field held here today, the reports were heard by more than 80 officials and experts, including State Council member, State Science and Technology Commission chairman and chairman of the State Council leadership group on the high-technology plan Song Jian [1345 0256], State Science and Technology Commission chairman and State Council high-technology plan coordination group member Zhu Guangya [2612 0342 0068], State Science and Technology Commission vice-chairman and State Council high-technology plan coordination group member Zhu Lilan [2612 7787 5695], and State Planning Commission vice-chairman Sheng Shuren [4141 2885 0088].

When implementation of the "863 Plan" was begun in March 1987, two major topic areas were established in the automation technology field, namely, computer integrated manufacturing systems (CIMS) and intelligent robots. In the subsequent 2-plus years, the expert committee on automation, under the leadership of its chief scientist Zhang Xinsong [5592 2450 2646], director of the Shenyang Automation Research Institute, Chinese Academy of Sciences, has made use of domestic and foreign surveys to complete preliminary drafting of the ultimate and intermediate objectives and is beginning to carry out the plans. The specific CIMS experimental projects have been assigned, selection and study of certain applications plants has begun, and the overall design of the experimental projects has been completed.

In the area of intelligent robots, three models, with a total of five varieties, have been selected, the appropriate overall organization has been set up, and the establishment of the project objectives and project environment has been begun. Under the principle of concentrated utilization under limited funding, the automation field is systematically joining forces with state laboratories set up during the Sixth and Seventh 5-year plans; it has established seven laboratories nationally, and has created a components technology tracking and research environment. Some of the laboratories have already been opened, and others are scheduled to open soon.

Nationally, the expert committee on automation technology has already organized a carefully chosen, hierarchically organized scientific and technical contingent of nearly 2000. It has assigned more than 120 research topics and is scheduled to produce its first results next year [1990].

National Defense Science, Technology Tasks Examined

90CF0171C Beijing KEJI RIBAO [SCIENCE AND TECHNOLOGY DAILY] in Chinese 2 Nov 89 p 2

[Article by Chairman of State Defense Science and Technology Industry Commission Ding Henggao [0002 5899 7559]: "The Current Situation and Future Tasks of Defense Technology"]

[Text] The evolution of the international situation and the strategic changes in China's defense construction necessitate a development of defense science and technology and weapons and equipment, with a rapid changeover to sustained, steady, coordinated development consistent with a period of peace. Making this changeover requires major readjustments and reforms in thinking, development policies and programs, and structure. We must vigorously and consciously implement this changeover as rapidly as possible, displaying the same far-sightedness and boldness as in the period when the defense science and technology industry was being created and developed and the same unified will and action as when the breakthrough was made in sophisticated science and technology.

First, we must recognize fully that science and technology are the first productive force, and we must establish a defense science and technology development strategy and tactical approach oriented toward the 21st century, with a strong awareness of scientific and technological competition. The developed countries are actively adjusting their science and technology strategy, treating the development of science and technology as an essential condition for survival in the 21st century, and are concentrating personnel, resources and funds in order to carry out major scientific and technical plans aimed at achieving and developing the most advanced science and technology. The salient characteristic of current science and technology is intense competition

and high-speed development. In terms of the development of weapons and equipment, this means that the birth of a new weapon not only requires that one start out from a relatively high level, but demands a multitude of breakthroughs in new technology and their integrated utilization; in addition, the time between generations of equipment is shorter than ever. This demanding situation requires that when developing advanced military technology, we keep our eyes on the future and formulate a long-term development strategy.

Second, a full comprehension of the development of defense science and technology requires that we support and adapt to the development of the national economy. The shortage of funding will be a troublesome problem for some time to come, and we must make thorough, effective use of limited resources with a strong emphasis on benefits. As science and technology are upgraded, their funds-intensiveness increases. Keeping up with new technology and developing new equipment with advanced capabilities will increase funding requirements manifold. In a certain sense, the struggle for technology relies on abundant funding. Since we are a developing country and are still in the initial stage of socialism, the state must concentrate its efforts on economic construction for some time to come, and it cannot spend increasing amounts of money to develop the defense science and technology industry: this is a real and troublesome contradiction. The development of defense science and technology must be based on China's circumstances and capabilities. But the shortage of funds is just one side of the problem; the question of using the limited funds effectively is the more important and more realistic side. Owing to excessively large scale, too many projects, and inadequate management, the problem of poor benefits has become quite serious, and we must take a creative approach, emphasize overall benefits, strive to use limited funds effectively, and accomplish more in some areas.

To summarize, we must survey the situation scientifically and clear-headedly, make use of all favorable conditions, and mobilize all available positive factors. We must guard against a lack of defense-mindedness in a peaceful environment and avoid losing a sense of crisis and of urgency about the situation and about current problems; in addition, we must protect against overestimation of current difficulties, and against loss of confidence and inaction. Under the centralized, unified leadership of the party Central Committee, the State Council and the Central Military Committee, while subordinating ourselves to the situation, obeying orders, and continuing and developing good traditions, we must creatively make use of successful experience under the new historical conditions and make conscientious, effective efforts, focused on overall benefits, in the following main areas.

1. Continue to Implement the General Policy of Integrating Civilian and Military Production and Peacetime and Wartime Production, with Priority to Military Products, and Having Civilian Production Nourish Military Production, and Further Promote the Strategic Development of the Defense Science and Technology Industry.

The "16-Character Policy" of "integrating military and civilian production and peacetime and wartime production, with priority to military products, and with civilian production nourishing military production," announced by the Central Committee, is a vital, flexible long-term policy to guide the healthy development of the defense science and technology industry. The military and civilian sectors have intrinsic close ties and common interests, and they promote each other's development. We must vigorously pursue the conversion of military technology to civilian uses, develop civilian production, and bring about a high-technology combination that integrates military and civilian production, internal and external orientations, and technology, industry and trade, make a contribution to the construction of the national economy and to the development of an externally oriented economy, and lay the groundwork for further development of the defense science and technology industry. In addition, we must devote attention to the transplanting of advanced civilian technologies to defense uses in order to shorten the research and development cycle for new weapons and equipment. We must specially emphasize effective overall planning for both military and civilian products so that both achieve sustained, steady, coordinated development. We must conscientiously accord priority to military products, assure that military research and production assignments are completed, concentrate the most able personnel and complete already signed defense research contracts and weapons and equipment production contracts with high quality and high efficiency; we must consistently raise the level of research on military products and make effective technological preparations for future development of weapons and equipment; we must concentrate limited funds and step up the construction of research, experimentation and testing facilities. We must take effective measures to keep and nurture the scientific research and production mainstay contingent; we must make use of the importation and assimilation of advanced foreign technology for technological upgrading of retained production capabilities in order to assure that the development and production needs for the next generation of weapons and equipment will be met. After a period of effort, we will gradually make the transition to having civilian production nourish military production.

2. Make Reform More Thorough, Establish a New Order Suited to the Requirements of the Planned Commodity Economy and the Characteristics of the Defense Science and Technology Industry

As a result of several years' experience, after instituting the contracting system, we are currently exploring a new research management system that both thoroughly

embodies the guiding role of state directive plans and can appropriately introduce the market mechanism and make use of economic regulation and legal regulation. It includes several major points: centralized, unified policy-making, management with division of responsibility; a contracting system based on implementation of directive plans, and plan guarantees based on the contracting system; the use of task-oriented target management and a management method that integrates programs, plans, and budgets. Research projects must consistently promote and improve the contract system, the funding system, the research topic responsibility system and the like, introduce competitive mechanisms, and optimize research organization. Some projects should solicit bids and select units to be assigned defense research tasks, so that the research organizations will gradually establish a new mechanism with both incentives and restraints. The Central Committee's guiding policies with regard to managing the economic environment, rectifying the economic system and making the reform more thorough should be implemented with consideration of the actual situation in the defense science and technology industry and its general and specific policies and principles; the legal system governing defense research, experimentation and production must be improved; and a new order that is suited both to a planned commodity economy and to the distinctive character of the defense science and technology industry must be gradually established.

3. Consistently Strengthen and Improve the Policymaking System for Defense Scientific and Technological Development and Improve Scientific Management

The development of defense science and technology takes the national interest as its highest standard of value, uses state investments as its primary source of funding, and treats directive plan as its basic means of control in implementing centralized, unified state leadership. As a result, effective policy making is extremely important. Relying on the existing policy-making system that links the administrative departments and experts, we must strengthen and expand strategic research, gradually establish a high-quality research contingent with high standards, make scientific forecasts and comprehensive analyses of military requirements and of our scientific and technological level, economic conditions and the social environment, propose general and specific policies, key focuses, objectives and paths for the development of defense science and technology, and provide scientific data for policy making. In formulating development goals, we must combine the pull of requirements and the thrust of technology, make integrated whole-system, whole-lifetime decisions, and achieve a dialectical unity of military requirements, scientific and technical level, and overall benefits. We must gradually establish a system of regular dialog between the cognizant administrative departments, specialized groups and experts in all areas, introduce consulting services into the policy-making system, make policy-making more scientific, democratic and systematic.

4. Continue to "Shorten Battle Lines and Break Through at Key Points." Increase Investment Support and Overall Benefits

We must break through at key points, select the best research projects, and increase the investment support of projects; we must increase the investment support per worker in the top units, consistent with overall capabilities. Steadily adhering to mid- and long-term weapons and equipment development plans approved by the military commission and to the defense science and technology development strategy, we must adjust the organization of research, testing and production units in a manner consistent with their tasks. We must carefully select units with superior capabilities and strengthen their research, testing and production facilities, gradually forming several state research and development centers, key development laboratories, and military production bases, so that our limited funds obtain good overall benefits. We must vigorously step up advanced research and conscientiously accord it strategic status. We must take the necessary steps and gradually solve the problem of dispersal of topics, separation of departments, and low-level duplication. We must establish and strengthen a management system for advanced research, follow the principles of plan guidance and level-by-level and category-by-category management in implementing the project management operating mechanism. We must conscientiously implement the policy of limited objectives and breakthroughs at key points in order to assure that there is reserve power for scientific and technological development.

Establish a Defense Science and Technology Contingent with Good Political Qualities and High Professional Standards

Defense science and technology is a sacred activity that serves the country's scientific and technological progress and defense modernization. Scientific and technical personnel who serve in this area must be persons with lofty ideals who firmly uphold the leadership of the CCP, fervently love the socialist system, be eager to work hard and devote themselves to this cause. They must feel the glory and pride of this type of political character. We must strive to create a favorable environment that fosters talented defense scientific and technical personnel and continually improve their working and living conditions. A special incentive policy must be applied to scientific and technical personnel working in remote areas and responsible for major scientific and technological projects. We must strengthen the nurturing of talent and technical training, and raise the standards of research and experimentation. We must make thorough use of the international environment and conditions, extensively pursue international cooperation and exchange in military technology, make use of a variety of forms and channels to attract people of ability and intelligence, focus on selecting a group of superior scientific and technical personnel to go abroad for study and training, and increase the manpower pool for the long-term development of defense science and technology.

Under the leadership of the party Central Committee, the State Council and the Central Military Commission, through 40 years of arduous struggle, the defense science and technology industry has accomplished great things and has made a major contribution to national defense construction and the development of the national economy. In the future, we must continue to adhere consistently to the basic line of "one center, two starting points" formulated at the 13th party congress, strengthen party leadership and ideological and political activity, serve the overall situation, respect the law, work as one, overcome difficulties, and win new victories in developing the defense science and technology industry.

Song Jian Comments on Intelligent Systems

90CF0171D Beijing KEJI RIBAO [SCIENCE AND TECHNOLOGY DAILY] in Chinese 20 Nov 89 p 1

[Article: "Progress with Intelligent Automation and Invigorate China's Manufacturing Industries"]

[Text] State Council member and chairman of the State Science and Technology Commission Song Jian [1345 0256] today delivered the closing remarks at the conference on strategic objectives in automation technology, in which he emphasized that the use of intelligent automation to improve traditional production lines are the banner under which China's manufacturing industries will flourish.

Comrade Song Jian gave a favorable appraisal of the notable achievements that the automation field has posted under the leadership of the expert committee headed by its chief scientist Jiang Xinsong [5592 2450 2646]. He stated that we are striving to promote the 863-Plan spirit of "fairness, devotion, realism, cooperation, and creativity." Our experts are bold in practice and conscientious in taking responsibility, which has assured smooth implementation of plans. In order for the large and middle-size enterprises to realize a great improvement in labor productivity and in product quality and an increase in enterprise competitiveness, especially international competitiveness, it will be necessary to develop modern computer-based automation technology, especially computer-integrated manufacturing systems (CIMS) and intelligent robot technology. In this sense, CIMS and robotics may become two fresh banners under which to invigorate China's manufacturing industries.

Song Jian also said that the just-concluded Fifth Plenary Session of the Central Committee had decided that the entire country must accord a high-priority strategic status to education and to science and technology and must intensify the modernization of traditional industries and raise their technical level. This gives us an excellent chance to develop high-technology and new-technology industries. We have affirmed the guiding idea of the strategic objectives: first, that we must make reliance the main battlefield and must be able to guide the technical-modernization orientation of the current

large and middle size enterprises so that they steadily raise the degree of intelligent automation in traditional production lines. While the scientists in the "863 Plan" automation area devote their main effort to tracking tomorrow's technological objectives, they must also do everything possible to guide the technical-modernization orientation of the current basic manufacturing industries: this is the only way to lay the foundation for tomorrow's large-scale adoption of intelligent automation. It is to be hoped that the expert committees and groups will conduct studies and constantly present suggestions regarding technological modernization and other industry policies to the government departments and develop productive conditions for an even higher level of automation.

Song Jian stated that we must assimilate and develop advanced systems that have already been imported; that we must strengthen system analysis and develop our own design capabilities in order to replace imports and develop export; that we must focus on bringing in increased numbers of qualified personnel, particularly young personnel, to participate in the "863 Plan"; and that we must persistently strive to expand foreign cooperation based on our own capabilities.

In addition, he stated that any international cooperation in science and technology, particularly in high technology, must be based on our own real capabilities and must be founded on self-reliance: we must not repose unrealistic hopes in the western countries. Only by establishing ourselves and being able to keep up with or even surpass them in certain scientific and technological capabilities will it be possible to achieve true international cooperation based on mutual benefit. While continuing the opening to foreign countries, we emphasize self-reliant development and research: this is not a temporary expedient, but a basic principle of work in science and technology. Imported technology must be combined with domestic research and development if we are to establish ourselves on a firm footing amid the turbulence of international competition.

Weihai High-Technology Development Zone Established

90CF0171E Beijing KEJI RIBAO [SCIENCE AND TECHNOLOGY DAILY] in Chinese 31 Oct 89 p 1

[Article: "Weihai Establishes High-Technology Development Zone"]

[Text] The Weihai high-technology development zone, one of three key development and testing zones recently approved by the State Science and Technology Commission, is now under construction.

The development zone is centrally located on Wenhua Road in Weihai City, with a total area of 6 square kilometers. It is jointly administered by the State Science and Technology Commission and Weihai City. The zone is based on a development model in which Chinese science and technology is the mainstay and the reliance

is on the major domestic academies and institutes, supplemented by foreign investments; the result is a Chinese technology main organization combined with foreign capital. The focus of development is electronic communications technology, integrated electromechanical products, new materials, new energy sources, and marine bioengineering and its products.

The marine technology development center's experimental specialty marine products area, which is used to develop marine technology and optimum mariculture structures, has already been handed over for operation. Construction on the 500-square-meter main project of the first stage of the high-technology manufacturing services center is expected to be completed by the end of the year [1989]. Joint efforts on the development of high technology and the securing of foreign capital by the development zone and major academies and institutes are proceeding smoothly.

The other national key development experimental zones approved at the same time by the State Science and Technology are the Xiamen Development Zone in Fujian Province and the Zhongshan Development Zone in Guangdong Province.

Shanghai Drafts S&T Outlook for Eighth 5-Year Plan

90CF0171F Shanghai WEN HUI BAO in Chinese 19 Oct 89 p 1

[Article: "Shanghai Outlines Scientific and Technological Development During 5-Year Plan"]

[Text] Evaluation of the major software study "5-Year Scientific and Technological Development Prospects for Shanghai," which was assigned to the Shanghai Scientific and Technical Information Institute by the municipal science and technology committee, was completed yesterday.

Shanghai's science and technology development strategy for 1991-1995 is as follows: continue to develop new technologies centered on the modernization of traditional industries and the adjustment of industry structure and product structure; implement a preferential policy and concentrate relatively large amounts of financial and manpower resources for the further development of such basic industries and products as communications, transport, electric power, and materials; vigorously arrange for the assimilation of imported advanced technology and use it to innovate for export; and strive to develop high technology and form an emerging-industry cluster focused on the electronic communications industry, the integrated electromechanical products industry, bioengineering, the communications industry, and the new materials industry.

The main report summarized in a global context the current status of Shanghai's scientific and technical development, progress and problems, suggested a science and technology development strategy and policy for the

Eighth 5-Year Plan and the focus of development in the major fields, and gave an overview of Shanghai's science and technology development prospects during the Eighth 5-Year Plan and the policies and measures that should be adopted. By 1995, Shanghai's integrated science and technology level has the possibility of matching the late 1970's or early 1980's world state of the art; the traditional industries will make noteworthy progress by importing advanced technology; the high-technology industry cluster will have essentially taken shape; there will have been improvements in such social-base structures as communications, transport and energy; technology will be in the transition from copying to innovation; and the scientific research system will have been improved. To realize the objectives, the government must draft and implement a series of new policies and guidelines, such as policies on new industries and industrial science and technology, investment, accumulation tax preference, incentives for export that earns foreign exchange and replaces imports, personnel, and the like.

Nine New High-Technology Development Zones Established in Eastern China

90CF0171G Shanghai WEN HUI BAO in Chinese 27 Oct 89 p 1

[Article: "Nine High-Technology and New-Technology Development Zones Created in East China"]

[Text] It was learned at the conference on the East China new technology development zones that concluded yesterday that nine new-technology zones and high-technology development parks have been set up in the East China region.

The new-technology development zones are a new product of the international new-technology tide and have resulted from China's exploration of the establishment of high-technology industries that began in the mid-1980's. At present, East China alone has nine such zones, namely, the Nanjing (Jiangsu), Hefei (Anhui), Jinan, Qingdao and Weihai (Shandong), Caohejing (Shanghai), Fuzhou, Xiamen and Hongshan (Fujian) high-technology and new-technology development zones and industrial parks. Hangzhou (Zhejiang), Nanchang (Jiangxi) and Bengbu (Anhui) are also making vigorous plans to establish such zones.

The establishment of the new-technology development zones is doing a great deal to accelerate the formation of Chinese high-technology industries: they can bring in foreign and domestic capital and technology and quickly develop high-benefit high-technology products. The Caohejing new-technology development zone in Shanghai has already brought in 14 Chinese-foreign joint ventures and foreign-financed enterprises with a total investment of U.S.\$190 million. From January to September of this year [1989] the development zones had a total industrial output value of 1.4 billion yuan, and

their high-technology products have created great benefits. Since the Pukou (Nanjing) foreign-oriented high-technology and new-technology zone opened last April [1988], it has already obtained 40 projects, of which 33 involve investments by major academies and institutes and large enterprises.

Structure of Semiconductor Industry, Its Developmental Strategy

40081050 Beijing KEJI RIBAO [SCIENCE AND TECHNOLOGY DAILY] in Chinese 17 Aug 89 p 3

[Article by Xu Juyan [6079 1446 5888]: "A Tentative Discussion of China's Semiconductor Industry Model and Its Development Strategy"]

[Text]

I. Proposing Issues

The development of China's semiconductor industry has gone through two major developmental stages. The initial stage, prior to 1978, adopted a developmental model of starting with military uses and choosing optimum investment categories. In this period, more attention was given to foundations and scientific research. The relationships between scientific research and production and between basic and applied research were more coordinated. Relying on our own strengths, we established a rather complete semiconductor industry system and developed several achievements. After 1978, under guidance by the line of reform and opening up, the semiconductor industry entered a period of two major transitions from a closed to an open form and from a product economy to a commodity economy. We clarified the guiding ideology and strategic principle of a series of emerging industries in the new period and gradually moved onto the open developmental track of importing, digesting, developing, innovating, focusing on civilian uses, and economic diversification. Because this period had an obvious readjustment and transition quality, several problems which required attention and solution appeared. For example, the rate of development during the later stage began to slow. From 1968 to 1978, the compound average annual growth rates for output of integrated circuits and discrete components were, respectively, 81 percent and over 27 percent, but from 1978 to 1988 these figures were just 12.3 percent and 15.5 percent. Moreover, three troughs occurred in 1980, 1982, and 1986 when there was a negative average yearly growth rate of as much as 14 to 30 percent. Moreover, no unified understanding was gained on major issues concerning developmental patterns like import protection and strategic products, and so on. Thus, in a situation of reform and opening up, we still must study and explore the establishment of a semiconductor industry developmental model suited to China's real conditions.

II. Several Factors in Development of the Semiconductor Industry

Establishment and development of a semiconductor industry depends on the four main factors of state

support, market demand, international cooperation, and scientific research. Among them, state support is the dominant factor because it restricts and affects the roles of the other three factors. The state affects scientific research which promotes industrial progress via personnel and technology policies, it uses industrial policies to affect market demand which engenders industrial growth, and it uses foreign relations policies to affect international cooperation which accelerates industrial development.

State support. The semiconductor industry is the foundation of an information society. In the early stages of development, a low level of social information and lack of prominent basic characteristics made it hard to attract attention. Moreover, it was restricted by a "sacrifice" quality unique to the industry, whereby prices had to be lowered [to attract business], so economic benefits were not apparent and it was very hard for it to rely on its own accumulation to enter a benign cycle. Thus, formation of state consciousness is essential for attaining smooth development in the semiconductor industry. The United States relied on the military to support establishment of its semiconductor industry. Japan relied on MITI to formulate industry policies and moved into niches in the United States' consumer market to promote development of its semiconductor industry. In a situation of a weak foundation and strong adversaries, South Korea relied on state foreign relations policies and an inclination toward high-strength investments to become the third semiconductor superpower in one leap.

Market demand. There is a well-known wave phenomenon in the semiconductor industry called the "silicon cycle." There is one wave roughly every 4 to 5 years which is synchronized with the wave cycles of electronic equipment and the overall industry. This shows that semiconductor "components" are interrelated with the "overall" market, while the latter is related to a nation's industrial structure. Research has shown an obvious regular relationship between per capita semiconductor consumption and per capita GNP. This reflects an important property of the semiconductor applications market, which is that it depends mainly on the level of development of tertiary and quaternary industries which are related to per-capita amounts. This characteristic creates an extremely passive situation for industrializing nations: underdevelopment of tertiary and quaternary industries hinders development of the semiconductor industry, while in turn backwardness in the latter greatly restricts progress in the industry as a whole. This demands that nations have great foresight and make firm decisions to formulate correct foreign relations policies and industry policies to encourage the semiconductor applications markets and continually draw industrial growth and development forward and promote invigoration of the entire national economy.

International cooperation. This is an external environmental factor which accelerates industrial development. International cooperation is indispensable, both for superpowers and for weak nations. The main concerns of

enterprises in the superpower countries are technology and markets, meaning development of ever-harder technologies at lower cost and entering ever-expanding markets of their counterparts with less obstruction. The cooperation needs of weak nations are to establish their own industries at a rather small cost. South Korea, for example, used United States technology and 5 years' time to complete a course it took Japan 20 years to complete and thus passed over the "agricultural" semiconductor development stage. International experiences show that "strategic mutual benefit" is the key to successful international cooperation, which means starting with long-term goals and overall economic progress for mutual benefit in each country developing a semiconductor industry.

Scientific research. This is an internal factor which drives development of the semiconductor industry. Semiconductors originated with the invention of the first transistor in 1948. Each generation lasted exactly 10 years and changed through five periods from transistors to ultra-large-scale integration. Each 10-year period saw many important technical innovations and product replacements. Investments in scientific research in the semiconductor industry exceeded all other industries, with scientific research expenditures that were 10 to 15 times the proportion of sales volume compared to traditional industries and one or two times compared to emerging industries (like computers). Thus, we call the semiconductor industry a "scientific research-type industry." This tells us that the semiconductor industry involves importing production lines as well as relying on our own scientific research strengths to promote the development of production. Otherwise, technical innovation may lead to an imported product or even an entire plant being wasted.

III. The Current Situation in China's Semiconductor Industry

1. Economic results are low in China's semiconductor industry. Only one-half of inputs are obtained as outputs, 80 percent below foreign countries. Our per capita income is 10 to 30 times less than in foreign countries. Although our enterprise depreciation rate and sales expenditure rate are only 50 percent and 30 percent, respectively, of the figures in foreign countries, the proportion of the corresponding depreciation and sales costs are higher than or about the same as levels in foreign countries, which greatly negates our advantages in low labor costs. These situations show that besides technical and management factors, the failure of human factors to play their role is one reason for the low per-capita results.

2. Although economic benefits in China's enterprises are very low, the rates of profit and tax collection on their capital are 2 to 3 times higher than in foreign countries. In another area, the comprehensive fixed assets depreciation rate in enterprises, per capita investments to expand production and scientific research expenditures are several times or several tens of times lower than in

foreign countries. These facts show that we have been using traditional industrial policies to develop an emerging industry, which has led to widespread "premature aging" disease in semiconductor enterprises.

3. Expenditures on commodity sales in China's enterprises are several tens of times lower than in foreign countries, which is an inevitable outcome in a planned economy. Even now, semiconductor marketing networks are still restricted to a simple "direct-supply" pattern with semi-annual product-ordering conferences and weak market mechanisms. However, experience in semiconductor industry development has shown that a free economic system (United States and Europe) is not as advantageous as a mixed market system (Japan and South Korea). China's implementation of a planned commodity economy should benefit development of the semiconductor industry, but the problem lies in how to take advantage of its role.

4. Most of China's semiconductor enterprises are specialized enterprises. During the current stage, which is characterized mainly by development of semiconductor technologies in the direction of applications and services, this is extremely unfavorable to industrial development. This point has been confirmed by international experience. At present, however, competitive mechanisms in China's markets have not been established and no independent decision-making management system has taken shape in enterprises. This has retarded enterprise organization toward a "vertical-integration" structural development process.

5. Besides the four characteristics listed above which stem from enterprise administration characteristics, China's economic foundation and international environment are different from those in foreign countries. Statistics for 1987 show that for every 100 enterprises in China, 63 are metallurgical, mining, and other types of enterprises which serve traditional industry. This shows that China is still in an initial stage of industrial development, which is extremely unfavorable to development of the semiconductor industry. However, China is also a large and unevenly developed nation. The economic foundation and per capita GNP of some Chinese provinces and municipalities (like Jiangsu and Shanghai) far surpass those in Japan and South Korea for that year [i.e., 1987]. Moreover, the foundations of Fujian, Guangdong, and other coastal cities have already provided conditions to attract the outward migration of industries from developing nations.

IV. Models and Countermeasures for Developing China's Semiconductor Industry

We should form a national consciousness and engage in long-term struggle to develop the semiconductor industry. China has weak per-capita economic strengths and is also in the initial stages of industrialization. To develop the semiconductor industry, we must take full advantage of the socialist planned commodity economy

and aggregate economy. We must begin with the characteristics of a dual economy and regional imbalances and formulate policies to transform traditional industries and promote development of emerging industries. China's markets have enormous potential and we historically have been a country dominated by domestic demand. The goal of developing an export-oriented economy is to use international cycles to promote domestic economic development. For this reason, developing the semiconductor industry should involve entering international competition on the basis of forming economies of scale domestically and competitive advantages to form a dual-cycle system with two markets. China has enormous personnel potential but seriously inadequate capital, so we must formulate policies to promote personnel competition and growth. Administrative systems in China's semiconductor enterprises cannot adapt to the needs of industry development, so we must formulate competitive policies which pursue scientific and technical progress and economic benefits.

In summary, China's semiconductor industry should develop along a model of "open-type independent decision making," which means using our own strengths as a foundation for reforming the economic system and utilizing the conditions of international cooperation to the greatest possible extent to develop a semiconductor industry with the characteristics of Chinese-style socialism. This model is not the same as an "export-oriented" type (South Korea) since it places great emphasis on foundations and our own scientific

research. Neither is it the same as an "import-substitution" model (Brazil) in that it strives to utilize "advantages of late development" in using an entire industry to enter international markets. Nor is it the same as a "national-challenge" model (France) since it does not pursue advanced levels but follows a principle of making attacks in weak areas for a rather long period to concentrate advantages and strengths to take over appropriate middle-technology product realms to serve national industrialization and earn foreign exchange.

Based on this developmental model and beginning with systems engineering, we should become involved in perfecting the operation of drive, support, control, and other subsystems.

The drive subsystem includes the two main factors of market inducements and scientific and technical promotion. The support subsystem concerns basic factors like personnel, special equipment, materials, and so on. The control subsystem is a multilayer coordinated self-driven regulation system. To enable the smooth formation of this model, we must formulate a whole series of mutually coordinated and matching policies and strategies including the issue of coordinating development of the semiconductor industry with the electronic equipment industry, traditional industries, and so on.

In the present international situation, developing nations face many problems in developing a semiconductor industry. If we conscientiously study the characteristics and developmental laws of the semiconductor industry and form our own developmental model based on our national conditions, we certainly will be able to invigorate and develop China's semiconductor industry.

Long March 2E Ballistic Measurement Equipment Developed

40080008A Beijing ZHONGGUO DIANZI BAO in Chinese 28 Nov 89 p 1

[Article by Yang Zhonglian [2799 6988 3425]: "External Measurement Equipment for 'Long March 2 Strap-On' Heavy Launch Vehicle Developed"]

[Summary] Radio measurement and safety equipment for the external ballistics of the "Long March 2 Strap-On" [i.e., CZ-2E] heavy launch vehicle has been developed by Research Institute 10 of the Ministry of Machine-Building & Electronics Industry and passed its expert technical appraisal in Chengdu on 13 November. This equipment, mounted on the launch vehicle, sends

radio signals to ground controllers for precise tracking of the rocket's position, speed, and attitude—as well as for safety control—during the satellite launch and orbital-insertion process. Compared to similar equipment in current domestic use, the new equipment is 67 percent to 87 ½ percent smaller and over 50 percent lighter. Mean time between failure [MTBF] has been raised from 200 hours to 500-700 hours. A complete set of this equipment, which consists of over 100 pieces in 47 different kinds, was developed by Institute 10 in less than a year's time after signing of the production contract.

Editor's note: this launch vehicle is called the "Long March 2 Strap-On" because four strap-on boosters are used to increase the thrust [above what the original model, the CZ-2, would provide].

State-of-the-Art Gyrotron Developed

40080007B Beijing GUANGMING RIBAO in Chinese
18 Dec 89 p 2

[Article by Mu Yi [4476 0076]]

[Summary] A new high-power gyrotron developed by the Chinese Academy of Sciences' (CAS) Institute of Electronics recently passed technical appraisal. This millimeter-wave and sub-millimeter-wave power source, also called an electron cyclotron resonance maser, has an output power of 200 kilowatts and an efficiency greater than 30 percent, surpassing the highest known values for similar devices abroad. This electronic device has applications in high-capacity communications, in high-resolution probes and detectors, and in directed-energy transmission, and will therefore provide significant benefits to China's economic construction and military modernization.

Simultaneously reported is the joint development by the CAS Institute of Physics and the CAS Institute of Electronics of a high-power millimeter-wave transmission system. This development overcomes a major obstacle to the realization of controlled thermonuclear fusion.

New-Generation Airborne Radar Certified

40080008D Beijing GUANGMING RIBAO in Chinese
30 Dec 89 p 1

[Article by Mao Rongfang [3029 2837 2455]]

[Summary] China's first new-generation airborne radar, developed over an 8-year period by Nanjing Electronic Technology Institute in cooperation with affiliate units, was accredited a few days ago in Nanjing. The new radar system incorporates advanced technologies such as digital moving target indication [MTI], fast Fourier transform [FFT] algorithmic processing, constant false-alarm rate [CFAR] processing, and protected channels. Under background conditions of extremely strong ground clutter, this radar can implement a frequency analysis of the return-wave signals, and thereby discovers a useful target signal.

Shanghai University of S&T Develops All-Fiber-Optic Gyro

40080008C Shanghai YINGYONG JIGUANG
[APPLIED LASER TECHNOLOGY] in Chinese Vol 9
No 6, Dec 89 p 272

[Article by Yi Min [0044 3046]: "All-Fiber-Optic Gyro-scope' Developed by Shanghai University of Science & Technology's Optical-Fiber Institute Passes Technical Appraisal"]

[Summary] On 16 September 1989, the "all-fiber-optic gyro development" project of Shanghai University of Science & Technology's Optical-Fiber Institute passed the technical appraisal held by the National Natural Science Foundation and the Shanghai Municipal Science & Technology Commission. This gyro system fits in a cylindrical case 150 mm in diameter by 160 mm high. The turntable can measure speeds of rotation ranging from 0.01°/sec to 300°/sec, wavelength of the semiconductor laser light source is 1.3 microns, and single-mode-fiber output power is around 200 microwatts. Output coupling ratios of the two single-mode-fiber couplers are 50/50 and 49/51, respectively; additive losses [for these couplers] are 0.14dB and 0.03dB, respectively. The extinction ratio of the single-mode-fiber polarizer is 23dB and additive losses are about 2dB. Fiber [loop] length is 1000 meters, and the internal diameter of the fiber-optic ring is 100 mm.

Test results follow:

1. Random drift Ω_{\min} , for 60-sec sampling, is 5°/hr x square-root Hertz; for 160-sec sampling, 7°/hr x square-root Hertz.
2. Sensitivity Ω , 60-sec sampling, is 20°/hr; 160-sec sampling, 30°/hr.
3. Response time $t_c = 50$ ms, bandwidth $B = 20$ Hz.

Experts certified the gyro as China's first all-fiber-optic gyro, but remarked that it is still far from practical use.

New High-Power CO₂ Laser Developed

40080007A Beijing KEJI RIBAO [SCIENCE AND TECHNOLOGY DAILY] in Chinese 3 Dec 89 p 1

[Article by Ke Xin [2688 2946]]

[Summary] China's first high-power, low-mode continuous-wave (CW) CO₂ laser, developed in a 3-year-plus effort by a team from Hunan University, recently passed its technical appraisal. This high-quality low-mode laser, which has a CW output power of 6 kilowatts, incorporates technologies such as ion-beam-holding discharge with large uniform discharge area and pneumatic aperture output. It is especially useful for penetration fusion welding and cutting and will therefore make a significant contribution to development of industrial electromechanical products and national-defense equipment.

First OEIC Industrial Test Line Set Up*40080007D Beijing GUANGMING RIBAO in Chinese
20 Dec 89 p 2*

[Article by Lin Yutang [5677 3768 1016]: "First Optoelectronic-Integrated-Module Industrial Test Line Finished: China's Fiber-Optic Communications Equipment Reaches State-of-the-Art Level"]

[Summary] On 15 December at Shijiazhuang City, China's first industrial test line for optoelectronic integrated[circuit] (OEIC) modules passed its acceptance test sponsored by the Ministry of Machine-Building & Electronics Industry's (MMEI) Research Institute 13. The completion of this high-tech microelectronics test line and initial small-batch production with it signify that China's fiber-optic communications equipment meets advanced international standards.

OEIC's are key components of the transmitters and receivers used in fiber-optic communications equipment, and using them to replace expensive, often fault-ridden discrete components will produce smaller and more reliable units with a higher level of integration, lower power consumption, and superior performance. Institute 13 can produce over 2000 OEIC modules annually and, according to user requirements, can adjust the product mix to achieve small-batch production of a variety of products.

Reactive Ion Etching Equipment Developed*40080007C Beijing GUANGMING RIBAO in Chinese 3
Dec 89 p 1*

[Article by Cao Jian [2580 0256] and Deng Jiuxiang [6772 0036 5046]: "Breakthrough in China's Ultrafine Microstructure-Fabrication Technology Achieved"]

[Summary] Beijing, 2 Dec 89 (XINHUA)—China's ultrafine image-reduction/microstructure-fabrication technology has seen a new breakthrough with the domestic development of reactive ion etching (RIE) equipment. After a 12-year effort involving over 10,000 experiments and the development of numerous test models, researchers at the Chinese Academy of Sciences' (CAS) Microelectronics Computer Center have perfected

an RIE machine with perpendicular etching directionality and a high degree of uniformity. This equipment, fabricated throughout with all-Chinese-made parts, has been used successfully to manufacture high-power turn-off silicon controlled rectifiers (SCR's).

Additional Details on New GaAs VHSIC's Released*40080008B Beijing ZHONGGUO DIANZI BAO in
Chinese 28 Nov 89 p 3*

[Article by Huang Deming [7806 1795 2494]: "Gallium Arsenide High-Speed Frequency Divider, 120-Gate Gate-Array Circuit Developed"; for earlier report, see JPRS-CST-89-026, 11 Dec 89, p 25]

[Summary] The Chinese Academy of Sciences' (CAS) Shanghai Institute of Metallurgy recently developed the first domestic gallium-arsenide (GaAs) 120-gate gate-array circuit and GaAs high-speed frequency divider. The development of these two very-high-speed integrated circuits (VHSIC's) has achieved one of the primary goals of the state's Seventh 5-Year Plan.

By organizing the talent and resources of several laboratories and plants in a one-year-plus effort, the institute was able to solve problems involving the design, mask-making, ion implantation, metallization, double-layer metal wiring, and testing of the circuits. In the first half of this year it completed development of the all-ion-implanted planar GaAs high-speed frequency divider circuit and the 120-gate gate-array circuit, and incorporated the frequency divider in a 1-GHz digital frequency meter and other instruments.

The thinnest lines of the metal gates in the frequency divider are 0.6-0.8 micron, and the chip size is 0.9 millimeter (mm) x 0.8 mm; operating frequency exceeds 3.5GHz, and power consumption is 200 milliwatts. The gate-array circuit consists of over 120 BFL [buffered field-effect-transistor logic] NOR logic gates, has 876 components, a chip size of 1.7mm x 1.4mm, and an operating frequency of over 1GHz; it has been incorporated into a 21-stage ring oscillator, a 4D flip-flop, a four-digit reversible calculator, and other medium-scale-integration (MSI) digital circuits.

Influence of MO_2 , M_2O_3 , MO_3 Oxides on Conductivity of Lithium Borate Glasses

40090003d Beijing WULI XUEBAO [ACTA PHYSICA SINICA] in Chinese Vol 38 No 10, Oct 89 pp 1628-1633

[English abstract of article by Huang Pengnian [7806 1756 1628] and Huang Xihuai [7806 3556 2037] of Shanghai Institute of Ceramics, Chinese Academy of Sciences]

[Text] The total conductivity and the electronic conductivity of $45\text{Li}_2\text{O} \cdot 50\text{B}_2\text{O}_3 \cdot 5\text{M}_m\text{O}_n$ ($\text{M} = \text{Al}, \text{Ti}, \text{Zr}, \text{P}, \text{V}, \text{Nb}, \text{Ta}, \text{Cr}, \text{Mo}, \text{W}$) glasses are measured. The Raman spectra of the glasses are studied. The influence of MO_2 , M_2O_3 and MO_3 oxides is discussed based on the properties of the negatively-charged groups acting as the localization sites for the Li^+ ions.

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Surface Mode Absorption, Infrared Optical Properties of Small Spherical $\alpha\text{-Fe}_2\text{O}_3$ Particles

40090003c Beijing WULI XUEBAO [ACTA PHYSICA SINICA] in Chinese Vol 38 No 10, Oct 89 pp 1585-1592

[English abstract of article by Li Ruolin [2621 5387 2651], Li Zengfa [2621 1073 4099] et al., of the Department of Physics, Nankai University, Tianjin

[Text] Small spherical $\alpha\text{-Fe}_2\text{O}_3$ particles with uniform size and regular shape were prepared by an improved hydrolysis method. The infrared transmission spectra of two of these kinds of particles with different dimensions have been measured, and all surface modes of the small spherical $\alpha\text{-Fe}_2\text{O}_3$ particles obtained. The effect of aggregation on absorption is discussed, and the two absorption bands in the spectra are explained by approximating the chain aggregation by cylindrical microcrystals. The surface mode theory of multi-atomic cubic particles is generalized and applied to $\alpha\text{-Fe}_2\text{O}_3$ particles in a mono-axial crystal structure. The theoretical results of the surface mode frequency of the $\alpha\text{-Fe}_2\text{O}_3$ particles are presented, and they agree well with those of the experiments. The existence of a generalized modified LST relationship has been verified.

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Theoretical Study of Electronic Structures of Si(111) Surface

40090003b Beijing WULI XUEBAO [ACTA PHYSICA SINICA] in Chinese Vol 38 No 10, Oct 89 pp 1578-1584

[English abstract of article by Mei Liangmo [2734 5328 2875], Zhang Ruiqin [1728 3843 0530] et al., of the Department of Physics, Shandong University, Jinan; Guan Daren [7070 1129 0117], et al., of the Institute of Theoretical Chemistry, Shandong University, Jinan]

[Text] The electronic structures of the Si(111) surface have been studied by means of the SCF-CNDO molecular orbital theory with the cluster model treatment. The calculated results show that: (1) The distribution and transfer of net charges of the surface have localized characteristics at the atomic orbitals. In addition, the T₃⁰, T₃⁺ and T₃⁻ defect forms do not exist readily in the practical system. (2) The electronic structures can be described with the stochastic potential, from which the adsorption site and the adsorption dynamic process of the ions and ionic molecules adsorbed on the Si(111) surface can be determined. (3) The surface states mainly appear in the region from the top of the valence band to the center of the gap, and are strongly localized at the atomic orbitals. The above-mentioned results are consistent with some experimental discoveries.

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Stability of Structure Models of Si(111) 7 x 7 Surface

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[English abstract of article by Liu Huizhou [0491 1920 0719] and Li Zheyin [2621 0772 0692] of the Department of Physics, Zhongshan University, Guangzhou]

[Text] In this paper, based on the concept of building blocks with interactions, the authors study the stability of models of the Si(111) 7 x 7 reconstructed surface. Employing the tight-binding method, the formation energies of various building blocks and their interactions have been calculated. With these building blocks, various large unit surfaces can be constructed and their total energies can be estimated easily, without requiring heavy calculations. The authors have evaluated the surface energies of Si(111) 5 x 5 and 7 x 7 DAS models, obtaining the values of -0.467 eV and -0.477 eV, respectively, which are close to the results reached by Qian and Chadi^[9]. The authors also point out that neither the 7 x 7 adatom model^[16] nor the 7 x 7 adatom-vacancy model^[2] is stable.

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