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Sino-Japanese S&T Cooperation Expanding

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[Article by Zhang Huichun [1728 1979 2504]: "Strengthen Sino-Japanese Cooperation, Make Greater Contributions to Mankind"]

[Excerpts] [passage omitted] The signing of the Sino-Japanese S&T Cooperation Agreement on 28 May 1980 was a turning point, and S&T cooperation between China and Japan has now developed from civilian to intergovernmental cooperation. This type of development was also carried out at two levels.

1. Horizontal cooperation (focused on science)

This type of cooperation refers mainly to each party using its own advantages, assuming the burden of expenditures, and sharing achievements, which is an arrangement for carrying out cooperative research on new objectives. For example, we made use of tropical and subtropical plant resources to extract antibiotics for agricultural and medical uses, did a joint survey of black tides, extracted niobium from molten iron, and so on. These cooperative research projects produced achievements that satisfied both China and Japan. Cooperative projects at this level have increased very quickly during the past several years and 113 cooperative projects have been included in the S&T cooperation agreement so far. Of them, 61 were cooperative projects that were newly signed at the 6th Joint Committee Meeting held in Tokyo, Japan in June 1992. This shows that S&T cooperation between the Chinese and Japanese governments is developing in the direction of higher levels. While expecting an increase in cooperative projects, we have also been able to produce even more satisfactory cooperative achievements that have further improved the quality of cooperation.

2. Vertical cooperation (focused on technology)

This type of cooperation refers to uncompensated technical cooperation in the Japanese government's ODA Plan. For the past 13 years, this channel for cooperation has produced substantial achievements. The modes of cooperation have now developed from single projects to assign students for advanced training and single projects to invite experts in the earliest stages to seven modes at the present time. They are: sending personnel for advanced training, inviting experts, providing single items of materials, special technical cooperation projects, development and survey projects, and inviting young cooperation teams and experts from foreign countries. The fields of cooperation include industry, agriculture, communication, communications, energy resources, social development, the environment and public health, and so on. With the exception of China's Taiwan Province and Tibet Autonomous Region, the regions involved in cooperation cover all of China. The unique property of cooperation via this channel is that transfers of appropriate technology are the primary line and personnel training is the link, so it has a reputation of substantial influence in China and has played an active role in promoting China's economic construction.

We have used this channel to send 3,233 personnel ot Japan for research and advanced training and invited nearly 1,000 experts of all types. Some 34 single items of materials, 22 special cooperation projects, and 70 development surveys have been provided via this channel, and we have invited 119 young cooperation team members from foreign countries. China has also paid for the travel expenses for nearly 700 experts to come to China. To consolidate and develop this channel for cooperation, we are using the 20th anniversary of the normalization of diplomatic relations in 1992 as an opportunity and we will hold the Sino-Japanese Intergovernmental Uncompensated Technical Cooperation Exhibition in September 1992 in China that will use graphics and text recordings to summarize the accomplishments in cooperation and report the work achievements made through this channel to the people of China and Japan to derive greater understanding and support from the people of both countries and manage cooperation via this channel even better.

Somewhat later in 1992, we will also hold a symposium in Tokyo on S&T cooperation between China and Japan in the 21st Century that will seek greater common understanding of the challenges faced by S&T cooperation between China and Japan and make the proper contributions to the prosperity of mankind.

International S&T Cooperation Brings Fruitful Results

92FE0785D Beijing KEJI RIBAO [SCIENCE AND TECHNOLOGY DAILY] in Chinese 9 Jul 92 p 3

[Article by Yao Weike [1202 3634 0344]: "On International S&T Cooperation and Exchange"]

[Text] Since the 3d Plenum of the 11th CPC Central Committee, China's international S&T cooperation activities have developed quickly. In the past 13 years, China's international S&T cooperation battlelines have destroyed the many unrealistic regulations of the past that restricted our ideas. We have made use of the favorable international environment and gradually adopted exchange and cooperation modes that are in general use internationally and achieved significant development in these areas:

I. A Growing Intensity of S&T Activities With the Outside World

China has now established S&T cooperation and exchange relationships with 129 countries and regions, including 68 countries with whom we have signed intergovernmental S&T cooperation agreements or economic, trade, and S&T cooperation agreements. More than half of these agreements were signed after 1978. We

have gained positions in over 30 S&T-related organizations in the United Nations system, including the United Nations Science and Technology Development Commission, United Nations University, International Atomic Energy Agency, World Health Organization, World Intellectual Property Organization, and others. Cooperation and exchange between all regions and all departments in China and the scientific research units and institutions of higher education under their jurisdiction with relevant departments in foreign countries are more lively and widespread. For example, the Chinese Academy of Sciences has now signed over 50 academy-level cooperation agreements with science academies or scientific research organizations in more than 30 countries and regions. The National Natural Science Foundation has established cooperative relationships with 12 world funding organizations. The China Association for Science and Technology and the academic groups under its jurisdiction have joined a total of 192 international S&T organizations and assigned leading members to 39 organizations in joining international science commissions. China is a member of over 280 international S&T and academic organizations. One-third of China's 344 pairs of Friendship [Sister] Cities that are connected to foreign countries have undertaken S&T and economic exchanges. The number of exchange projects and personnel have increased every year. In 1978, China had only 1,060-plus official and civilian S&T cooperation and exchange projects with foreign countries that involved visits by only 5,600-plus personnel. By 1991, the number of exchange projects had reached 14,000 and the number of personnel visits surpassed 53,000, nearly 13 times and 9 times, respectively, the 1978 figures.

II. Substantial Growth in Channels for Cooperation and Exchange

While developing international bilateral S&T cooperation, China has also been concerned with developing relationships with multilateral organizations of the United Nations. Each year China has sent delegations and S&T personnel to attend special conferences held by the relevant S&T organizations of the U.N. and some persons have taken posts in international organizations. China has now become a direct supporter and participant in the U.N. Science and Technology Intergovernmental Commission, Science and Technology Promotion and Development Center, Science and Technology Fund System, and International Atomic Energy Agency. China's relations with the European Community have developed very quickly and we have now undertaken over 100 cooperation projects in energy resources, information, biotechnology, nuclear safety technology, and other areas. China is a member country of the International Standardization Organization and now participates in 123 special technical committees and 338 subcommittees of this organization that involved 39 ministries, commissions, and central bureaus in China. Before 1978, only 500 people from China went abroad each year to participate in international academic conferences. After 1978, China viewed the sending of S&T personnel to participate in international academic conferences as an important channel for spurring China's S&T personnel to move toward the world stage and thus actively encouraged and supported experts and scholars in going abroad to participate in academic conferences. In 1991 alone, 5,900 persons from China went abroad to participate in international academic conferences. Besides going abroad to participate in international S&T academic conferences, China has also actively advocated the convening in China of international S&T academic conferences, including medium-sized and small symposia. In 1991, there were 275 international academic conferences held in China and 6,600 scholars visited China.

III. Growing Diversification in the Forms of Cooperation and Exchange

Before 1978, the primary form of China's S&T cooperation and exchange with foreign countries was to go abroad for investigations, participate in international academic conferences, attend international exhibitions, hold exhibitions and technical meetings in China, invite experts to come to China and lecture, and so on. After 1978, besides the exchange modes listed above, the breadth of the exchanges has expanded. Now, for example, they have developed to include cooperative research, joint design and development, joint surveys, joint exploration, cooperative convening of symposia, cooperative operation of laboratories, cooperative running of training centers, sending scholars to organizations in foreign countries for cooperative research, inviting experts for technical consulting and feasibility research, having S&T personnel go abroad to accept work, making joint investments to establish high and new-tech enterprises, holding technology export exhibitions in China and foreign countries, and so on. For the past 13 years, China's international S&T cooperation has gradually developed toward a cooperation mode that includes the integration of technology-industry-trade, technology-agriculture-trade, and technology-trade-banking, and S&T cooperation is becoming more integrated with economic cooperation.

IV. Continuous Reform of Science and Technology Foreign Affairs Work and Systems

Along with reform of China's economic and S&T systems, we have also carried out reform of our S&T foreign affairs management system. We first restored the State Science and Technology Commission as the unified S&T foreign affairs outlet for the state and ended the irrational past system in which the State Science and Technology Commission and economic and trade parts managed S&T foreign affairs work to enable us to consider S&T foreign affairs work from a comprehensive world perspective, facilitate the formulation of unified principles, policies, and management systems, and facilitate coordination and deployments, which thereby straightened out relationships and improved efficiency. Second, we transferred downward examination and approval

authority. The downward transfer of authority strengthened the examination and approval authority and leadership responsibility of provinces, autonomous regions, municipalities directly under the central government, and cities with province-level economic decision-making authority and all ministries and commissions of the central government's State Council, which made S&T foreign affairs work more timely and more flexible. As the administrative department responsible for S&T foreign affairs work, the State Science and Technology Commission's work has shifted toward macro guidance, and the focus of its work has been formulating principles and policies, legislation, coordination, information transmission, and opening up channels.

V. Great Development of Local S&T Foreign Relations Work

Before 1978, international S&T cooperation and exchange work basically was carried out by several departments and organizations in the central government and there was very little participation by local areas. After 1978, the state formulated a series of policies to encourage local areas to undertake international S&T cooperation activities and in 1986 it stipulated that S&T foreign affairs work in provinces, autonomous regions, municipalities directly under the central government, and cities with province-level economic decision-making authority was under the leadership of local people's governments and that local science and technology commissions were responsible for its administration, which greatly strengthened S&T foreign affairs work. All regions in China have now established over 60 S&T exchange centers that together with the China S&T Exchange Center have formed a national network. These exchange centers have played a substantial role in opening up channels in China and foreign countries, promoting "importing from abroad and cooperating with units in the interior", spurred the integration of S&T and trade, and served invigoration of local economies, and other areas, and they have become an important force in civilian foreign S&T exchange work.

To adhere to the state's call to send S&T into mountainous areas and support poor areas, the State Science and Technology Commission decided that S&T foreign affairs work should also serve invigoration of the rural economy. It called on S&T foreign affairs in all regions to use projects to support poor regions in overcoming their poverty and achieving prosperity. The selection of these projects must begin with the actual needs of poor regions and use local poverty elimination programs and development foci to select projects that would help foster local resource and market advantages, solve technical problems in support poor areas and development, improve local S&T development capabilities, and promote development of the commodity economy in poor regions. In 1988, the State Science and Technology Commission organized a visit by peasant entrepreneurs from the Dabieshan region for inspections in Japan, France, Italy, and several Eastern European countries.

In 1990, to solve the problem of complicated procedures for S&T exchanges by high and new-tech enterprises, the state issued a special document that simplified the procedures for part of the personnel in these enterprises to make several trips to foreign countries, which helped the technology and products of these enterprises enter the international market.

For the past 10-plus years, we have used international S&T cooperation and exchange to obtain significant economic and social benefits.

1. We have obtained information, conducted technical comparisons, and effectively promoted trade. In China's development of household appliances, for example, many products were produced by first using technical exchanges, making many inspections and conferences, and then importing production lines. Sino-Swedish S&T cooperation has promoted the establishment of the Sino-Swedish joint investment enterprise Ruihua [Sweden-China] Pharmaceutical Plant. China has now placed bismuth germanate, barium borate, neodymium-iron-boron permanent magnetic materials, infrared transducers, and other high and new-tech products into the international market.

2. We have effectively promoted exports of Chinese technology and technical products.. The total number of China's export contracts from 1986 to 1990 was 1,110 for a total amount of $3.471 billion. Our total technology export volume in 1991 was $1.277 billion, 60 times the figure in 1986. China's total volume of trade exports in 1991 was $71.91 billion and technology exports accounted for 1.78 percent of our total volume of exports. Since 1986, technology exports have increased every year both in amount and in the proportion they account for of total exports. There has been constant growth in the modes of technology exports, such as transfers of patent rights or trademark rights; transfers of proprietary technology; technical services; exports of production lines, sets of equipment, and key equipment; cooperative production; cooperative design; cooperative development; compensated trade; direct investments, contractual responsibility for projects, and so on.

3. We have studied advanced theories and scientific management methods in foreign countries and studied advanced technology in foreign countries. For example, the Beijing Positron-Electron Collider was built via international S&T cooperation and we received technical guidance from foreign experts in the design and construction processes. Through international S&T cooperation, China has developed residual oil catalytic cracking mixing and manufacturing technology that can be extended and transferred throughout the world. The Jing-Qin [Beijing-Qinhuangdao] Railroad and Dayaoshan Tunnel projects also studied foreign technology, which improved quality and shortened construction schedules. Beijing Municipality adopted a consulting program using foreign experts for the Gaopaidian Waste Water Treatment Yard project that conserved 19

million yuan in investments, reduced electricity consumption by 7,000 kWh/day, and saved 100 mu of land.

4. We have used Sino-foreign cooperative research, joint surveys, and joint development and utilized foreign equipment to absorb advanced research methods from foreign countries. The nuclear magnetic resonance imaging scanner developed via Sino-American cooperation attained advanced world levels. The Sino-French joint survey of the Himalayan Mountains produced breakthrough developments in plate tectonics. The Beijing Municipality Communication Bureau cooperated with relevant units in England's transportation departments for joint development of the urban traffic management system (SCOOT) system that included bicycles, and it has now been placed into operation at intersections in the eastern area of Beijing Municipality and has increased the traffic capacity of intersections by 20 percent.

5. Significant achievements in work to import intellect from foreign countries. In 1986, the State Science and Technology Commission established the Foreign Intellect Importing Office and it had imported the intellect of 1,392 skilled personnel from foreign countries by 1991. The China Science and Technology Exchange Center established a cooperative relationship with Japan's Sexagenarian Association and has invited over 700 Japanese experts . Their exquisite technology and rich experience contributed to China's agricultural bumper harvest and enterprise development. Since 1978, we have invited 980 Japanese experts through Japan's International Development Group channel alone that involved administration and management, public affairs, agriculture and forestry, water conservancy, manufacturing and mining, energy resources, commerce, tourism, medicine and health, social welfare, specialized training, and many other fields, and all of the expenses of their visits to China were provided by the Japanese government.

6. We have fought to obtain a substantial amount of capital subsidies and advanced technology and equipment from foreign countries. For example, the European Community subsidized the establishment of a comprehensive new energy resource and renewable energy resource demonstration base area on Zhejiang Province's Dachen Island that includes wind energy, solar power, tidal energy, and bioenergy that has provided a model for energy-short regions on the islands of China's East China Sea and South China Sea and for several Pacific countries.

7. We have improved the international status of China's S&T. Through international S&T cooperation and exchange, the academic levels and personnel quality of China's S&T personnel have attracted the attention of international colleagues. China now has over 350 scientists working at posts in international organizations and Chinese acupuncture technology has been accepted by world medical circles. The World Acupuncture Federation, of which China was the founder, has now been established and its headquarters is located in China. In several S&T fields where we have advantages, China has begun technology exports and technical services for foreign countries. After China's recoverable satellites installed microgravity experimental devices for France and Germany, we have now begun providing satellite launch services to foreign countries. China successfully launched the Asia Communications Satellite in April 1990. Besides importing technology and management experience, the 50-plus feasibility surveys carried out via technical cooperation between China and Japan have also promoted Japanese loans and uncompensated assistance projects and the direct export of Hami melons, lichees, mat straw, and other products to Japan. China has also begun providing other developing countries with experts, technical assistance, and so on. Singapore, for example, has hired Chinese biotechnology and computer experts for scientific research and development work.

There have been intense changes in the world situation in recent years. The present international environment is complex and there are many indeterminate factors. However, they also provide us with many unique possibilities and opportunities for undertaking international cooperation and exchange.

As international S&T cooperation has developed until today, we are still not satisfied with the regular mode of activities of the past of specialized inspections and academic exchanges. We should adapt to the variety of modes that are common in international society and self-consciously link up with economic activities. There should be a substantial increase in cooperative research, joint development, cooperative administration, and other projects as a proportion of our international S&T cooperation to reinforce our consciousness of administration in S&T foreign affairs activities. We must create more favorable environmental conditions in policies and management mechanisms, provide firm support in expenditures and cadres, send out our technical products and finished goods, and enable our S&T personnel to actively participate in international activities. We must pay special attention to major efforts to guide and spur high and new-tech industry to take the path of internationalized development, actively promote exports of high and new technology and its products, open up international markets, and give China's high and new-tech industry more powerful motive force.

China has already begun sending S&T personnel to foreign countries to work and serve and in the future we must formulate correct policies to provide guidance, establish new systems and measures, open up more channels, and allow more S&T personnel to move onto the international stage.

We must truly strengthen survey research work.

We must do more to open up more laboratories and research institutes, and invite foreign scientists and scholars to engage in cooperative research or scientific

research. In fields where the conditions are mature, we should strive to establish international research centers in China.

We should continue reinforcing S&T foreign affairs work in all provinces and autonomous regions. In particular, we should aid interior and frontier regions and assist underdeveloped regions in opening up the situation in S&T foreign affairs work, provide them with opportunities to participate in international exchanges and international cooperation, and give them more support and assistance in policies, channels, information, and other areas. Coastal, interior, and frontier provinces should take the initiative in opening up and formulate international S&T cooperation programs and measures that are closely interrelated with economic development in their region to invigorate their local economies and strengthen service to local S&T forces.

We must advocate and encourage all departments of the central government and all local areas to invest more manpower, materials, and financing in the area of S&T foreign affairs work to create the necessary manpower, material, and financial conditions for undertaking international S&T activities. They must view such inputs as an indispensable form of investment for developing S&T activities in their regions. If the work is done well, this type of input/output ratio will be multiplied by several times or even several 10 times as time passes.

We must reinforce S&T foreign affairs staff construction. We should gradually train and create skilled S&T foreign affairs personnel who are both red and expert and who have a solid political footing and powerful action capabilities and who understand the profession, understand foreign affairs, and understand foreign languages and who understand other skills. We must encourage and support all departments and all local areas in taking full advantage of all training conditions to train foreign affairs cadres through measures, programs, and objectives, get started soon, produce qualified personnel as soon as possible, and derive benefits as soon as possible.

CAS New Strategy—Internationalization

92FE0785A Beijing ZHONGGUO KEXUE BAO [CHINESE SCIENCE NEWS] in Chinese 14 Jul 92 p 2

[Article by Liu Honghai [0491 3163 3189]: "A New Starting Point for Chinese Academy of Sciences Strategy Spanning the Centuries"]

[Excerpts] **Editor's note:** Since the relaying of comrade Deng Xiaoping's speech during his tour of south China, a new tide of reform has taken shape throughout China in the areas of expanding opening up, accelerating economic construction, relying more on science and technology, developing high S&T industry, and so on. This has provided reform in the Chinese Academy of Sciences [CAS] with a more favorable external environment. On the other hand, if we fail to make self-conscious reform we will be subject to even greater shock and pressure. From the central authorities to local areas, all have even higher hopes for the CAS and want the CAS to take even greater steps in the areas of intensive reform and expanded opening up. The CAS is now proposing truly feasible measures based on actual conditions and wants to hear opinions or proposals from all areas. After participating in survey research by relevant departments of the central authorities concerning reform in the CAS, comrade Liu Honghai of the CPC Central Committee Office Survey Research Office has offered some of his own views. They are being published below for reference purposes only.

In the spring of 1992, several 10,000 workers in the CAS again felt a tide of emotion rising in their hearts as if they were sitting in a spring breeze. Deng Xiaoping, the chief engineer of reform and opening up in China and the bosom friend of S&T workers, stood at the heights of the intersection of centuries, based himself on the future of the Chinese nationality, and turned his expectant sights toward S&T circles: I thank S&T workers for their contributions and the glory they have given to the nation; we must advocate science and rely on science if we are to have hope; I hope that the pace of S&T will be accelerated in the 1990's; develop S&T, the higher the better, the newer the better. Each word of our elder resounded in the heart of every comrade in the CAS. Everyone was thinking about one question: How can the CAS develop more quickly, what strategies should be established, what objectives should be chosen? This article will discuss this question from the perspective of internationalization.

I. What Is Internationalization

Internationalization refers to having the CAS integrate its strategic direction, macro deployments, and allocation of forces with the larger environment and great momentum of world S&T, absorb the superior achievements of every world nation, and take the route of international cooperation. Concretely speaking, it has implications at three levels:

1. Work in the CAS should take aim at the international leading edge. After 40 years of efforts, the CAS is now China's biggest comprehensive basic research center and a powerful high and new-tech development center. It has first-rate S&T personnel, equipment, reserve strength guarantees, and administration and management systems. For historical reasons, however, the CAS during its first 30 years was basically forced to be established and grow in a closed situation, and it formed a set of system models with a high degree of concentration that were adapted to the old commodity economy. Reform in the 1980's brought vitality to the CAS and a fundamental change took place in the internally-oriented situation. The problem was that overall, the CAS had not truly entered international competition and a substantial part of its scientific research projects repeated others and themselves at rather low levels. Technology development often gave too much consideration to domestic needs and it was hard to foster comprehensive advantages. Reform of the management system was not able to adapt

to the intense changes in scientific research forces of production and opening up industry. Taking aim at the leading edge internationally means that scientific research, industry, and management must move forward together and that the four wheels of projects, capital, personnel, and equipment must rotate together. Over 100 research institutes, several 100 enterprises, and several 10,000 employees must all be pushed toward the arena of international S&T.

2. Observe the regulations of international competition, move quickly to link up with international practices. If we wish to participate in international competition, we must of course manage affairs according to the international arena. We see soberly that the developed Western nations hold the dominant status in world S&T and the economy, so international practices mean the practices of the developed countries. In a certain sense, these international practices discriminate against the developing nations and the late developing nations have no choice but to accept this as a fact. To catch up with its counterparts in competition and surpass the other side, the CAS must pay double tuition, which includes acknowledging the present situation. Acknowledging the present situation does not mean being led along by the developed countries, but it does mean having a prerequisite of a comprehensive understanding of the current situation and exploring development models conforming to China's national conditions that use intelligence to gain victory. The relative increases in investments in scientific research in competition among the developed nations forms a distinct difference from the developing countries. As a proportion of GNP, investments in the developed nations are 5.6 percent for national defense, 5.2 percent for education, 4.8 percent for public health, and 2 to 2.5 percent for scientific research. In the developed countries, 60 to 80 percent of new increases in value of output come from S&T factors. Investments in the developing countries are 5.6 percent for national defense, 3.8 percent for education, 1.5 percent for public health, and 0.2 percent for scientific research. There is a 10-fold difference in investments in scientific research. China's investments in scientific research are higher than the average level for developing countries, 0.7 percent, but this is far below the developed countries and newly emerging industrializing nations (regions). Scientific research factors account for only 30 percent of new increases in value of output in China. Although we have acknowledged in theory that S&T are the first force of production, I am afraid this is still very hard to achieve in policies and practice. Accelerating our participation in the outside world can enable us to think about several problems in S&T development and use this to radiate into all aspects of our national conditions. Comrade Qian Xuesen [6969 1331 2773] set forth an issue that has caused people to think deeply: "We have abundant tungsten and rare earths, first in the world. We have always said that so-and-so is a petroleum kingdom that controls the world's petroleum market. Our reserves in both tungsten and rare earths are first place in the world, so why can't we affect the world's tungsten market and rare earth market?" Is the reason that our advantages in national conditions have not become international advantages related to the fact that we do not manage according to the international practices of the commodity economy? Based on the dividing line between the two great camps, the former Soviet Union in the 1950's artificially constructed a socialist market that paralleled the capitalist market (the Council of Mutual Economic Assistance). Besides its national interests and its rigid understanding of socialism, the Soviet Union's original intention was also a simple desire to truly break away from the Western nations. They only thought about suffering losses and forgot about a fundamental principle: socialism must be established on a foundation that carries on all the achievements of human civilization. Unless it is absolutely necessary and unless international channels are totally blocked, a socialist country must try in every possible way to pursue an open international environment and adopt various measures to destroy powerful blockades. China has a common saying: "a brave man does not suffer present losses". Another statement is "suffer small losses, take over the real bargains". Comparing these two statements, the latter is more brilliant than the former.

3. Orienting toward the world means moving toward the world, and participating in international competition is the key place in international competition. The CAS must dare to fight for world gold medals. It must truly use comrade [Deng] Xiaoping's demands on his southern tour to make correct selections of important realms that play key roles in China's economic and social development, concentrate all of the academy's forces, make major efforts at cooperation, join together to attack key problems, create powerful local advantages, and achieve leap-type strategic breakthroughs. Since reform and opening up, the CAS has made accomplished explorations in the two areas of basic research and orienting toward economic construction. The Wu Wenjun [0702 2429 0193] method for machine confirmation of geometric theorems, the Beijing Positron-Electron Collider and its high energy experiments, high temperature superconduction research, and so on have brought glory to China's S&T circles. The moderate and low-yield field upgrading for the Huang-Huai-Hai region [Huang He-Huai He-Hai He] organized by the CAS is unique in global agriculture. The Lianxiang Group Company established by the CAS Computing Institute started orienting toward foreign countries from the beginning and its volume of sales reached 1 billion yuan in 1991, attracting the attention of the international computer industry. During the 1990's basic research should hold high the banner of the Chinese people in intersecting comprehensive fields (high temperature superconduction, non-linear science, molecular cytology, neurobiology, nanometer technology, cognitive science, artificial intelligence, etc.), basic questions concerning human existence (biodiversity, global atmospheric changes, etc.), huge scientific projects (particle physics, synchronous radiation, nuclear fission, astrophysics), and other areas. There is a common international phenomenon in

S&T development at present. All countries, especially the developed nations, are paying growing attention to establishing and perfecting mechanisms for the mutual promotion of scientific invention and technology transfers. England and Japan are, respectively, representative countries in scientific invention and technology transfers. England has consistently been concerned with basic research and neglected technology transfers, which has made it the "sick man of Europe" with a stagnant economy. Japan has a very powerful technology development capability but relatively poor basic research. Both countries began to face up to their own "lame legs" during the 1980's. As indicated by England's "Harwell Plan" and Japan's "Tsukuba (Science) City Plan," England decided to change its situation of "inventing it ourselves while others get rich" and Japan made a major effort to invest in basic research and attract scientists from many nations, with the intention of establishing scientific fountainheads in their own countries. On the surface, the strategies of these two countries are similar and in essence they are pursuing an optimum arrangement for coordination and matching up of science, technology, and the economy. The core of China's reform of the S&T system is to achieve three-dimensional integration of science, technology, and the economy. The efforts of the CAS in this area are typical. The temple of science should become a reserve force for S&T innovation and a force that propels the economy up to a new stage. Along with actively transferring achievements to enterprises, the CAS should also use its advantages in basic research as a basis for reinforcing utilization and industrialization of inventions in new materials, the chemical industry, automation, microelectronics, computers, lasers, biology, natural drugs, medical instruments, and so on and try to establish 10 additional export-oriented enterprise groups at levels and scales like those of the Lianxiang Company. Work as quickly as possible to open up a new route for invigorating the CAS that closely integrates basic research, applied research, and development research, closely integrates high and new technology with the international market, and closely integrates S&T with the economy.

II. Why Must We Achieve Internationalization

Proposing a strategic direction for internationalization does not simply mean mechanically applying reform and opening up but instead involves more profound causes. Besides the most general principles of socialism and opening up S&T, the tasks the CAS takes on, its existing advantages, its future prospects, and its status in the state's overall strategy determine that the CAS can only take the route of internationalization. There is no other route.

The party and government have been extremely concerned with the CAS. Shortly after our nation was founded, when there were hundreds of things to be done, the founders of New China moved first to establish the CAS on 1 November 1949 when the overall situation had just been determined. The older generation of revolutionaries represented by Mao Zedong had a profound understanding of the importance of science for China. The hundreds of things that had to be done could not be done all at once, but science was essential. Looking over the series of important instructions the CPC Central Committee has given to the CAS since its founding, the tasks of the CAS were relatively clear: unite and gather together all of China's superior scientists, train and send into society qualified S&T personnel, foster the key role of the national S&T team, use all types of S&T activities to make the cause of S&T prosper, promote economic development, and spur service to social progress. This task in itself stipulates that work in the CAS should be at the vanguard and lead scientific research in other departments and industries. Encouraged by comrade Xiaoping's talks during his tour of south China, scientific research and economic departments are all actively pursuing export-oriented international cycles and the CAS should step into the lead. Otherwise, how can we congeal China's S&T forces and how can we become the national team?

The CAS has China's most powerful comprehensive scientific research forces. At the end of 1991, the CAS had a total of 60,000 S&T personnel that included 40,000 scientific research personnel, equal to 1/200th and 1/9th, respectively of the corresponding totals for China. Its yearly expenditures on scientific research were 1.5 billion yuan and it had 4 billion yuan in fixed assets. It has assumed responsibility for 25 percent of the National Natural Science Fund projects during the Seventh 5-Year Plan, 38 percent of the five civilian realms in the "863" Plan, and 50 percent of the major projects under the State Science and Technology Commission. This is especially true in the area of basic research, where the CAS is uniquely excellent. The award situation for National Natural Science Awards in each session is:

National Natural Science Awards, 1956-1991

Year (Session)	Total number of awards received in China	Number of awards received by CAS	Proportion of awards received by CAS
1956 (1st)	34	28	82.4%
1982 (2d)	125	68	54.5%
1987 (3d)	178	72	40.4%
1989 (4th)	59	31	52.5%
1991 (5th)	52	18	34.6%
Total	448	217	48.6%

The proportions of first-place awards received by the CAS are even higher

When looking at the status of the CAS, we also see an obvious trend: the situation of the CAS in the 1950's of taking on everything under heaven has changed. This was the objective pursued by several generations of S&T workers in the CAS for many years. We see the rapid surge of the four staffs in industry, institutions of higher education, the military industry, and local areas that have each formed their own characteristics and the CAS

as the vanguard is happy to see the surging growth of those who follow it. Moreover, the achievements by those who came later are the result of the selfless assistance by the pioneer. S&T activities in the atomic energy, space, and other departments were basically established by relying on comprehensive transfers of personnel, equipment, and achievements from the CAS. There is another side of things. Those who came later have certainly grown and there is no longer a relationship of guardianship and being under the guardianship between them and the CAS. Instead, it is a relationship of equal competition. Should those who follow seize the bowls of the pioneers? Posing such a question is superficial. First, we must note that in the initial period of an entirely new system and government authority, it was entirely necessary for the party and government to concentrate forces and establish the CAS. Second, it was a wise choice to use administrative measures and planning measures to establish a unified structure for S&T in China and develop "orderly chaos" in S&T activities. Third, those who came later compete with the pioneers and cannot be denounced for being "ungrateful". We must determine who would be the more reasonable one to carry this bowl. The CAS has changed from being an only child originally to being a member of many children, so it naturally is active, but it also lost a little of pampering as a single child. In this type of situation, then, what are the CAS's advantages? The CAS is unique in its basic research, comprehensive research, and high-cost project research. This type of research cannot and should not be the focus of competition by many parties in China. How could the state foolishly advocate and condone this type of wasteful high consumption! This S&T deployment in the CAS is also closely integrated internationally, even to the point of being impossible without international cooperation on topics like the global environment. Having a powerful international character is precisely the advantage of the CAS.

The development trends of science and technology show that basic research is becoming increasingly important. Since the 1960's, the number of new discoveries and new inventions in basic research has far exceeded the total number of discoveries and inventions during the preceding 2,000-plus years and they have generated countless new materials, new techniques, and new technologies. The speed of converting basic research achievements into commodities has been greatly accelerated. To convert new discoveries and new inventions from basic research into commodities, it took about 100 years during the 18th Century, 60 to 80 years in the early 19th Century, 30 years in the early 20th Century, 5 years during the 1950's, and 2 to 3 years now. Fundamental changes have also occurred in the modes of basic research. During the 19th Century, it mostly involved independent research by individual scientists. In the early 20th Century, enterprise circles began organizing scientific research. During the Second World War, governments became the dominant force in organizing scientific research. Now, it is relatively common for governments and even multinational circles to organize basic research. The CAS has an integral system for basic and applied basic research, and its scientific research activities provide a guide for S&T progress for all of China and prepare reserve forces for economic development. The main benefits of the CAS are not embodied in the technology it develops itself (of course, this area must also be strengthened). Instead, they are embodied more in drawing and spurring overall economic and social development. Cross-border scientific research is a common experience in all of the developed nations and newly emerging industrializing nations. Since the Beijing Positron-Electron Collider was completed, it has accepted a large number of scientists from foreign countries to engage in high energy experiments. Many of our scientists have also done a great deal of research in research organizations in foreign countries and made several advanced achievements. Using the water of others to sail one's own boat is the reason for cross-border scientific research.

The 1990's are a key decade for China. During these 10 years we must achieve our second strategic objective for economic and social development and attain a per capita GNP of $800 to $1,000 by the end of this century. New consideration must be given to strategic choices. When discussing the experiences of the 1980's, comrade Xiaoping said we got started on Pudong [New Zone, Shanghai] too late. If we had established Pudong at the same time as we established Shenzhen Special Economic Zone, there would certainly have been double the vitality in the Chang Jiang basin. Comrade Xiaoping's summarizations have enlightened us to think of a question: the first doubling [of the gross value of industrial and agricultural output] during the 1980's was mainly achieved by relying on an extensive expanded reproduction mode and the S&T content was relatively low. It would be unreasonable as well as impossible to continue following the 1980's model during the 1990's. We could not compensate for the consumption of large amounts of precious resources. We must reinterpret the widely popular statement "rely on policies, rely on S&T, rely on investments", remove policies and investments, focus on the main topic of science, and convert policies + science + investments into science X (policies + investments). Comrade Jiang Zemin clearly proposed in his speech to the 4th Congress of the China Association for Science and Technology in May 1991 the establishment of a water-saving, energy-saving, consumption-saving, and land-saving resource conservation-type economy, and the greatest potential for resource consumption lies in S&T. People often speak of using S&T to invigorate this and invigorate that, but who doesn't know that we must first invigorate S&T. Opening up is a prerequisite for invigorating S&T. Who should be opened up first? Like a family with many children that also has limited conditions, the parents naturally want to choose their healthiest and most intelligent child with the best prospects for training to send out for tempering. The CAS must assume this responsibility, volunteer to go all out regardless of the consequences, and be duty-bound to be the first to have a comprehensive international orientation,

rely on its strengths to charge into the rivers and lakes, and serve as a model for its brothers and sisters. Comrade Xiaoping made a famous remark regarding Shenzhen Special Economic Zone in 1991: You yourselves must fight along a bloody path. We can see that this path is not smooth. Many people only see the Shenzhen of today and envy everyone's glory and who knows the hardships of cutting off all means of retreat. Can the CAS be the Shenzhen on the S&T battlelines in the 1990's?

System reform in the CAS is now at a crucial moment, and the core of intensive reform is the transformation of operational mechanisms. What operational mechanisms are rational and effective? This is a practical question, not a theoretical one. If it is said that during the 1980's the basic line for internal reform in the CAS is relaxation of authority, giving a free hand, and opening up of activities, then the 1990's should be a shift toward retransformation, restructuring, and optimization. Retransformation, restructuring, and optimization require international consultation to avoid starting everything from the beginning. The developed countries have successful experiences in management and operation of scientific research organizations and we can boldly seize them, accomplish things in one step, and achieve an historical leap in operational mechanisms. Examples include the contract system, hiring system, discarding system, stockholding system, linking the income of research personnel with projects, international circulation of research and industry personnel, and so on. Internationalization is good and powerful medicine for transforming mechanisms in the CAS, but it undoubtedly is also a bitter medicine, and it is the key to bringing renewed vitality to the CAS. Comrade Xiaoping pointed out incisively that the present moment is a favorable opportunity for our reform and development. Having the CAS take the first step in reform is essential. Internationalization is equivalent to a fundamental exploration of routes for S&T system reform and its significance goes far beyond the CAS itself.

The political significance of internationalization in the CAS is even more commonly understood. This is a major step in accelerating reform and opening up in China and harbinger of China's S&T circles taking a new route. Its role in condensing the Chinese nationality alone has boundless beneficence. The Chinese nationality is an intelligent and remarkably talented nationality, and Chinese account for a substantial portion of the prominent scientists of the present era. Most of the young scientific workers whose accomplishments lead the ranks in first-rate research organizations and institutions of higher education in the United States and Europe are Chinese. Their specializations cover almost all fields in modern science, physics, chemistry, biology, computers, lasers, energy resources, new materials, space technology, and so on. In essence, S&T competition is personnel competition. Most of the top-notch young Chinese scientists in first-rate research organizations and top institutions of higher education in Europe and the United States during the 1940's and 1950's later became leaders in all disciplines. Mr. Li Zhengdao [2621 2398 6670] has stated with assuredness that in the next century, this group of outstanding new scientists will certainly become the new authorities who guide all disciplines. The hope of S&T in the 21st Century lies in China. As for converting hope into reality, one important guarantee is providing scientists with an open environment, and internationalization in the CAS will provide an infinite space for scientists to gallop across. Two birds in the forest are better than one bird in the hand. When the will of the people gives the direction and rules the roost, what is the difficulty?

III. How To Achieve Internationalization

As for internationalization, talking about it is reasonable but doing it involves many difficulties. It requires breakthroughs in ideological concepts, it requires that policymakers establish a strategic position for the CAS, it requires even more than all internal areas work together in cooperation and make a difficult but heroic decision, work jointly on a big plan to escape by cunning maneuvering, and together write a second creative new page.

We must destroy the superficial understanding of the relationship between socialism and capitalism that has formed over many years. For a long time, we have put too much emphasis on the opposition between socialism and capitalism, struggled for one side, and neglected the side of continuity and cooperation between the two. Socialism does not fall from heaven. It is a special stage in mankind's historical development. Socialism's advantage is its broadest vision and capacity for absorbing every civilized achievement created by mankind. Certain theorists consider themselves infallible and reason fallaciously. If we must always ask about the ideological dullness of the name of everything and theory sinks to this step, it is hard to avoid being a little laughable and sad. This is particularly true for exploration in the natural sciences and if we go so far as to have scientists wrapped up in a circle of arguing over whether something is socialist or capitalist and consume their energies, this can only cause a withering of science. It is true that the Western countries hold the advantage in S&T competition, but can we give up on cooperation and exchange with these countries because of this? The essence of a country is not some supernatural power that means that the S&T activities of an entire country are always capitalist or socialist. S&T are the first force of production, the most important and most vigorous force of production, and they cross over classes and national borders. Their essence gives them a natural relationship to the socialist system. The more developed S&T are, the more powerful the technical rationality of socialism. In the early stages of Soviet political power, Lenin proposed the famous formula: "Soviet political power + Prussian railroad management procedures + American technology and trust organization + American national education + etc. + etc. = Total = Socialism." In this formula, except for Soviet political power, all the others are science and technology (including soft science) from capitalist countries. If we do not work at internationalization, how can we learn about the things of people? We are the younger generation and have reviewed Lenin's teachings from 70

years ago. Looking again at the questions raised by certain theorists about what to call it, one can't help recalling Marx's ridiculing of fake "Marxists": I am not a "Marxist". I sowed dragon seeds but harvested fleas. Certain people give a snort of contempt and admire it as being an evil offspring of capitalism. They also constantly pay lip service to the four great inventions of the feudal era. Is it possible that they do not fear that others will attack them and mock them as worshipers of the feudal dynasties! To achieve internationalization in the CAS, we must first have internationalization of our ideology. It is exactly like the "Internationale": "let ideas smash our bonds". People often say that the mind is an unselfish as heaven and earth are broad, but actually the mind has no "bands" (selfishness is also a type of "band", and names are deft reins), and heaven and earth are even broader.

The CAS holds the balance in China's S&T circles. Should CAS serve as a strategic shock brigade in modernization and construction, the aircraft carrier of all of China's S&T staff, and the growth point for the new S&T system, or should it passively be treated as a burden left over from the old system and a "black hole" for capital inputs, or should we be eager for quick success and instant benefit and allow the CAS to find its own way out and thereby form a sharply contrasting development model. According to the first idea, the central authorities would make the CAS the comprehensive trial point for reform of the S&T system. The direct point is to turn the CAS into a special S&T zone, allow it to face the international wind and rain, experience the world, and feel its way along. All departments of the central authorities should do as comrade Xiaoping has said, transfer authority downward, and not block it and make it an enlightened mother-in-law, have a new relaxed hatred less than 1,000 feet tall with the air of an elder, and allow the CAS to crash through the international waves to escort the guard ships. Relax authority, give a free hand, open up activities in regard to policies, and have laws, procedures, and systems in regard to management. In the most simple example, it is a common occurrence for everyone to accept it without reservations: we again declare that students studying in foreign countries can come and go freely to eliminate the apprehensions of students. While coming and going freely is progress, it still goes against internationalization. We should switch the two words and change it to "going and coming freely". If S&T personnel working in China can freely participate in international activities when they want to or when they need to, the worries of students studying abroad would naturally disappear, and where would we have to give them advice with scorched mouths and dry tongues! According to the second type of idea, there are two possibilities. One is to treat the CAS as an ivory tower, allow it to work on high, precision, and incisive problems in detachment from reality, toilsomely repeat what others have done, and create some firsts in China. This type of self-closure would appear to be very powerful, but actually it is seriously weak. If detached internationally, what would be the significance of being the first to do something in China! The first author to use a flower as a metaphor for a woman was a genius, the second was a mediocre person, and the third was an idiot. Thus, there is absolutely no use for a completely independent metaphor and you do not have the rights as discoverer. Second, indiscriminate action that ignores the characteristics of the CAS by simply copying the slogan of orienting toward the economy would lead to blindly giving up advantages and using disadvantages, fighting chaotically like a beehive, paying the madame and suffering losses, and eventually learning the steps from Handan and crawling back. Comparing the two types of ideologies, they are entirely different. Why is it hard for the CAS to get started on internationalization? The problem is that the external environment for the CAS has not gotten underway and a series of rules and regulations are encircling you. With people of remarkable ability everywhere, can they leap out like the hand of Buddha? Certain management departments are two fragile psychologically and are always worried about our competitiveness, and they frequently base their argument that internationalization is not feasible on the flow of achievements and qualified personnel to the outside. This concerns a basic guiding ideology. First, we do not have to state that the competitive abilities of our side are far from being as weak as certain departments are worried they are. If we assume that their worries are realistic, can we always remain outside of the world? It is correct that the Art of War by Sunzi contains the tactic of "avoiding if possible", but this only concerns tactics. The strategy should be the opposite of tactics: "participate if possible". As Mao Zedong said, "in strategy, despise our enemies, but in tactics take them seriously", choosing only either half of the sentence is inferior. The National Technology Program (NTP) selected by Singapore can serve as a reference for us. Singapore knows it is incapable of competing with the developed countries in areas like computer software, aviation, and so on, and they adopted an original approach for participation in international cooperation by improving the software designs of developed countries, upgrading existing aircraft, and so on, and suddenly they stood on the shoulders of others. For internationalization in the CAS, other countries naturally have advantages (any type of cooperation is based on mutual benefit), but the biggest advantages are still in China. We have a staff of scientists, technical experts, and entrepreneurs at international standards that has grown up. It could not be bought for 1,000 pieces of gold, but it is worth 10,000 pieces.

Similarly, internationalization is a challenge for the CAS, and it is a challenge to advance or retreat, succeed or fail, and live or die. [passage omitted] The CAS should make ideological preparations, tight organizational measures, and leading countermeasure schemes. If the central authorities give the final verdict, how can the CAS move? It must focus on the objective of internationalization, establish an overall strategy of "opening up to promote reform, reform to protect opening up", and carefully map out each step. As the first step, we can first

decide on four nodes for connecting with international S&T. One is scientific research interconnection. Reallocate scientific research forces according to basic science, applied basic science, and high and new technology and important disciplines that concern our country's overall situation to form a crack and optimized scientific research staff. Each key field should have sufficient capital support and adopt evaluation systems and evaluation methods in general use internationally. Change from a tracking type to an innovation type, go to sea in borrowed ships in order to compete for cooperation, collect together the excellent things under heaven, create a family of the best. The second is personnel interconnection. People are the carriers of S&T and using talent, collecting talent, and nurturing talent is the foundation of S&T. In the past 100 years, the developed countries have relied on the nets of their powerful economic strengths and money to trap skilled S&T personnel from the developing nations, which is the true secret behind their development. The rate of return for students who left Taiwan to study in foreign countries from the 1950's to 1970's was only one-seventh. In the mid and late 1980's, the government of Taiwan established an environment in Hsinchu [Xinzhu] Science Park that copied institutions of higher education in the United States and Europe. This made all types of skilled personnel who had become accustomed to European and American lifestyles again have a feeling of repaying their nationality and return home, and the return rate gradually rose to 40 percent and the momentum is still very powerful. We do not have to copy Taiwan's methods, but can we receive some enlightenment from it? Besides impelling the invigoration of our nationality, it would give all qualified personnel (inside China and in foreign countries) the convenience of being able to adapt as much as possible. The third is industry interconnection. High and new-tech industry represents the direction of future industry and is the commanding heights for the S&T and economy of the future. Whoever seizes high and new-tech will be the one who has the initiative. The CAS now has several 100 enterprises and high and new-tech is the personal task of most. How many of these several 100 enterprises conform to internationalized management standards? How many are still operating according to traditional mechanisms? How many have excellent prospects? The CAS must establish industry. If it does not, it will break its golden bowl and go begging. CAS industry must be based on new mechanisms and work on internationalized administration. Otherwise, it is just old wine in new bottles and will be the same as recopying antiques that lack vigor and vitality. The fourth is administrative interconnection. Management covers a broad area including the organization of scientific research, guaranteeing reserve strengths, ideological and political work, and other activities in leading departments at all levels in the academy. The main thing now is to start from reality, improve management ideology, management systems, and management regulations to integrate the internal aspects with internationalization, comprehensively borrow from effective management modes of scientific research organizations in the developed countries, drastically reform personnel, wage, labor, and social guarantee systems, and establish various types of standards and regulations that conform to international practices. The personnel in Zhuhai City who won important awards in early 1992 correctly stated that it was implementing allocation according to labor and providing rational remuneration according to the actual contributions by S&T personnel. Is the CAS capable of exploring a route of true allocation according to labor (material and spiritual) in basic research and other areas? There are certain deep-going reforms that have been seen correctly but still lack the conditions for implementation over a wide area. The CAS must dare to be the first under heaven and be the first brave warrior to eat crabs. It may be that this experiment is hard to improve and in the extreme case it may even fail on the verge of success. Everything must be done without mistakes, and who dares boast about it. Even if it truly fails it will also have unique value, and showing others that this path does not work will move our reform one step closer to the truth. Some people misunderstand internationalization and hold different views merely from the perspective of improvement in individual material interests. We must eliminate this type of psychological mistake as soon as possible and establish a new concept of fairness of more pay for more work. The CAS is a vast pool of running water, and strict requirements, strict management, and strict discarding are also international practices.

Internationalization is a new starting point for the CAS strategy that will span the centuries. While it is new, it is also truly a high starting point and even more truly a difficult starting point. This is a stern test for every one of us and can we pass it? Thinking about the hardships the CAS has endured in doing its pioneering work, thinking about the report of victory in the initial battle of reform in the 1980's, and thinking about the concern and support given by the CPC Central Committee and State Council, our determination, bravery, and strengths swell up in our hearts!

"There will be times when we are braving the wind and the waves, hoisting our sails to sail through the seas". This is our conviction.

Shanghai Promulgates S&T Development Plan for 1990's

92FE0785B Beijing ZHONGGUO KEXUE BAO [CHINESE SCIENCE NEWS] in Chinese 24 Jul 92 p 2

[Article by ZHONGGUO KEXUE BAO reporter Huang Xin [7806 6580]: "Shanghai Formulates S&T Development Plan for the 1990's, Shanghai Municipality Science and Technology Commission Chairman Jin Zhuqing [6855 2691 7230] Says Focus To Be on Developing High and New-Tech Industry"]

[Text] What are the overall ideas for Shanghai's S&T development during the 1990's? I paid a special visit on

23 July 1992 to Shanghai Municipality Science and Technology Commission chairman professor Jin Zhuqing. He said that the Shanghai Municipality Science and Technology Commission has already formulated an S&T development plan that will continue resolute integration of S&T progress with economic development, make orientation of S&T toward economic construction the main battlefield of S&T work, make industrialization of S&T achievements the center, make industrialization of high and new-tech achievements the focus, and serve invigoration of Shanghai's economy.

Jin Zhuqing told me that this S&T development plan actually focuses on four objectives: the one main battlefield, two parks, three demonstration points, four realms, and implementation of eight plans.

One main battlefield: This refers to using intensive reform of the S&T system and economic system to further promote the orientation of S&T work toward the economic construction battlefield, solve the problem of S&T's detachment from the economy, apply modern S&T to upgrade traditional industry, make all industries basically achieve reliance on S&T progress, improve the quality of the labor force, and increase the contribution of technical progress to the development of industry and agriculture over 50 percent and over 60 percent, respectively, by the end of the century.

Two parks: This refers to focusing on good construction of Caohejing Emerging Technology Development Zone and Pudong Beicai Zhangjiang High-S&T Park. During the 1990's, Caohejing Emerging Technology Development Zone will basically be completed and attain a yearly value of output of 10 billion yuan. Zhangjiang High-S&T Park will have an initial scale and become a demonstration park and important base area for high-tech industrialization.

Three demonstration points: This refers to the selection of three streets, townships, and towns including Ruijin Street in Luwan Ward, Luodian Town in Baoshan Ward, and others for application of S&T to undertake population control, environmental protection, resource development and utilization, and so on, readjust man's relationship to nature, and complete highly civilized and scientifically modernized social area demonstration points.

Four realms: This refers to continuing to maintain and foster Shanghai's advantages in basic disciplines and fields, focus on modern biology, modern electronics, materials science, and other fields, and make new breakthroughs in squeezing into leading world ranks. We must focus on organizing forces to undertake work in micromachinery, neural element computers, and other high, precision, and incisive realms.

Content of the eight plans: These are 50 S&T activity plans including the Plan To Attack Key S&T Problems, the Spark Plan oriented toward township and town enterprises and medium-sized and small enterprises, the Torch Plan, the Venus Plan to support growth of young S&T personnel, the Major S&T Achievements Extension Plan, the S&T Invigoration of Trade Plan, the International S&T Cooperation Plan, and organizing and making arrangements for cooperative research, joint development, establishing technological vanguard enterprises, and so on.

Civilian S&T Enterprises Flourishing

92FE0785C Beijing KEJI RIBAO [SCIENCE AND TECHNOLOGY DAILY] in Chinese 8 Jul 92 p 1

[Article by reporters Zhu Weiwei [2612 5898 5898], Liu Jianhua [0491 1696 5478], and Feng Baoping [7458 1405 1627]: "New Momentum Appears in Development of China's S&T Activities, Big Army of S&T Pioneers Marches to the Main Battlefield"]

[Text] Under the impulse and promotion of the big army of civilian-run S&T industries, a new momentum of five big armies of S&T pioneers marching to the main battlefield in economic construction has come to the fore, the core of S&T pioneering is now shifting toward scientific research organizations, and industrialization of high-S&T has now become the main current in the development of S&T industry. Statistical information for 1992 regarding applications for awards for pioneering work submitted by several 100 S&T industrialists throughout China clearly reflects this momentum.

Civilian-run S&T industry is still a powerful army and 20,000 entities have now been formed in China at a scale of 400,000 personnel involved. Civilian- run S&T industries accounted for 30 percent of those who applied for pioneering awards, and among them several enterprises are now promoting unique high and new-tech products in China and even throughout the world. Their management work is now progressing toward greater science and standardization.

Large academies and institutes have reformed their S&T system and taken the development path of integrating science, industry, and trade to produce a surging momentum. A large group of powerful institute-run enterprises or academy and institute pilot plants have now come to the fore throughout China and they are incubating their own high and new-tech achievements, forming industries, and using high starting points to quickly, economically, and effectively gain market advantages. This type of S&T entity now accounts for 26 percent of those submitting applications. They include several large academies and institutes with several 1,000 personnel whose per capita profits and taxes exceed 10,000 yuan. This shows that the development center of China's S&T industry is now shifting and it points out the path of reform in large academies and institutes and other scientific research organizations.

School-run industries are using their powerful technology and skilled personnel as a reserve force and displaying enormous potential in S&T pioneering. The portion of the income in school-run industries being used to support education now accounts for 20 percent

of educational expenditure allocations in China and has reached 1:1 or even higher in some institutions of higher education.

Several state-run large and medium-sized enterprises and military industry enterprises have now entered the second pioneering stage. Along with reinforcing technical upgrading, they are also using commercialization of S&T achievements as a turning point for creating new industries, accelerating readjustment of the product mix, and establishing new operational mechanisms. Several military industry enterprises that formerly had no relationship with civilian products are making major efforts to develop civilian products with high technology contents and become holders of commodities that are well-known in society.

Several advanced township and town enterprises have bid farewell to the initial phase of relying simply on flexible mechanisms for development and are using their accumulated capital to purchase patented technology and high wages to snare skilled personnel, and they are cooperating with academies and institutes and institutions of higher education and entering the new stage of reliance on high and new-tech and generating new vigor and vitality.

The statistical information from the applications that were submitted show that the group of the last four types of enterprises accounted for 70 percent of the total number of applications and that there was a 30 percent increase in the overall proportion compared to those who submitted applications during the previous session. These S&T enterprises are borrowing from and transplanting self-management, self-responsibility for profits and losses, self-restraint, and self-development mechanisms from civilian-run S&T industry and the abundant creative abilities of pioneers to mold enterprises with distinctly individual characteristics. Moreover, they are also manifesting the common characteristics and laws of S&T industry development: the powerful role of using the market as a guide; high, precise, and incisive technology; new, unique, and special performance of products; high quality of the personnel involved; a shift to scales in enterprise administration and internationalization of their goals of struggle; and their fight for a first-class status on the large stage of world high S&T.

New Contract System to Commercialize Results of Scientific Research

40101002B Beijing CHINA DAILY (National) in English 8 Oct 92 p 3

[Article by He Jun]

[Text] China has introduced a comprehensive contract system among State-run scientific research institutions in a bid to push them further into market-oriented management.

The State Science and Technology Commission (SSTC), the Ministry of Personnel, the Ministry of Finance and the State Administration of Taxation jointly issued a regulation to define the basic principles and contents of the contract system.

According to the regulation, the contracts should set the spread and use of the fruits of research and promote the marketing of scientific and technological achievements.

The contractors will have complete freedom on research, development and management, including autonomy over personnel and wages.

But they must meet their contracts, which include improving economic efficiency and accomplishing the research projects appointed by the State, the regulation said.

The contractors can make a fortune after they earn money for their institutes and staff. But if they fail to meet their contract, their wages will be decreased, according to the regulation.

Such contracts in the past usually did not stipulate a penalty for the contractors.

To ensure the institutes have sustained development, the contractors must:

—Guarantee the increase of the institutes' fixed assets;

—Increase the investments in personnel training and research on high technology.

The regulation summarizes the good experiences of nearly 3,000 institutes that have tried such systems before, said Duan Ruichun, an SSTC official.

Duan said the system both improved the economic efficiency of the institutes and encouraged the initiative of researchers.

China's current economic reform started with the successful practice of the contract system in rural areas. Now the government is pursuing the new system in all fields.

Kunming Sets Up Tech Zone

40101002C Beijing CHINA DAILY (Yunnan Supplement) in English 31 Aug 92 p 1

[Article by Hu Jinghua]

[Text] Kunming established its development zone for high and new technology industries in March 1990 with an area of 10 square kilometres.

The zone includes Jinding Science Park and a science and technology street. A complete network of power, transportation, communications, gas and water supplies, and drainage has been constructed in the zone.

The zone is a high-level, intelligence-intensive area of Yunnan Province boasting 14 colleges or universities and 40 independent research institutes.

Around 70 percent of the scientific and technological personnel of Kunming city—more than 200,000 scientists and technicians—are concentrated in this zone.

To date, 31 new and high technology firms have settled in the zone, bringing with them 45 projects covering new materials, biological engineering, microelectronics, new energy sources and integral development of optics, machinery and electrical products.

The major preferential policies for investors in the zone include:

—The income tax is lowered to 15 percent and exports are to account for no less than 40 percent of total production;

—New and high technology enterprises are exempt from paying income taxes in the first three years after they become operational; in the second three years, they pay only half of the fixed income rate;

—Bonded factories and warehouses are permitted;

—Export tariffs are exempted except for those covered by special regulations;

—Import tariffs are exempted for building materials, production equipment, raw materials, parts and components, vehicles, and office facilities that will be used directly by the importer;

—In the first three years, enterprises will keep all foreign exchange earning quotas allowed to local areas according to State regulations; after that the local government will take a 20 percent share;

—Favourable working and living conditions are provided to science, technological and managerial personnel who volunteer to work here;

—A shareholding system will be allowed in the zone; science institutions and personnel are welcome to join the shareholding companies with their patents and scientific research results;

—Land-use rights can be leased, inherited, mortgaged or granted to others;

—According to the 10-year development programme of the zone, 250 new and high tech enterprises will be established before 1995, including four to six enterprise groups each with more than 100 million yuan in assets. By the end of the century, the number of enterprises will have reached 500 and that of the newly developed products 800.

Langfang To Host Science, Trade City

40101002D Beijing CHINA DAILY (Economics and Business) in English 14 Sep 92 p 2

[Excerpts] Construction of the Chinese Tsukuba Science and Technology Trading City, the first of its kind in the country, will begin before the end of this year.

The science-tech city, occupying 2.2 square kilometres within the Langfang Economic and Technological Development Zone in Hebei Province, 40 kilometres southeast of Beijing, will cost 6.5 billion yuan ($1.18 billion) and is scheduled to be completed before the end of 1987.

[Passage omitted]

The science-tech city, which is to be based on Japan's Tsukuba Science City, will be built into a multi-functional trading city for science and technology, which includes exhibition, research and development of high-technology, trading of technology and related products, education, tourism and exchange of science-tech information.

The city will have six parts: service sector, science and technology exhibitions, international fair, villa district, commercial housing and bonded warehouse district.

The director said the preparatory work is proceeding smoothly with the help of the local governments and the Chinese Academy of Sciences. (Xinhua)

LM-2C Puts Two Science Satellites Into Orbit

40100009A Beijing CHINA DAILY in English 7 Oct 92 p 1

[Article by staff reporter Gao Jin'an]

[Text] China yesterday sent two satellites—one Swedish and one Chinese—onto separate orbits with a Long March-2C rocket launched from the Jiuquan Space Centre in Gansu Province.

Minutes after ignition, an official from the Beijing Space Control Centre announced that both satellites, carrying scientific experiments, were successfully placed in their planned orbits.

Yesterday's successful launch was the second attempt to send the two satellites into space. The shot was previously scheduled on Monday, but a computer problem in the Chinese satellite was discovered just hours before blast-off and the attempt was postponed till yesterday.

Chinese rocket experts made some innovations in the 34-metre-long and 3.35-metre-diameter LM-2C carrier rocket before the launch to improve its performance, experts said.

It was learned that an eight-day space mission is planned for the retrievable Chinese scientific experiment satellite, which is expected to return to earth in Sichuan Province. It will conduct both global survey and mini-gravity tests.

The Swedish satellite, Freja, is 2.2 metres in diameter and weighs 259 kilograms. Equipped with various instruments, it is designed to study the polar lights and conduct tests in electric fields, magnetic fields, and particle and plasma research.

The satellite was flown into Jiuquan aboard special plane on August 21.

More than 50 government officials and experts from Sweden, the US, Germany, France and Canada witnessed yesterday's launch at the Jiuquan Space Centre.

The launching contract was signed in 1988 with Sweden.

The Swedish satellite is the second foreign satellite sent up by China this year.

On August 14, a LM-2E carrier rocket successfully put the Australian communication satellite, Optus-B1, into orbit from the Xichang Space Centre in Sichuan Province.

The second Australian satellite, Optus B2, made by the Hughes Aircraft Corporation of the US, is scheduled to be launched in mid-December from Xichang, also using LM-2E rocket. As is the usual practice, the satellite is expected to be flown into China about 60 days before the scheduled launching date for preparation and tests.

In a related development, China will set up a space foundation to reward the work of outstanding Chinese space experts.

According to sources from the Chinese Ministry of Aero-Space Industry and the Commission of Science, Technology and Industry for National Defence, the foundation will also sponsor activities in the astronautics field and help train people in space science.

The foundation will be financed through donations from enterprises, organizations and individuals from home and abroad, they said.

Sino-Russian Glonass/GPS Contract Signed

93P60016A Beijing ZHONGGUO KONGJIAN KEXUE JISHU [CHINESE SPACE SCIENCE AND TECHNOLOGY] in Chinese Vol 12 No 4, Aug 92 inside back cover

[Article by Yu Mingsheng [0151 2494 3932]: "China, Russia Cooperate in Research on Glonass/GPS Positioning and Navigation Technology"]

[Summary] In May 1990, representatives of space technology groups from China and the (Former) Soviet Union (FSU) signed in Moscow a space technology cooperative agreement spelling out 10 cooperative projects, of which the first covered joint development of a Glonass/GPS [global navigation satellite system/global positioning system]-compatible receiver. On 30 April 1991, a group of Glonass/GPS experts representing China's Ministry of Aerospace Industry (MAS) and officials of the FSU's NPO of Space Instrument [Building] (NPOSIB) signed in Moscow an agreement for [bilateral] technical talks. In this agreement, the Chinese side expressed an interest in using Glonass/GPS systems on space vehicles. On 22 August 1991, both sides signed in Beijing an agreement "to use a global positioning system Glonass/GPS to accurately determine space-vehicle center-of-mass movement parameters and orientation in space." On 11-28 May 1992, a China Academy of Space Technology (CAST) group of representatives led by Senior Engineer Tong Kai [4547 0418] met with various Russian space units and with NPOSIB officials signed a formal contract. According to this contract, in August of this year the Russian side will submit a research report on the project in quotes above.

This research report will provide relevant Glonass/GPS background materials, including navigational system forms and principles, navigational signal structures, signal modulation and ranging codes, navigational electronic messages, etc. The research report gives the user spacecraft a position accuracy of 30 m (1 σ), a velocimetric accuracy of 0.15 m/s, and a spatial [orientation] accuracy of 3' to 5' (mean square error) per axis; synchronization accuracy between the user spacecraft and UTC (USANO) time is to be 0.5 ms, positioning time interval is to be 30 s, and direction-finding time is to be 60 s. The report will also cover navigational algorithm

structures, computational formulas, information processing techniques, state determination methods, computational mathematical models, [Glonass/GPS] compatible receiver mode selection and demonstration, deterministic system structures, system initial design, hardware requirements, external interface requirements, positioning and timing error allocation and accuracy analysis, measured data/time/coordinate-system conversions, and methods for relating the space-borne computers to navigation processing. Finally, both sides will offer suggestions on further cooperative exchanges on the space-borne receiver and other items.

Deployment and Shock Analysis of Spacecraft Solar Array

40100008A Beijing ZHONGGUO KONGJIAN KEXUE JISHU [CHINESE SPACE SCIENCE AND TECHNOLOGY] in Chinese Vol 12 No 4, Aug 92 pp 2-5

[English abstract of article by Zhou Zhicheng of the Beijing Institute of Spacecraft Systems Engineering; MS received 12 Mar 92]

[Text] A method of shock analysis of deployable solar array is presented. The dynamical model is obtained using the Finite Segment Method. The curves of acting forces on BAPTA [bearing and power transfer assembly] and attitude angles of a satellite are given by using the software SDFX.

Positioning and Navigation for Visual Guided Robot

40100008B Beijing ZHONGGUO KONGJIAN KEXUE JISHU [CHINESE SPACE SCIENCE AND TECHNOLOGY] in Chinese Vol 12 No 4, Aug 92 pp 6-9, 48

[English abstract of article by Huang Yuming of the Beijing Institute of Control Engineering; MS received 2 Mar 92]

[Text] Summarizing the previous work concerning qualitative navigation for robots, this paper discusses systematically two qualitative positioning methods—Sequence Region Positioning & Orientation Region Positioning, their own properties and mutual relations, while the experimental results are also presented.

Research on Application of Remote Sensing Image Processing to Oil and Gas Exploration

40100008C Beijing ZHONGGUO KONGJIAN KEXUE JISHU [CHINESE SPACE SCIENCE AND TECHNOLOGY] in Chinese Vol 12 No 4, Aug 92 pp 19-25

[English abstract of article by Wang Yanguang of the Beijing Institute of Satellite Information Engineering; MS received 24 Mar 92]

[Text] Work that has been done since 1987 is summarized. The background and principle of the research, the key image processing technique, main achievement and the prospects in remote sensing oil and gas exploration are given. The processing technique is a hi-tech one with a great future. All the techniques used in the research can be widely applied to mineral resource exploration. Final results were completed by computer.

Spectral Shaping and Phase Equalization Techniques for SCPC Satellite Communication Systems

40100008D Beijing ZHONGGUO KONGJIAN KEXUE JISHU [CHINESE SPACE SCIENCE AND TECHNOLOGY] in Chinese Vol 12 No 4, Aug 92 pp 26-32

[English abstract of article by Gao Wei of Xian Institute of Space Radio Technology; MS received 25 Apr 92]

[Text] Based on development of SCPC [single carrier per channel] earth stations in the special satellite communications network of the aerospace systems, the spectral shaping and phase equalization techniques are described. These techniques are effective for compressing transmission spectrum and reducing intersymbol—interference (ISI). The measurement and operation show that the techniques have evident advantage in improving the spectral efficiency and bit-error-rate performance of the system.

Programmable Memory Application in Simulation Signal Source of Onboard Satellite Telemetry

40100008E Beijing ZHONGGUO KONGJIAN KEXUE JISHU [CHINESE SPACE SCIENCE AND TECHNOLOGY] in Chinese Vol 12 No 4, Aug 92 pp 67-73

[English abstract of article by Song Liding of Yantai Inst. of Telemetry Technology; MS received 1 Apr 92]

[Text] A new telemetry simulation signal source system which consists of E^2PROM (Electrically Erasable Programmable Read-only Memory) and some auxiliary circuits is introduced. First, according to the signals needed by the telemetry system, the system makes programming on computer and generates telemetry simulation data and data format by means of CAD. Then E^2PROM programming card writes E^2PROM simulation data and data format. This system implements programmable design and automatic generation of telemetry simulation data stream. In fact it has been shown that the system can overcome the traditional complexity, poor generality and difficulty in modification of data and format in data stream; in addition, the reliability and stability of data stream are improved largely. It can be used for a better telemetry system.

A Study on SPF Technology for Thin Corrugated Plate of TB_2 Titanium Alloy

40100008F Beijing ZHONGGUO KONGJIAN KEXUE JISHU [CHINESE SPACE SCIENCE AND TECHNOLOGY] in Chinese Vol 12 No 4, Aug 92 pp 74-78

[English abstract of article by Kan Guoli of Beijing Spacecraft (Beijing Satellite Mfrg. Plant); MS received 18 May 92]

[Text] The technology for SPF [superplastic forming] of TB_2 (Ti-5Mo-5V-8Cr-3Al) titanium alloy in corrugated plate (t = 0.25 mm), an element of spacecraft structure, is discussed. The paper includes discussion of the parameters of the forming process and experimental equipment. The results show that rough-grain plate of TB_2 titanium alloy has good superplasticity at 750 +/- 10°C when no treatment of refined structure is done. Because of the dynamic recrystallization during SPF, the grain becomes smaller. Also, both the strength (σ_b) and the plasticity (δ) are better. For thin corrugated plate of TB_2 titanium alloy, forming dies made of stainless steel (1Cr18Ni9Ti) and its plane sealing structure can meet the practical demand of SPF.

GMS Stretched VISSR Data Receiving/Processing

92FE0803A Beijing ZHONGGUO KONGJIAN KEXUE JISHU [CHINESE SPACE SCIENCE AND TECHNOLOGY] in Chinese Vol 12 No 3, Jun 92 pp 39-45

[Article by Xu Jianping [1776 1696 1627] of the Satellite Meteorology Center, SMA, Beijing: "Geosynchronous Meteorological Satellite Data Receiving & Processing;" MS received 25 Apr 91]

[Text]**Abstract:** The main features of GMS [geosynchronous meteorological satellite] stretched VISSR [visible infrared spin scan radiometer] data receiving and processing are discussed. The configurations and functions of a stretched data receiving system and three date processing systems of different capacity (real-time image processing system, microcomputer processing system and mainframe computer processing system) are described.

1. Introduction

The data collected by geosynchronous meteorological satellites provide an important source of information for weather forecasting. Currently, the satellite data used in this country is primarily obtained from Japan's GMS, which broadcasts real-time data at frequent intervals; this data is essential for monitoring typhoons and rain storms.

There are two types of GMS data. One is low-resolution cloud maps (WEFAX [weather facsimile]), whose resolution is 4 km in the visible channels and 6 km in the infrared channels; it uses an analog transmission system which broadcasts global cloud maps once every 3 hours and cloud maps of the Far East region every hour. The other is stretched VISSR (abbreviated S.V), whose resolution is 1.25 km in the visible channels and 5 km in the infrared channels; it uses a digital transmission system which broadcasts a fully-disk map every hour; it can also broadcast every half hour if necessary.

In recent years, the Satellite Meteorology Center (SMC) has developed an S.V receiving system and three data processing systems; a real-time image processing system, a microcomputer processing system and a mainframe computer processing system. This article gives a description of the basic features and the system configurations and functions of the S.V receiving system and processing systems.

2. Basic Characteristics of the S.V System

2.1 S.V Transmission Characteristics

- broadcast frequency: 1687.1 MHzEIRP [effective isotropic radiated power]: 56 dBm
- modulation type: DPSK [differential phase shift keying]
- baseband coding format: NRZ-M [Non Return-to-Zero Mark]; data rate: 660 kbit/s. The data is divided into 8-bit groups; every other group is inverted in order to avoid the difficulty associated with synchronous extraction when there is a continuous stream of zeros (e.g., a large cloud cover). To extend the frequency spectrum of the baseband signal, a random code is added to the signal; the random code is generated by the polynomial $1 + x^{14} + x^{15}$.
- IF [intermediate frequency] bandwidth: less than 2 MHz
- data sequence: most significant bit first, least significant bit last.

2.2 Data Format

S.V is broadcast once every hour, and each broadcast lasts 25 minutes. It consists of 2500 frames; the format of each frame is shown in Fig. 1. The first segment of each frame contains 20,000 sync bits; the data segment contains 2293 words of file code, scan-line data of each of the three IR channels, and scan-line data of the four VIS channels.

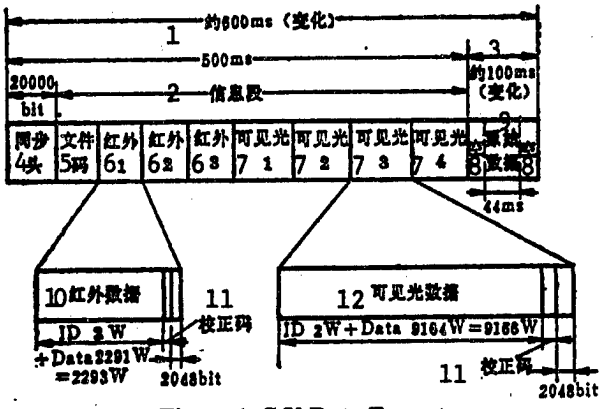

Figure 1. S.V Data Format

Key: 1. approximately 600 ms (variable); 2. data segment; 3. approximately 100 ms (variable); 4. sync header; 5. file code; 6. infrared; 7. visible; 8. idle; 9. initial data; 10. data in the infrared channel; 11. error correcting code; 12. data in the visible channel

2.3 Unique Features of S.V

S.V has the following features which are important for data receiving and processing.

(1) The duration of each S.V frame is not fixed; it varies with the spin velocity of the satellite. The satellite has a spin velocity of 100 rpm with an error of plus or minus 1%; the corresponding frame duration is 600 ms plus or minus 1%. The sync code occupies a fixed duration of 500 ms; the remaining segment (100 ms) which varies in duration is used for initial data broadcast (approximately 44 ms) and for idle segments. The signal received by an S.V receiving system is intermittent; the maximum interrupt time is approximately 44 ms. Therefore, it is necessary to consider fast capture of the interrupted signal in the receiver design.

(2) The data rate is a constant (660 kbit/s); it does not vary with the satellite spin velocity. Hence it is difficult for the ground receiving station to deduce the spin velocity from bit clock information.

(3) Each picture element of the IR channel has 8 bits, whereas each picture element of the VIS channel has 6 bits. Therefore, it is necessary to take into account the different word clock speed of the IR and VIS channels in data separation and data processing.

(4) The data of the IR picture elements and the VIS picture elements are concentrated in different time segments; therefore, with respect to each IR or VIS frame, the data is always intermittent. Also, because S.V has variable frame duration, special treatment is required to create images on a drum-type facsimile machine.

(5) Each S.V frame contains a line for each of the three IR picture elements and four lines for the VIS picture elements. Each IR picture has 2,500 lines and each VIS picture has 10,000 lines. The S.V data provides one VIS picture and three IR pictures simultaneously; but the current GMS satellite has only one IR picture (IR_1)—IR_2 and IR_3 are used as backups. If two FAX machines are available, then both IR_1 and VIS pictures can be obtained simultaneously; if only one FAX is used, then synthesized processing is required to obtain the IR_1 and VIS pictures.

(6) S.V has large data capacity; each line on an IR picture has 2291 elements, and each line on a VIS picture has 9164 elements. The data capacity of each S.V frame is 2293+2293x3+9164x4=45.836 kbytes; the data capacity of a complete S.V is 45.836x2500=114.59 Mbytes.

(7) The S.V data segment of each picture element does not contain grid map information. The user must calculate the grid map by extracting position information from the file code.

3. S.V Data Receiving System

The S.V data receiving system consists of the antenna, the down-converter, the receiver, the bit synchronizer, the frame synchronizer, and the analog signal source, as shown in Fig. 2. It can be linked to any one of the three processing systems.

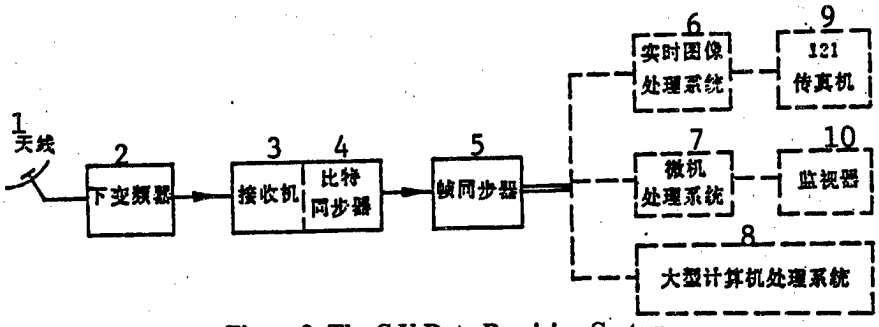

Figure 2. The S.V Data Receiving System

Key: 1. antenna; 2. down-converter; 3. receiver; 4. bit synchronizer; 5. frame synchronizer; 6. real-time image processing system; 7. microcomputer processing system; 8. mainframe computer processing system; 9. 121 facsimile machine; 10. monitor

The required G/T [figure of merit] of the receiving system is approximately 10 dB/K. By using a 4-6-m aperture antenna and a 1.5 dB-noise-figure preamplifier, it is possible to receive a high-quality picture with a bit error rate (BER) of less than 10^{-6}. Because of the diurnal motion of the satellite in a figure "8" pattern, it is desirable to have a small antenna aperture to produce a broader beam so that the satellite will always lie within the beamwidth over a 24-hour day. However, with a small aperture, the antenna gain is reduced; hence, an even smaller noise figure is required to ensure that the BER remains below 10^{-6}. The local oscillator of the down converter is made of a crystal frequency multiplier or a dielectric cavity oscillator; it requires high degree of frequency stability.

The receiver is a superheterodyne phase-locked receiver; it uses a Costas loop for phase-locked demodulation. The unique feature of the S.V receiver is that it must capture the signal quickly, because each frame of the S.V signal has an interrupt time of 44 ms.

The main functions of the frame synchronizer are: (1) to acquire the synchronization signal of each frame, remove the PN code in S.V, and invert every other 8 bits to recover the original code; (2) to separate the IR data, the VIS data and the file code data; (3) to send the data segment and the timing control signal in the form of parallel code to the processing systems; (4) to monitor BER; and (5) to separate the ephemeras of satellite motion and print it out on the printer.

The analog signal source can produce a frame of S.V IF and video-frequency signals for tuning purposes.

4. S.V Processing

In recent years, the SMC has developed three different processing systems, which will be described below.

4.1 Real-Time Image Processing System

The real-time image processing system developed by the SMC is shown in Fig. 3. The system uses specially designed hardware for processing S.V data without using a computer; it is simple, low-cost, and provides good real-time capability. Processing can be accomplished swiftly by an operator with no special training required; however, the processing functions are limited and rather inflexible. Such a system is suitable for receiving stations with limited financial and human resources and whose processing requirements are moderate. In particular, since S.V data are received once every hour, and the receiving time lasts 25 min, there is very little time available for processing; therefore, such a system can only perform routine processing tasks such as enlargement, enhancement, adding geographic grid lines, etc. This type of system has been implemented at 20-30 of China's receiving stations; they played an important role before the development of microcomputer processing systems. This was also the first system in this country capable of receiving and processing S.V data; it succeeded in receiving a clear picture of Japan's test S.V signal on the first day the signal was transmitted.

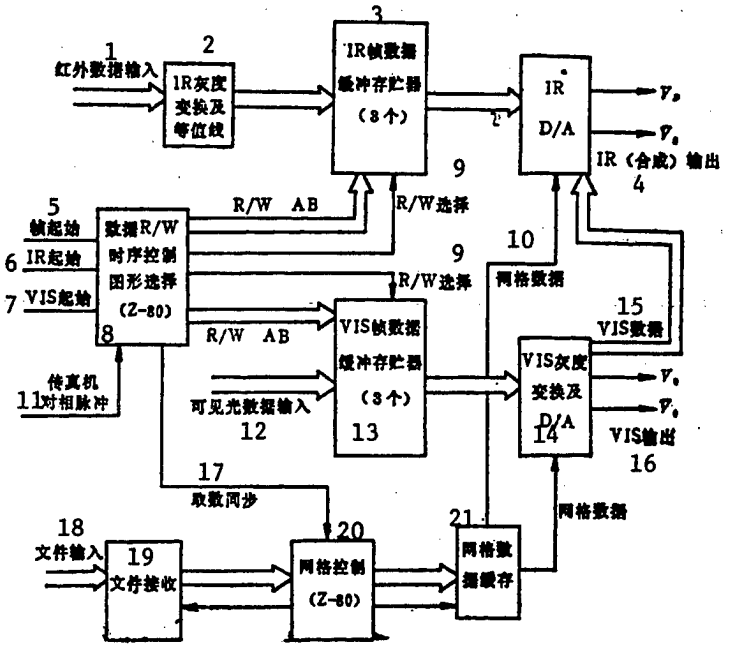

Figure 3. Real-Time Image Processing System

Key: 1. IR data input; 2. IR grey-scale conversion and contour lines; 3. IR frame data buffer (3); 4. IR (synthesized) output; 5. frame start; 6. IR start; 7. VIS start; 8. data R/W; time sequence control; graph selection (Z-80); 9. R/W selection; 10. grid data; 11. FAX machine phase-alignment pulse; 12. VIS data input; 13. VIS frame data buffer (3); 14. VIS grey-scale conversion and D/A; 15. VIS data; 16. VIS output; 17. data synchronization; 18. file input; 19. file reception; 20. grid control (Z-80); 21. grid data buffer

The main functions of the real-time image processing system are:

(1) Providing the interface between the frame synchronizer and the 121 facsimile machine. It allows the recording of constant-speed (100 lines per min) S.V pictures on a drum-type facsimile machine rotating at 400 rpm. This interface is the key for successful graph production on a facsimile machine; a bad interface will cause jitter or distortion in the picture.

(2) Performing simple processing tasks such as picture enhancement, enlargement (1/4 disk map), synthesized channel display, adding contour lines, etc. without using a computer. The synthesized channel display allows the facsimile machine to produce a picture containing half IR data and half VIS data.

(3) Superimposing map grids on the picture. The broadcast S.V data does not contain grid information; it must be calculated from the file code. By storing the precalculated grid file into an EPROM, it is possible to automatically calibrate the grid errors by comparing the latitude and longitude coordinates of a reference point with those contained in the file code. However, the accuracy of this method is rather limited because it can only correct for translational errors but not rotational errors; the result is that the position accuracy over the entire region may not be uniform. Furthermore, because of the inclined orbit of the satellite and its diurnal figure "8" motion, the position accuracy also depends on the time of day.

(4) Adding labels such as date, time and channel number on the picture.

4.2 Microcomputer Processing System

The S.V microcomputer processing system is shown in Fig. 4. The microcomputer is an IBM/PC 286 or 386 with an expanded memory of 2-3 Mbytes and a 70-150-Mbyte hard disk; it is equipped with a 80287 co-processor for increased speed, and EGA or VGA monitor and frame storage card with resolution of 640 x 350 and 640 x 480 respectively. The newly developed interface circuit provides real-time data reception and disk storage; it also provides real-time monitoring of cloud maps. The cloud map can be scrolled up and down on the color monitor to select an area of interest for post processing.

This processing system is strong in performance and moderate in price, which makes it quite affordable to local stations. Therefore, it is currently being used at more than 20 stations around the country, where it plays an important role in weather forecasting.

The main functions of this system are:

(1) S.V data input and pre-processing, which includes: reading the S.V data into disk storage according to the specified area, channel number and sampling rate, and creating a picture data file; extracting data files containing the satellite subpoint, constants for coordinate transformation, time and satellite ephemeras, and creating a file of longitude-latitude grid points at 5° and 1° intervals; and performing quality checks and processing of parameters transmitted by the satellite.

(2) Image processing, which includes enhancement, enlargement, generating histogram statistics and contour lines, noise filtering, smoothing, artificial coloring, adding temperature or albedo scales, and adding notations and captions.

(3) Positioning, which includes superimposing 5° or 1° geographic grids on the cloud map, generating political boundaries, coastal lines and rivers, applying corrections to the positions and performing coordinate transformations.

(4) Plot generation, which includes plotting and displaying 8-frame, 16-frame or 24-frame pictures with different resolutions.

(5) Routine data processing and display, which includes displaying the input data, performing data analysis,

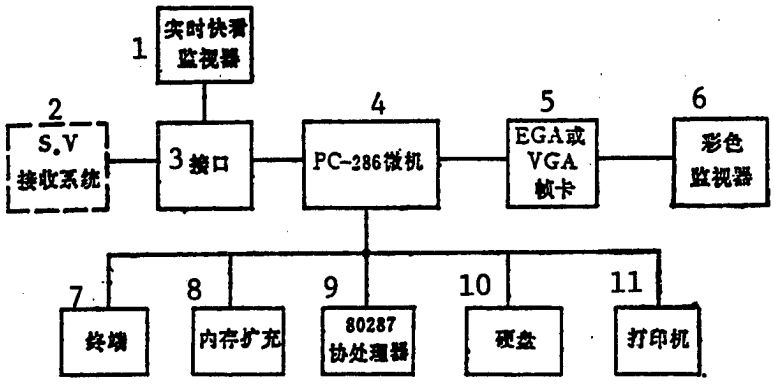

Figure 4. S.V Microcomputer Processing System

Key: 1. real-time quick-look monitor; 2. S.V receiving system; 3. interface; 4. PC 286 microcomputer; 5. EGA or VGA card; 6. color monitor; 7. terminal; 8. expanded storage; 9. 80287 co-processor; 10. hard disk; 11. printer

calculating the physical parameters and generating contour lines based on the node values in the data base.

(6) Superimposing routine weather data and TOVS [Tiros Operational Vertical Sounder] data on the cloud map.

(7) Other applications software, which include software for calculating the temperature or albedo at any point on the picture, displaying the position, time and path of a typhoon and calculating its speed and direction, determining the distance between any two points, and displaying positions or flight paths on the graph.

4.3 Mainframe Computer Processing System

The IBM computer processing system of the SMC was originally designed to process data from the FY-1 weather satellite. Since Japan began broadcasting S.V, the system was also used for S.V processing. Fig. 5 shows the overall configuration of the system, whose central element is the IBM 4381 computer; it performs the functions of data separation, area selection and projection transformation, and sends the data to the user for further processing. Such a configuration takes full advantage of the high processing speed and large memory capacity of a mainframe computer, and transmits the edited data to the user, who can then perform additional processing according to his specific needs.

The data from the frame synchronizer of the receiving system is sent to the S/I computer, which serves as an input interface unit for the 4381 computer; it also sends the data to the PC/AT (equipped with the FG-151 image processor), where notations, maps and grids (low-accuracy grids) are added to the pictures of cloud maps for broadcast by the Central Television Station. If the projection-transformed data are sent back to the S/I computer and then to the PC/AT, then the user will have access to projection-transformed cloud maps. Such cloud maps are expected to be broadcast by the Central Television Station in the near future.

The basic functions of the 4381 computer are:

(1) Data separation. The 115-Mbyte disk map is divided into four VIS files and one IR file.

(2) Area selection. The full-disk map is divided into areas with three different scales (512x512, 1024x1024, 1024x1536); the sampling rates for these areas are 1:1, 1:2 and 1:5 respectively.

(3) Projection transformation. It provides transformed data using either Lambert projection or Mercator projection. The time-consuming task of projection transformation can best be carried out by a mainframe computer to conserve computing time on the user's microcomputer.

The edited cloud map is sent to another S/I computer to control a storage transponder, which converts the data to a FAX-compatible signal and sends it to the 121 FAX machine at the Beijing Meteorological Center to produce a hard-copy picture.

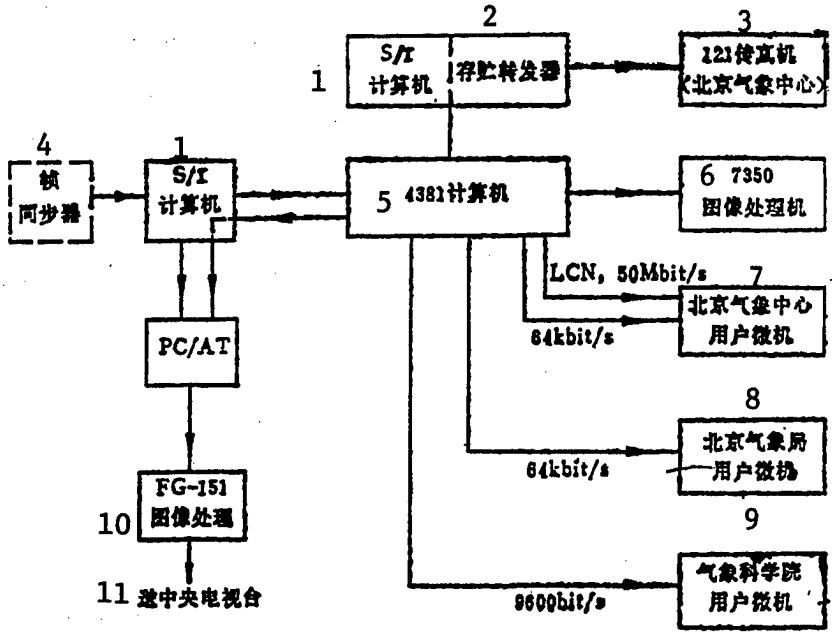

Figure 5. IBM Mainframe Computer Processing System

Key: 1. S/I computer; 2. storage transponder; 3. 121 FAX machine (Beijing Meteorological Center); 4. frame synchronizer; 5. 4381 computer; 6. 7350 image processor; 7. user microcomputer at the Beijing Meteorological Center; 8. user microcomputer at the Beijing Weather Bureau; 9. user microcomputer at the Meteorological Institute; 10. FG-151 image processor; 11. to Central Television Station

The cloud map is also transmitted to the user's microcomputer processing systems at the Beijing Meteorological Center and the Beijing Weather Bureau via two 64-kbit/s lines and to the user's microcomputer processing system at the Meteorological Institute via a 9600-bit/s line. These systems perform the user-required processing functions including image processing, positioning, plot generation, etc.; their functions are similar to those of the microcomputer processing systems described earlier. The user can request data at different sampling rates for his area of interest. The processing software of the user's microcomputer systems are all provided by the SMC. The microcomputer processing system at the Beijing Meteorological Center is also linked to the 4381 computer via an LCN network; the acquisition time for a 512x512 picture is less than 1 second.

The edited cloud map is also sent to the 7350 image processor at the SMC to perform various image-processing functions.

The main advantages of using a 4381 computer for editing the data before sending it to the user microcomputer system are as follows:

(1) It has a sufficiently large memory capacity for storing a 24-hour disk map which can be easily accessed by the user.

(2) It can process data from a wide area with a great deal of flexibility.

(3) It provides higher processing speed; for example, it takes 0.5 hour to edit the data and perform projection transformation on the 386 microcomputer, but only 1 min on the 4381 computer.

(4) It can be connected to a tape drive for easy data storage.

(5) The edited data can be shared by a large number of users; the user can save considerable computer time because the time-consuming tasks of editing and projection transformation are performed by the 4381 computer.

Of course, the disadvantage of linking multiple-user computers is that a failure in the 4381 computer will affect a large number of users.

5. Concluding Remarks

The GMS is China's most important information source for monitoring typhoons and severe rain storms at the present time and for the foreseeable future. The FY-2 meteorological satellite to be launched in the mid 1990s will have S.V data which are compatible with those of the GMS except for the transmitting frequency. Once the FY-2 satellite is launched, the user can receive and process S.V data from both satellites by simply changing the receiving frequency and the antenna orientation. Therefore, China will receive, process and use S.V data for a long time to come.

The S.V receiving and processing system which we developed in recent years can meet different levels of user requirements. The microcomputer processing system is particularly welcome at many local stations. With the continuing development of microcomputers and workstations, further progress will undoubtedly be made in S.V processing and applications.

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Robust Self-Tuning Guidance Law for Tactical Missile, Realization With Single-Chip Microcomputer

92FE0852A Beijing YUHANG XUEBAO [JOURNAL OF CHINESE SOCIETY OF ASTRONAUTICS] in Chinese No 3, Jul 92 pp 13-18

[Article by Zhang Zhiyong [1728 1807 0516], Wang Shimi [3769 6108 1348], and Fang Chongzhi [2455 1504 2535] of Qinghua University and Kang Jingli [1660 2529 0448] of Beijing Institute of Technology: "Robust Self-Tuning Guidance Law for Tactical Missile, Its Realization With Single-Chip Microcomputer"; MS received 5 Mar 91]

[Excerpts] **Abstract:** In this paper, a new guidance law—robust self-tuning guidance law (RSTGL)—for tactical missile is presented. In the RSTGL, the high-order, non-linear mathematical model of a tactical missile is reduced to an equivalent low-order, linear time-varying model. On the basis of this equivalent model, a time-varying parameter identification technique and robust self-tuning guidance algorithm have been developed. Simulation results show that the RSTGL provides good performance in terms of hit accuracy and interference-rejection capability; in addition, the simple structure of the algorithm makes it easy for practical implementation. This paper also discusses some problems associated with the realization of the guidance system using single-chip microcomputers.

I. Introduction

The guidance problem for tactical missiles is a complicated control problem. With increasing complexity of the combat environment and the enhanced self-defense capability of the target in terms of hardness and mobility, increasing requirements are imposed on the

guidance system. Since the 1970's when modern control theory was applied in the design of missile guidance systems, optimum guidance laws[1] and adaptive guidance laws using reference models[2] have been proposed; the accuracies of these new guidance techniques are significantly higher than those of classical guidance methods. In the current guidance laws, the mathematical models used to describe the tactical missile are mostly represented by state-space equations which are effective tools for analyzing missile dynamics. But they cannot be used directly in the design of robust control systems because it is necessary to measure intermediate variables and to estimate the model parameters in real time.

In order to overcome this difficulty, a RSTGL based on the theory of adaptive control is proposed. The main feature of this approach is to describe the guidance system by an input-output model whose parameters are estimated continuously from the measured input and output data during flight; the estimated parameters are then used to construct a self-tuning controller.[3] Because of rapid changes in the missile dynamics and the mobility of the target, the model parameters of the guidance system are rapidly time-varying. Therefore, the success of this technique depends on the development of an effective parameter identification algorithm in order to ensure the robustness of the control system. [passage omitted]

IV. Synthesis of the Guidance System and Realization With Single-Chip Microcomputer

In actual combat, both the missile and the target are traveling in three-dimensional space. For a tactical missile with four cross-shaped rudder fins, it is necessary to feed the input valve of the rudder drive mechanism with four separate control signals u^1_y, u^2_y, u^1_z, u^2_z. In order to synchronize these four signals with the input signals of the three-channel self-tuning controller, u_r, u_1, u_2, a control signal synthesizer is required. Based on the principle that two coplanar rudder fins can produce actions in the yaw or pitch directions when rotating in the same direction and action in the roll direction when rotating in opposite direction, the following signal synthesizer is chosen:

$$\begin{cases} u^1_z = u_1 + 0.5u_r \\ u^2_z = u_1 - 0.5u_r \\ u^1_y = u_2 + 0.5u_r \\ u^2_y = u_2 - 0.5u_r \end{cases} \tag{19}$$

where the limits of u_r, u_1, u_2 are chosen to be +/- 5V.

The single-chip microcomputer has many desirable features such as small size, low cost, high performance and high reliability, and is being increasingly used in the aerospace industry. The 8098 single-chip microprocessor[10] is a high-performance very-large-scale integrated (VLSI) circuit developed by the INTEL Corp. following the 8048 and 8051 chips. It uses a 16-bit internal data bus and a 232-byte memory chip which can be used as an accumulator to enhance computing speed; it also has an 8-bit external data bus which is compatible with external storage devices. In particular, it has four 10-bit A/D converters with the sample-and-hold feature, thus minimizing the number of components external to the chip and the space for the print boards. Figure 3 shows a block diagram of the 8098 single-chip microprocessor used in a space guidance system. The 8098 is connected to a 16K EPROM 27128 chip and a 32K RAM 62256 chip; it has a total of 48K storage space and four expanded D/A output ports via the I/O port.

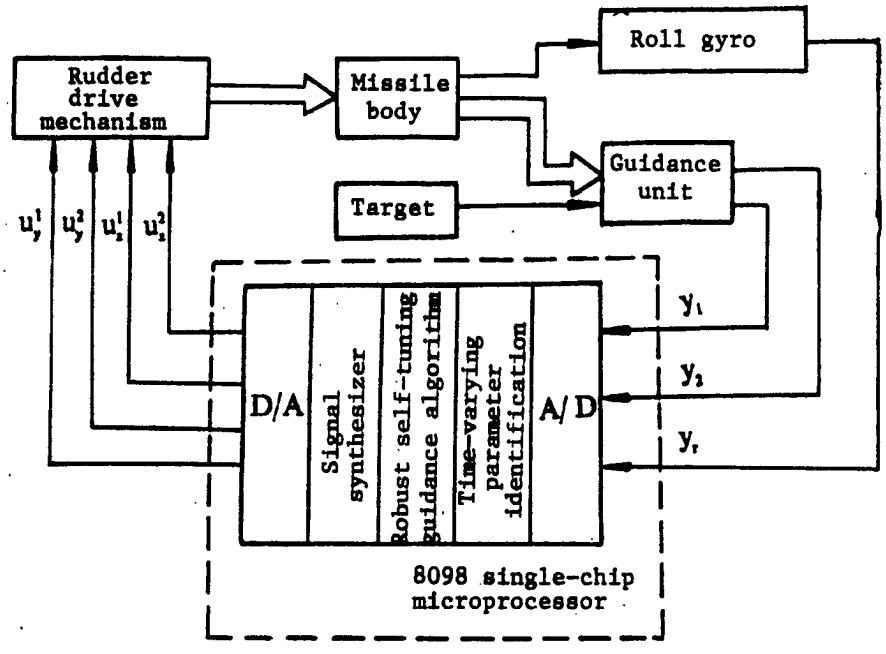

Figure 3. Block Diagram of a Space Guidance System

V. Conclusion

In this paper, a new guidance law for tactical missiles is proposed where the high-order, non-linear mathematical model of the missile is reduced to an equivalent low-order time-varying model. This equivalent model has fewer intermediate variables and leads to simpler hardware design of the guidance system; the critical issue of the new system involves identification of time-varying parameters and improving the robustness of the controller. For rapidly time-varying parameters, it is necessary to design an identification algorithm with fast convergence; this is accomplished by expressing the parameter to be a linear function of time and developing an algorithm with fading-memory RLS and reset covariance matrices; this algorithm is effective in tracking rapidly varying parameters and ensures the adaptability and robustness of the self-tuning guidance system. These features have been verified by computer simulations.

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Accuracy Analysis of Image-Matching Guidance Systems

92FE0852B Beijing YUHANG XUEBAO [JOURNAL OF CHINESE SOCIETY OF ASTRONAUTICS] in Chinese No 3, Jul 92 pp 19-23

[Article by Su Kang [5685], Guan Shiyi [7070 0013 0034], and Chu Weili [7110 3262 5461] of the No. 3 Institute, Ministry of Aerospace Industry: "Accuracy Analysis of Image-Matching Guidance Systems"; MS received 21 Aug 91]

[Excerpts] **Abstract:** In this paper, a mathematical expression for analyzing the accuracy of image-matching guidance systems is derived from an associated model of the system. An analysis of the major factors affecting accuracy is also presented. The validity and feasibility of the analysis method have been verified by computer simulations. The main contribution of this paper is to provide the theoretical basis and an effective method for accuracy analysis of image-matching guidance systems.

I. Introduction

Image-matching guidance technique is a precision guidance technique developed within the past 30 years; it is one of the key techniques used in composite navigation. In practical applications however, the accuracy of an image-matching guidance system is often degraded by the effects of noise and geometric distortions. Because of the complexity of the factors affecting system accuracy, accuracy analysis of the image-matching guidance system has always been a difficult problem. In this paper, a mathematical expression for the system accuracy which takes into account the effects of noise and geometric distortion has been derived from an associated model of the system; an analysis of the factors affecting system accuracy is presented. In addition, computer simulation results which verify the validity and feasibility of the method are also given. [passage omitted]

Substituting equations (20), (21), and (22) into equation (15), one obtains

$$E[(\hat{m}-\bar{m})^2] \approx \frac{L_0 d^3}{\rho^2 SNR \cdot Area} + \frac{\pi(1-\rho^2)L_0^2 d^2}{4\rho^2 Area} \qquad (23)$$

Similarly, one can derive an expression for E[(n estimated value - $\bar{n}$)^2]; the result is the same as that of equation (23).

Under the condition of one-dimensional single measurement and no geometric distortion, i.e., $\rho = 1$, Area = d^2, equation (23) can be simplified, and an expression for the circular error probable (CEP) can be derived by invoking the relationship between CEP and lateral and longitudinal errors:

$$CEP = 0.589\left[\sqrt{E[(\hat{m}-\bar{m})^2]} + \sqrt{E[(\hat{n}-\bar{n})^2]}\right] \approx \frac{1.18\sqrt{L_0 d}}{\sqrt{SNR}} \quad (24)$$

In equations (23) and (24), L_0 is the correlation length, d is the half-power-point width of the spatial filter H(x,y) (sensor resolution function), SNR is the signal-to-noise ratio, Area is the effective area of the image, and ρ is the geometric distortion factor.

From equations (23) and (24), one can draw the following conclusions:

1. A higher signal-to-noise ratio yields higher system accuracy, and vice versa.

2. A larger effective area yields higher system accuracy, and vice versa.

3. A smaller relative distortion yields higher system accuracy, and vice versa.

4. A smaller correlation length, which causes larger variation in the image signal and produces images with more pronounced features, leads to higher system accuracy, and vice versa.

5. A smaller d, which implies better selectivity of the spatial filter H(x,y) and better noise suppression, leads to higher system accuracy, and vice versa.

IV. System Simulation Results

Computer simulations of two digital maps with grid sizes of 100 x 100 m^2 and 200 x 200 m^2 and frame sizes of 50 x 1800 and 50 x 200 respectively have been carried out; the simulation results and theoretical results are shown in Figure 1 and Figure 2. The solid curves in the figures represent simulation results and the dashed curves represent theoretical results. Comparison of the two curves shows that the theoretical results are in good agreement with simulation results, particularly under high SNR conditions. These results not only validate the theoretical analysis but also show that the method of accuracy analysis has practical engineering applications.

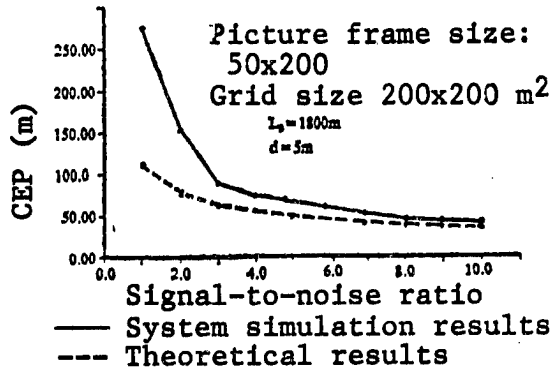

Figure 1. Theoretical and Simulation Results

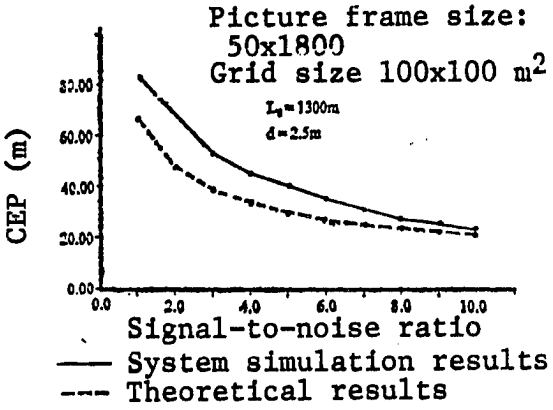

Figure 2. Theoretical and Simulation Results

V. Conclusion

Both theoretical results and simulation results show that the effects of signal-to-noise ratio, geometric distortion, correlation length of the image signal, the half-power-point width of the spatial filter (sensor resolution function) and the effective area of the image are important factors which affect system accuracy. The effects of geometric distortion and effective image area can be classified as the noise effect on system accuracy, whereas the effects of correlation length and the half-power-point width of the spatial filter can be classified as the system's ability to suppress noise. Therefore, to achieve high system accuracy in practice requires careful selection of the system parameters and taking other measures to reduce the system noise level and to improve the system's noise suppression ability. The analysis results presented in this paper provide the theoretical basis and an effective method for analyzing the accuracy of image-matching guidance systems and for designing high-performance image-matching guidance systems.

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Minimum-Fuel Coplanar Orbit Transfers With Finite Thrust

92FE0852C Beijing YUHANG XUEBAO [JOURNAL OF CHINESE SOCIETY OF ASTRONAUTICS] in Chinese No 3, Jul 92 pp 24-31

[Article by Wang Mingchun [3769 2494 2504], Jing Wuxing [5427 2976 5281], Yang Di [2799 3321], and Wu Yaohua [0702 3852 5478] of Harbin Institute of Technology: "Minimum-Fuel Coplanar Orbit Transfers With Finite Thrust"; MS received 17 Apr 91]

[Excerpts] **Abstract:** In this paper, an analysis of the problem of minimum-fuel coplanar orbit transfer of space vehicles with finite thrust is presented. The analysis is based on the application of the Pontryagin maximum-value principle to derive conditions for optimum transfer orbit and optimum controls. In order to overcome the difficulties associated with the adjoint variables in solving two-point boundary-value problems, a non-linear programming method which avoids the direct use of transversality conditions has been introduced. In this method, the initial value of the adjoint variable is replaced by the initial value of the control variable by applying the "adjoint-control transformation"; this provides physical meaning to the starting value of the iteration process and facilitates its selection. A numerical example based on this approach is presented.

I. Introduction

The problem of orbit maneuvers is an important topic in orbital dynamics and control of space vehicles. It is often necessary for a space vehicle, e.g., a space plane, an interplanetary spaceship, an orbit maneuvering motor, or an orbit transfer vehicle, to change its orbit in order to mate with other space vehicles such as satellites, space platforms, space stations, etc., or to carry out its mission such as assembling space stations, transporting astronauts and materials, or space rescue and surveillance. Since the 1950's, the United States and the Soviet Union have devoted a great deal of research effort in this area. Early studies were focused on the simple analytical technique of impulse orbit transfer. This technique represents an engineering approximation where it is assumed that the orbit elements can be changed by an instantaneous velocity increment produced by an infinite thrust acting over a very short duration. In practice, however, the engine thrust in most cases cannot be approximated by an impulse, and finite thrust must be considered. With the development of the aerospace industry, the low-thrust engine is playing an increasingly important role because of its small size and its multiple ignition capability. Therefore, the analysis and design of orbit transfer maneuvers under the action of finite thrust has become a problem of great interest.

The unique feature of orbit transfer with finite thrust is that the force acts continuously over a finite arc along the orbit. The thrust direction can vary according to a certain rule or can be any continuous function of time.

In this analysis, it is assumed that the space vehicle is under a central gravitational force field with no disturbances, and the orbit transfer takes place in a plane; the initial orbit and the target orbit are both Keplerian orbits. The engine thrust is assumed to be a constant, and the thrust direction, which is the control variable, is assumed to be a continuous function of time. The ignition point and cut-off point of the engine are parameters to be optimized.

As shown in Figure 1:

ω is the position angle of the elliptical orbit in space;

θ is the position of the space vehicle along its orbit;

μ is the angle between the thrust vector and the normal velocity;

ψ is the thrust direction, which is any continuous function of time.

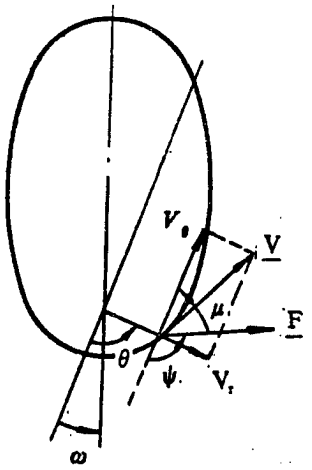

Figure 1. Definition of Angles

In the case of orbit transfer from one elliptical orbit to another elliptical orbit, as shown in Figure 2, one can consider the following four situations:[2]

1. $r_{11} = r_{12}$, $\omega_2 = \omega_1$.
2. $r_{11} = r_{12}$, ω_2 free.
3. r_{12} free, $\omega_2 = \omega_1$.
4. r_{12} free, ω_2 free.

Where r_{11} is the perigee of the initial orbit, r_{21} is the apogee of the initial orbit; r_{12} is the perigee of the target orbit, r_{22} is the apogee of the target orbit; ω_1 is the line-of-apsides angle of the initial orbit, and ω_2 is the line-of-apsides angle of the target orbit.

The problem is reduced to the following optimum control problem: given the state equations of the system, determine the optimum control u (or ψ) so that the performance index J is minimized while satisfying the associated constraint conditions. The initial value and final value of the independent variable θ are both free, but the initial state and final state are constrained.

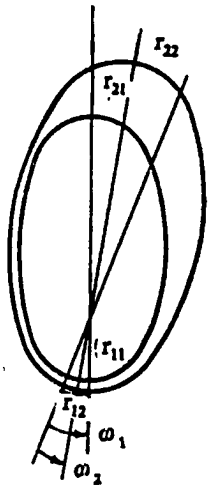

Figure 2. Definition of Perigee and Apogee of Elliptical Orbit

This is a complicated optimum control problem which cannot be solved analytically because of the highly nonlinear system equations. In this paper, the Pontryagin maximum-value principle is applied to derive the conditions of optimum orbit transfer and optimum control, and numerical solution of the control problem is obtained. Generally, the optimum control problem is reduced to a two-point boundary-value problem; while this approach has been quite successful, it has certain shortcomings.[3,4]

1. It is difficult to treat the end conditions and the transversality condition, and they are problem-dependent.

2. Since the adjoint variable in general has no clear physical meaning, it is difficult to choose an appropriate starting value for the iteration procedure. Similarly, since there is no clearly defined quantitative relationship between the adjoint variable and the problem of interest, it is difficult to choose a proper scale to carry out the computations.

To overcome these difficulties, we have proposed a nonlinear programming method where direct use of the transversality condition is avoided. We have also introduced an "adjoint-control transformation" which allows one to use the initial value of the control variable as the starting value for the iteration procedure. The effectiveness of the proposed method is illustrated by a practical example. [passage omitted]

V. A Practical Example

Consider a 5,000-kg space vehicle undergoing an orbit transfer maneuver from a 500-km circular orbit to an elliptical orbit whose perigee is 500 km and whose apogee is 1,000 km.

Assume the thrust to be F = 1,500 Newtons and the nozzle velocity to be C = 3,000 m/sec.

The initial values are chosen to be as follows:

$\theta_1 = -0.2$ radian, $\theta_2 = 0.2$ radian

$\psi_1 = \pi/2$ ($u_1 = \pi/2 + \theta_1 - \psi_1 = \theta_1$)

$\psi[dot]_1 = 0$ ($u'_1 = 1 - \psi'_2 = 1$)

From calculations, we obtain:

Optimum engine ignition point $\theta_1 = -0.09996$ radian

Optimum engine cut-off point $\theta_2 = 0.3648358$ radian

Duration of orbit transfer T = 333.0 sec

Fuel consumption mf = 166.5 kg.

The discrete values of the optimum thrust direction ψ relative to the angle θ are shown in Table 1.

Table 1. Discrete Values of Optimum Thrust Direction ψ Relative to θ (unit: radians)

N	1	2	3	4
θ	-0.0999600	-0.0754971	-0.0510341	-0.0265712
ψ	1.1874000	1.2107290	1.2342110	1.2578530
N	5	6	7	8
θ	-0.0021083	0.0223547	0.0468176	0.0712805
ψ	1.2816640	1.3056540	1.3298300	1.3542020
N	9	10	11	12
θ	0.0957435	0.1201064	0.1446695	0.1691323
ψ	1.3787790	1.4035710	1.4285880	1.4538400
N	13	14	15	16
θ	0.1935952	0.2180582	0.2425211	0.2669840
ψ	1.4793370	1.5050890	1.5311060	1.5574000
N	17	18	19	20
θ	0.2914470	0.3159099	0.3043728	0.3648358
ψ	1.5839790	1.6108550	1.6380380	1.6655370

Concluding Remarks

In this paper, the Pontryagin maximum-value principle is applied in the analysis and design of minimum-fuel coplanar orbit transfers; the main purpose of this work is to provide a theoretical basis for orbit-transfer maneuvers using finite-thrust engines. The key to solving the finite-thrust orbit transfer problem is to reduce it to an optimum control problem and to develop a numerical technique for carrying out the optimization procedure. The approach presented in this paper which combines the Pontryagin maximum-value principle and dynamic programming method has proved to be a successful one.

However, there are still many topics that require further research in the area of finite-thrust orbit transfer:

1. Multiple ignitions, i.e., applying thrust along multiple arcs of the orbit.

Based on the results of single-arc orbit transfer, one can introduce a switching function which is related to the optimum control conditions to control the optimum number of ignitions and the optimum ignition arcs. Such an approach will produce significantly improved performance results for low-thrust engines.

2. Three-dimensional orbit transfer.

By establishing a dynamic model of the space vehicle in orbit-element coordinates, it is possible to combine the orbit elements with spatial positions and derive convenient expressions for various orbit maneuvers. This technique can be used in both single-arc and multiple-arc orbit transfers.

The analysis method and optimization procedure presented in this paper can be readily applied to the above problems.

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8 mm Varactor Diode Up-Convertor

40100002A Beijing TONGXIN XUEBAO [JOURNAL OF CHINA INSTITUTE OF COMMUNICATIONS] in Chinese Vol 13 No 4, Jul 92 pp 93-95

[Article by Deng Shaofan and Qiu Jinghui, (Harbin Institute of Technology), (MS received 23 Nov 90)]

[Abstract] A new-structure, high-performance 8 mm sum-frequency up-convertor is described in this paper. The convertor consists of double-ridge waveguide, cross-beam structure and low-loss varactor diode. The convertor operates over X-band, K-band and Ka-band. The conversion loss measured is as little as 2.9 dB at sum frequency of 35 GHz, as well as bandwidth over 500 MHz. Variation difference between output and input signals is 0.08 dB when variation of signal equals 33 dB. The maximum output power of sum-frequency signal is 1.34 mW. There is no stray frequency observed during the experiment as the sum-frequency signal extent exceeds 30 dB. Testing results show that the design of this up-convertor realizes to convert X-band signal linearly to Ka-band signal.

Multi-Element Oxide Ceramic Nanoparticles Fabricated

93P60018A Beijing ZHONGGUO KEXUE BAO [CHINESE SCIENCE NEWS] in Chinese 1 Sep 92 p 2

[Article by Tao Mingde [7118 2494 1795]: "China Develops Multi-Element Oxide Ceramic Nanometer Materials"]

[Summary] The CAS Xinjiang Institute of Physics has announced a breakthrough in the leading-edge area of nanometer materials research. Using spray thermal decomposition and sol-gel techniques, the CAS scientists have fabricated CoMnNiO superfine particles with a granularity of 3-4 nm and MnCoNiO nanometer thin films with a granularity of 15-50 nm and a thickness of 5,000-8,000 Angstroms. These thin films, with a B value of 3,200K and a uniformity of 0.2 percent, can be directly used to fabricate high-uniformity thermal sensitive devices such as millisecond-response-time temperature sensors.

Structure Study of Nanometer-Size Crystalline Ti Films

40100001A Beijing WULI XUEBAO [ACTA PHYSICA SINICA] in Chinese Vol 41 No 7, Jul 92 pp 1132-1136

[Article by Wu Xuemei, Department of Physics, Suzhou University, Suzhou 215006, Wu Qinchong and Sui Yifeng, Institute of Plasma Physics, CAS, Hefei 230031, (MS received 8 Jul 91)]

[Abstract] Nanometer-size crystalline Ti films have been manufactured by use of a sputtering deposition utilizing Electron Cyclotron Resonance (ECR) plasma at room temperature. The substrates are quartz glass, NaCl monocrystal and pure Al. The structure and the composition of the Ti films have been determined by using XRD, TEM, and XPS. The results show that the granular Ti films consist of nanocrystal particles with the uniform grain size, the average grain size d<10nm, and with a stable abnormal fee structure. The influence of working parameters on the crystal structure, the gain size, deposition rate and adhesion of the films has been studied systematically. The mechanism of depositing Ti films has been discussed.

Vacuum Heat Treatment Oven, Powder Metallurgy Bearing Material Certified

93P60024A Beijing ZHONGGUO DIANZI BAO [CHINA ELECTRONICS NEWS] in Chinese 14 Sep 92 p 3

[Article by Zhang Shengyi [1728 3932 5030]: "MMEI's Technology Institute Develops Two New Technologies"]

[Summary] The "ZZG-250 vacuum heat treatment oven" and "powder metallurgy lead (Pb) 25-5 bearing material and manufacturing technique" developed by MMEI's Technology Institute [i.e., Institute 2] have passed the technical appraisal organized by the Shanxi Province Defense Science, Technology and Industry Office. The vacuum heat treatment oven has demonstrated in trials to be stable, reliable, and easy to operate in industrial environments. The new powder metallurgy Pb bearing material and manufacturing technique has raised the accuracy of part blanks, permitting an increase in part usability from 60 percent to 90 percent.

6-Inch-Diameter Silicon Monocrystals Developed

93P60024B Beijing RENMIN RIBAO [PEOPLE'S DAILY OVERSEAS EDITION] in Chinese 5 Oct 92 p 1

[Article by Zhang Pingli [1728 1627 0500]: "Large-Diameter Silicon Monocrystals Successfully Drawn for First Time"]

[Summary] The nation's first 150-mm-diameter (6-inch), 32-kilogram large-diameter direct-draw silicon monocrystals were recently developed by the State Semiconductor Materials Engineering & Research Center of Beijing's China General Research Institute of Nonferrous Metals. All main performance indicators for these crystals meet international standards for this type of product. This breakthrough advance represents a major step forward for the domestic development and manufacturing of micron and sub-micron VLSI circuits.

Cubic Boron Nitride Thin Film Developed

93P60018B Beijing ZHONGGUO KEXUE BAO [CHINESE SCIENCE NEWS] in Chinese 11 Sep 92 p 1

[Article by Wang Lichao [3769 4539 2600]: "New Synthetic Material: Cubic Boron Nitride Thin Film Developed"]

[Summary] Scientists at the CAS Lanzhou Institute of Chemical Physics and at Lanzhou University's Physics Department have developed a new artificial synthetic material—cubic boron nitride thin film fabricated from 100-micron monocrystalline particles. This "new diamond thin film," which passed technical appraisal on 6 August in Lanzhou, has numerous advantageous electrical, optical, mechanical, thermal, and chemical properties, including resistance to high temperatures and radiation. Applications include abrasion-resistant surface coatings for superhard cutting tools, gears, and bearings; electronic components for spacecraft and nuclear reflecting equipment; and LSI circuits for high-temperature (1,000°C-plus) engines.

Study on the High-Temperature Oxidation Resistance of SiC Whisker-Reinforced AlN Composite

40100004A Beijing GUISUANYAN XUEBAO [JOURNAL OF THE CHINESE CERAMIC SOCIETY] in Chinese Vol 20 No 3, Jun 92 pp 212-217

[English abstract of article by Li Ningfang, Dai Ying, Zhou Yi and Pei Xinmei, (Department of Materials Engineering, Wuhan University of Technology), (MS received 9 Jan 91)]

[Text] The isothermal oxidation behaviour of AlN (Y_2O_3), AlN (Y_2O_3)-SiC_w material obtained by hot-pressing at 1300°C is studied. Phase composition, microstructure and mechanical properties of oxidized samples are investigated by XRD, SEM, EPMA and TEM/EDSA. It is found that two samples are oxidized in a parabolic manner for weight gain curves and the composites have better resistance against high-temperature oxidation than the monolithic ceramics. The mechanism of oxidation of AlN-SiC_w composites is proposed in the paper.

Study on High-Temperature Stability of SiC_w/ZTM Composites

40100004B Beijing GUISUANYAN XUEBAO [JOURNAL OF THE CHINESE CERAMIC SOCIETY] in Chinese Vol 20 No 3, Jun 92 pp 218-222

[English abstract of article by Yang Zhengfang, Wang Shuqiang, Tan Jiaqi and Yuan Qiming, (Department of Materials Science and Engineering, Tianjin University), (Project supported by grant from NSFC; MS received 10 Jan 91)]

[Text] The high-temperature stability and the changes in microstructures of ZTM-20vol.% SiC_w composites are studied. Experimental results show that the effect of short-time heat treatment at high temperature in air on the mechanical properties of the composites is negligible, although the fact that the oxidation of the SiC whiskers occurred during the heat treatment is verified by the measurement of resistivity of the samples at room temperature. However, when aging the composites at 1100°C for 100h in air, a compound with low melting point, i.e., $NaAlSi_3O_8$, appears in the surface layer of the samples, which results in obvious changes in microstructure between the interior and the oxidation layer of the heat-treated samples. The cause for the formation of the compound is believed to be related to the oxidation of SiC whiskers and the impurities in the ZTM matrix.

Toughening Mechanism and Mechanical Properties of SiC_w/Y-TZP Composites

40100004C Beijing GUISUANYAN XUEBAO [JOURNAL OF THE CHINESE CERAMIC SOCIETY] in Chinese Vol 20 No 3, Jun 92 pp 223-229

[English abstract of article by Shen Zhijian, Li Tingkai, and Ding Zishang, (Department of Materials Science and Engineering, Zhejiang University), (Project supported by grants from NSFC and CAS; MS received 3 Dec 90)]

[Text] The microstructure and mechanical properties of SiC-whisker-reinforced Y-TZP matrix composites have been studied. The effects of the stability of zirconia and the properties of whisker, matrix and interface on toughening characteristics have been discussed. The results show that the synergistic toughening of whisker reinforcement and transformation toughening can be obtained by carefully controlling the degrees of stabilization of zirconia and selecting the suitable whiskers. The prepared 5 vol.% SiC_w/2.2Y-TZP composite has fairly high fracture strength (1130 MPa) and toughness (19.1 $MPa.m^{1/2}$) at room temperature.

Stress-Strain Character of Ce-TZP Ceramics Under Compression

40100004D Beijing GUISUANYAN XUEBAO [JOURNAL OF THE CHINESE CERAMIC SOCIETY] in Chinese Vol 20 No 3, Jun 92 pp 230-236

[English abstract of article by Sun Qingping, Si Wenjie, Huang Yong and Jiang Zuozhao, (Department of Materials Science and Engineering, Qinghua University), (Project supported by grant from NSFC; MS received 24 Jan 91)]

[Text] The ferroelastic and pseudoelastic toughening mechanisms in 12mol% Ce-TZP+10wt%Al_2O_3 ceramics have been investigated by a macro-micro combined approach. The pseudoelastic behavior of the material during loading and unloading cycles has been found for the first time at room temperature and the corresponding reversible martensitic transformation mechanism has been verified. The existence of reversible ferroelastic domain switching mechanism at room temperature is discussed. Finally the toughening effects of these two mechanisms are analyzed and a formula for pseudoelastic toughening calculation is proposed.

Preparation of Superfine Fiber by Vacuum Arc Plasma Jet Method

40100004E Beijing GUISUANYAN XUEBAO [JOURNAL OF THE CHINESE CERAMIC SOCIETY] in Chinese Vol 20 No 3, Jun 92 pp 237-240

[English abstract of article by Lin Chenfu, Qian Shengwei, Yu Bing, Wei Wenduo and Wen Lishi, (Institute of Metal Research, Chinese Academy of Sciences), (MS received 6 Jul 91)]

[Text] Superfine fiber [1 μm length, 10 nm average diameter] of Si+SiO_2 or Si+Si_3N_4 is prepared by vacuum arc plasma jet method. The influences of surface effect of superfine particle, plasma jet sintering action, reaction gas and deposition temperature field of superfine fiber on the process of superfine particle growth with different agglomerated forms are discussed.

Self-Propagating High-Temperature Synthesis of Silicon Nitride Powder in Pressurized Nitrogen Atmosphere

40100004F Beijing GUISUANYAN XUEBAO [JOURNAL OF THE CHINESE CERAMIC SOCIETY] in Chinese Vol 20 No 3, Jun 92 pp 241-247

[English abstract of article by Zhang Baolin, Zhuang Hanrui and Fu Xiren, (Shanghai Institute of Ceramics,

Chinese Academy of Sciences), (Project supported by grant from NSFC; MS received 10 Sep 91)]

[Text] The self-propagating high-temperature synthesis of silicon nitride powder under pressurized nitrogen has been studied. It is found that silicon powder can be completely nitrided during combustion reaction. The product obtained is pure β-phase Si_3N_4 with high nitrogen and low oxygen content. An appropriate amount of Si_3N_4 added is indispensable to the synthesis. The wave propagation rate of combustion reaction increases with the nitrogen pressure and decreases with the increase of the packing density of reactants, and is not affected by the vessel diameter and composition of the raw materials. The maximum combustion temperature increases with nitrogen pressure and vessel diameter, and is not dependent on the composition and packing density of the raw materials. The relationship between the combustion parameters and the morphology of powder synthesized is also studied.

State-of-Art of Nanocrystalline Ceramics

40100004G Beijing GUISUANYAN XUEBAO [JOURNAL OF THE CHINESE CERAMIC SOCIETY] in Chinese Vol 20 No 3, Jun 92 pp 286-291

[English abstract of article by Guo Jingkun and Xu Yueping, (Shanghai Institute of Ceramics, Chinese Academy of Sciences), (MS received 3 Jan 92)]

[Text] Research and development of nanometer crystalline ceramics are reviewed in the paper. A series of development processes from the preparation and characterization of nanometer ceramic powders to the sintering processing and the properties of nanometer crystalline ceramics, especially for superplastic properties, are summarized. Based on the successful experimental results, it is pointed out that study nanometer crystalline ceramics is a theoretical and practical basis for the study of material science at home and abroad. Finally, the promising future of the development of nanometer crystalline ceramics and its role in the challenge to traditional ceramics and ceramic technology are also discussed.

Biochemical Toxicology Research: Biochemical Mechanism of Soman and Acetylcholinesterase Function

93P60032A Beijing SHENGLI KEXUE JINZHAN [PROGRESS IN PHYSIOLOGICAL SCIENCES] in Chinese Vol 23 No 3, Jul 92 pp 279-281

[Article by Zhou Tingchong [0719 1694 0394], other researchers include Sun Manji [1327 2581 7221], Zhang Zhaogeng [1728 0340 5087], Xiao Meizhen [5135 5019 3791], Huang Ruheng [7806 1172 5899]; Institute of Toxicology and Pharmacology and Institute of Basical Medical Science, Academy of Military Medical Sciences, Beijing; The project was given a National Natural Sciences Second-Place Award in 1987 and a Military Sciences Second-Place Award in 1986]

[Excerpts] Among the three nerve agents, soman [pinacolyl methyl phosphonoflouridate], sarin [isopropyl methyl phosphonoflouridate], and VX [O-ethyl-S-(di-isopropylaminoethyl) methyl phosphonothiolate], soman poisoning is the most difficult to reactivate. The three agents can strongly inhibit the activity of acetylcholinesterase (AchE) and cause the accumulation of a large amount of acetylcholine at nerve endings, which results in cramps, convulsions, and finally death to people or animals exposed. Although the AchE function inhibited by sarin and VX can easily be reactivated by reactivating agents such as pralidoxime chloride (2-PAM-Cl), inhibition caused by soman cannot. Researchers believe that study on soman-poisoning treatment is a leading-edge technology in the field of chemical warfare medicine, and is also an urgent mission of the academy. The team has made some progress which has not been reported previously.

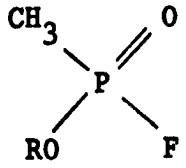
(1) The study elucidated the reasons why soman-phosphonylated AchE is difficult to reactivate. Experiments show that dealkylation of the oxyalkyl group of AchE causes aging reaction and irreversibility of AchE. Exciting results were obtained by using the electric organs of the Chinese ray (torpediniforms nacline timilei) to replace swine brains as test specimens. For example, under similar conditions of pH 7 and 37°C, sarin-phosphonylated AchE produces only 8 percent of dealkylated groups after 5 hours' incubation of the specimen, while soman-phosphonylated AchE produces 82 percent of dealkylated groups in 3 minutes, which means that rapid dealkylation causes rapid aging reaction of the agent-poisoned AchE. The experiment also concluded that AchE itself may be the catalyst of the aging reaction.

(2) The study disclosed the effect of substituting methyl group for oxyalkyl groups of phosphorous compounds on the speed of the phosphonylated-AchE aging process. Research findings indicate that: a) the numbers of oxyalkyl group on alpha-carbon atom of phosphorous compounds being substituted with methyl group affects the aging reaction; b) when the number of oxyalkyl group on beta-carbon atom of phosphorous compounds like sarin being substituted with methyl group is increased and sarin is changed into soman by methylation, the aging process accelerated; and c) when the alpha and beta sites of the oxyalkyl group of phosphorous compounds are simultaneously replaced by methyl groups, a coordinated effect occurs, which explains why aging of soman-poisoned AchE is faster than sarin and VX. It is also found that when one oxyalkyl group on alpha-carbon atom and three oxyalkyl groups on beta-carbon atom of phosphorous compounds are replaced by methyl groups, faster aging process occurs to the phosphonylated-AchE, and that the tertiary-hexanoxy group is responsible for the aging reaction. Because soman possesses this group, aging caused by soman poisoning is faster.

(3) The study has found that soman causes aging to organs. Studies on whether aging happens to organs of soman- and sarin-poisoned animals have been conducted on isolated rat phrenic nerves and diaphragms. The studies found that both soman and sarin poisonings inactivate rat diaphragms, but the inactivating agent 2-PAM-Cl can only revive sarin-poisoned diaphragms.

(4) Extra soman found in the body of animals exposed to soman may be another reason to explain the difficulty of reactivating the soman-phosphonylated AchE. The presence of extra soman can further inactivate the 2-PAM-Cl-reactivated AchE by causing a "second poisoning" to the enzyme.

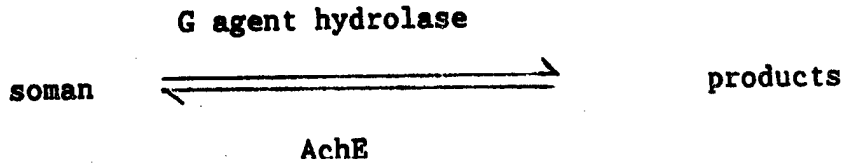
general formula of sarin and soman



R: $CH_3CH(CH_3)$- sarin

$(CH_3)_3CCH(CH_3)$- soman

(5) As soman is resynthesized in the presence of catalyst AchE through reversible reaction, it causes further aging reaction to AchE, it may be another factor contributing to the difficulty of reactivating soman-phosphonylated AchE. The reaction is shown below:



(6) Soman poisoning causes specific nicotinergic postsynaptic ATP (adenosine triphosphate) degradation, remarkable degradation of ATP may also be a factor contributing to irreactivation of AchE caused by soman poisoning. Research results indicate that soman poisoning causes ATP degradation through the nicotinergic system, which causes a shortage of oxygen supply in those exposed to soman. The finding supports the fact that oxygen should be used in first aid treatment involving soman poisoning. In 1984, tests conducted on earthworms found that remarkable decrease of ATP content in earthworms' back muscles had resulted from soman (4.5 μg/ml) exposure, while only little change of ATP content occurred in the ammonium sulfate (1-3%)-treated muscles and the higher the soman concentration the faster the ATP content decreases. ATP degradation in earthworms' back muscles caused by soman poisoning can be prevented by using the reversible AchE inhibitor (neotocopherol) to protect AchE and the cobra toxin (25 μg/ml) to block nicotin receptor.

(7) The research team also discovered that the sulfhydryl (-SH) group, a group that actually participates in the catalytic reaction of AchE activity, exists only in the Chinese ray. The finding indicates that the Chinese electric ray (torpediniforms nacline timilei) is superior to swine brains or swine red blood cells (RBCs) for using in soman poisoning study.

Bioluminescence ATP Microsensor Developed

93P60032B Beijing YIYAO XINXI LUNTAN [CHINA MEDICAL TRIBUNE] in Chinese Vol 18 No 36, 10 Sep 92 p 1

[Article by Gan Hanxiang [3927 3352 4382]]

[Summary] A group of researchers headed by Associate Professor Zhou Yikai [0719 1355 7030] of Tongji Medical University has developed a bioluminescence ATP (adenosine triphosphate) microsensor, the first state-of-the-art technology applied in energy metabolism research to date. Based on the rules of substance-energy transfer and photochemical principles, the researchers put together luminescence analysis, enzyme fixation, optical fiber, and optoelectronics technologies and designed an interference-resistant microsensor with high sensitivity and fast response. The microsensor is capable of transforming all kinds of chemical and biological signals into measurable light signals through long-distance signal-transmission optical fiber. The sensor can either measure a single biochemical parameter or several parameters such as ATP/ADP, ATP/ATP enzymes at the same time. The sensor has been used to detect the estrogen receptor of endometrial cancer tissues down to a sensitivity of 10^{-15} Mole, and detect ATP content of myocardial cells to 10^{-18} Mole. The sensor has provided an effective tool for early diagnosis of endometrial cancer and cardiovascular diseases.

Studies on the Cloning, Expression and Function of the Yeast PHO2 Gene

40091001A Shanghai SHENGWUHUAXUE YU SHENGWUWULI XUEBAO [ACTA BIOCHIMICA et BIOPHYSICA SINICA] in Chinese Vol 24 No 4, Jul 92 pp 359-365

[English abstract of article by Gu Jirong [6253 4949 2837], Wang Jingying [3769 7234 5391], Cao Zhuwei [2580 6175 0251] and Ao Shizhou [2407 0013 3166], (National Molecular Biology Laboratory, Shanghai Institute of Biochemistry, Academia Sinica)]

[Text] Through *in situ* hybridization a 3.6kb HindIII fragment was obtained from the yeast gene library. The cloned fragment containing the complete PHO2 gene was analyzed with restriction mapping, Southern hybridization and DNA sequencing. Using the expression vector pKK233-2, the PHO2 gene under the control of the trc promoter could be expressed in *E. coli*. The expression products were detected by means of SDS-PAGE and the presence of a 60kd PHO2 protein was confirmed. The HpaI-BglII fragment of the PHO2 gene was replaced with the yeast URA3 gene and used as donor to transform DY150 to URA3+. A PHO2 mutant resulted from disruption of the chromosomal counterpart. The expression of acid phosphatase genes in various yeast strains indicates that PHO2 is a positive regulator of PHO5 and PHO11 genes.

Expression of Human Immunodeficiency Virus gag Gene Fragment in E. Coli

40091001B Beijing ZHONGHUA WEISHENGWUXUE HE MIANYIXUE ZAZHI [CHINESE JOURNAL OF MICROBIOLOGY AND IMMUNOLOGY] in Chinese Vol 12 No 4, pp 205-209

[English abstract of article by Ji Changhua [0679 2490 5478], Su Chengzhi [5685 2052 5347] and Shen Liqun

[3088 0448 5028], (Department of Biochemistry, The Fourth Military Medical University, Xi'an)]

[Text] The P20 gene was inserted into a prokaryotic expression vector pBV220 and the recombinant plasmid pCY6 was obtained. In order to achieve a high expression, the SD-ATG interval was shortened to 7 nucleotides by removing the EcoRI site with Mung bean nuclease. pCY6, as well as the modified expression plasmid named pCY7, were then transformed into host bacteria DH5α and the recombinant bacteria were cultured at 32°C and induced at 42°C for expression. It was found that a new protein band appeared with a molecular weight identical to P20 protein, whilest this protein was absent for DH5α (pCY7) before induction and DH5α (pCY6) and DH5α (pBV220) before and after induction. It was observed that the amount of expressed P20 protein increased as the induction time prolonged. The expressed P20 protein accounted for 9.1% of the total bacterial proteins by estimation with gel scanner. The P20 protein expressed in *E. Coli* could be recognized by anti-P17 monoclonal antibodies, demonstrating its perfect immunogenicity.

Antibody-Dependent Enhancement of EHF Virus Infection in Cultured Lymphocytes and Macrophages

40091001C Beijing ZHONGHUA WEISHENGWUXUE HE MIANYIXUE ZAZHI [CHINESE JOURNAL OF MICROBIOLOGY AND IMMUNOLOGY] in Chinese Vol 12 No 4, pp 210-213

[English abstract of article by Yao Xiaojian [1202 1420 0494] and Yu Yongxin [0205 3057 2450], (National Institute for the Control of Pharmaceutical and Biological Products, Beijing)]

[Text] The antibody-dependent enhancement of EHF virus infection was studied in three kinds of macrophages or lymphocytes (Mongolian Gerbil peritoneal macrophages, human peripheral blood lymphocytes and monocytes, mouse macrophage-like cell line $P388D_1$) by using diluted EHF immune serum. The results indicated that immune sera diluted to sub-neutralizing level could enhance virus infection (strains A_9 and 76-118) in the three kinds of cell cultures. About 10-100 fold higher virus titers were obtained by pretreatment of the virus with sub-neutralizing immune serum. However enhancement in M. Gerbil macrophage culture was observed only under pretreatment at 4°C. In the human blood lymphocytes and monocytes, enhancements could be observed under pretreatment at both 4°C and 37°C.

Preliminary Study of Mouse Immunosuppressive Factor Induced by Epidemic Hemorrhagic Fever Virus (EHFV)

40091001D Beijing ZHONGHUA WEISHENGWUXUE HE MIANYIXUE ZAZHI [CHINESE JOURNAL OF MICROBIOLOGY AND IMMUNOLOGY] in Chinese Vol 12 No 4, pp 214-218

[English abstrct of article by Sun Jiyao [1327 4921 5069], Guo Qingfu [6753 1987 4395] and Zhuang Hanlan [8369 3352 3482], (Institute of Microbiology and Epidemiology, Academy of Military Medical Sciences, Beijing)]

[Text] The effects of the frozen-thawed and culture supernatants of the spleen cells from BALB/c mice infected with EHFV on Con-A-induced lymphocyte transformation and IL-2 secretion of inbred BALB/c mice were investigated with modified MTT assay. 15 of 16 mice 20 days after infection with EHFV showed immunosuppression and the suppressive rates were 69%-79% and 47%-69%, respectively. Apparently the spleen cells of infected mice produced and released immunosuppressive factor. The factor was non-dialysable, trypsin-sensitive, and inactivated at 80°C 30 min but tolerable to 56°C 30 min, suggesting that it is a protein in nature with molecular weight>10kD. With ruling out tests, the factor was not IFNγ, opio-peptide, corticosteriod, prostaglandin etc. The factor was only secreted by the whole splenic cells culture, as the culture supernatants of splenic nonadherent cells or peritoneal Mφ from infected mice showed no suppression. The factor might be a molecular event involved in the EHFV induced suppression of nonspecific cellular immune in vivo.

Genomic Cloning of BK Virus Isolated From China and Its Application

40091001E Beijing ZHONGHUA WEISHENGWUXUE HE MIANYIXUE ZAZHI [CHINESE JOURNAL OF MICROBIOLOGY AND IMMUNOLOGY] in Chinese Vol 12 No 4, pp 219-221

[English abstract of article by Du Minjie [2629 2404 2638], Gu Zhiyuan [6253 1807 6678], et al., (Molecular biology laboratory, PLA General Hospital, Beijing)]

[Text] Genomic DNAs of BK virus China strain (BKV-C) isolated by our laboratory and the prototype BKV (BKV-P) were cloned into the EcoRI site of plasmid pUC9, respectively. The size of the viral DNA was equal in all of the BKV-C DNA recombinants, but the recombinants containing BKV-P DNA had 3 different lengths of viral DNA. Hind III restriction endonuclease analysis showed that only 3 fragments were obtained for BKV-C DNA, the size of the smallest fragment was equal to the sum of the 3rd and 4th fragments of BKV-P DNA digested by Hind III, the 2 large fragments had minor difference compared with that of BKV-P DNA, Cloned BKV-C DNA labeled with protobiotin was used as probe to detect BKV DNA in the urine specimens of 18 immunosuppressed patients, 8 cases of the immunosuppressed patients were positive by dot hybridization. Same result was obtained for the cloned BKV-P DNA probe.

Molecular Cloning of 4.2kb Cryptic Plasmid DNA From Neisseria Gonorrhoeae

Beijing ZHONGHUA WEISHENGWUXUE HE MIANYIXUE ZAZHI [CHINESE JOURNAL OF MICROBIOLOGY AND IMMUNOLOGY] in Chinese Vol 12 No 4, pp 225-227

[English abstract of article by Wu Guofeng [0702 0948 7685], Ye Feng [0673 6912], et al., (Affiliated Hospital of Zhanjiang Medical College)]

[Text] The 4.2kb cryptic plasmid DNA was obtained from the reference strain-D of Neisseria gonorrhoeae by alkaline lysis. The 4.2kb plasmid DNA and pBR322 plasmid vector DNA were digested with Hind III and ligated with T4 ligase, then transformed into the *E. Coli* MC 1061 Cell. The recombinant plasmid DNA was identified by cleaving with single Hind III, EcoRI and both EcoRI/BamHI and also by the 4.2kb plasmid DNA probe labeled with ^{32}P. The results showed that the recombinant contained desired 4.2kb plasmid DNA of Neisseria gonorrhoeae, while the pBR322 plasmid vector DNA did not contain homologous DNA of gonococcus.

The Specific Cytotoxic Effect of Daunomycin Conjugated to Monoclonal Antibodies Directed to Myeloid Cell on the Leukemic Cells

40091001G Beijing ZHONGHUA WEISHENGWUXUE HE MIANYIXUE ZAZHI [CHINESE JOURNAL OF MICROBIOLOGY AND IMMUNOLOGY] in Chinese Vol 12 No 4, Jul 92 pp 247-250

[English abstract of article by Ma Weili [7456 1218 7787], Li Zailian [2621 0961 6647], et al., (Institute of Applied Immunology of Weifang Medical College)]

[Text] Daunomycin was covalently bound via a dextran bridge to monoclonal antibodies against the differentiated antigens-Zh805 of myeloid cell. The activities of the specific antibodies, daunomycin and the conjugates were measured by complement-mediated cytotoxicity, indirect immunofluorescence staining and inhibition of ^{3}H-TdR incorporation. The data showed that the conjugates retained more than 80% original antibody activities. The conjugation of daunomycin to antibodies did not cause a detectable loss of antibody specificity and of toxicity of daunomycin. Significantly selective cytotoxicity against HL-60 cells was observed after 8hr incubation of the cells with the conjugates at a antibody concentration of 20μg/ml. In a 48hr incubation assay the conjugates inhibited concentration-dependent cytotoxicity against HL-60 cells. Cultured with the conjugates at concentration of 20μg/ml of antibody for 20hr, HL-60 cells were selectively killed by more than 80%. The data showed that attaching daunomycin to the myeloid cell-specific antibodies enabled them to express a selective cytotoxic effect on various leukemic target cells and cells lines. These antibody-daunomycin conjugates are therefore sufficiently toxic and selective in their effects to be potentially useful in therapeutic studies in vivo.

Immunocytochemical Detection of Viral Antigens, Antibodies and Complement in Situ on the RBC in the Tissues of Patients With Epidemic Hemorrhagic Fever

40091001H Beijing ZHONGHUA WEISHENGWUXUE HE MIANYIXUE ZAZHI [CHINESE JOURNAL OF MICROBIOLOGY AND IMMUNOLOGY] in Chinese Vol 12 No 4, pp 262-264

[English abstract of article by Yang Shoujing [2799 1343 0079], Liu Yanfang [0491 1750 0119], et al., (Department of Pathology, 4th Military Medical College, Xi'an)]

[Text] The viral antigens, antibodies and C3 complement on the red blood cells in the tissues of the patients with epidemic hemorrhagic fever were studied with immunocytochemical techniques. The viral antigens on the RBC were further confirmed by tracing of the viral antigens in BALB/c suckling mice infected with Chen strain EHFV using gold-labeled antibody against EHFV. The results showed that there were three types of antigenic forms, designated membrane, membrane granules, and cytoplasm antigens on the RBC, and the first one was often detected in every kind of tissue together with Ig and C3 complement. The characteristics and significance of viral antigens and its immune complex on the RBC were analyzed and discussed.

Router for Interconnecting LANs With X.25 Networks Developed

93P60008A Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 34, 2 Sep 92 p 2

[Article by Gao Lihua [7559 7787 5478]: "Jiangsu Develops OSI-Standards-Compliant Gateway for Interconnecting Local Area Networks and X.25 Public Networks"]

[Summary] The "LAN-X.25 Public Network Interconnection Technology and Router" jointly developed by Nanjing's Southeast University and the Nanjing Institute of Posts & Telecommunications recently passed the formal appraisal organized by the Jiangsu Province S&T Commission. This technology, meeting mid-to-late eighties international standards, is designed for interconnecting the lower three OSI-Reference-Model layers [i.e. physical link, data link, and network] of Ethernet LANs (ISO 8802/3) with those of Jiangsu's independently developed JSnet, as well as other X.25 public networks. This project, designated as State 863 Plan CIMS [computer integrated manufacturing systems] special topic #511-09, complies with the OSI-standard internetworking protocol (ISO 8473).

486 EISA High-Grade Microcomputer, Applications Software Unveiled

93P60008B Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 35, 9 Sep 92 p 1

[Article by Xiao Yan [2556 3601]: "Vigorously Promote the Beijing Computer Industry"]

[Summary] Over 500 representatives from the State Planning Commission, MMEI, the State Council, the Beijing government, and various research institutes and institutions of higher education attended the "State Eighth 5-Year Plan S&T Key Project—486 EISA [Extended Industry Standard Architecture] High-Grade Microcomputer Development and Typical Applications Demonstration Project Results Exposition" conducted by the Office Automation unit of the Beijing Leading Group for Promotion of Electronics and held in the Great Hall of the People on 24 August. At the exposition, the representatives saw the unveiling of the Bei Dou [0554 2435 "Big Dipper"] 486 EISA high-grade microcomputer, developed on a U.S. Arche Company's development environment by the Beijing No 3 Computer Plant in cooperation with the CAS Institute of Computing and the Liming [7812 2494] Co. The Bei Dou 486, available in 33 MHz and 50 MHz versions, comes with a Cache controller and a high-resolution graphics/image system. Some 16 applications software packages were demonstrated, including three MISs for industry, commerce, and the restaurant business; nine CAD systems for machinery, construction, electronics, and apparel; a color graphics processing system; multimedia system(s); the ANY BUS new bus system; and the fourth-generation language system Z.

Study on Recognition of Isolated Chinese Syllables by Neural Nets

40100007A Beijing DIANZI XUEBAO [ACTA ELECTRONICA SINICA] in Chinese Vol 20 No 8, Aug 92 pp 56-62

[English abstract of article by Yang Shulin, Ke Youan, and Wang Zong of the Department of Electronic Engineering, Beijing Institute of Technology, Beijing 100081; MS received 24 Sep 90, revised May 91]

[Text] The neural net model, feature extraction and learning algorithm for speech recognition by neural nets are investigated in this paper. A non-uniformly-windowed pyramidical architecture is proposed, the normalizations of the feature vectors of two extraction algorithms are investigated and the Polak-Ribiere learning algorithm is modified to guarantee that the weight vector does not converge to unstable local minima. Speaker-dependent experiments show that over 99 percent accuracy can be achieved for recognizing five vowels and ten numbers. Speaker-independent experiments involving 90 speakers from 25 provinces of China show that 90.3 percent accuracy can be obtained for number recognition, and performance can be increase by 1.0 percent after the pre-processing window is employed. The windowed model is more applicable for speech recognition.

Efficient and Complete Exploitation of Irregular Parallelism Across Loop Iterations

40100007B Beijing DIANZI XUEBAO [ACTA ELECTRONICA SINICA] in Chinese Vol 20 No 8, Aug 92 pp 70-76

[English abstract of article by Jin Guohua, Yang Xuejun, and Chen Fujie of the Changsha Institute of Technology, Changsha 410073; MS received Jan 91, revised Dec 91; project supported by grant from NSFC]

[Text] Because most FORTRAN programs spend most of their time inside loops, efficient exploitation of the loop parallelism is one of the most crucial activities during program parallelization. Although loop parallelization has been researched extensively and deeply, existing techniques do not handle loops in a satisfactory manner. In this paper, we present a new technique exploiting irregular parallelism across loop iterations efficiently and completely.

Navigation of Mobile Robot and Fundamental Issues of AI

40100006B Beijing TSINGHUA DAXUE XUEBAO [JOURNAL OF QINGHUA UNIVERSITY] in Chinese Vol 32 No 4, Aug 92 pp 42-47

[English abstract of article by Wang Tianmiao of the Department of Computer Engineering and Science and Ai Haizhou and Lu Tao of the National Laboratory of Intelligent Technology and Systems; MS received 29 Dec 91]

[Text] Research on mobile robot navigation and control over the past 20 years shows that systems based only on traditional symbolic processing methods cannot adapt themselves to uncertain and dynamic environments for solving real-time control problems with due reliability. This paper focuses its efforts on investigation of perception-action behavior, emergence control from interaction with real world, and successfully develops such a behavior-based navigation system. A number of experiments were done to show the effectiveness of this system.

Design of PARLOG Sequential Compiling System

40100006A Beijing TSINGHUA DAXUE XUEBAO [JOURNAL OF QINGHUA UNIVERSITY] in Chinese Vol 32 No 4, Aug 92 pp 21-29

[English abstract of article by Wen Dongchan, Li Wenfeng, and Fang Jiaguo of the Department of Computer Engineering and Science; MS received 1 Jul 91]

[Text] PARLOG is a parallel logic programming language, having a prospective application future in AI and the parallel processing area. A practical parallel logic programming environment on SUN workstation—PARLOG sequential compiling system (PSCS)—is presented with a description of PARLOG semantics, AND/OR tree computational model and a process scheduling algorithm. The PSCS uses structure of intermediate abstract machine, and C as the target language to provide efficient executive code and good transportability.

Institute of Automation Markets MRP II Applications Software Package

93P60019A Beijing ZHONGGUO DIANZI BAO [CHINA ELECTRONICS NEWS] in Chinese 9 Sep 92 p 2

[Article by Dong Ruixiang [5516 3843 5046]: "Institute of Automation Puts Out MRP II Applications Software Package"]

[Summary] Based on assimilation of the newest foreign-made management software technology, engineers at the Software Center of MMEI's Institute of Automation have developed an advanced MRP II (Manufacturing Resources Planning II) applications software package which has proven valuable in trial operation at over 20 domestic firms, including the Tianjin Refrigerator and Compressor Plant. The package includes a computer-aided production management system CAPM/VMS designed to run on DEC's VAX/VMS version 5.1 operating system.

Optical Element of Array of Two-Dimensional Parallel Beam Splitter

40100003A Beijing YIQI YIBIAO XUEBAO [CHINESE JOURNAL OF SCIENTIFIC INSTRUMENT] in Chinese Vol 13 No 3, Aug 92 pp 263-271

[Article by Yan Yingbai, Yao Changkun, Wu Minxian and Jin Goufan, (Qinghua University), (Funded by State 863 Plan grant; MS received Jun 91)]

[Abstract] A phase grating array interconnection element for optical digital image processing system and optical computing system is developed. On the basis of diffraction theory and numerical analysis, the self-image property of the binary phase grating is discussed. By using this property, $\pi/2$ and $2\pi/3$ gratings with 16X16, 32X32 arrays have been fabricated. A light spot of 0.4mm diameter has a divergence less than 1% in the transmission distance of 500mm. The main technical features are analyzed and some experimental results are demonstrated.

Wuhan Institute's Advances in GPS Technology Described

93P60020A Beijing RENMIN RIBAO in Chinese 2 Sep 92 p 3

[Article by Wen Hongyan [3306 4767 1750]: "Wuhan Institute of Cartography Develops Satellite Positioning Technology"]

[Summary] Wuhan Institute of Cartography scientists and engineers have realized several notable advances in their past 2 years of research on global satellite position system (GPS) technology, including establishment of observational networks totaling over 700 control points—creating direct economic benefits of 30 million yuan. Importing four GPS receivers in 1990, institute personnel in a cooperative project with State Oceanography Bureau units took only 50 days to set up a 12-positioning-point network covering 1.6 million square kilometers of the Nansha Islands. The institute has also participated in international GPS projects on the Qinghai-Tibet Plateau and Nepal border. Faced with the problem of imported GPS software not being suitable to domestic needs, institute engineers developed a GPS network-adjustment comprehensive data software package, which converts global coordinate system data into China's coordinate system. This software package, certified early this year to meet international standards, provides a very high positioning accuracy, with an error of only several centimeters per thousand kilometers. Recently, the institute has completed a 7-positioning-point experimental GPS network for the Three Gorges project.

Report on First National Flat Panel Display Conference

93P60020B Beijing ZHONGGUO DIANZI BAO [CHINA ELECTRONICS NEWS] in Chinese 7 Sep 92 p 3

[Article by Cui Yachao [1508 0068 6389]: "The Bright Development Prospects of Flat Panel Displays: Report on First National FPD Conference"]

[Summary] Over 110 scientists and engineers from 54 domestic units involved with flat panel display (FPD) technology R&D, production, and applications participated in the recent First National FPD Conference, held in Changchun. Organized by the Light Emitting Sub-Society and Liquid Crystal Sub-Society of the China Physics Society, the conference covered the latest developments in domestic and international FPD R&D. Included were invited presentations by a scholar from Japan's Dai Nippon Printing Co., Ltd. on "Prospects for Japan's FPD Industry" and by a scholar from Tokai University on "Liquid Crystal Display Development Trends."

Several papers covered domestic FPD device development and industry. In the nation, there are now over 10 LCD production lines, making LCDs for calculators, wristwatches, games, platform-type office typewriters, portable terminal displays and the like. The CAS Changchun Institute of Physics presented a paper on its development of an ac electroluminescent thin-film computer terminal display, now being put into batch production at the Nanjing Display Tube Plant. MMEI's Nanjing Institute 55 has developed a 3-inch active matrix display. Also, the CAS Shanghai Institute of Metallurgy, CAS Shanghai Institute of Silicates, CAS Shanghai Institute of Organic Chemistry, and State-Run Xinxiang Plant 713 have jointly developed a 64 mm x 64 mm array LCD screen. China has also begun R&D of airborne FPDs: in 1990, Shenzhen's Tianma [1131 7456] Microelectronics Co. and Shenyang Aeronautical Institute's Plant 251 jointly developed a liquid-crystal aircraft oil indicator. This LCD flight oil indicator principles demonstrator has now passed acceptance check, and is being used at various plants. In the area of S&T policy, the State S&T Commission, CAS, and MMEI have allocated huge amounts of funds for research, development, and manufacture of FPD devices in the Eighth 5-Year Plan.

6.7W Output Power From Dye Laser Pumped by CVL

40100005A Shanghai ZHONGGUO JIGUANG [CHINESE JOURNAL OF LASERS] in Chinese Vol 19 No 7, Jul 92 pp 481-485

[English abstract of article by Shangguan Cheng, Tang Xingli, Lin Yingyi, Yu Kaiyi, Qiao Futang, Jiang Shangli, Wang Wei, Dou Airong, Sun Guohua, Wang Yiman and Qian Yulan, (Shanghai Institute of Optics and Fine Mechanics, CAS, Shanghai), (MS received 15 Oct 91, revised 4 Dec 91)]

[Text] Experimental research on dye oscillator-amplifier configuration pumped by CVL [copper vapor laser] is described. The characteristics of the dye laser, such as bandwidth, output power, efficiency, pulse duration, tuning range, spectral purity and frequency stability etc., are measured in details. 6.7W output power has been obtained from the Rh6G dye laser.

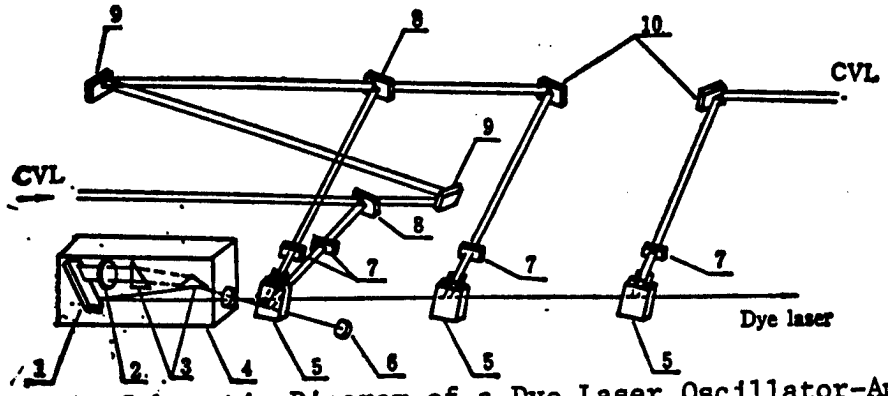


Fig. 1 Schematic Diagram of a Dye Laser Oscillator-Amplifier System Pumped by CVL

1—grating; 2—etalon; 3—prism beam expander; 4—tuning box; 5—dye flow cell; 6—resonator mirror; 7—cyl. focusing lens; 8—beam spliter; 9—delay-line mirror; 10—total reflector

Table 1. Dye Laser Output Power and Efficiency in Each Stage

	Oscillator	No. 1 amplifier	No. 2 amplifier	No. 3 amplifier
Dye concentration (mol.)	$3x10^{-4}$	$3x10^{-4}$	$2x10^{-4}$	$1.5x10^{-4}$
Pump power (CVL) (W)	3	4	12	17
Pump power divided by total pump power (%)	8.3	11.1	33.3	47.2
Output power of dye laser (W)	approx 0.003	0.3	2.8	6.7
Amplifier power gain		approx 100	8.3	1.7
Efficiency (%)	1	7	20.8	23.0

Study on Laser-CCD Microdisplacement Sensors for Vibration Measurements

40100005B Shanghai ZHONGGUO JIGUANG [CHINESE JOURNAL OF LASERS] in Chinese Vol 19 No 7, Jul 92 pp 507-511

[English abstract of article by Lin Youyi, Chen Zhenfu, Yi Liyan, (Nanjing Aeronautical Institute, Nanjing), (MS received 6 Aug 90, revised 25 Oct 90)]

[Text] The principle and the method of vibration measurements by means of laser-CCD microdisplacement sensors are presented. This measurement technique can be applied for larger amplitudes (>60μm). In 60-800μm range, the absolute maximum error is <10μm, and the relative error <6%.

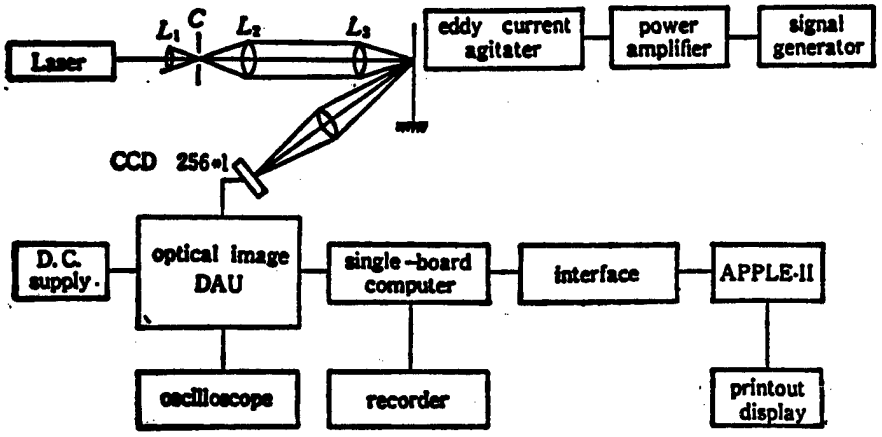


Figure 6 Vibration Measurement System of Laser-CCD Microdisplacement Sensor

Phase Matching of Optical Parametric Generation in KTP Crystal

40100005C Shanghai ZHONGGUO JIGUANG [CHINESE JOURNAL OF LASERS] in Chinese Vol 19 No 7, Jul 92 pp 523-528

[English abstract of article by Zhao Qingchun, Guo Jinhua, Lu Yutian, He Huijuan, Li Yongchun, Gu Shengru, Qian Linxing and Zhao Longxin, (Shanghai Institute of Optics and Fine Mechanics, CAS, Shanghai); Liu Yaogang and Wang Jiyang, (Institute of Crystals, Shandong University, Jinan), (MS received 12 Sep 91, revised 30 Dec 91)]

[Text] The calculation method of angle phase-matching for optical parametric generation (OPG) in biaxial crystals is presented. The angle phase-matching curves and their characteristics of OPG in KTP crystal pumped by 355nm, 532nm, and 1064nm radiation are calculated and analyzed. Our experiments have confirmed the OPG pumped by 532nm laser output, which is in agreement with the calculated curves for angle phase-matching of type II in X-Z plane.

New Nonlinear Optical Material $ZnS.BaSO_4$

40100005D Shanghai ZHONGGUO JIGUANG [CHINESE JOURNAL OF LASERS] in Chinese Vol 19 No 7, Jul 92 pp 538-539

[English abstract of article by Yu Qunli, Zha Xinwei, Lei Jie, Li Xiangsheng and Gou Zengguang, (Shanxi Normal University, Xian); Li Jianqi, (Institute of Physics, CAS, Beijing), (MS received 12 Jul 91)]

[Text] A new nonlinear optical material $ZnS.BaSO_4$ is first reported. It generates second-harmonic radiation with a powder efficiency of about one thousand times that of KDP. The structural properties of this material have been studied by electron diffraction.

Investigation on Colliding Pulse Mode-Locking of (Ce^{3+}, Nd^{3+}): YAG Laser

40100005E Shanghai ZHONGGUO JIGUANG [CHINESE JOURNAL OF LASERS] in Chinese Vol 19 No 7, Jul 92 pp 553-555

[English abstract of article by Zhu Xiaolei, Sun Zhanao, Wu Zhaoqing and Yang Xiangchun, (Shanghai Institute of Optics and Fine Mechanics, CAS, Shanghai), (MS received 21 Aug 91)]

[Text] Results of colliding pulse mode-locking of (Ce^{3+}, Nd^{3+}): YAG laser using an antiresonant ring in the unstable resonator are presented. Using a (Ce^{3+}, Nd^{3+}): YAG laser crystal of φ3x40mm in size and pentanethine cyanine [pentamethylidyne] in 1, 2-dichloroethane, 3.2mJ output energy with 9ps pulse width has been obtained.

Domestically Developed Multivalued-Logic ICs Described

93P60009A Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 35, 9 Sep 92 pp 91, 93

[Article by Hu Mou [5170 6180] of the Shanghai Railway Institute: "Multivalued Logic in Computer Science and Technology"]

[Excerpts] [Passage omitted]

II. Domestic Advances in Research on Multivalued Logic

[Passage omitted]

4. Multivalued ICs

The main achievements in domestically developed multivalued ICs include the following:

(1) The [CAS-developed] multi-element logic (DYL) IC series is now in trial production at the Handan Semiconductor Plant in Hebei [Province]. These ICs have found practical applications in telephone systems and electronic instruments.

(2) A four-valued DYL IC has been trial-manufactured at the Foshan No 4 Radio Plant, and has been incorporated into a multi-valued-logic telephone system (the model MDA-016). This is a type of non-switch-controlled, multi-functional distributed automatic internal-line telephone system.

(3) A multi-valued-logic gate array has been developed and patented. This is a type of semi-custom chip; i.e., the manufacturing plant can, according to the customer's requirements, carry out the final wiring processes, so that the IC provided will have the functions required by the customer. Also, with this technology, an electronic lock based on 10-valued logic has been developed.

[Passage omitted]

MPT Outlines Communications Development Targets for 1995, 2000

Main Points

93P60023A Beijing KEJI RIBAO [SCIENCE AND TECHNOLOGY DAILY] in Chinese 17 Sep 92 p 1

[Article by Ji Hongguang [1323 3163 0342]: "MPT Sets New Communications Development Targets for 2000"]

[Summary] Beijing, 16 Sep (KEJI RIBAO wire report)—At the Third China International Communications Conference convened today, MPT Vice Minister Yang Xianzu announced new domestic development targets before the scholars from China and abroad. Following upon the 24.5 percent continuous annual growth of the Seventh 5-Year Plan, the nation's telecommunications industrial output for January-August this year grew 45.1 percent compared to the same period last year, long-distance telephone traffic grew 61.8 percent, and urban telephone traffic grew 46.5 percent. The new development targets, intended especially to raise the telephone dissemination rate and the spread of digital communications, include the following: gross capacity of the national telephone network is to grow from 48 million lines in 1995 [i.e., end of Eighth 5-Year Plan] to 96 million in 2000, representing 16 times the amount for 1980; the total number of telephones is to grow from 31 million in 1995 to 65 million in 2000; the national telephone dissemination rate is to grow from the current 1.26 percent to 2.5 percent in 1995 (with a 20 percent rate for municipalities such as Beijing, Shanghai, Tianjin, and Guangzhou, and the principal seacoast open cities) and to 5 percent in 2000 (with a 30-40 percent rate for the municipalities and major seacoast cities); 32,000 kilometers of high-capacity province-level fiber optic cable trunklines, 15,000 kilometers of new and expanded interprovincial digital microwave trunklines, and 19 satellite earth stations are to be completed by 1995; long-distance automatic switching capacity is to grow from 1.2 million terminals in 1995 to 3.5 million in 2000; and long-distance service circuits are to grow from 520,000 in 1995 to 1.4 million in 2000.

More on Fiber Optic Lines

93P60023B Beijing DIANXIN JISHU [TELECOMMUNICATIONS TECHNOLOGY] in Chinese No 9, Sep 92 p 46

[Unattributed article: "MPT Lays Out New Communications Development Targets"]

[Summary] In addition to the targets specified above, China in the next 3-5 years is to complete construction of over 400,000 additional long-distance telephone lines in a national fiber-optic-cable backbone transmission network centered on Beijing. At present, fiber-optic-cable trunkline construction of 22 lines is unfolding, including two Beijing-Northeast lines totaling 4,700 km and running from Beijing to Tianjin and Tangshan and on to the entire North China area; the Beijing-East China line running from Beijing to Nanjing and Shanghai; a Shanghai-South China line running from Shanghai to Fujian Province and on to Guangdong Province; Beijing-South Central-Southeast lines running from Beijing to Wuhan and Guangzhou (overhead cable and a separate buried cable); and Beijing-Northwest lines running from Beijing to Lanzhou, Beijing to Shanxi and Shaanxi Provinces, and Shaanxi to Gansu Province.

Scientists at Shanghai Institute of Nuclear Research Claim Discovery of Platinum-202

92FE0859 Shanghai JIEFANG RIBAO in Chinese 6 Aug 92 p 1

[Article by reporters Zhang Xuequan [1728 1331 0356] and Zhu Shunlin [6175 7311 2651]: "Shanghai Institute of Nuclear Research Discovers New Nuclide Platinum-202 For the First Time, Will Provide a Foundation for Testing and Confirming Nuclear Structure Theories and Discovering New Phenomena"]

[Text] Through arduous exploration, Chinese nuclear scientists recently discovered the new nuclide platinum-202 for the first time in the world. The Chinese Academy of Sciences Shanghai Institute of Nuclear Research that made this discovery announced on 5 August 1992 that this involved extremely difficult research. Finding new nuclides and systematically exploring nuclides distant from the β stable line requires unique advanced equipment and conditions. In undertaking this research, the Shanghai Institute of Nuclear Research faced difficulties in experimental technology and analysis and measurement work. The topic group led by researcher Shi Shuanghui [4258 7175 1920] advanced in the face of difficulties. They utilized the isochronous cyclotron rebuilt by the institute in spending more than 1 year and making continuous measurements lasting several 100 hours to eventually obtain a large amount of the new nuclide platinum-202.

According to the experts' description, research on radiative nuclides has extremely important academic significance and real applications prospects. Very few of the more than 2,000 nuclides that mankind has learned of to date are natural ones and most nuclides are "manufactured" by scientists using scientific means. For this reason, continual exploration of ways to generate new nuclides and research on their nuclear properties and possible applications prospects have become a vanguard realm in modern nuclear physics and nuclear chemistry research.

The discovery of platinum-202 for the first time by Chinese scientists will provide an important foundation for testing and confirming theoretical predictions on nuclear structure and the discovery of new phenomena.

New Neutron-Rich Nuclide ^{185}Hf

40100011a Beijing GAONENG WULI YU HE WULI [HIGH ENERGY PHYSICS AND NUCLEAR PHYSICS] in Chinese Vol 16 No 8, Aug 92 pp 765-766

[English abstract of article by Yuan Shuanggui, Zhang Tianmei, et al. of the Institute of Modern Physics, CAS, Lanzhou 730000; MS received 26 Jun 92]

[Text] New neutron-rich nuclide ^{185}Hf has been identified for the first time. The ^{185}Hf was produced via the ^{186}W (n,2p) ^{185}Hf reaction by 14 MeV neutron irradiation of natural metallic tungsten powder and separated by radiochemical methods. The identification of ^{185}Hf was based on the observation of decay γ-ray of its daughter ^{185}Ta. A half-life of 3.5 plus or minus 0.6min was determined for ^{185}Hf by fitting the measured growth and decay curve of the 177.59 keV γ-ray which is the strongest decay γ-ray of ^{185}Ta. In addition, a new γ-ray of 164.5 plus or minus 0.5 KeV was found and assigned to ^{185}Hf.

New Neutron-Rich Isotope ^{208}Hg

40100011b Beijing GAONENG WULI YU HE WULI in Chinese Vol 16 No 8, Aug 92 pp767-768

[English abstract of article by Zhang Li, Jin Genming, et al. of the Institute of Modern Physics, CAS, Lanzhou 730000; MS received 26 Jun 92]

[Text] The new neutron-rich isotope ^{208}Hg has been identified for the first time from the reaction products in fully-stopping thick $^{nat.}$Pb target bombarded by 30 MeV/u ^{12}C beam provided by the Heavy Ion Research Facility in Lanzhou. Assignment of the nuclide ^{208}Hg was based on the measurements of the decay γ energy and half-life of its daughter ^{208}Tl, which was grown up with ^{208}Hg β^- decay. The half-life of ^{208}Hg β^- decay was determined to be 42^{+23}_{-12} min. The average production cross section of ^{208}Hg over the incident energy region from Coulomb barrier to 30 MeV/u is found to be 1.1 plus or minus 0.5 μb.