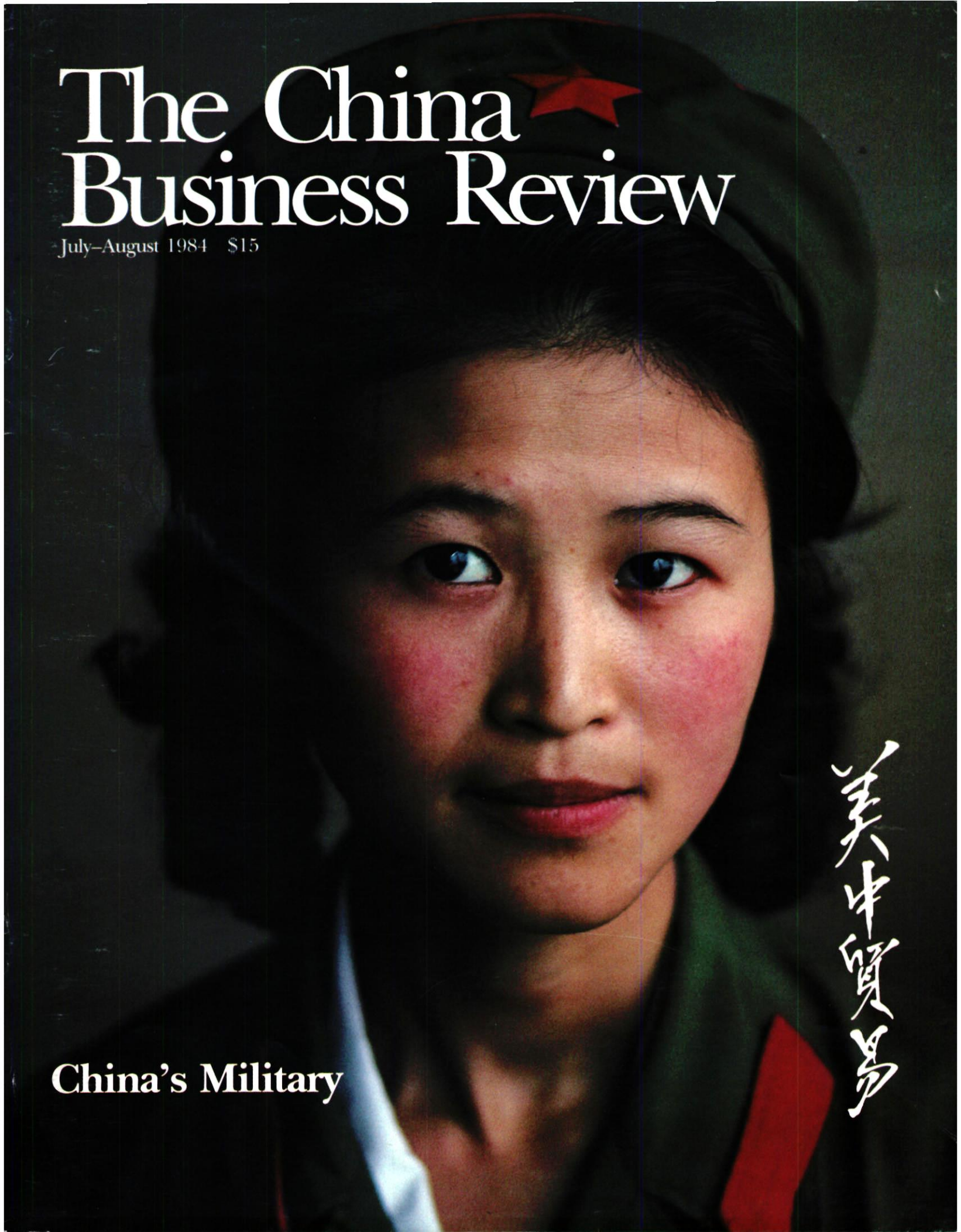
The China Business Review

July–August 1984 $15



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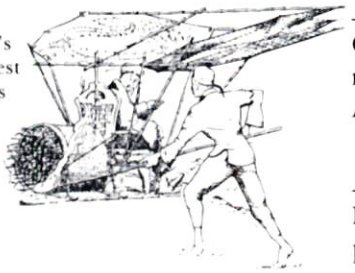
The China Business Review

The magazine of the National Council for US–China Trade

July–August 1984 Volume 11, Number 4

Cover: Today's military is looking for Western technology, modern equipment, and—most important—bigger budgets. This issue looks at what China needs to modernize its navy, air, and ground forces. *Photograph by D.E. Cox*



Space: China's historic interest in the heavens has only recently headed into outer space. **Page 12.**

Air Defense: China is seeking aviation equipment from the West, while marketing its own military equipment to less developed countries. **Page 31.**

Departments

摘要

"WE MUST ENCOURAGE COMPETITION"

Even long-time traders must sometimes wonder at the many changes that China has experienced in just six years.

Even more amazing is that the talk of reform has not abated since the historic December 1978 meeting that set China on its new course. Premier Zhao made that plain in his May 15 report to the Second Session of the Sixth National People's Congress.

This time Zhao called upon the nation to "encourage competition and prevent monopoly." His main targets for monopoly busting:

Capital construction Premier Zhao announced that henceforth all contracts for important projects ". . . must be awarded by the system of inviting tenders." This means that when office buildings, apartments, factories, and other projects are constructed in the future, "the unit that contracts with the designers and builders will select the best ones through public bidding."

Banking At a recent gathering of the Chinese Finance and Banking Society, the PRC's rigid banking system was criticized for its failure to provide "professional, flexible, efficient . . . banking services." This was accompanied by a proposal to allow new "collective, local, and cooperative banks" to be established that would compete with the Bank of China and other state banks.

Aviation After years of stern lectures and threats, Beijing has apparently decided that the only way to improve the country's airline services is to break CAAC's monopoly. Shanghai, Xinjiang, and virtually every province in south China is talking about launching its own regional airline.

The call for an end to monopolies strikes right at the heart of China's economic system, since there is hardly a significant economic activity in China that is not monopolized by a ministry or other state agency. Cutting back the power of these monopolies probably represents a healthy step, as it begins the slow and painful process of moving competition from the corridors of power to the open marketplace. Foreign traders, for one, would find it easier to deal with open competition than unseen bureaucratic rivalry.

But Premier Zhao's plan could backfire without price reform. As long as prices are irrational, competition could lead to even more irrational results than those produced by the current practice of leaving all major decisions to the bureaucracy. —JBS

THE 6TH NPC

In marked contrast to the uncertain tone of the 1983 congress, the Sixth National People's Congress in mid-May was characterized by a growing sense of confidence in the government's policies, which have sought to control the economy while maintaining growth. For the first time in many years, the government called for a hefty increase in capital construction investment—by 9 percent to ¥65 billion in 1984. This reflects satisfaction with 1983's results, which saw industrial output grow by 10.5 percent and agricultural output by 9.5 percent. If these rapid growth rates continue, it is more than likely that China's five year plan targets for 1986–90 will be set on the high side, which can only mean stepped-up investment and foreign trade.

The keynote of this year's congress was Premier Zhao's call for more reform, the strongest reformist appeal since 1980. Most significant is the attempt to further the use of taxation as a means to stimulate and control industrial performance. By the end of 1984, all state enterprises will have to pay an income tax, rather than submit their profits to the state. This, it is hoped, will make enterprises more efficient, and boost the government's revenues.

Tax rates will differ from industry to industry to help reduce sharp differences in profits due to price factors. Also, the Chinese sales tax will be changed to a value-added tax to eliminate the tax advantage currently associated with vertical integration. Finally, a "natural resources" tax will be levied on mines and oilfields with good natural conditions, in order to reduce the profit differential between poor and richly-endowed enterprises.

Another major thrust of the reform is the renewed drive to decentralize government planning powers. State Planning Commission chairman Song Ping announced that only the nation's major construction projects and most important commodities will be included in the state plan. All other projects and goods will be handled by the provinces, cities, or enterprises themselves.

In line with these initiatives, the government plans to incrementally expand the decisionmaking powers of enterprises. Under new guidelines, enterprises will be able to set the price of their goods within a 20 percent margin above or below the state price, exercise greater control

Photo courtesy of Charles Haigh

Charles I. Rostov (left), chairman of the National Council's Importer Committee and president of the Transocean Import Company, at the May 11 National Council luncheon in honor of Chen Muhua, Minister of Foreign Economic Relations and Trade. Madame Chen used the occasion to assure US importers that efforts would be made to alleviate their shipping problems and delayed letters of credit and import documents. US importers, Madame Chen emphasized, are "the true friends of China."

over the selection and purchase of materials, and even market above-quota output themselves. —MJM

THE 7TH FYP

China traders are already looking anxiously ahead to the PRC's Seventh Five-Year Plan, which begins in 1986. Initial signs suggest that it will continue Beijing's current emphasis on energy development, agriculture, light industry, transportation, and the modernization of existing enterprises.

But the State Planning Commission has indicated privately that a number of new concerns will join this list. Among these is a desire to accelerate the pace of modernization of the country's electronics industry and telecommunications infrastructure. Moreover, more reforms are contemplated, including a long overdue attempt to reform China's price structure. Finally, the government will undertake further measures to underscore China's hospitality to foreign investors. April's decision to grant expanded autonomy over foreign trade and investment to 14 port cities was just the first step. Greater legal protection for foreign enterprises is expected to follow. —JBS

WHERE IS THE RMB HEADED?

The 14 percent depreciation of the Renminbi since December represents a fairly sharp decline, even in these days of rapid currency fluctuations. It is also noteworthy that China plans to introduce a new currency sometime next year in the Shenzhen Special Economic Zone near Hong Kong. According to the June 14 announcement by Party General-Secretary Hu Yaobang, the new currency will be China's first attempt to launch a free floating currency.

The convertible currency would probably be closely related to the Hong Kong dollar. This proposal has been under study for about a year by Takugin International (Asia) Ltd., a subsidiary of the Hokkaido Takushoku Bank that has been Shenzhen's financial advisor since May.

This development could signal the end of China's internal "currency conversion" rate—the exchange rate used by Chinese state organizations to convert dollars and other foreign currencies into Chinese yuan. It was pegged at ¥2.8 to the dollar on January 1, 1981. There it has remained.

Meanwhile, China's official exchange rate—for example, the rate that tourists and business travelers must use—has risen from ¥1.6 to the dollar in January 1981 to its present level of roughly ¥2.3 to $1. A simple projection will show that at the yuan's current rate of depreciation since the beginning of the year, it will converge with the internal rate in January or February of 1985. The introduction of the new Shenzhen currency would be a convenient occasion to retire the internal rate. This would go a long way to clearing up the confusion that surrounds the PRC's exchange rate system. —JBS

SHENZHEN SPEED

The astonishing pace of change in Shenzhen, the largest and most developed of China's special economic zones has earned it a reputation for "Shenzhen speed," which shows no signs of slowing.

The Shenzhen–Hong Kong distinction is being blurred by several developments, the most recent being the decision to issue a special Shenzhen currency that could end up floating with the Hong Kong dollar. Another is the new 84 kilometer man-made boundary along Shenzhen's northern border that will become the de facto border with the rest of the PRC. A new customs law, expected to go into effect by next year, will establish six checkpoints along this border and do away with customs duties on trade between Shenzhen and Hong Kong.

When this so-called "second border defense line" becomes operational, prices in Shenzhen are expected to fall more into line with those of Hong Kong, and the entry–exit procedures for foreigners entering the zone through Hong Kong and Macao will be minimized. Meanwhile, the flow of people from the rest of China into Shenzhen and Hong Kong will be better controlled.

Despite these changes, there are no announced plans to merge Shenzhen with Hong Kong after the colony reverts to Chinese control in 1997. According to one official, Shenzhen will retain its identity as a socialist entity under communist rule, while Hong Kong will be allowed to retain its current capitalist system. But over time the powerful forces of economic integration that have been unleashed will further lessen the distinction between Shenzhen and Hong Kong. —MCR

MAGAZINE STAFF

James B. Stepanek
editor
Carol S. Goldsmith
managing editor
Madelyn C. Ross
associate editor
Priscilla Totten
copyeditor/production coordinator
Martin Weil
industry analyst
Jennifer Little
research assistant

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ISSN No. 0163-7169; USPS No. 320-050

我会活动

TRADE UPTURN PREDICTED AT 1984 ANNUAL MEETING

The theme of the National Council's 11th annual meeting in Washington, D.C., was the financing of US–China trade. In his address to 200 executives and government leaders, Eugene Lawson spoke about the dramatic improvement in the US–China trade outlook: "Last year's dark clouds have been replaced by the warm glow of Premier Zhao's successful visit and the President's trip this spring," he said. "Almost miraculously," the then deputy assistant secretary of Commerce for East Asia and the Pacific continued, "we have emerged from a time of troubles to find that the realization of the commerical potential of US–China relations may be at hand." Lawson noted that the volume of two-way trade fell in 1982 and 1983 from the historic high of $5.5 billion in 1981. But in 1984 that figure could easily be surpassed.

Commenting on the prospects for commercial banking in China, First Chicago's senior vice president, Wallace R. Anker, advised investors that "in the area of energy the potential for growth is rather impressive. China presently ranks number three in total energy production, but is in the bottom one-third worldwide on a per capita basis."

Anker, who served for two years as the bank's Beijing representative, offered the estimate that China's energy financing needs during the coming decades "will total fully $50 billion—$20 billion for offshore oil production, $15 billion for 10 major coal mines, and another $15 billion for nuclear power plants."

Looking to the future, the US Exim Bank's vice president, Raymond J. Albright, explained that China "has been completing a major review of its investment priorities and resources. . . . We expect China will be accelerating the rate at which it approaches various sources of external financing in the near future. Substantial external sources of financing will be needed to assist China in developing the major sectors to which it is now giving priority.

In his keynote luncheon address, Assistant Secretary of State Paul Wolfowitz promised that the US side "will continue to work hard to achieve an investment agreement. Americans have invested about $85 million in joint equity ventures and several times that much in other forms of investment. US oil companies will be investing hundreds of millions more in offshore exploration and major investments in coal are also likely."

The May 31 meeting also elected David C. Scott, chairman of the board and CEO of Allis-Chalmers Corporation, to the post of National Council Chairman. He replaced Walter S. Surrey, senior partner of Surrey & Morse, who has held the position since 1982.

Former Council chairman Walter S. Surrey (right), Chinese Minister-Counselor for Political Affairs Ji Chaozhu, and Council President Christopher H. Phillips

Paul Wolfowitz with Chinese Ambassador Zhang Wenjin

WOLFOWITZ

LAWSON

ANKER

ALBRIGHT

Photos by Ray Crowell

National Council chairman David C. Scott and William W. Clarke, the Council's Vice President for China Operations

Training Chinese Oilfield Workers

Western and Chinese viewpoints on training are as far apart as spoken Chinese and "Louisiana oilpatch"

Richard S. Ondrik

As one of the costs they paid for the right to drill in Chinese waters, foreign oil companies agreed to a massive program of "human technology" transfer. This will involve the creation of comprehensive training programs (at the oil companies' expense) to initiate Chinese oilfield workers into the arcane skills of oilfield communications, organization, quality control, inspection, safety, and equipment maintenance. The goal is to accelerate the placement of Chinese personnel into responsible oilfield positions while maintaining safety and efficiency.

The sheer size of the effort will be enormous. Even modest projections of offshore operations would call for an additional 2,500–3,000 skilled rig hands by 1985 just to support the minimum drilling programs required under current contract obligations. The same program would require the addition of 400–500 shore-based geologists to handle core analysis, stratigraphy, seismic analysis, and other critical functions. These numbers sound formidable, yet pale when compared to the myriad of positions and personnel that will be required to staff a modern offshore operation if substantial quantities of oil are found. Radio operators, electricians, crane operators, derrickmen, drillers, toolpushers, engineers, and mechanics will be required on the rigs, while operations managers, accountants, materials handlers, geophysicists, and other technical personnel will be needed at the shorebases. A high level of compromise, cooperation, and commitment will be necessary for such a massive endeavor to succeed.

The foreign subcontractors working for the oil companies in China are under similar pressure to provide training programs. These and other forms of technology transfer are also included in joint ventures, licensing, or other cooperative arrangements with Chinese factories and organizations. The number of such arrangements has grown enormously owing to the "preference clause"—the requirement that Chinese-supplied services and equipment be preferred to those of foreign subcontractors if they meet the same price and quality standards. Furthermore, the ramifications of the training issue go far beyond the oilfields, as the Chinese have become increasingly adept at tying technology transfer and training to direct purchases of equipment. More and more, sales are going to the companies willing to provide drawings, training, or demonstrate a willingness to assemble components in China. China's strong desire to indigenize Western technology means that in the future any company with substantial sales will probably face increasing pressure to engage in technology transfer and training.

China's unusual expectations

The Chinese are taking technology transfer and training much more seriously than most other developing nations with whom the US oil industry has dealt in the past. They do not want their petroleum industry to be just another third world state oil company—they want to be the next Exxon. They want state-of-the-art technology—and training—which meets the highest technical standards in the shortest possible time. They expect companies to make front-end commitments to train personnel by offering extensive classroom, on-the-job, and study abroad programs. Moreover, they want these companies to give responsible jobs to Chinese nationals with a minimum of delay. The much-touted Chinese patience is not evident in the area of training—they want it now.

The Western viewpoint

The attitudes of Western firms toward training vary greatly, but, by and large, they fall far short of China's expectations. Some companies try to provide the barest minimum of training in order to hold down overhead costs. This is particularly understandable in those cases where a manufacturer has been forced to transfer technology as a condition for the sale of its equipment, for which it has received little or no compensation for the technical expertise provided, and has no tangible stake whatsoever in the success or failure of the Chinese to absorb the technology. In addition, some of the joint ventures and other agreements are seen as "loss leaders." Western firms sign such agreements in the hope of gaining greater market access for their products. To fulfill their training commitments, the companies ship drawings, engineering diagrams, provide perhaps 1000 hours of training abroad, or provide the same lectures through on-site interpreters that they give to domestic employees. In such cases little concern is given to the ability of the Chinese to digest the information, or to the venture's ability to manufacture the equipment within a reasonable time frame—

Richard S. Ondrik is director of Business Development and manager of the Houston office of China Energy Ventures. He is the author of China's Petroleum Equipment Industry: A Reference Catalogue, *published by the National Council in 1983. His articles have appeared in* The CBR *and other trade journals.*

much less to the venture's commercial success.

Such marginal efforts, which view training only as an obligation, seldom transfer very much know-how. Furthermore, while the initial stages of the cooperative arrangement may, in fact, produce the desired market access, it could also become a two-edged sword. The company runs the risk that the Chinese could become disillusioned with the venture's inability to produce the world-class equipment or service, and retaliate by closing the China market to the foreign company.

Petroleum service contractors, particularly drilling service contractors, face very different circumstances. They must employ Chinese in their own drilling operations. In fact, they are under pressure to place Chinese in positions of high responsibility, such as driller and toolpusher, and they must maintain a certain percentage of Chinese on their rigs. Thus, the safety, operation, and profitability of the operation depends on the proficiency and productivity of their Chinese employees.

All of the major international drilling contractors have recruited employees worldwide, and already have a great deal of experience in training personnel to operate and maintain the vessels of their drilling fleets. Nearly all of their training programs, though, are on-the-job-training (OJT) programs that allow for a steady progression of learning and experience over time, leading to positions of responsibility.

The Chinese recognize the effectiveness of OJT, yet they are unwilling to accept the extended time frame needed for advancement. They have exerted heavy pressure in negotiations for apprenticeship programs and the horizontal integration of personnel directly into high-level positions, rather than follow the slower, step-by-step advancement procedures of the standard OJT program. For example, in the standard OJT program, the absolute minimum time required for advancement from floorhand to driller is three years, while such progress usually takes seven to ten years. In one negotiating session with a drilling firm, CNOOC's South Sea Branch asked that a man be apprenticed to an expatriate driller, whom he would replace, not in three years—*but after three wells.* Although the pressure is intense, no drilling contractor is willing to jeopardize the safety of the rig and its personnel, or suffer the losses caused by delays and down-time due to untrained and inexperienced crews.

Avoiding upfront costs

Several grandiose schemes have been proposed to establish extensive training complexes and even university facilities in China to be funded and operated by several companies. But such plans are premature. Not only are foreign oil companies unlikely to cooperate, partly for antitrust reasons, but a large educational venture would cost approximately $1–2 million annually. This may seem a relatively small amount when compared to the $10 million price tag of an average exploration well, but it is not really so small when one considers that under the contract terms the foreign operator must bear *all* costs of the exploration phase. If no oil is discovered, these costs will not be recouped. As a result, foreign operators are anxious to avoid front-end expenditures and any long-term commitments until oil is found. When it is found, the petroleum university project will no longer be just a pipe dream.

Contractual misunderstandings

The operating oil companies face the largest commitments, widest range of potential problems, and the highest degree of risk. To begin with, their offshore concession agreements place them under a contractual obligation to transfer technology and training. These contract clauses are vague and imprecise about the goals to be achieved; hence disagreements can easily occur when it comes time to measure the success of the training programs. In one case, the demands and expectations of the Chinese negotiators covered the entire gamut of technologies and were totally inconsistent. "They really didn't know what they wanted," claims one top oil industry negotiator. As a result, the clauses were left ambiguous because the issue threatened to derail the negotiations over drilling rights.

Although such a delaying maneuver may be expedient, it does present dangers. How are the operational people who arrive in China supposed to implement or quantify such contract phrases as "working together," "industry standards," or "mutual cooperation"? The company is required to transfer technology, yet there are no specific targets or objective measures of contract fulfillment. In the worst-case scenario, the Chinese could claim breach of contract if they are dissatisfied with the training results, and refuse to share production from wells brought onstream by the operator.

Dreaming different dreams

Most of the training clauses hammered out so far merely paper over the deep-seated differences in expectations that still exist. Technology transfer in most developing countries has been simply a spinoff activity, with OJT being the primary training mode. Any separate training programs were simply offered as an incentive in order to gain lease concessions, and were closely tied to OJT and the actual scope of the company's operations.

Under ideal circumstances, companies want training programs that conform to a realistic, cost-effective timetable, and reflect the actual progress and requirements of their operations. The Chinese, for their part, view training as a separate issue of great importance to the development of their entire economy, and as a steppingstone to the creation of a modern, nationwide oil industry. They look toward large shore-based training schools or even university complexes to train petroleum engineers, geologists, geophysicists, and financial analysts. The Chinese cannot agree with foreign operators who focus merely on OJT, hands-on experience, and advancement through the ranks, though such training methods utilize existing programs and in-house personnel.

The great divergence between Chinese and Western expectations regarding training is likely to have serious ramifications. Even if there were complete agreement between the parties on the larger issues—the goals, procedures, and objectives—there would remain sizable obstacles to the effective implementation of training programs in China. The bureaucratic and cultural barriers to successful training in China are not only sizable, but quite different from those encountered by international operators in other emerging nations. The prepackaged, in-house training programs that have served the indus-

The Chinese want the foreign oil companies to give responsible jobs to PRC nationals with a minimum of delay. The much-touted Chinese patience is not evident in the area of training—they want it now.

try so well in the past simply will not work in China. Creative approaches and extensive modifications to existing programs will be necessary to achieve a true "cross-cultural" transfer of human technology. Otherwise the programs will fail.

Selecting the right trainees

The experience of one oil company, in particular, sheds light on the actual circumstances that foreign trainers can expect to encounter in China. The company's director of training, who has worked for more than a year in the South China Sea area, places stress on selecting the right trainees. "Selection is the key to success," he emphasizes. The Western notion of selection, involving job descriptions, interviews, pre-testing, setting qualifications, and competition, is foreign to the Chinese and politically difficult to implement. China is the home of the "iron rice bowl," where no job vacancies are posted, and where all workers are guaranteed a minimum income and social welfare benefits. After completing his or her education, a typical Chinese worker is assigned to a "work unit," usually for life.

Foreign companies therefore have to obtain their employees from local Chinese labor service bureaus or other Chinese organizations (the "work unit"), to which they must submit requests for personnel. The notion of providing more than one candidate for a position so that the foreign company can select the more qualified candidate is completely alien. For one position, the Chinese will supply one candidate. If that individual does not work out, they will grudgingly provide another. Working for a foreign company is a prestigious appointment, but, conversely, being rejected carries an equally large loss of face. After six months of negotiation, one foreign company won the right to select its trainees from an average of three candidates per position. However, the procedure did not hold true in all cases, for when the foreign side agreed to send eight students abroad for advanced study, the Chinese provided exactly eight candidates.

Foreign operators in the South China Sea are fortunate in that CNOOC's South Sea Branch has access to a relatively large reservoir of experienced workers drawn from duty in the on-shore oil industry. Hence, the work unit is large. Companies dealing with other Chinese organizations may find that the local unit's labor pool is too small to provide an adequate selection option, even though China's petroleum industry has made a conscious effort to shift technically competent people to positions that deal with foreigners. Even worse, such units are not allowed to draw candidates from other work units with surplus labor, as this would normally require the approval of the Ministry of Labor, the other ministry or bureau involved, the other local work unit, and probably several other organizations. In short, it would require a command decision at the very highest level in the Chinese bureaucracy to accomplish such a relatively simple break with tradition.

Hiding the best

Generally speaking, a "job description" simply has no place in China. The work unit is accustomed to having employees assigned to it with little regard for the skills needed—they take what they get, and have no means of discharging an unproductive worker, except to redeploy the worker somewhere else in the unit. Even though high level technical skills are needed to operate modern equipment, the work unit has no means and little desire to prequalify its candidates. After all, the worker's educational institution—another unit—is supposed to provide the skills.

Under the circumstances, work units have a strong incentive to hide their best personnel so that they are not "lost" to other units, in this case foreign firms. For that reason the detailed job descriptions provided by foreign companies are likely to be politely accepted and promptly discarded. For example, in response to one company's two-page job description for the position of a maintenance engineer on a jack-up rig, the Chinese provided only one candidate whose entire work experience had been as a "fish feeder" at the Hainan fish hatchery. In the case mentioned earlier, only four of the eight students sent abroad for advanced study in petroleum engineering were able to pass the language examination for entry into the university program. This occurred after four months of intensive language study. The four individuals simply did not have the aptitude for foreign language. Ultimately, only one of the remaining four had the language skills and technical capability to successfully complete the university program.

The language barrier

Most foreign oil companies report that language aptitude testing is the most critical part of the final stages of the selection process. After obtaining the right to interview and test from a pool of candidates for each position (and realizing that experienced personnel, at least by Western standards, were not available) one company altered its selection criteria to test for learning aptitude—for basic technical skills, English, and new work attitudes. In this case the Chinese demanded that all candidates for the same job be interviewed simultaneously. But knowing that this would only produce a choreographed charade of identical responses, the company pressed for individual interviews. These were conducted through an interpreter provided by the SSB, and produced almost identi-

cal responses—almost as if the candidates had been programmed to respond with pat answers. Traditional Chinese cultural values of harmony and consensus will often lead Chinese to respond with answers they believe the questioner wants to hear. Knowing this, the company returned to the drawing board to make its questionnaire more discriminating, yet the results were still peculiarly similar. However, when the SSB interpreters were replaced with Hong Kong interpreters, the same tests were successful in distinguishing clear differences between candidates. This outcome is not surprising when one considers that the SSB interpreter reports to the same organization and same hierarchy as the candidates. The candidates know that it is the interpreter's duty to report on their interviews, particularly if their answers deviate from the norm. Furthermore, Chinese interpreters are notorious for "loose translations" that overlook the nuances of the original speech, and for using the same pat translations for very different original remarks. Chinese interpreters have been known not to translate at all, but to create a response they believe the interviewer wants to hear in lieu of the respondent's answer.

The language barrier and use of translators will have ramifications throughout both training and operations. Even with a cadre of highly qualified and interested trainees, the finest technical trainer or expatriate supervisor will be worthless if he or she cannot communicate effectively. Many foreign firms bring Chinese trainees to their domestic training schools or factories, or send technical teams to China to deliver lectures through an interpreter. In most cases, the firms rely on the Chinese to provide the interpreter. However, the great number of projects and ongoing negotiations with foreigners has depleted China's stock of competent interpreters such that many foreign firms have found that their interpreters have had less than one year of English language training. Moreover, few have had any technical language training or exposure to the industry.

English is the international language of the oil industry (although there is a big difference between the "King's English" and "Louisiana oilpatch"). Even the French firm Total Chine (CFP) runs English classes for its trainees in order to improve communications generally, and reduce the role of interpreters in its OJT program. With six instructors at its peak, Total trained 120 students in basic technical English over a three-year period, and sent five Chinese interpreters to England for advanced technical translating. As a result, Total's OJT program grew from 30 trainees on the rig at the outset to 70 on board when the drilling program was curtailed.

Raising motivation

The problem of motivating workers is perhaps even more serious than that of communications. A Chinese worker assigned to a foreign firm will be called upon to increase his or her productivity many times over the normal work load expected in domestic work units. Yet the foreign company has no way to reward the Chinese worker's efforts with salary increases, bonuses, or promotions. Furthermore, it is almost impossible to fire unsatisfactory workers for low productivity. Even dismissing workers for very serious reasons, such as violating safety rules, negligence, or absenteeism, is reportedly resisted by the Chinese side. Most remarkable of all, the Chinese workers remain the direct employees of their work units, which are still responsible for their compensation, bonuses, and promotions. Many expatriate supervisors have been shocked to discover that they have almost no influence over the status of their employees.

The two-tier wage system

Foreign firms pay international wage rates for their Chinese employees. These are normally paid to the employees' work unit, yet the employees take home only about 10 percent of the wages paid. According to one source, the average take-home pay for Chinese roughnecks, roustabouts, wipers, and utility men is about ¥70 per month ($35) plus ¥2 ($1) per day for days aboard the rig. The rigid wage structure applies as well to managerial and other positions of responsibility, even though these positions may call for considerable supervisory, administrative, and leadership skills.

China's adherence to the principles of egalitarianism makes it difficult for the Chinese to justify in ideological terms the payment of differential wages simply because a worker puts in longer hours, works harder, or takes increased responsibility. In addition, the two-tier wage structure allows the domestic work unit to subsidize its own expenses and projects, as well as increase the precious foreign exchange reserves of its parent organization.

Lingering fears

Chinese employees, too, realize that the foreign contractor has very little influence over their careers. Promotion within the work unit is often influenced more by ideological considerations and political propriety than by hard work. The worker realizes the political winds in China shift very quickly—the Cultural Revolution ended only eight years ago—and too cooperative an attitude toward the foreigners may become a liability and lead to criticism by one's peers and the party cadres. One foreign trainer remarked that when a Chinese engineer recently began showing initiative in rig opera-

ADVICE TO THE UNWARY: TRAINING PROGRAMS ALSO REQUIRE US GOVERNMENT APPROVAL

The delays and restrictions imposed by US export licensing restrictions are constantly on the minds of US and Chinese negotiators. The laws, which apply to both equipment and training, can pose a real hardship to US firms attempting to fulfill their contractual obligations. For example, the Nanhai–Oxy–Sedco drilling joint venture has had its training operation on the ground in China since February. The trainers are on-site, offices and classrooms have been reserved in Guangzhou, while classroom materials are translated and ready. But because of export clearance delays, no classes other than in basic English have begun. In spite of repeated assurances by high-level US government officials that China-bound technology license applications will be processed according to faster, liberalized guidelines, export controls remain a major obstacle to US oil companies, service contractors, and equipment suppliers trying to operate competitively in the China theater. —RSO

tion and maintenance, he came under intense peer pressure for being "too Western."

All of these factors contribute to poor work attitudes. The "iron rice bowl" guarantees a minimum subsistence regardless of the worker's output, while the opportunity for career advancement or reward is minimal. Thus, the Chinese worker or trainee is often apathetic, may show little individual initiative, is loathe to take responsibility, and may simply ignore basic maintenance, safety, and operational procedures. For example, a cementing job was done through the blowout preventer stack of China's new semisubmersible, Nanhai II. The stack was neither flushed, nor received any basic maintenance. It had to be completely stripped and rebuilt before it could begin drilling for BP in the Pearl River Basin in November 1983. Selection may be the key, but motivation is the only means to ensure continued success.

"Disappearing" workers

Since foreign companies do not directly employ Chinese workers, they have little control over external transfers or promotions. One company has experienced a turnover rate of about 60 percent in a single year. Most often, no explanations are given for either transfers or absenteeism. In the words of one trainer, the workers would "just disappear." On one occasion, the trainer's complement of trainees was almost entirely depleted in a single day. Pressed for an explanation, the Chinese manager replied that orders had come down from the top that the South Sea Branch was to return 200 "victims of the Cultural Revolution" to Shanghai to complete their education, which the Cultural Revolution had cut short. Therefore, to meet its quota, the SSB had rounded up young people from the base (including trainees) and put them aboard the train to Shanghai.

Meeting the challenge

The transfer of skills and know-how to China's offshore petroleum industry will be a formidable task. Yet it is not an impossible one. An international oil industry that has overcome the harsh environments of Alaska, Nova Scotia, and the North Sea is capable of meeting the challenge of training in China. In fact, the international oil companies have successfully integrated personnel from other emerging nations into their sophisticated operations, where the workers were less literate and had fewer basic skills than the typical Chinese oilfield hand. The first operators, like Total Chine, have spearheaded the effort and both the Chinese bureaucracy and the foreign oil companies are learning from each other. There are positive signs that both sides are becoming less intransigent and more understanding of the needs and problems of the other. Careful attention will have to be paid to the training programs. Above all, the procedures for selection, motivation, and tenure must be defined. Negotiations will continue to be difficult, but as Philippe Martin of Total Chine remarked to a group of Houston-area oil executives last March, "Everything can be negotiated in China, and they are reasonable people." ❧

China in Space

A new spaceport and powerful booster rocket show Beijing's determination to enter the "new frontier"

Bradley Hahn

Only recently has China emerged as a contender in space. While the specific date the PRC's space program was officially initiated is not publicly known, it probably got under way shortly after the establishment of the State Scientific and Technological Commission in 1958. Zhou Enlai was then designated to establish and direct a space program organization to include institutes, factories, and test facilities. Initial space program research and testing included sounding rockets and high-altitude balloons. These nonorbital launch vehicles probed the earth's upper atmosphere, measuring meteorological conditions, cosmic radiation, magnetic fields, and undertook instrumentation and space biological experiments. This initial effort provided considerable knowledge and experience in manufacturing modern rocket motors, instruments, and ancillary equipment. According to one Chinese official, the PRC is spending almost 1 percent of its gross national product on space research and development, equivalent to several billion dollars per year.

China's first artificial earth satellite, the SKW-1/DFH (Dong Fang Hong or "East is red"), was successfully launched on April 24, 1970. Weighing 173 kilograms, it was at least 24 kilograms heavier than the first satellite launched by the USSR, US, France, Japan, or India. Since that time, a total of 14 satellites have been placed into a low earth orbit (at least six were successfully recovered), and one into geostationary orbit. Through these experiments the PRC has acquired an extensive capability in spacecraft technology, remote sensing exploration, and its related infrastructure. In addition to enhancing the country's ability to design and manufacture space vehicles, carrier rockets, orbital control equipment, retro rockets, and heat resistant materials, Chinese scientists have been conducting studies in space medicine as preparations for a future manned space flight program. Complementing these efforts have been research and development programs in ground environment testing, tracking, telemetry, power source applications, attitude positioning, thermal control, and satellite structure.

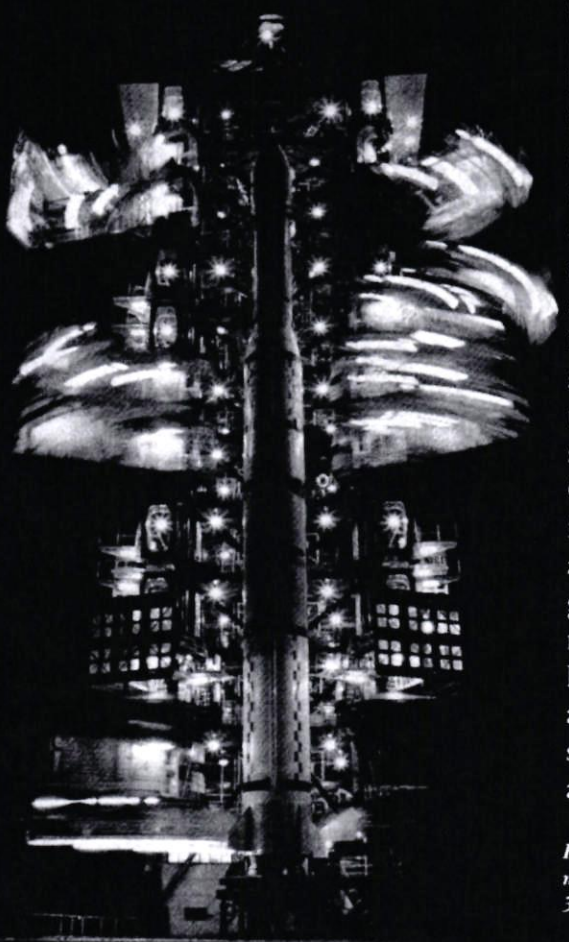

Photo courtesy Xinhua News Agency

Ready for launch: China's first communications satellite atop the powerful CZ-3 three-stage booster.

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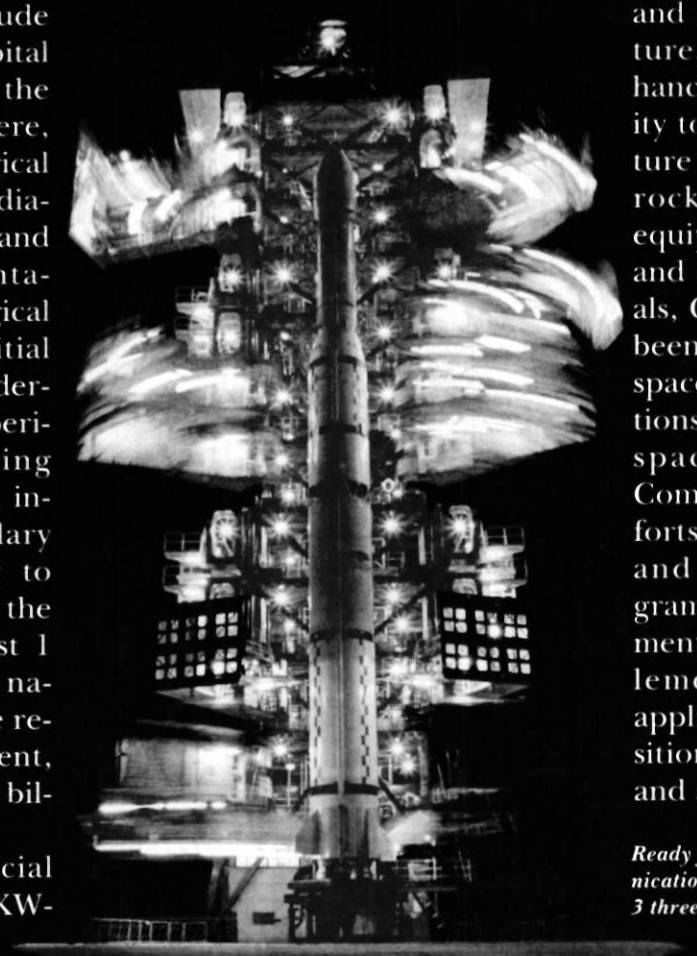


Ready for launch: China's first communications satellite atop the powerful CZ-3 three-stage booster.

Photo courtesy Xinhua News Agency

China's aerospace history can be separated into three phases. According to a top Chinese Academy of Space Technology official, "Between the mid-1950s and the mid-1960s was a foundation-laying stage. . . . Next was testing time, begun in 1970 . . . the third stage will be the application of these skills to create new satellite capabilities."

The Jiuquan spaceport and Chongqing complexes

Today more than 50 major Chinese aerospace design, research, test, production, launch, and support facilities have been publicly identified. Two-thirds of these facilities are known to be located in the Beijing and Shanghai regions. The metropolitan areas of Hohhot, Lanzhou, Nanjing, Taiyuan, and Xi'an also contain key program elements. From available evidence it appears that the first 13 of China's 15 successful (and possibly three unsuccessful) orbital missions were launched from the Shuangchengzi North launch complex at the edge of the Gobi desert at roughly 41°N and 100°E. Then, in early 1984, China opened a second spacecraft launch complex for the newly operational Changzheng San (CZ-3 or "Long March 3") booster, China's third space transportation system. This new spaceport appears to be located at approximately 2,000 feet elevation on the upper reaches of the Min River near the small town of Chongqing, Sichuan Province, about 40 kilometers west of the provincial capital, Chengdu. Based on published photography, this aerospace facility is a considerable improvement over the Jiuquan installation. Though it is purely guesswork at this stage, the Chongqing complex could be designed to serve as the base from which China will one day inaugurate its own commercial satellite launch program.

The Chinese Academy of Space Technology (CAST), established in Beijing in 1968, is the key facility for overseeing space program activities. This institution is responsible for program coordination and liasion. But since the field of space technology is the synthesis of many disciplines, the PRC leadership also found it necessary in 1977 to establish a center for space research to manage the nation's emerging space effort. Thus, the Chinese Academy of Sciences (CAS), itself organized around some 120 institutes, formally put into operation a Space Sciences and Technology Center. The center has five principle departments: Space Science, Technology, Programs and Systems Research, Remote Sensing, and Ground Systems. Within the past three years two other major experimental centers have become involved with China's advanced technology aerospace effort. One is the new astrophysics research center located in the Fenghuang mountains near Kunming, Yunnan Province. This center also has management responsibility for a number of projects in astrophysics related to national defense. The other is the Heilongjiang Laser–Infrared Experimental Center at Harbin, which commenced operation in 1981. According to various reports, this experimental center specializes in the development of laser and infrared technology and equipment.

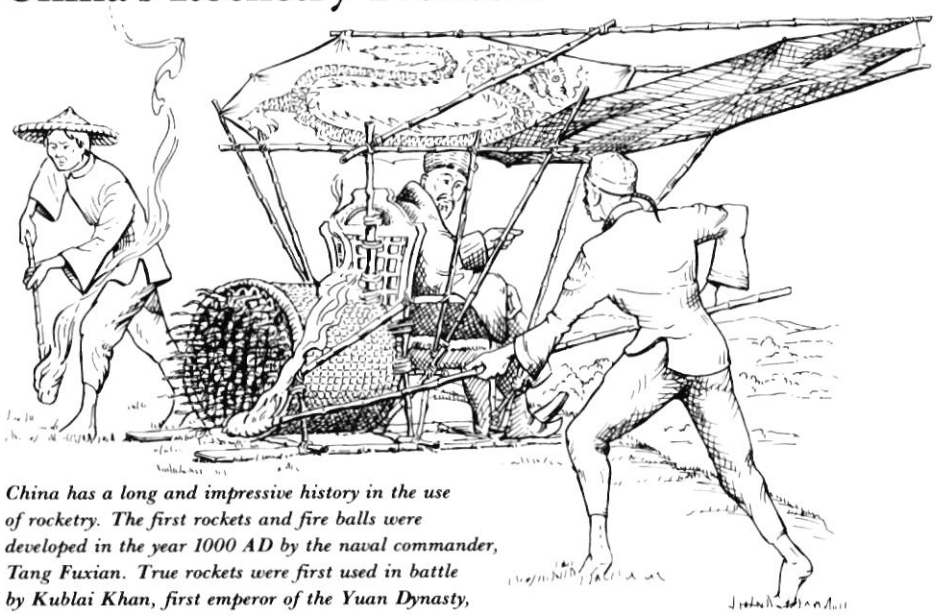
New fuel developments

In his first report to Congress in 1977, Secretary of Defense Harold Brown noted that the PRC had made a substantial investment in research, developmental testing, and production for both liquid and solid propellant missile systems. Originally, China received technology and technical assistance from the USSR to produce liquid rocket fuels. However, shortly after the departure of Soviet technicians around 1960, Chinese industry began unassisted production of its own liquid rocket fuel for satellite launch systems.

The result was the FB-1/CSL-2 liquid fuel booster (the designation FB stands for "Feng Bao" or "Tempest"), which in design and fabrication is up to date with US approaches used on the Titan and Saturn and on the Space Shuttle's external booster engines. Since its first flight in 1975, the FB-1/CSL-2 is China's second space transportation system. It has played a significant role in the PRC's evolving space capability, launching space probes numbers 3 through 13. Since perhaps 1978, China's rocket fuel industry has also been producing cryogenic (low temperature) fuels. These liquid hydrogen and oxygen fuels (like those used on the Space Shuttle's three main rocket engines) propel the third stage of the new CZ-3/CLS-3 spacecraft booster. The existence of this advanced rocket motor fuel technology was verified by Western visitors to the PRC as early as 1979.

Along with the establishment of

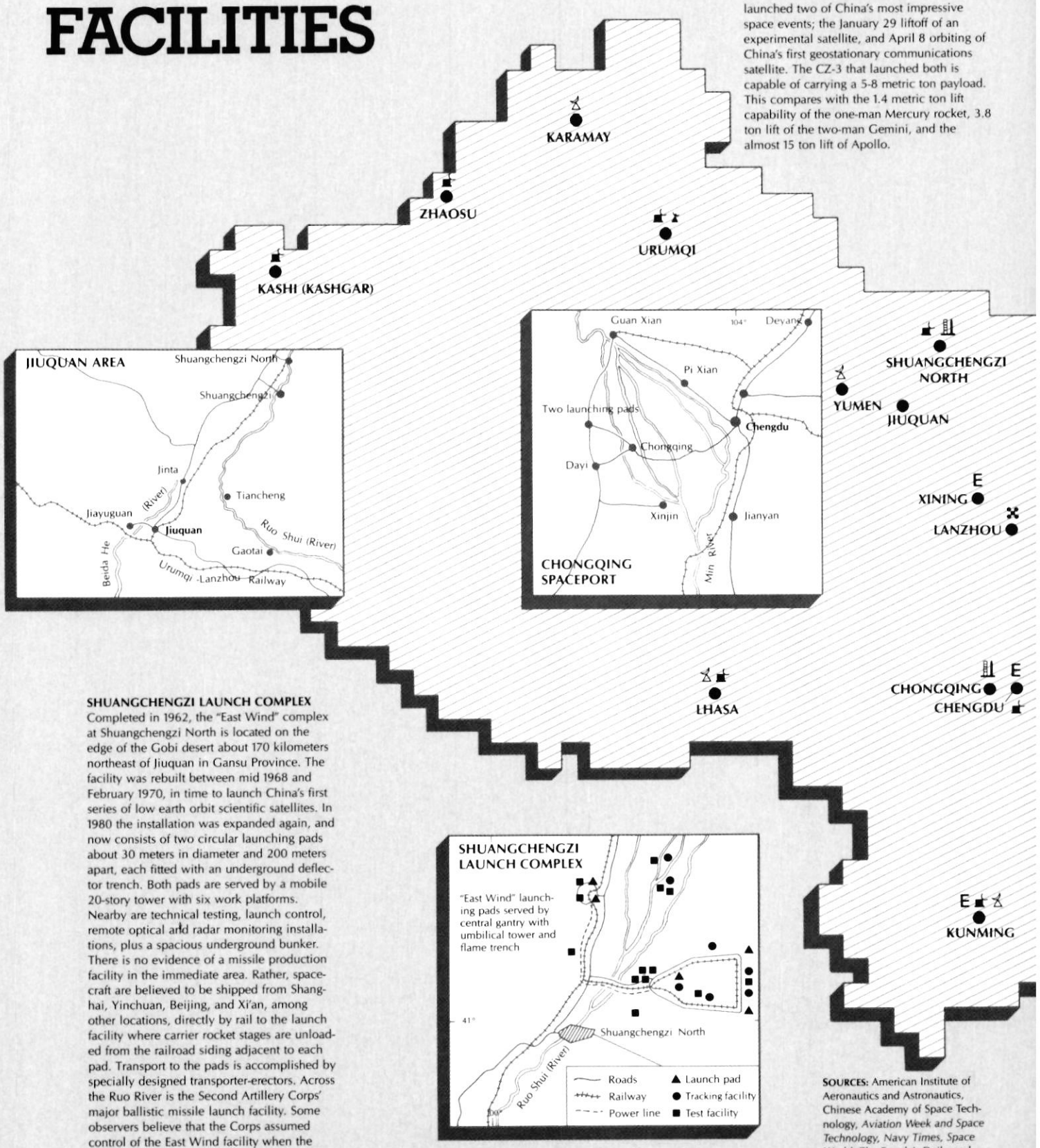
China's Rocketry Pioneers



China has a long and impressive history in the use of rocketry. The first rockets and fire balls were developed in the year 1000 AD by the naval commander, Tang Fuxian. True rockets were first used in battle by Kublai Khan, first emperor of the Yuan Dynasty, in military expeditions against Japan in 1274 and 1281. Multiple launchers followed in the fourteenth century, and in the fifteenth century primitive two-stage missiles appeared. The first reported instance of manned rocket launch attempt occurred about the beginning of the sixteenth century, when an inventor, Wan Hu, experimented with black powder propulsion. According to one source, Wan constructed a two-wheeled chair to which 47 black powder rockets were attached, bound together inside a cylindrical shield. The chair was also fitted with two large kites for balance and control. The report states, however, that soon after ignition of the rocket cluster, the chair, kites, and Wan Hu disappeared in a cloud of smoke and fire.

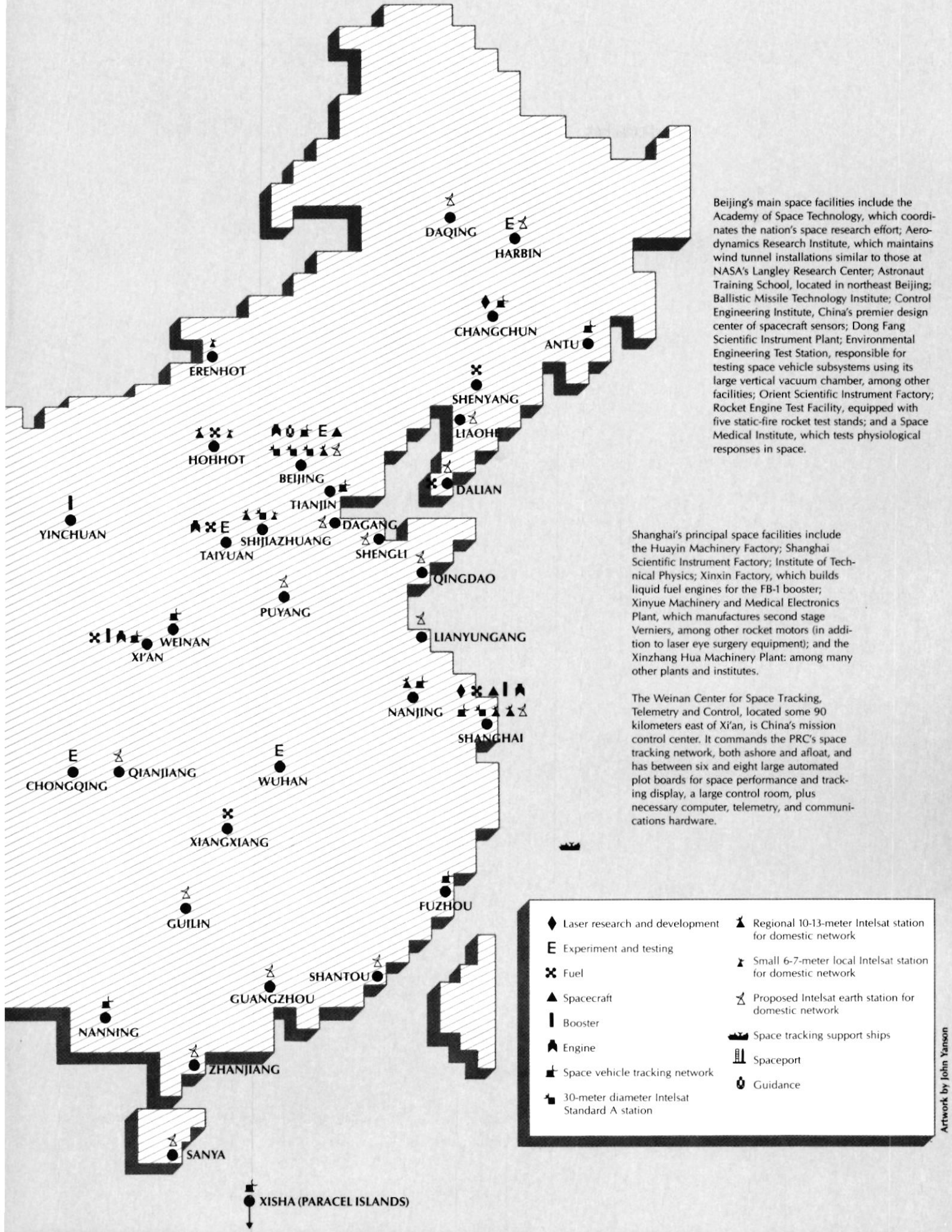
CHINA'S SPACE FACILITIES

CHONGQING LAUNCH COMPLEX China's newest spaceport is believed to be located just north of Dayi and Chongqing, and about 60 kilometers west of Chengdu, the capital of Sichuan Province. The facility has already launched two of China's most impressive space events; the January 29 liftoff of an experimental satellite, and April 8 orbiting of China's first geostationary communications satellite. The CZ-3 that launched both is capable of carrying a 5-8 metric ton payload. This compares with the 1.4 metric ton lift capability of the one-man Mercury rocket, 3.8 ton lift of the two-man Gemini, and the almost 15 ton lift of Apollo.



SHUANGCHENGZI LAUNCH COMPLEX Completed in 1962, the "East Wind" complex at Shuangchengzi North is located on the edge of the Gobi desert about 170 kilometers northeast of Jiuquan in Gansu Province. The facility was rebuilt between mid 1968 and February 1970, in time to launch China's first series of low earth orbit scientific satellites. In 1980 the installation was expanded again, and now consists of two circular launching pads about 30 meters in diameter and 200 meters apart, each fitted with an underground deflector trench. Both pads are served by a mobile 20-story tower with six work platforms. Nearby are technical testing, launch control, remote optical and radar monitoring installations, plus a spacious underground bunker. There is no evidence of a missile production facility in the immediate area. Rather, spacecraft are believed to be shipped from Shanghai, Yinchuan, Beijing, and Xi'an, among other locations, directly by rail to the launch facility where carrier rocket stages are unloaded from the railroad siding adjacent to each pad. Transport to the pads is accomplished by specially designed transporter-erectors. Across the Ruo River is the Second Artillery Corps' major ballistic missile launch facility. Some observers believe that the Corps assumed control of the East Wind facility when the new Chongqing spaceport opened in Sichuan Province.

SOURCES: American Institute of Aeronautics and Astronautics, Chinese Academy of Space Technology, *Aviation Week and Space Technology, Navy Times, Space World, The People's Daily,* and author's interviews with Chinese space experts.



Beijing's main space facilities include the Academy of Space Technology, which coordinates the nation's space research effort; Aerodynamics Research Institute, which maintains wind tunnel installations similar to those at NASA's Langley Research Center; Astronaut Training School, located in northeast Beijing; Ballistic Missile Technology Institute; Control Engineering Institute, China's premier design center of spacecraft sensors; Dong Fang Scientific Instrument Plant; Environmental Engineering Test Station, responsible for testing space vehicle subsystems using its large vertical vacuum chamber, among other facilities; Orient Scientific Instrument Factory; Rocket Engine Test Facility, equipped with five static-fire rocket test stands; and a Space Medical Institute, which tests physiological responses in space.

Shanghai's principal space facilities include the Huayin Machinery Factory; Shanghai Scientific Instrument Factory; Institute of Technical Physics; Xinxin Factory, which builds liquid fuel engines for the FB-1 booster; Xinyue Machinery and Medical Electronics Plant, which manufactures second stage Verniers, among other rocket motors (in addition to laser eye surgery equipment); and the Xinzhang Hua Machinery Plant: among many other plants and institutes.

The Weinan Center for Space Tracking, Telemetry and Control, located some 90 kilometers east of Xi'an, is China's mission control center. It commands the PRC's space tracking network, both ashore and afloat, and has between six and eight large automated plot boards for space performance and tracking display, a large control room, plus necessary computer, telemetry, and communications hardware.

Artwork by John Yanson

The long-run goal of China's aerospace program is to advance overall industrialization, but in the short term national defense will probably absorb the lion's share of China's aerospace budget.

the liquid rocket fuel industry, China also began a solid fuel development program. The success of this program was demonstrated on October 16, 1982, when one of China's new Xia-class nuclear submarines launched a two-stage solid fuel missile from underwater.

Tracking space vehicles

China's primary satellite tracking, telemetry, and command center is located 90 kilometers northeast of Xi'an, and controls a seven station network that began operation in 1970. Land-based tracking and monitoring facilities have recently been augmented by a series of specially configured seagoing vessels designed for satellite tracking, instrument recovery, navigation, spaceflight detection and tracking, long-range communications, bathymetric, seismic, and a number of other space-related research activities (*see* page 17).

China's satellite communications R&D effort began in the 1960s. An analog satellite communications ground station was completed in 1975, and the first Chinese-built digital satellite communication stations began operations in 1977, five years after the first foreign digital stations were placed in China. The Chinese-made antenna provides two-channel color television that apparently employs technology that approaches the most advanced in the world. Since 1978, China has designed, built, and placed into service a number of fixed and mobile earth stations with 10–13 meter antennas. Similarly, through use of the French–German Symphonie Satcom, a broad range of testing has been conducted that involves video conferences, single channel-per-carrier digital communications, multi-channel voice, and high resolution facsimile transmissions. Almost all of China's 29 provinces are reportedly equipped with automatic picture transmission ground stations that receive four kilometer resolution pictures transmitted from orbiting US satellites. In 1985 a US firm will install a $10 million Landsat earth station outside Beijing to enable China to systematically receive, process, and analyze data from US Landsat satellites. The completion of these and other projects reflects the growth of China's satellite and ocean communications capability in the area of space exploration and national defense.

China already has the capacity to deploy several unmanned space vehicles, each to a different orbital plane in low earth orbit (LEO), utilizing a single carrier rocket. The unmanned space program involves design and development of surveyor craft, applications, and scientific vehicles.

The first eight satellites launched by the PRC basically carried out four different missions: evaluating new technology, small space vehicles, photoreconnaissance, and developing re-entry techniques that would eventually prepare the way for manned spaceflight. To complement China's reconnaissance activities, the PRC purchased from the US in 1978 some 2,800 frames of "nonmilitary" Landsat photographs. Subsequent missions tested more sophisticated spacecraft, including a PRC-built comsat.

China's manned space program

Following the launching of dogs, mice, rats, and fruit flies into suborbital trajectories in the 1960s, China turned to planning a manned space flight program. The publicity surrounding China's astronauts began in 1980, and pictures of them undergoing training have appeared in a number of Chinese-language magazines.

The initial astronaut training for the selected PLA Air Force pilots included an emphasis on physiological stress, centrifuge, and zero-gravity activities. Later, capsule vibration, rotations, and pendulum movement tests took place to condition the candidates to an actual launch environment. This was followed by exposure to space vehicle habitability, earth and extraterrestrial simulation, as well as impact tests for ground landings. Space food and pressurized space suit technology have also been under development for at least five years.

Recent reports suggest that China may be reassessing the direction of its future manned space programs. By utilizing Russian and American knowledge and experience, the Chinese are expected to bypass the entire phase of space exploration that utilized Soyuz and Apollo-type earth orbiting craft. Some Western observers now believe that China will attempt to take the quantum jump from unmanned space instrument testing to the launching of a reusable flying body space vehicle.

In this way, China could learn from the successful US Space Shuttle program as well as the series of Soviet experiments with aerodynamic lift body technology. This approach would significantly reduce China's program costs, while at the same time materially advance its overall objectives. Ever since Vice Premier Deng Xiaoping visited the Johnson Space Center in Houston in early February 1979, he has reportedly been keenly interested in the military aspects of unmanned and manned space flight.

A manned space launch in the 1980s?

Senator John Glenn told the 18th Space Congress on April 29, 1982: "America won the space race to the moon, but is losing the technological race because of inadequate funding for research. . . . The US may be out-

distanced by not only the Soviet Union, but Japan and China." He claimed that the Soviets expect to have a cosmonaut on Mars by the end of the decade, while China and Japan may have astronauts in space even earlier.

Contrary to some past reports that manned space flight will not occur during the 1980s, US Space Shuttle astronauts Lousma and Fullerton, who recently toured China as guests of the Chinese Academy of Space Technology, have confirmed that the PRC is currently preparing to launch its first manned space mission into low earth orbit.

There is considerable supporting evidence that a manned shuttle mission could occur within the next few years. For more than ten years the PRC has been experimenting with the thermal problems associated with spacecraft re-entry. These tests reportedly achieved results that could ensure the successful operation and return of a space vehicle. Moreover, American and European aerospace experts recently returned from Beijing and Shanghai report stepped-up activity in the areas of environmental conditioning and development.

Examination of published photographs of the inside layout of the Chinese manned spacecraft mockup or simulator gives the impression of a rather large configuration, perhaps larger than a US Apollo capsule. The appearance also suggests a Space Shuttle-type interior structure as well. This has given rise to speculation that China intends to rely on reusable space vehicles instead of costly one-time-only capsules. The dimensions of the mockup also appear to be compatible with the size and lift capabilities of China's third-generation space transportation system, the CZ-3/CSL-3 booster, launched for the first time in January 1984.

China's surprising state-of-the-art technology

Perhaps the best description of the PRC space program is "advanced but simple." In November 1979, a group of highly qualified specialists visited a number of PRC aerospace facilities under the joint sponsorship of the American Institute of Aeronautics and Astronautics (AIAA) and the Chinese Society of Astronautics. The AIAA's technical assessment appeared in its 1980 "China Space Report." It said: "In many cases our preconceived notions proved misleading. We were, in fact, surprised at the advanced state of development in several technological areas based upon work conducted in China in the last two or three years. In several areas, such as in the development of

CHINA'S SPACE PROGRAM SUPPORT FLEET

Class name/number	Type	Date placed in service/ operating authority	Characteristics tonnage/ dimensions/speed	Comments
Daijiang J506	Capsule recovery	1980/Navy [1]	4,300/112×15×5m/16 knots	Space instrument, recovery and salvage ship fitted with helodeck and fully equipped hanger for 2 Super Frelon helicopters.
Haiyang 1	Geophysical research	1972/CAS	@5,000/106×NA×NAm/20 knots	Converted merchant ship equipped with scientific instrumentation including seismic gear, satellite navigator, gravimeter, and magnetometers.
Keyue 1	Geophysical survey	1981/CAS	2,925DWT/98×16×7m/19 knots	A marine geophysical survey ship built by Shanghai's Hudong Shipyard, and fitted with imported advanced satellite navigation, position finding, and seismic mologic equipment.
Nanhai 502	Geophysical research	1980/CAS	943GRT/66×11×4m/15 knots	Built by Mitsubishi Heavy Industries, designed for bathymetric and seismic research using satellite and terrestrial fixing.
Xiangyanghong 5	SESS	1972/CAS	14,000/153×20×9m/16 knots	Polish built 1967-type B41, purchased by China in 1970; rebuilt and stationed in Guangzhou.
Xiangyanghong 9	Oceanographic research	1978/Navy [1]	@5,000/112×15×6m/NA	A deep ocean general purpose scientific research ship equipped with satellite navigator, Omega, Loran A & C, instrumentation for physical, chemical, biological, and geological work; capable of 60-day periods of independent operation.
Xiangyanghong 10	SESS	1974/CAS	10,975/156×21×7m/20 knots	Used primarily for missile test support, oceanographic and meteorological duties; equipped with folding crane, parabolic as well as "mogoperi" long range communications antennae.
Xiangyanghong 11	Oceanographic	1975 [2]/CAS	@14,000/153×20×9m/20 knots	Ship type similar to Xiangyanghong 5, but without as extensive scientific installations.
Yuanwang 1 [3]	SESS	1979/CAS	17,100/190×23×8m/20 knots	Fitted with all types of missile and space flight tracking equipment and stern helodeck; stationed in Shanghai.
Yuanwang 2	SESS	1980/CAS	17,100/190×23×8m/20 knots	Detection and tracking "suit" different from that installed on Yuanwang 1.

NOTES: One nautical mile equals 6,076.1 feet. m=meters. CAS=Chinese Academy of Sciences. SESS=Space event support strip.

[1] Assigned to operational control of CAS as required.

[2] Approximate date.

[3] PRC authorities report that this class will eventually number 10 units. Their detection and tracking capabilities will undoubtedly vary depending upon future space project requirements.

Chart prepared by Bradley Hahn.

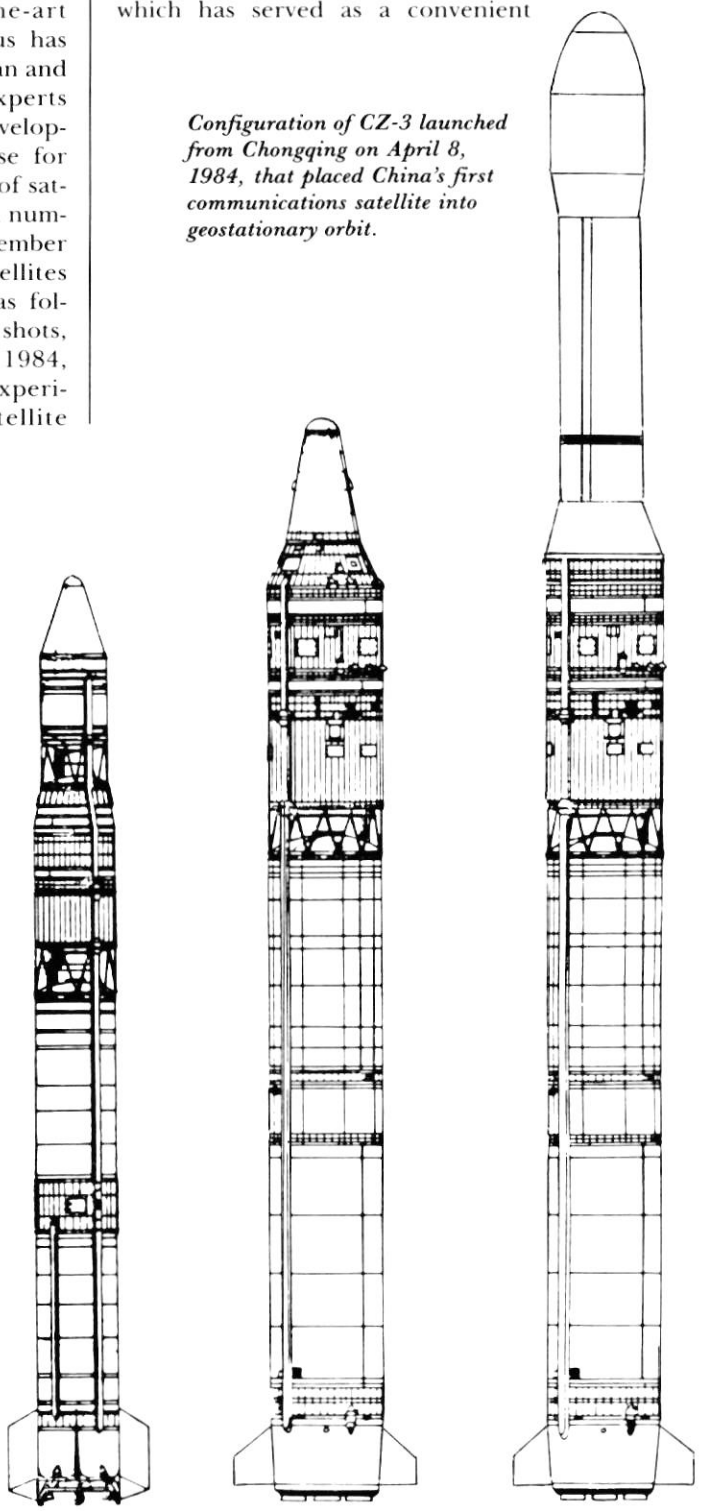
microwave solid state devices and techniques, the research appeared to be advancing apace with that in the US. Certainly, any sweeping observation that China aerospace technology is 'n' years behind the US must be made with care. In truth, 'n' is anything from zero to ten or fifteen years. It might even be negative in a few areas."

Foreign experts continue to bring back surprising observations concerning China's state-of-the-art space technology. A consensus has now developed among American and European space program experts that the Chinese are rapidly developing a broad technological base for the production and launching of satellites. For example, space shot number 11 (*see* page 20) on September 19, 1981, put up three satellites with a single booster. This was followed by three more successful shots, and then climaxed on April 8, 1984, with the launching of an experimental communications satellite into geosynchronous orbit.

Absorbing Western technology

Despite a minimal level of interactions with the world's scientific and technological community, the PRC has nonetheless developed and maintained a system for the collection, collation, analysis, and distribution of scientific and technical data. This is complimented by covert activities, centered mainly in Hong Kong, which has served as a convenient "back door" to obtain critical materials and equipment. In addition, a sizable number of highly qualified Chinese scientists and technicians have returned to the PRC over the years from various parts of the world, carrying with them a wide range of Western scientific and technical knowledge, ideas, and practical experience.

Configuration of CZ-3 launched from Chongqing on April 8, 1984, that placed China's first communications satellite into geostationary orbit.



CZ-1/CSL-1 **FB-1/CSL-2** **CZ-3/CSL-3**

The CZ-1 *A 3-stage modified CSS-3 limited range ICBM with total length of 27.6 meters, diameter of 2.4 meters, satellite bay of 2.7 meters, and stage spacing of 0.6 meters. First stage: length 15.6 meters; diameter 2.4 meters, launch weight 84.5 metric tons, engines four 37.5 metric ton thrust stainless steel rockets with caste aluminum turbopumps; propellant liquid nitrogen tetroxide and unsymmetrical dimethylhydrazine; total thrust approximately 1,471,000 newtons at sea level. Second stage: length 5.8 meters; diameter 2.4 meters; launch weight: 15.3 metric tons; engine one 37.5 metric ton thrust rocket; structure same as second stage of CSS-3 limited range ICBM with skin 4 percent copper-aluminum alloy milled chemically; total thrust approximately 367,750 newtons in vacuum. Third stage: length 2.9 meters; diameter 2.0 meters; total thrust 68,650 newtons in vacuum; engine possibly an experimental first or second stage of early PRC SLBM; propellant solid bipropellant fuel; structure probably similar to early US Polaris SLBM; maximum payload 250-300 kilograms in circular low earth orbit.*

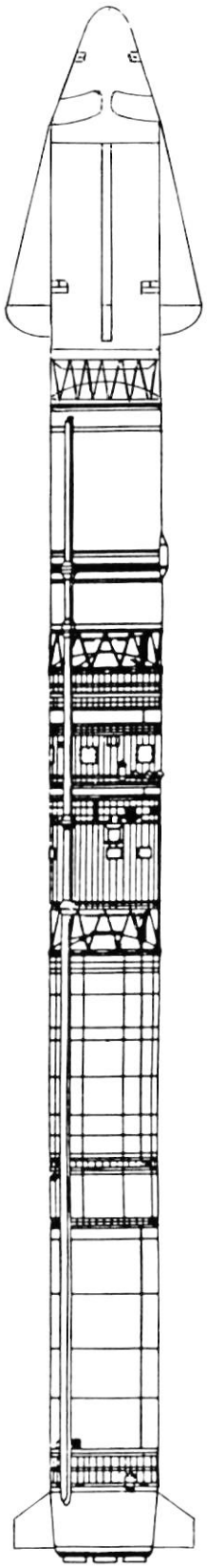
CZ-3 Third Stage *Length 8 meters; diameter 2 meters; launch weight 12.5 metric tons; engines cluster of four cryogenic 1.135 metric ton thrust rockets using liquid oxygen and hydrogen; maximum payload 800-900 kilograms into geosynchronous transfer orbit and about half that weight into synchronous orbit; total thrust 44,530 newtons in vacuum.*

FB-1 and CZ-3 Second Stage *Length 8.3 meters; diameter 3.35 meters; launch weight 36.3 metric tons; engine one 70 metric ton thrust rocket plus four 1.125 metric ton thrust Verniers with 10 degree gimbals; total thrust 730,600 newtons in vacuum. Most other characteristics same as for first stage.*

FB-1 and CZ-3 First Stage *Length 19.2 meters; diameter 3.35 meters; launch weight 172.4 metric tons; engines four 70 metric ton thrust rockets with cast aluminum turbopumps, 10:1 expansion ratio, 74 kilogram per square inch chamber pressure, direct impingement-type injection, 10 degree gimbals, and self-pressurized system for main ducts connected to propellant tanks; skin 4 percent copper-aluminum alloy milled chemically; total thrust approximately 2,746,000 newtons at sea level. (One newton is the unit of force required to accelerate a 1 kilogram mass 1 meter per second per second.)*

SOURCE: Hahn Associates International.

Artist's rendering of possible two-astronaut space shuttle on modified CZ-3 weighing 5-7 metric tons and fitted with 4 cryogenic 1.5 metric ton thrust engines.



Modified CZ-3

These and other factors have allowed China to make a series of breakthroughs in nuclear weaponry and military ballistic missile systems. For example, in late 1981 the PRC became the fourth country to successfully test a new type of miniature electric rocket, after the US, USSR, and Japan. This type of micropropulsion rocket, known as a pulsed plasma selector, is designed to ensure proper attitude and direction control of a satellite while in orbit. This recent success has ushered in a new stage of research and development for future space applications.

Mastering satellite technology

China's earth resources research lags behind its meteorological program, and no satellite launch is expected prior to 1985. However, the PRC is presently using the US Landsat and French Spot satellites to further their knowledge.

Satellite technology in the PRC is also moving ahead in a number of areas such as detectors, linear arrays, digital signal processing, optics, bearings, plastics, receivers, transmitters, multiplexers, and total remote sensing. Principal areas requiring considerable attention are component and system reliability, along with long life designs.

Limited coordination in the areas of project control, scheduling, quality assurance, and modeling reliability continue to slow progress. The lack of integrated program management, rather than lack of funds, appears for the moment at least to be the "Achilles' heel" of China's space program.

As a result of the post-1972 US–China rapprochement, the scientific communities of the two countries have initiated a series of "show and tell" activities designed to acquaint each side with the other's research activities. The fields covered include high energy lasers and particle beam experiments. The Chinese reportedly used lasers rather than electricity as a more economical method for processing the uranium that was used in the PRC's first successful detonation of a nuclear device almost two decades ago. Since that time, the Chinese have made considerable progress in the study and application of laser technology and the production of laser equipment.

In addition, the US sold $265 million worth of aviation equipment to China in 1983, and several technology transfer agreements are now under discussion. Some of these involve equipment of a dual-use nature, which is to say it has both military and nonmilitary applications. US aerospace corporations have been encouraged by US officials to cooperate with the PRC, and aerospace will be the focus of a presidential trade mission to China in 1984. CAD/CAM computer technology, in particular, is a major focus of PRC interest.

Unlike its other industrial sectors, China's space industry enjoys the latest in modern technology, the support of a comprehensive industrial complex, and a highly trained contingent of scientific and technical personnel. The workforce officially stood at 12,000 administrators, advisors, scientists, technicians, and production personnel in 1981, and is expected to double by the end of this decade. China presently has thousands of students in aerospace disciplines in a number of West European, Japanese, and US universities. Much of the growth in staff undoubtedly will be assigned to key military space programs.

Limited coordination in the areas of project control, scheduling, quality assurance, and modeling reliability continue to slow progress. The lack of integrated program management, rather than lack of funds, appears for the moment at least to be the "Achilles' heel" of China's space program.

In short, the PRC's present and probable future aerospace capability vis-a-vis the other five countries involved in the so-called space race (the US, USSR, France, Japan, and India) shows that China occupies a strong competitive position. Assuming that its current level of commitment is maintained, China could attain a low earth orbit lift capability by the end of the decade, nearly comparable to

CHINA'S SPACECRAFT

Attempt	Launch Time (GMT)/date carrier system	Designations PRC	USA	International	Weight (Kg)	Configuration (Dimensions in meters)	Perigee (Kms)	Apogee (Kms)	Inclination (Degrees)
1	-/68/-	—	—	—	—	—	—	—	—
2	1330/24 Apr 70 (Dong Fang Hong)	Mao 1 (SKW-1)	4382	1970-34A	173	Multifaced spheroid (1)	439 [434*]	2,384 [2,267*]	68.4
	CZ-1/CSL-1[1]		4392	1970-34B	—	Cylindrical	441 [422*]	2,386 [1,785*]	68.4
	Fragment		4400	1470-34C	—		423	2,076	68.5
3	1300/3 Mar 71	Mao 2 (SKW-2)	5007	1971-18A	221	Multifaced spheroid (1)	268 [165]	1,830 [1,127]	69.9
	CZ-1/CSL-1		5041	1971-18B	[218]	Cylindrical	265	1,825	69.9
4	1330/26 Jul 75	Mao 3	8053	1975-70A	@ 1,200	Cylindrical (2.5L × 1.7D)	186 [155]	464 [380]	69
	FB-1/CSL-2[2]		8054	1975-70B		Cylindrical	184	453 [361]	69
5	0330/26 Nov 75	Mao 4	8452	1975-111A	@ 1,200	Spheroid	173 [175]	483 [399]	63[3]
	FB-1/CSL-2		8453	1975-111B					
	Largest fragment		8454	1975-111C		Cylindrical	177	466	63
	Fragment		8455	1975-111D					
	Fragment		8456	1975-111E					
	Fragment		8457	1975-111F					
6	0925/16 Dec 75	Mao 5	8488	1975-119A	@ 1,200	Cylindrical (2.5L × 1.7D)	185 [155]	387 [380]	69 [68.9]
	FB-1/CSL-2		8491	1975-119B		Cylindrical	185	380	69
7	1140/30 Aug 76	Mao 6	9394	1976-87A	250-270[4]	Spheroid?	195	2,145	69.16 [69.2]
	FB-1/CSL-2		9395	1976-87B		Cylindrical	190[5]	2,150	69.17
8	0435/7 Dec 76	Mao 7	9587	1976-117A	@ 2,200	Tapered	172	479	59.45
	FB-1/CSL-2		9596	1976-117B		Cylindrical	169	481	59.45
	Module		9597	1976-117C	[6]	Spheroid	—	—	—
9	-/26 Jan 78	Mao 8	10611	1978-011A	@ 2,400	Tapered	161	479	57.03
	FB-1/CSL-2		10612	1978-011B		Cylindrical	—	—	59.5
10	/29-31 Jul 79	—	—	—	—	Tapered	—	—	—
11	-/19 Sep 81	PRC 9A [9]	12842	1981-093A	—	Tapered			
		PRC 9B [10]	12843	1981-093B	—	Tapered			
	FB-1/CSL-2 [improved][7]		12844	1981-093C	2,650-2,900	Cylindrical	240	1,600	59.5
		PRC 9C [11]	12845	1981-093D		Tapered			
	Fragment		12847	1981-093F	—				
	Fragment		12884	1981-093G	—				
	Fragment		12885	1981-093H	—				
	Fragment		12890	1981-093J	—				
	Fragment		12958	1981-093K	—				
12	-/9 Sep 82	PRC 12	13521	1982-90A	@ 3,000	Tapered	194	390	63
	FB-1/CSL-2 [improved]		13540	1982-90B		Cylindrical			
	Fragment		13557	1982-90C					
13	-/19 Aug 83	PRC 13	14288	1983-086A	@ 3,000	Tapered	160	266	63.3
	FB-1/CSL-2 [improved]		14289	1983-086B		Cylindrical			
	FB-1/CSL-2 [improved]		14290	1983-086C					
			14293	1983-086D					
			14294	1983-086E					
			14296	1983-086F					
14	-/29 Jan 84	PRC 14	14670	1984-008A	@ 900 [gto]	Tapered	287 [359]	468 [6,479]	31.0 [36]
	CZ-3/CSL-3		14671	1984-008B		Cylindrical	283	471	31.0
			14672	1984-008C			343	384	31.0
15	1920/8 April 84	PRC 15	14899	1984-035A	902 [gto]	Tapered	35,786	35,790	0.6
	CZ-3, CSL-3		14900	1984-035B	@ 420 [gso]	Cylindrical	439	35,501	31.1

Note: Data in [ ] reflects divergent foreign sources. *indicates Perigee & Apogee parameters as of December 31, 1983.

[1] The CZ-1/CSL-1 is a three stage version of the CSS-3 ICBM, reportedly capable of lifting 250-300kg into a circular 1000km LEO. In Comparison, the Soviet B-1 Cosmos launch vehicle, whose first stage is a SS-4/Sandal, has been regularly used to launch Cosmos satellites weighing 400-450kg.

[2] FB-1/CSL-2, a modified CSS-4 ICBM, according to PRC sources, is capable of lifting up to 2,200kg into LEO. It should be noted that a variety of payload weights have been reported for Mao 3-8 launches ranging from 2,700-4,500kg, with Western evaluations of 3,500kg predominant; the FB-1 is assembled at a factory in Shanghai and shipped by rail to the Jiuquan Space Center near Shuangchengzi where the spacecraft and shroud are fitted.

[3] At a 63 degree orbit inclination, the spacecraft had extended time over PRC territory just above Lopnor and Gobi Deserts allowing for the reentry module to land on flat terrain; also provides good coverage of the USSR land mass.

[4] Figure based upon orbital parameters.

[5] Data based upon 3,600 radar and optical observations; orbit at 51 epochs from October 16, 1976 through February 4, 1978; height band of 200-230km; eccentricity was 0.129.

LAUNCH STATISTICS

Period (Minutes)	Estimated life (Yr/Mo/Day)	Decayed (Date)	Remarks
—	—	—	Unconfirmed reports allege a satellite launch attempt occured during 1968 using an experimental booster launched from Shuangchengzi; payload and partially expended rocket impacted somewhere in the Himalayas.
114 [112.7]	100/-/-	—	Broadcast music to "Dong Fang Hong" [The East is Red], a Chinese song paying tribute to then Chairman Mao Zedong, transmitted on frequency of 20.002MHz until June 1970; also announced the time as it passed over various parts of the world; became the heaviest initial payload orbited by any country to date.
114 [107.3]		—	
110		23 Mar 83	
106.2	5-6/-/-	17 Jun 79	Two telemetry systems; short term 20.002MHz; long term 19.996MHz; transmitted on 20.002MHz for 12 days when batteries failed; remained joined to carrier until March 11, 1971; powered by solar cells; TV camera made observations of meteorological features above Asia; data received by APT stations and SESS; was only 10-day mission.[6]
106.1		16 Feb 76	
91	-/1/20	14 Sep 75	Transmitted on 19.996MHz[9]; good definition TV camera for photo-reconnaissance and meteorological observations; prototype vehicle for Mao 4 and 5; intentionally reentered the atmosphere September 14 over the Pacific Ocean; decay point near 52S, 136E; Xinhua claims was "preparedness against war."
90.8 [89.9]		25 Aug 75	
91	-/1/-	29 Dec 75	First generation operational photo-reconnaissance satellite; six pieces went into orbit; equipped with high resolution camera system; after six days of orbital life a data film capsule was successfully ejected and recovered on December 2; mission believed to have monitored USSR military activities along portions of the Sino-Soviet border.[8]
		22 Dec 75	
91		29 Nov 75	
		28 Nov 75	
		28 Nov 75	
		28 Nov 75	
90.2 [89.9]	-1/10	27 Jan 76	Large satellite identical to Mao 3; equipped with good resolution TV camera for photo-reconnaissance and meteorological operations; different orbital plane suggests no recovery operations planned; equipped with 3-axis stabilized solar cells and on-board computers; was 10 day mission.[8]
90.2 [89.4]		10 Jan 76	
108.7 [108.8]	5-6/-/-	25 Nov 78	Transmitted on frequency 20.002MHz; reportedly a small experimental space vehicle equipped with one TV camera and powered by solar cells; believed similar to Mao 2 and perhaps its replacement; also reported as the PRC's first electronic 'ferret'.
108.7		4 Feb 78	
91	-/1/-	2 Jan 77[10]	Large satellite, reportedly a 2-ton vehicle, with a heavy recoverable module weighing two-thirds of the total payload; possibly a manned spacecraft prototype; photo-reconnaissance mission oriented; 2-day coverage accomplished some photography of specific USSR and US targets by a new very-high resolution camera system for the comparison of test photos of similar PRC installations; an unqualified success.
91		29 Dec 76	
89		9 Dec 76	
90.9	-/-/15	7 Feb 78	The 2,400kg photo-reconnaissance satellite was successfully recovered on February 7 after a five-day mission.
		6 Feb 78	
—	—	—	PRC satellite launch attempt failed in late July 1979, according to a 1527 GMT Tass report of August 1; contained 2 experimental units, solar cells and actuators.
		26 Sep 81	Three space physics experimental satellites were accurately placed into separate and independent orbits; systems functioned normally; mission shows the PRC has masted the single rocket-multiple satellite launching technique.
		6 Oct 81	
103	-/6/-	22 Nov 81	
		17 Aug 82	
		25 Nov 81	
		22 May 82	
		20 May 82	
		20 Oct 81	
		16 Nov 81	
90.2	-/-/15	21 Sep 82	Scientific test satellite; precursor to the 1984 launch of the CZ-3/CSL-3.[11]
		9 Sep 82	
		11 Sep 82	
88.8	-/6/-		Announced as another successful launch of a space science satellite which "entered orbit accurately, and all meters and instruments functioned normally. Satellite returned to earth August 24, as scheduled."
		30 Aug 83	
		20 Aug 83	
		20 Aug 83	
		21 Aug 83	
		20 Aug 83	
92.1	-/6/-	—	Launched into a highly elliptical orbit; spacecraft was initially placed into a low-altitude parking orbit before being boosted to a higher trajectory.[12]; first successful launch of China's CZ-3 space transportation system from China's new spaceport at Chongqing, Sichuan Province.
92.1		—	
91.8		30 Jan 84	
1,436.2	indefinite	—	Experimental communications satellite placed into geostationary orbit across the equator at 125 degrees east longitude; propelled by a "new type of three-stage rocket," this was the second satellite launched from China's new space port at Chongqing.
830.2	indefinite	—	

[6] FB-1 booster engines extension and increased expansion ratio would improve performance by 2,000kg to 900km retrograde or about 2,900kg to LEO.
[7] Improved FB-1, perhaps with elongated nozzles, improved expansion ratio and/or small power buss, with a 15-20 percent improved LEO lift capability.
[8] PLA military authorities commanded all phases of the launch, orbit, and recovery operations (if any).
[9] These frequencies are regularly used by Soviet Cosmos and manned space vehicles because they permit long range communications.
[10] Atmosphere decay rates before and after capsule ejection on December 9, strongly suggests a large portion of the initial payload was deorbited lending credence to the manned spacecraft flight equipment theory.
[11] The CZ-3/CSL-3 is a three stage version of the FB-1 launch system; third stage engines used cryogenic fuel. Reportedly capable of lifting between 5,000 and 8,000kg into LEO; definitely a manned spacecraft launch vehicle. Launch weight including payload is approximately 215 tons.
[12] The orbit achieved by this satellite was far too low to allow insertion of the spacecraft later into geosynchronous orbit [gso], though the mission probably was related to the development of China's communications spacecraft program.

SOURCE: Hahn Associates International, July 1984.

ESTIMATES OF CHINA'S FUTURE UNMANNED SATELLITE LAUNCH SCHEDULE, 1984-87

Year	Designation/type	Weight	Orbital parameters	Instrumentation	Comments
1984	PRC 16/ Meteorological [1]	@ 650 kg	900 km polar; inclination 99°; sun synchronous	Two channel very high resolution radiometer [VHRR] 4 km-visible and infrared bands; 30 kg; 65 watts; one solar monitor; 1,400 2×2 cm solar cells; 3 panels, absorption area 6 sqm; 250 watts; attitude control; two scanners; 0.006/sec jitter; 2 APT transmitters; two channel mag-tape analog recorder.	Stabilization accuracy plus or minus 1° in 3 axis, zero momentum system; life expectancy about six months; instrument mockup observed at Huayin Machinery Factory, Shanghai; if successful, the PRC will become the third nation, after the USSR and US, to launch a meteorological satellite into geosynchronous orbit.
	PRC 17/ STW-2 [T-2] [2] Experimental ComSat	@ 650 kg	70° E Stationary	C-band FSS communications package; two channel radiometer for high resolution-visible infrared bands	Stabilization accuracy plus or minus 1° in 3 axis, zero momentum system; could be a further development of Mao 3, and use same frequencies during 10-day mission; tested on-board computers, horizon scanner and video recording systems.
1985	PRC 18/ Earth resources	—	@ 155 × 380 km	—	Similar to US Tiros-N or NOAA-6 systems.
	PRC 19/ Hybrid-ComSat and TV Broadcast	—	Geosynchronous	—	A PRC-1 operational communications satellite system.
1986	PRC 20/ Meteorological	—	Polar orbit; inclination 99°	—	If successfully launched, the PRC will become the fourth entity, after the US, ESA, and USSR, to have an operational meteorological satellite system.
	PRC 21/ Communications	—	Geosynchronous	—	A PRC-2 operational communications satellite system.
1987	PRC 22 or 23/— Communications	—	Geosynchronous	—	The direct broadcast satellite may be purchased either in the US or France, and be launched by the US Space Shuttle, French Ariane, or US McDonnell Douglas Delta boosters.

NOTE: China's original launch schedule was materially cut back in May 1981; hence, some of the above launch schedules could be delayed.

[1] The first launch of the three-stage CZ-3/CSL-3 booster occurred in January 1984; this 3.3 meter diameter, 3-stage booster undoubtedly will be scheduled for launching most follow-on missions.

[2] Registered with ITU. STW-1/2 refers to the "Shiyan Tongxun Weixing 1/2." Chart prepared by Bradley Hahn.

that of the Space Shuttle.

Ren Xinmin, president of the Chinese Academy of Space Technology, said in a recent visit to Japan, "we also are actively conducting research on launching of 'Skylabs'. . . . The development of space flight projects cannot be divorced from the industrial base as a whole." He obviously viewed spacecraft production and launch vehicles as being prime stimuli of basic industrial progress.

According to comments by William Perry, undersecretary of Defense during the Carter administration, the PRC appears to have "launched an all out effort to advance its technology." The US has pledged to cooperate. While visiting Beijing in May 1983, Commerce Secretary Malcolm Baldrige announced, "China can expect to obtain higher levels of US technology more quickly under new orders from President Reagan."

During Premier Zhao Ziyang's visit to the United States, he and President Reagan signed on January 12, 1984, two bilateral cooperation agreements in science and technology that will open new areas for industrial and technological cooperation.

Advances in stationary orbiting

A major focus of Chinese interest continues to be geosynchronous earth satellites. Significantly, the equatorial orbit achieved by China's first geostationary communications satellite in April lies at 125 degrees east longitude, or over the East China Sea and the island of Taiwan. A broadcast satellite development project has also been underway for some time now. China plans to buy two direct broadcast satellites with a lifespan of seven years from the US or West Germany. These would be launched by 1986 or 1987. Together with the related technology they expect to acquire, the Chinese will attempt to build their own second generation direct broadcast satellite system.

Recent reports indicate that as many as six more unmanned satellites are scheduled to be launched during the next three or four years. Current satellite hardware programs for unmanned and manned space vehicles appear to include receiving and processing terminals, research, development, fabrication, and the testing of spacecraft technology. The latter would include thermal control, electric power, propulsion, communication subsystems, radio engineering, spectral channel application, thematic mapping, high resolution radiometer sounders, and fine resolution instruments.

The greatest effort in the field of

electronics seems to be centered on lasers, radar, infrared, radio, semiconductors, and computers. China is only gradually making the move from transistors to chip technology. The current PRC goal appears to focus upon the 64K chip popular in the US in the early 1980s.

The next series of Chinese space shots will probably include basic communications, direct broadcast, weather, earth resources, navigation, space astronomy, and ocean surveillance satellites, followed by a manned space laboratory and controlled orbit military space ships. Most Western space scientists believe that based upon its past progress, current commitment of resources, and anticipated rate of technological advancement, China should be able to achieve all of these goals by 1990.

China's "star wars" development program

Comments by US Defense Secretary Caspar Weinberger and others about the possibility of fighting wars in space have obviously created apprehension and insecurity in Beijing, and increased the desire to "keep up with the Joneses." Partly as a result of the fear of falling behind, the Chinese are rapidly pursuing the US and Soviet lead in developing nuclear and laser weapons platforms in space. In particular, China has been closely following US work in chemical high energy laser technology, as well as pulsed pump, electron beam pump, chemical, excimer, rare gas halide, and nuclear explosive-driven orbital lasers. The first generation of PRC testing and development has centered on scaled-down chemical lasers. The next step will be to place such instruments in orbit, even though their intercept accuracy is still limited to a narrow tolerance.

The Chinese also appreciate that space technology intersects a host of related defense technologies, particularly communications and surveillance. Other related priorities include missile guidance, antisubmarine warfare, and antisatellite weaponry. It is perhaps only a matter of a few years before Chinese-manned military space platforms become a reality.

Antimissile lasers

There is some unofficial evidence that the PRC hierarchy believes that a space-based defense capability promises the best immunity against a nuclear first-strike by a hostile power. They may also recognize that such a capability by other major powers will simply extend the arms race deeper into space.

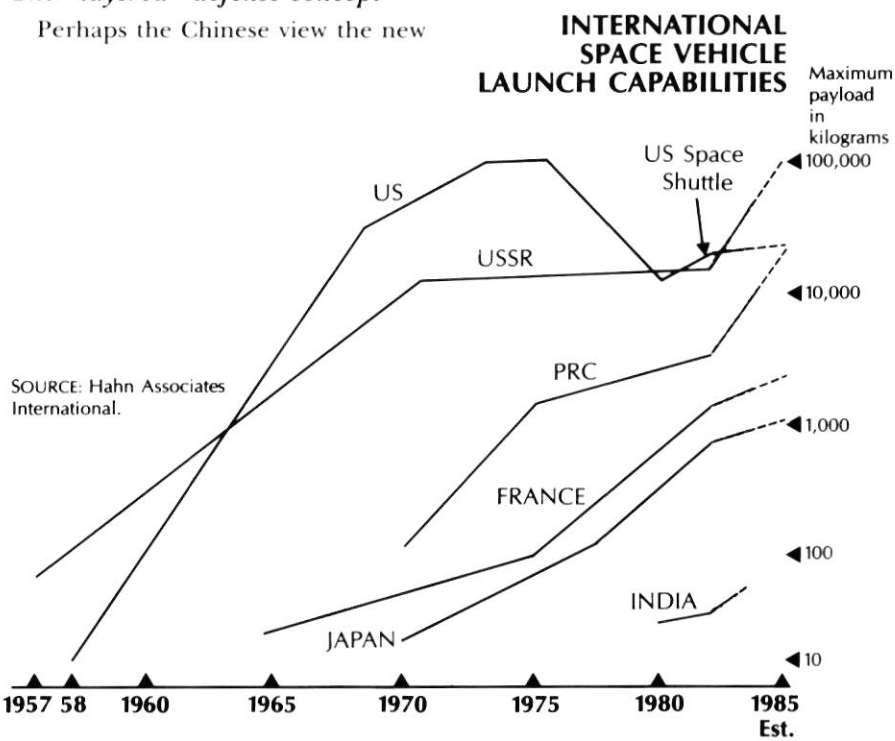
The realization that "directed energy" laser weapons may make ICBMs obsolete by the end of the century is probably behind the decision to accelerate research and development in this field. Since space is the first line of defense against any strategic missile exchange, the Chinese would naturally view this field as the easiest and least expensive means to overcome Soviet preponderance in conventional weaponry.

Using its present technological and industrial base, the PRC could produce within several years a one- or two-man space interceptor fitted with conventional antimissile armaments. The infrastructure is already there: a sufficiently powerful launch vehicle, spacecraft environmental systems, attitude control devices, landing facilities, infrared solid fuel missile-guided rocketry, space foods, and a space-to-ground long-range communications network. Such a space interceptor would significantly improve China's international strategic posture vis-a-vis the US and USSR. It would also reduce internal pressures to amass nuclear weapons on a scale similar to the other superpowers.

The "layered" defense concept

Perhaps the Chinese view the new "high frontier" in much the same way as do the Soviet and American military strategists, who regard space as just another defense perimeter requiring a "layered" or defense-in-depth capability. It is this kind of thinking that has led strategists to advocate manned or unmanned maneuverable platforms capable of attacking missiles soon after liftoff; a network of LEO satellites deploying barrages of heat-seeking conventional warhead missiles on signal to intercept and destroy incoming missiles about to reenter the atmosphere; and ground-oriented ABM defensive installations strategically placed so as to protect missile silos and key facilities.

The former Minister of National Defense and CCP Central Committee member, Su Yu, stated on the 50th anniversary of the PLA's founding that "We have decided to constantly improve our weapons and equipment and through our own efforts, to possess the same weaponry that our enemies have, indeed invent new weapons." Concentration on the advantage of being able to fight a "space war" might be a major factor advancing the PRC toward being a full-fledged superpower before the end of the century. In sum, it is possible that China intends to utilize its current and future space projects in a manner that will provide both mili-



tary and political advantages in a number of developing international situations. Therefore, the 21st century may find the US confronted not only by a serious Soviet space warfare capability, but a significant Chinese one as well.

The political implications

According to the view from Beijing, the political and military realities of the Soviet space threat and the US space exploration effort have placed China in a serious national security predicament.

From the Soviet side the Chinese see a relentless program of space exploration for military purposes. For more than a decade the Soviets have had a working nonnuclear low altitude antisatellite orbital interceptor with an explosive warhead. Four years ago it was learned that the Soviets were probably constructing an atomic particle accelerator at a new Russian installation at a missile range close to the Sino–Soviet border. The USSR is also working on multishot high energy laser weapons, and could deploy some type of orbital laser system about mid-decade.

In addition, the Soviet "Kosmolyot" Space Shuttle has been under development for five years. It is much smaller than the US shuttle, but both the Kosmolyot orbiter and booster rocket are piloted and reflyable (an option the US rejected due to its high cost).

The Chinese likewise see a strong American drive to gain preeminence in space, though in recent years the US has cut back its space efforts. It is believed in Beijing that this might give the Soviet Union an opportunity to achieve dominance. In part to cement closer ties between the Chinese space programs and NASA, a Chinese astronaut is expected to participate in a future US Space Shuttle mission as a payload specialist.

In short, while the long-run goal of China's aerospace program is to advance agricultural and industrial modernization, national defense will for the foreseeable future absorb the lion's share of China's aerospace budget.

Bradley Hahn is director of the Titusville, Florida, consulting firm, Hahn Associates International.

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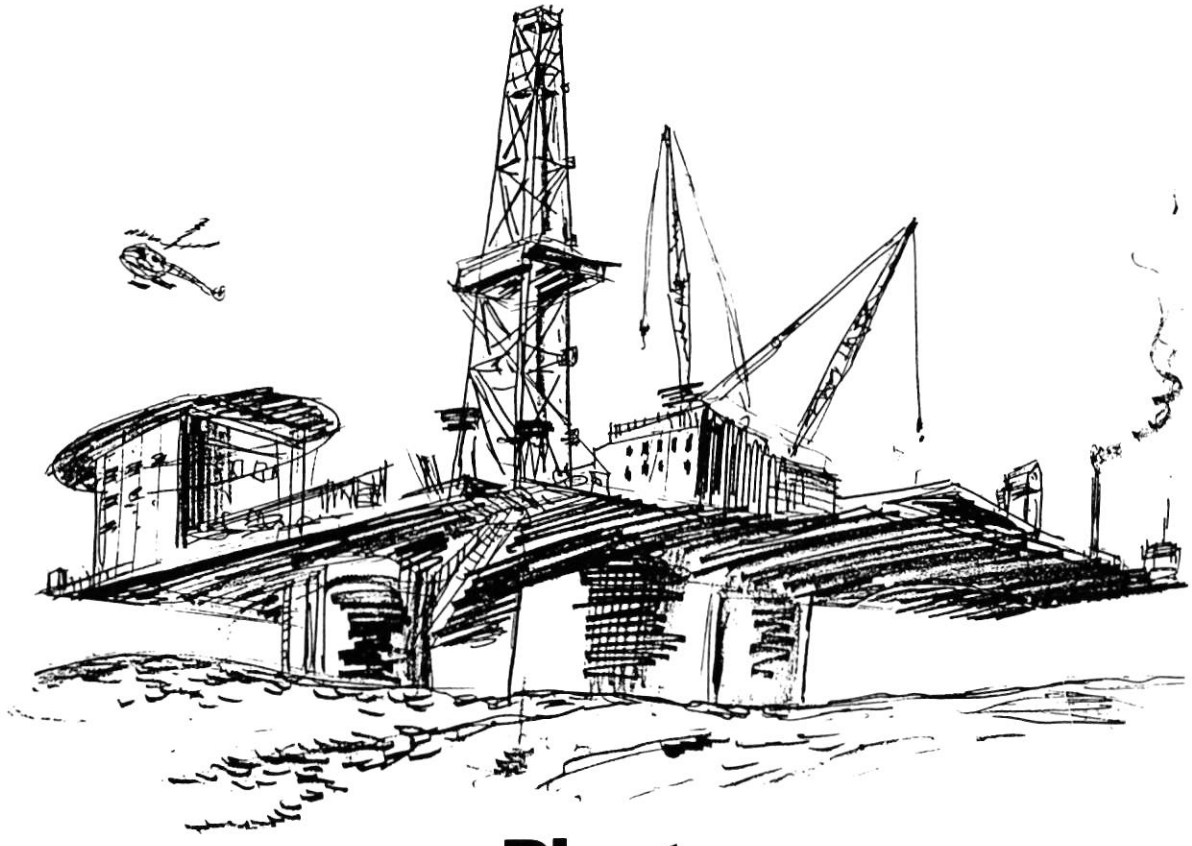

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China's Emerging Navy

Its technical prowess is growing as it moves further offshore

Bruce Swanson

Since 1970, one of the most dramatic changes in China's military has been the ascendency of the navy. Once a small coastal defense force whose main task was to protect fishing fleets and defend against Chinese Nationalist coastal raids, the PRC navy now possesses a limited blue-water capability and is thought to be the world's third largest navy. During the past decade it has become China's glamour service, playing host to many foreign military and civilian delegations. Even former President Jimmy Carter made a point of visiting Shanghai's naval facilities, and many European and third world officials have also participated in this now familiar ritual. Many left impressed by what they saw. Chinese leaders also are often photographed aboard ship surrounded by sailors whose uniforms bear a strong resemblance to those of Western navies.

But a better indicator of the navy's increased importance has been its sustained growth, both in terms of number of personnel and ships. For example, since about 1970, the navy's conventional submarine force has tripled from 35 to 100 vessels; missile craft have increased tenfold from 20 ships to more than 200; over 35 guided missile destroyers and frigates have been commissioned; at least one 12-to-16 tube nuclear-powered missile submarine (SSBN) and two nuclear-powered attack submarines (SSN) have been placed in service; various auxiliary vessels including long-range replenishment ships have been constructed; and manpower has doubled.

As another measure of its progress, an 18-ship Chinese navy task force sailed to the vicinity of the Fiji Islands in May 1980, where it supported two ICBM test launches from western China. Two years later, China's navy alerted the world to its growing power with an apparently flawless firing of an underwater submarine-launched ballistic missile.

Lately, the navy has been upgrading its academies and recruiting trained personnel. Since 1980, naval schools have added courses in operational research and military science and technology. In the spring of 1982, the PRC navy held its first scientific symposium and numerous papers were presented whose topics ranged from natural science and mathematics to statistics.

There have been other significant changes that have moved the navy far beyond Mao Zedong's original concept of an egalitarian, peasant-run coastal defense force. Now only commissioned naval academy graduates can become officers, and all ship captains must pass certain tests. Those who fail twice are reportedly being demoted.

Chinese naval congresses, which are conducted annually, no longer resemble past events where politics and ideology dominated the discussions. Now technology preoccupies the meetings. During a recent congress even old-time military hero Marshal Ye Jianying advised the navy to "make vigorous efforts to catch up with the advanced world standard."

Beijing's changing military strategy

China's naval awakening occurred because of a confluence of factors that directed the country away from its traditional continentalist philosophy to one that is increasingly maritime oriented. In brief, a few of these factors include:

A major geo-political reorientation One reason for China's shift toward a maritime doctrine was its decision in the early 1970s to increase its trade and political ties to the West. China has used the new relationships effectively, keeping its adversary, the USSR, off-balance. Of equal importance was the transition of power in the 1970s after the passing of Mao. The new leadership has emphasized modernization and economics over ideology. Moreover, it has discarded the philosophy of total self-reliance, and removed the stigma associated with being an "expert" rather than "red".

Changing economic objectives One of the most important factors that has moved the navy into the forefront of China's national defense plans is the emphasis on coastal and offshore economic development. In the early 1970s, the Chinese leadership began to modify the nation's Soviet-style planned economy, replacing it with a more trade-oriented system. Once in motion, it was obvious that a stronger navy would be needed to defend and protect Chinese interests beyond China's immediate coastal zones.

Topping the list of new economic improvements has been the effort to modernize China's port and shipping infrastructure. At the outset, it was clear that more merchant ships and efficient ports would be needed if the industrialized coastal regions were to take off economically. The results have been spectacular—the decade of the 1970s saw China purchase or build nearly 10 million dead-weight tons of merchant ships. Moreover, every major port gained new capabilities, from container loading systems

Bruce Swanson is a retired US Navy officer, and the author of a book on Chinese maritime history, The Eighth Voyage of the Dragon, *published by the Naval Institute Press in 1982.*

to petroleum-handling facilities.

As a follow-up action to the coastal facelift, Beijing decided to open the now-familiar special economic zones at various coastal sites. It also moved rapidly to develop potential offshore oil and gas reserves. In recent years numerous wells have been sunk as China and its many foreign partners have drilled for petroleum in the Gulf of Bohai, the East China Sea, and the South China Sea.

Recently, coastal aquatic food production has received major emphasis, and the Chinese have completed nearly one-half of a six-year survey of the coastal zones. They have also modernized many of their fishing fleets and are beginning to fish at greater distances from the shore.

Another spur to increased maritime activities has been the Law of the Sea Treaty. Beijing has never stated its claims under the treaty, which has yet to be completely ratified, but it seems a sure bet that the Chinese leadership intends to exercise economic control out to 200 nautical miles.

If it chooses to make such claims official, the Chinese will come into conflict with other Asian states. In the South China Sea, for example, this has already occurred, owing to China's claim to some 160 islands, reefs, and islets also claimed by the Philippines and Vietnam, among other countries.

Military-strategic considerations Despite some recent thawing in Sino–Soviet relations, the two countries remain far apart on several key issues. Although China has temporarily deleted "hegemony" from its rhetoric, it still has three basic complaints vis-a-vis the Soviet Union. They are directed at the massive deployment of Soviet forces along their common border, the Soviet occupation of Afghanistan, and the stationing of Soviet naval units in Vietnam.

The latter activity includes the permanent assignment of a Soviet naval squadron at Cam Ranh Bay, and TU-95/Bear-D reconnaissance and TU-142/Bear-F ASW aircraft at Danang. The aircraft conduct frequent surveillance flights along China's coast, while the Soviet ships carry out similar operations in the seas adjacent to Chinese naval bases. The Russians are also modernizing the Vietnamese navy. Recently, the USSR has given Hanoi four Petya Is, one ex-Barnegat frigate (now fitted with SS-N-2/Styx missiles), one Admirable class corvette, four SO1 PCs, a Shershen Class PTF, and eight OSA II Class PTGs.

Increased government support Chinese Defense Minister Zhang Aiping's strong support is perhaps the single most important factor propelling the PRC navy to high-level "visibility." Before being named to the post in 1982, General Zhang held the key position of chairman of the important National Defense Scientific and Technological Commission (NDSTC). In that capacity he directed the successful development of China's nuclear-powered missile submarine. Moreover, it was at Zhang's urging that Deng Xiaoping authorized funds to develop the computer technology needed to test the submarine-launched missile.

Zhang's interest in naval affairs stems from his early association with the navy in the 1950s. Although a Long Marcher (and now 73 years old), he was a principal organizer of the East Sea Fleet in 1949. More significantly, he planned and directed the PLA's first combined air-land-sea operation in 1955—the assault and capture of the Nationalist-held Dachen Islands.

The navy also boasts another important figure as its "chief of naval operations." In October 1982, then-General Liu Huaqing assumed control of the navy after having served as the assistant chief of staff of the People's Liberation Army between 1979 and 1982. Liu, like Zhang, also served in the navy during the 1950s. He was purged in the Cultural Revolution and did not reappear until 1975, when he was identified as vice chairman of the NDSTC, a position that made him a key assistant to Zhang Aiping. In this capacity, Liu likely played a critical role in supporting the navy's modernization plans, including its submarine missile and nuclear propulsion programs.

Organizational structure

China's navy is one branch of the People's Liberation Army (PLA), and is divided into three fleets: North Sea (Beiyang), East Sea (Dongyang), and the South Sea (Nanyang). The fleet headquarters are located at Qingdao, Ningbo, and Zhanjiang, respectively. Naval Headquarters is located in Beijing, and includes standard departments for logistics, operations, research and technology, training, personnel, and intelligence. There are, of course, parallel political departments and committees. A Schools Command also exists with various "officer" and "enlisted" training sites in Dalian, Qingdao, Shanghai, Guangzhou, and Nanjing. Naval ranks reportedly will be restored in 1985.

The navy remains a service arm of the PLA and its commander reports to the PLA General Staff Department. Naval ship construction and some research, development, testing, and evaluation activities are now handled by the China State Shipbuilding Corporation. Naval Headquarters has a commercial representative, Madame Wang Lurong, who heads the navy's Equipment and Technology Department.

Like the army itself, the navy has main forces composed of frigate/destroyers and missile craft. These forces can operate at fairly long distances from the coast and probably take their orders from Naval Headquarters. The numerous patrol craft and conventional torpedo boats have only limited at-sea capability, and patrol coastal zones. In time of war, they take their orders from the respective military region commander having local coastal defense responsibility. Submarines are in a special category, and are likely viewed as a strategic force.

China's naval doctrine

As the Chinese navy has moved further offshore, its technological prowess has been raised considerably. For example, there have been several major sorties by Chinese naval squadrons into the South China Sea and Philippine Sea in recent years. During these operations, ships refueled in alongside maneuvers and helicopter operations were carried out.

These activities reflect a keener appreciation of sea power by the PLA high command and have served notice on the USSR that any Soviet invasion against China could be an expensive endeavor from a naval standpoint. The PRC is believed to have six nuclear-powered missile submarines under construction and, when all are commissioned by the end of the decade, the Chinese will be able to deploy 84 200-kiloton nuclear missiles at sea.

Other sources report that the Chinese are planning to build up to five

20,000 ton aircraft carriers. Each may carry as many as 25 helicopters or 12 vertical/short takeoff and landing (VSTOL) aircraft. At present, China has no VSTOL aircraft and would either have to buy such planes abroad or build their own. Chinese navy planners are also examining the possibility of building a new class of missile destroyers with better endurance capability than the short-range Luda class.

Much of this naval activity is keyed to Chinese wartime contingency planning. There are five conventional wartime scenarios involving the navy. Three deal with limited Soviet invasions of Xinjiang, the Beijing–Tianjin corridors, or northeast China. In the latter two scenarios Chinese strategists would expect amphibious landings by Soviet naval infantry on the Bohai Gulf coast or Liaodong Peninsula. Chinese planners further believe that China's missile submarine force will help deter the USSR from any adventures in Xinjiang.

The fourth scenario is centered on China's southern flank, and attempts to cope with the growing presence of the Soviet navy in the South China Sea, and particularly the increased air and naval activity from Soviet bases now established in Vietnam. The PRC navy has substantially added to its South Sea Fleet as well as improving its shore-based support facilities on Hainan Island.

The last scenario involves Taiwan. Both the PRC and Taiwan undoubtedly have contingency plans. The cost of any confrontation, however, would be prohibitively expensive politically as well as in terms of manpower and equipment.

The navy's deficiencies and needs

Despite its achievements and growing importance, China's navy remains severely constrained by dated technology. Some of its deficiencies are readily identifiable.

Outmoded electronic systems Over the past several years the Chinese have permitted a number of Western technical experts a closer look at their ships. Some have been critical of what they found. For example, China's OSA missile craft lack modern fire control radar. Most carry several-decades-old systems introduced by the Soviets in the 1950s, such as Pot Head surface search radar. Only a few have newer Drum Tilt fire control radar.

China's most modern destroyer, the Luda, also carries vintage radar, including types similar to the old Soviet Knife Rest and Wasp Head. The fire control radar is similar to the Soviet Square Tie while the navigation radar, a Neptune, dates back to World War II. The Luda also lacks a combat information center (CIC), although there are plans to create the necessary space during overhauls.

The new class of Chinese Jianghu frigates possess radar similar to the older Soviet Top Bow and Post Lamp systems. Like the Luda, the Jianghu also lacks a CIC.

Sonar information is lacking, but it is suspected that most are obsolete and incapable of acquiring and holding targets in deep sea operations.

"Antique" weaponry China's major combat vessels generally lack modern ASW capability. The ASW rocket systems include the old, short-range RBU-1200 and RBU-1800 systems. Both the Jianghu and Luda apparently possess modern 12-barrel RBU-2500A or RBU-6000 long-range rocket launchers. But some gun armament systems aboard Jianghu and Luda vessels are inefficient, and the 100 mm mounts are manual loaders. The 130 mm dual purpose guns on the Ludas are estimated to fire 15 rounds per minute. The surface-to-surface missile (SSM) systems aboard these ships also have no apparent reload capability. All SSMs are of the Styx type and are based on outdated Soviet designs. The Chinese are anxious to acquire a more modern SSM system as well as better guns.

Torpedo systems aboard the older Romeo submarines are "antiques" and lack effective speed and range against fast ships. Loading of torpedoes is a time-consuming process and those destined for the aft tubes can only be loaded forward and then hauled manually through the boat.

For over a decade, the Chinese have been trying to produce a reliable surface-to-air missile (SAM) system. Several have been seen aboard two classes of warships, but there are reports the Chinese SAMs still have serious fire control problems.

Conventional propulsion Not much is known about the navy's conventional propulsion systems, except that most of the PLA's smaller warships have diesel engines. The Luda destroyers probably have steam turbines, and the Jianghu frigates may be equipped with either combined diesel or gas (CODOG) or combined diesel and gas (CODAG) gas turbines. The Romeo class submarines are diesel-electric.

The Chinese nuclear propulsion program has had major problems over the years, and only recently has some degree of reliability been achieved. The problems could increase as the Chinese strive to reach serial production.

Naval aviation The Chinese naval aviation arm is not equipped to carry out extended sea missions. Rather, it is designed to protect ports and other coastal facilities from air attack. It lacks the ability to carry out maritime patrol or antisubmarine warfare operations, and this remains a major weakness. The only aircraft in the Chinese inventory that has long-range strike and surveillance capability is the B-6 (the Chinese version of the Soviet TU-16 Badger). There are indications that the B-6 also has engine problems, and is not reliable on long sea sorties.

Mine warfare China's coast is vulnerable to mining but its mine sweepers are badly out of date and cannot perform effective sweeping operations. The entire fleet will have to undergo considerable modernization if the Chinese navy expects to keep the coastal sea lanes open in wartime.

Lessons learned

China's naval modernization program offers considerable opportunities to firms that deal in naval systems. Defense Minister Zhang has warned of declining military budgets, but the navy is expected to continue its steady growth in the 1980s. And even though serious technical problems exist, a consensus seems to have been reached in Beijing that calls for even bolder maritime policies in the future.

Companies should exercise caution, however. China has been trying to build a modern navy for over a century, and it has a poor record of carrying out its naval modernization plans. In the late 19th century, China bought the latest warships from abroad, but failed to develop a supporting infrastructure. As a result, its navy was hopelessly outclassed by an inferior fleet in the 1894 Sino–Japanese War.

The disastrous naval defeat set the Chinese navy on a perilous course. It

attempted time and again to modernize with the help of various Western navies and naval manufacturers. But each effort failed for a variety of reasons, and the lessons have not been forgotten by the current Chinese leadership. Some of the lessons of the past:

▶ ***Feigning the promise of large purchases*** In the past the Chinese tended to keep negotiations alive for months or years by holding out the promise of large, lucrative contracts. A good example involved attempts by the Bethlehem Steel Company to sell warships to China at the turn of the century. Initially, the contract called for the sale of a substantial number of warships, but when it became evident that the naval budget was not adequate to close the sale, the Chinese proposed to increase their requirements. The negotiations dragged on for nearly twenty years.

Another time, senior Chinese naval officers visited the Electric Boat Company in New London, Connecticut, to observe the construction and operation of US submarines. Plant officials were stampeded into months of negotiations when one Chinese admiral offered the view that China might buy a fleet of two hundred submarines.

▶ ***Falling into the quick-fix trap*** One bad habit exhibited by the Chinese navy past and present has been its tendency to seek quick results at the expense of practical step-by-step improvements. In their haste to accommodate the Chinese, companies and governments have been inclined to apply Western naval techniques that are unsuitable to conditions in China. As one Chinese naval thinker put it, "most of these (maritime and naval) things . . . served as the foundations on which Europe became rich and strong, but when we applied them in China, they were like a good orange tree on the bank of the Huai River which, after it was transplanted, produced thick-skinned oranges." As a result, the Chinese have reacted with increased wariness toward glib sales representatives who have not done their homework. In many cases, it seems that the Chinese expect the visitor to understand their special needs without having to be told.

▶ ***An over-emphasis on prestige*** In the past, the Chinese developed a keen respect for the British navy and preferred to deal with it in a traditional teacher–student relationship. Firms will discover that today the Chinese have great respect for the US Navy, and attach great importance to its technical know-how. In fact, one of the reasons that China has yet to consummate any large sales deals in Europe is its suspicion that US naval technology may be better than comparable European systems. This could be a definite advantage to US firms. For over a decade now, Chinese naval delegations have been going abroad sizing up the market and educating themselves on new technologies. Very likely some decisions have been reached and a "priority buying list" drawn up. The United States could be the last stop before the Chinese finally make their purchases.

▶ ***Agreeing on broad principles*** Foreign negotiators found that the Chinese preferred to discuss broad principles before settling down to specific items. This proved to be advantageous when the foreign firm could agree to the principles being offered. The British understood this negotiating technique very well, and were able to gain exclusive naval rights in China for many years. One contract, drawn up in 1929, contained the general principle that the Chinese would only place new construction ship orders with Great Britain.

In conclusion, China's navy now stands at the crossroads. It has the backing from the national leadership. But for that very reason Chinese negotiators will be extremely cautious. They will want to avoid the mistakes of the past as well as the promises of unscrupulous salesmen. Naval planners, therefore, can be expected to take their time, and do business with firms that best understand the Chinese navy's history, equipment needs, and future plans. ₹

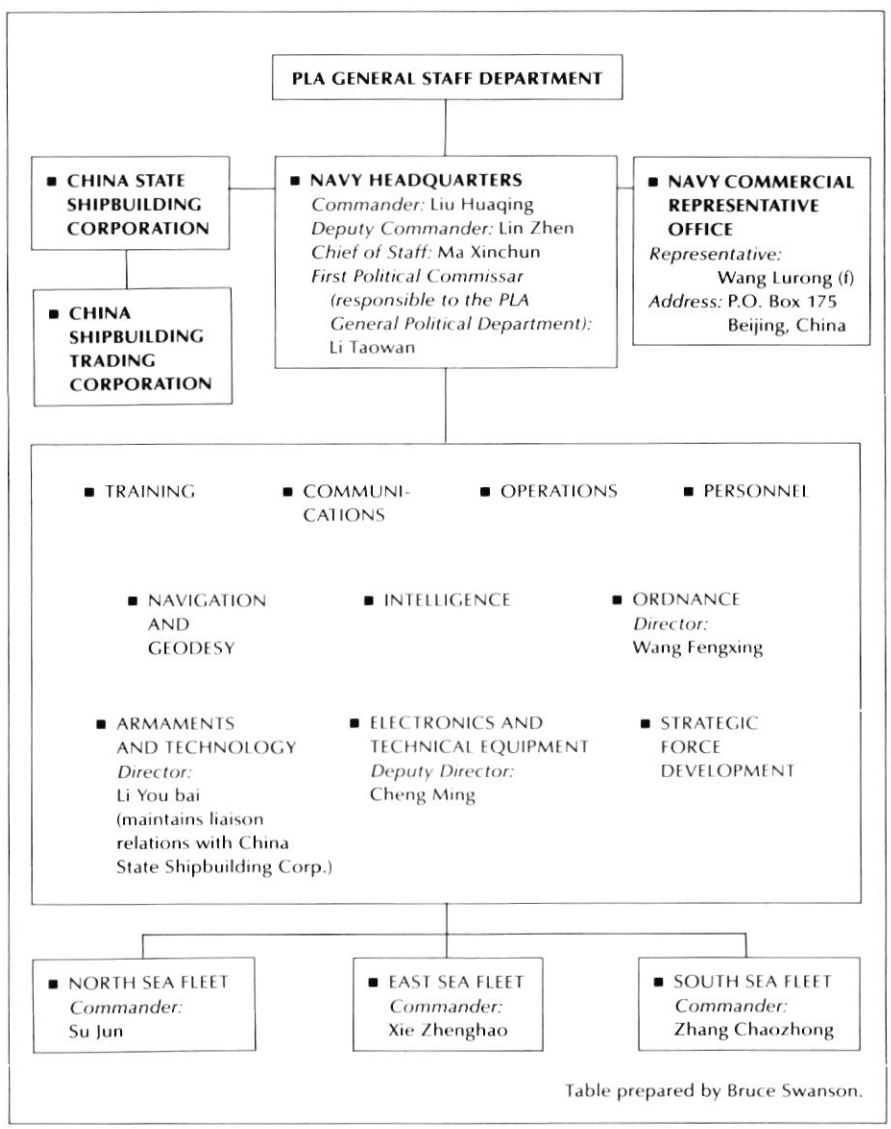


Table prepared by Bruce Swanson.

The Chinese Navy's Purchasing Priorities

Bruce Swanson

An excellent guide to the Chinese navy's needs was provided at last year's naval exhibition in Shanghai. Hosted by the Chinese Society of Naval Architecture and Marine Engineering, it was called the Naval Technology and Shipboard Electronic Defense Equipment Show, or NATSEDES. Exhibitors included more than 75 companies primarily from Great Britain, France, and Italy. Only a handful of US firms showed up. On display were 250 exhibits that ran in conjunction with 50 technical briefings covering a full array of naval equipment, ranging from propulsion systems, weapons, aviation, electronics, and technical data processing.

The exhibition attracted more than 15,000 visitors, of which most were PLA in-service personnel. The Chinese VIPs in attendance included Li Guang, director of the PLA General Staff's Equipment Department; Lin Zhen, deputy head of the navy's General Staff; and Li Youbai, director of the navy's Armament and Technology Department.

Two French firms, Creusot-Loire and CSEE, made sales at the show. The former concluded a contract for two 100mm compact gun mounts, while the latter company sold two Naja optronic directors to be installed in two new Chinese frigates. A Creusot-Loire official claimed that more gun orders may be forthcoming.

The Chinese kept British hopes alive that some elements of the aborted Luda modernization contract, canceled in early 1983, would be renegotiated. The original contract called for the Sea Dart SAM system to be installed on PRC destroyers, but was reportedly canceled because of the weaknesses exhibited by Sea Dart during the Falklands dispute.

The exhibition also provided strong rumors of two future Chinese naval projects. The first involves the construction of at least 75 fast attack craft to replace older vessels, while the second calls for the acquisition of a combined diesel or gas (CODOG) system for a new class of frigates.

The technical briefings were well attended and covered topics selected by the Chinese. They are listed below. The firms that made the presentations are indicated in italics.

Air systems for maritime surveillance
Aerospatiale (France)

BA1225 message processor system
MEL (UK)

ORION 20X, *ORION* 30X, and RAN 10S radar
Selenia-Elsag (Italy)

Mine-laying installation, and the motion of airlifted mines
R. Alkan & Cie (France)

Frigates, corvettes, and hydrofoils
CNR (Italy)

Spectrometric oil analysis
Baird Corporation (US)

Inertial navigation system for ships *(FINS)*
Ferranti plc (UK)

Degaie, centroid effect system
CSEE (France)

Sonars for submarines
Thomson-CSF (France)

Acoustic systems for ASW airplanes
Thomson-CSF (France)

High-performance diesel engines
SAGEM (France)

Magnetic speedometers
Chernikeeff (UK)

Naval crotale
Thomson-CSF (France)

Mine warfare tactics
NAVFCO (France)

Submarine control system
SAGEM (France)

CODOG or all diesel
Alsthom-Atlantique (France)

Airborne radar systems
OMERA (France)

"MATILDA" alarm systems
MEL (UK)

SEAGUARD naval system
Contraves (Italy)

Minehunter
CMN (France)

Surface ship propulsion systems
DTCN (France)

Fast-tuning HF radio equipment
Marconi Communication Systems, Ltd. (UK)

Torpedo design
Whitehead Sistemi Speciali (Italy)

Sonars
Sintra Alcatel (France)

Diesel engines in submarines
CGE (France)

Command and control systems
Selenia-Elsag (Italy)

Naval precision fixing system
Racal Decca (UK)

Piloting and navigation equipment
SAGEM (France)

Ship defenses against low-flying aircraft and sea skimmers
Thomson-CSF (France)

The Simtec Naiad-automatic nerve agent detector
Thorn EMI Simtec, Ltd. (UK)

CA Submarine operation in variable depths, shallow waters, or straits
Alsthom-Dubigeon (France)

MIN mine detection and disposal
Selenia-Elsag (Italy)

Maritime surveillance
AMD (France)

Equipment and systems for naval forces
Thomson-CSF (France)

F17P torpedo
DTCN (France)

Passive sonars and the UX37 combat system for submarines
Sintra-Alcatel (France)

ASW Silure Corvette
Alsthom-Atlantique (France)

Airbomb fuses, with an emphasis on point detonating fuses
Borletti (Italy)

The new "Hyber-Fix" high quality, low cost system for precision fixing for naval tasks
David Brown Gear Industries, Ltd. (UK)

Helicopter force building
NAVFCO (France)

Marine radar system
SMA (France)

Sonars for surface ships
Thomson-CSF (France)

China's Air Defense

New technology strengthens the roof over China's military

Madelyn C. Ross

The Chinese People's Liberation Army Air Force presents perhaps the greatest modernization challenge to China's military planners. While the PLA Air Force ranks third in the world in terms of aircraft numbers—possessing about 8,500 aircraft—it lags far behind in terms of sophistication. Although China's first jet fighter was built in 1956, air force equipment has not kept up with changing technologies, and is now essentially 20 years out of date.

National defense ranks fourth in priority among China's "four modernizations," and the air force has been assigned a relatively low priority within the military as a whole. On paper, the air force, army, and navy each received an average of 20 percent of the total defense budget between 1965 and 1979, but China's nuclear weapons programs and large ground forces are both probably viewed by the armed forces leadership as of more immediate priority than the air force.

Least adequately equipped of the armed forces, the PLA Air Force needs to invest across the board to come up to world standards. Foreign equipment is prohibitively expensive to buy on a large scale, and Western technology difficult to absorb through coproduction agreements.

Building an air force from scratch

The major impetus for aircraft development has come almost solely from outside China. The industry has few original designs to its credit, although it has proved adept at learning from the Russians. China's first aircraft plants were built by the Japanese in the 1930s. During the 1950s, Russia helped China develop its own production capacity, based in many of the Manchurian facilities left by the Japanese. Today Shenyang and Harbin continue to be major aircraft production centers.

The withdrawal of Russian technical experts in 1960 hit the Chinese aeronautics industry hard, and paralyzed major production lines for about four years. Russian technicians had been helping the Chinese build MiG-17 and MiG-19 aircraft (designated the F-5 and F-6, respectively), and were also in the process of establishing new airframe and engine production facilities in Chengdu and Xi'an. The industry had never been permitted to become too independent of its Russian advisors, and languished without their support. Air force morale hit a low in the mid-1960s as the nation's air defense capabilities continued to erode. Maoist military philosophy, which attached great weight to guerrilla warfare and nuclear deterrence, did not help the situation. In fact, China's nuclear weapons program became an important symbol of nationalism in the early 1960s, and effectively crowded out the air force in the competition for resources.

But several "reverse-engineering" feats were still achieved after the Sino–Soviet split. Despite the deterioration in relations between the two countries, the Russians sold China several dozen MiG-21s in 1962, which the Chinese promptly copied. By 1969, the Chinese began serial production of this advanced daytime fighter in Chengdu under the Chinese name F-7. It remains China's only Mach-2 combat aircraft, but lacks the sophisticated equipment found on later versions of the aircraft.

By the mid-1960s, China was also able to independently resume production of the F-6 (based on the MiG-19), which they had begun to build with Russian help in the 1950s. The F-6 is still numerically the most important plane in the Chinese air force, and has been exported to Pakistan, Albania, and Tanzania.

When its nuclear program created the need for a bomber to carry nuclear weapons, China began to reverse-engineer the Russian Tu-16 bomber, acquired from the USSR in 1960. A prototype called the B-6 was produced by 1967, and continues to come off the production line at a slow pace.

Apart from its many Russian copies, the air force boasts several aircraft largely of indigenous design. The Q-5 (known as the A-5 in its recently developed export version, and previously referred to in the West as the Fantan-A, the F-9, and the F-6bis) mystified Western analysts until the late 1970s, when it was finally determined that this plane had been designed for an attack, rather than fighter role. This single-seat, twin-engine supersonic attack aircraft, first built in the late 1960s, is a modification of the MiG-19 designed to provide close air support. The Q-5 is widely regarded as one of China's more impressive indigenous aircraft achievements. Although the technology is now about 15 years old, Pakistan recently ordered about 60 of the Nanchang-built Q-5s in a new export version that may extend the Q-5's useful life. The total Chinese inventory of Q-5s now stands at approximately 500 aircraft.

China's success in designing military aircraft seems to have convinced them that their emphasis should be on importing key pieces of equipment and know-how rather than large numbers of foreign aircraft. The opening of the air force's Academic Research Committee in May

1983 underscores an increasing emphasis on strengthening domestic R&D. Hence, the type of overseas purchases being considered will probably be designed to supplement, not supplant, China's existing production lines.

Upgrading fighters

Despite its limited funds, the air force's number one project is to develop a reliable all-weather fighter-interceptor plane for air-to-air combat, which many countries in the West have had for 25 years. Purchase of a US fighter, such as the General Dynamics F-16, has been raised in bilateral government talks. But political considerations alone make such a sale extremely unlikely, given the effect it would have on the PRC–Taiwan strategic balance. Sale of an intermediate US fighter such as the Northrop F-20 Tigershark has been suggested in the past, and should not be ruled out in the longer term. The Tigershark, while less than state-of-the-art, closely matches China's current needs.

Whether or not such sales eventually take place, the air force's immediate priority is to import key equipment to enhance the F-8, a modified fighter-interceptor based on the MiG-21 (Chinese F-7). Produced in Shenyang, the F-8 has been under development for over a decade, but only recently deployed in small numbers. Salvaging the F-8 program will save the air force both time and money, despite problems inherent in such an attempt. Originally designed as a high altitude interceptor, the F-8 lacks the maneuverability and power to adequately meet the threat from low flying enemy bombers, and will require a new engine and avionics.

Some observers feel that the Rolls Royce Spey engines built under license by the Ministry of Aviation Industry in the 1970s were destined for the F-8. But the Spey engines were not installed, and there is doubt that the air force ever even supported such an arrangement, since the Spey would have been too large for the twin-engine F-8. Instead the Chinese have recently expressed interest in both Pratt & Whitney and General Electric engines. When and if such sales are made, Pratt and Whitney has urged China to consider developing a new airframe around the engine, but time and expense may dictate the reverse strategy of fitting the engine to the existing F-8 airframe. It would take the PRC at least until the late 1990s to develop its own F-8 engine of comparable sophistication to current jet engines in the West.

Photo courtesy of Xinhua

The Q-5 is an adaptation of the MiG-19 (or Chinese F-6) fighter with an extended nose bay—although China apparently lacks the sophisticated radar to put there—and air intakes moved to the side of the fuselage.

The F-8 will also need an advanced avionics system, likely to be bought overseas. Only a very small percentage of China's fighter planes have onboard radar for searching and tracking enemy aircraft, and even these are of such limited range that the planes cannot accomplish missions under all-weather conditions. In fact, better navigation and communications systems, particularly for close air support, are urgently needed by most Chinese fighters, and will probably be among the most important items purchased from abroad. The UK has been the largest Western avionics supplier to date, led by Marconi's quiet $95 million sale in 1980. According to the US State Department, which has only permitted military sales to China since 1980, the leading US sales to date include radar, navigation systems, and communications equipment. Rockwell-Collins, the major avionics supplier for US civilian transports sold to China since 1972, is currently negotiating licensed production of military-standard radio transceivers and tactical air navigations systems in China. The market could open much wider depending on how both sides choose to implement the understandings reached during the June 1984 visit to Washington by Chinese Defense Minister Zhang Aiping.

Sensitive sales issues

In fact, the Chinese air force may find that some of the US technology it desires will still be hard to obtain. Many cockpit items found even on commercial jets, such as radar altimeters, inertial navigation systems, and advanced display systems, require export licenses, and previous commercial sales to China have come under close scrutiny by the Commerce, Defense, and State departments.

Sales that alter the strategic balance between the PRC and Taiwan will be ruled out. For instance, the US will probably not sell advanced items to the PRC that Taiwan does not have, such as radar-guided missiles. Even jet engine sales could be controversial in the US Congress, because they might lead to development of a PRC fighter more advanced than those in Taiwan. US avionics sales to the PRC may be approved more easily, since they are viewed as less likely to affect Taiwan's qualitative superiority. Sale restrictions could ease up in a few years if and when Taiwan completes development work on its own jet fighter.

In general, only "defensive" weapons may be sold to the PRC but, as military analysts like to point out, almost any weapon can be used in either a defensive or offensive mode. In such a politically charged atmosphere as that between the PRC and Taiwan, most weapons can be construed as offensive. Another complicating factor will be China's professed desire for technology transfer as part of almost any military sale, although just how much emphasis this will receive in the final analysis is not yet clear.

Renewed interest in VSTOL

China currently has no VSTOL (vertical/short take off and landing) aircraft, but interest in this technology was apparently rekindled by the impressive performance of such planes during the 1982 Falklands conflict. In 1981 China considered buying British Harrier VSTOL jets but backed off at the last minute. With talk of the development of several Chinese aircraft carriers, the navy's air defense forces are evaluating VSTOL planes for a possible sea-based role. The navy's air defense forces exist in parallel with those of the PLA Air Force, coming under the air force's operational control only during times of war. The navy now operates approximately 800 combat aircraft, including fighters,

bombers, and attack planes.

Another continuing interest is in military transport planes. China's own military transport, the Y-8, roughly equivalent to the Lockheed C-130 Hercules, can carry 96 fully armed soldiers, two trucks, or two tons of boxed cargo. Lockheed demonstrated the C-130 in China in 1981, but despite an enthusiastic reception, sales did not follow. In December 1983, China was again impressed by C-130s when they delivered helicopters from Sikorsky, Bell, and Aerospatiale to Tibet for flight demonstrations. Nevertheless, it seems likely that the air force will try to improve the Yun-8, with its outdated instrument panel, rather than buy very many transports from overseas. Another possibility is that the still experimental Yun-10, originally developed as a civilian jetliner, could be used as a military transport instead, although a turboprop would be preferable for military missions.

The need for long range surveillance has led to Chinese interest in a medium-sized airborne warning and control system (AWACS), which would improve China's ability to locate enemy aircraft approaching its borders at low altitudes.

Finally, the PLA would also like to acquire helicopters for a wide variety of uses, including personnel and small cargo transport, artillery support, border patrol, and antisubmarine warfare. In December 1983 the PLA evaluated medium-utility Bell, Sikorsky, and Aerospatiale helicopters at a high altitude demonstration in Tibet, raising the subject of both sales and coproduction.

China has also seriously evaluated heavy transports such as Boeing's CH-47 for heavy lift requirements. The military's helicopter inventory, with the exception of 13 Super Frelons purchased by the navy from Aerospatiale in the late 1970s, mainly consists of old Russian models, which are now very difficult to maintain. Despite the Ministry of Aviation's trouble-prone 1980 deal with Aerospatiale to coproduce the Dauphin helicopter in Harbin for industrial use, the military does not seem to have been deterred from pursuing a similar contract for larger helicopters that meet its needs.

Promoting arms sales

China's growing interest in the aviation equipment of developed countries has taken place at the same time that the PRC is actively marketing its own military equipment to less developed countries. Since 1965 Pakistan has bought a number of Chinese F-6s, and recently outfitted several squadrons with A-5s. Judging by the high-level reception given to Bangladesh's visiting Chief of Air Staff in early 1984, Bangladesh may be increasing its cooperation with the PLA Air Force. Thailand could be next. Egypt has been a partner in some transactions going both ways. But the PRC's most notorious aircraft customer, and possibly the largest, is Iraq. Iraq has been supplied with F-6s and F-7s through Egypt, where they are assembled in kit form, to replenish planes shot down in its long-running war with Iran. Meanwhile, there are reports, denied by the PRC, that Iran receives Chinese-made F-6s from North Korea.

China sent a delegation to AUSDES '84, a defense equipment exhibition held in Australia in May. This group made it clear that they hope to increase foreign exchange earnings from the sale of military equipment, including jet fighter aircraft. Some of these earnings may conceivably be used to buy Western equipment. Such promotional efforts serve as a reminder that the Chinese air force has come a long way since the days when the nation's aviation industry was stymied by the withdrawal of Soviet technicians.

Finally, even the US may prove to be a market for China's military aircraft. The US Navy's Adversary Squadron program needs 24 more planes to simulate "aggressor aircraft" in pilot training. It has been proposed that the navy acquire *actual* MiG-21s instead of US-manufactured planes that merely mimic Soviet aircraft performance. Although several countries could supply the navy with older MiGs, China continues to produce the F-7, based on the MiG-21. Thus, interestingly enough, a US program to help China upgrade its fighters might be preceded by a US order for the planes China hopes to phase out with our help. ✦

Marketing to the PLA

Its long shopping list has aroused the entire US defense industry, though few firms see the possibility of immediate sales

Richard E. Gillespie

Although China has the world's largest military establishment, there are technological, economic, and financial limitations on how effectively these resources can be utilized in the nation's defense. While China continues to improve its nuclear forces, its conventional capabilities are only slowly being modernized in step with China's overall economic modernization.

Among its severest limitations, China's ground forces lack mobility, are short on armor and air defense, and suffer from logistics problems. The navy has only begun to work toward becoming a true blue-water force. And while the air force has large numbers of combat aircraft, the majority lack advanced avionics equipment necessary to operate at night or in bad weather.

China's ability to counter a Soviet attack, either nuclear or conventional, is *not* impressive. Military operations against Taiwan or India would pose serious problems today, as would any prolonged confrontation with Vietnamese forces.

Although China's military modernization remains the lowest priority of its "four modernizations" program, China has been seeking outside help for the past decade. In the mid-1970s it made an unsuccessful purchase of British Rolls Royce Spey engine technology for its fighter aircraft program. More recently, China has purchased American computers with potential military applications and has sent many military delegations on "window shopping" trips to Europe. China has also improved on the original design of Soviet military equipment obtained from Egypt. Despite its emphasis on self-reliance, China is prepared to import Western military equipment and technology needed to upgrade specific systems in its army, navy, and air force.

Information dating back to the Vietnam War indicates that the Chinese have shown a strong interest in a broad range of US military technology and equipment. They were afforded a close look at US equipment captured from the Vietnamese during the 1979 border campaign. Since then, Chinese military attachés and defense ministry delegations have had increasing opportunity to visit US defense industries.

1984 is clearly a good year for US industry to begin exploring the Chinese military market. The improvement in US–China political relations that began last year has led to concrete steps to normalize relations between the two defense establishments. In February, a mid-level team led by Zhang Pin, son of Chinese Defense Minister Zhang Aiping and a staffer on the National Defense Science, Technology, and Industry Commission (NDSTIC), visited the US in part to survey the US defense industry. (Zhang Pin has since become chairman of the Chinese Working Group on US–China Military Technology Cooperation.) The delegation's number two member, He Ping, is a key officer in the PLA General Staff's equipment department. In May and June, several military working groups—a navy delegation and at least three teams examining the TOW missile, jet fighter upgrading, and heavy caliber artillery technology—also toured the US. NDSTIC Vice Chairman Wu Shaozu was a top ranking member of the Chinese defense minister's delegation, which was hosted here by the US Department of Defense in June. Then in mid-June, China's Defense Minister Zhang Aiping visited the US to set the stage for possible purchases of US military technology. This rapid succession of top Chinese defense visitors has already prompted US firms to begin thinking seriously about marketing strategies in this important sector.

Richard E. Gillespie is assistant director of the Council's Business Advisory Services Department. Since joining the Council in 1979, Mr. Gillespie has organized eight engineering and mining delegations to China.

Special features of the China military market

There is a distinct difference between marketing military technology in China and selling commercial products and services. Since US companies are required by law to obtain licenses before talking too specifically with foreign buyers about military hardware, it is difficult to make contacts with PRC military endusers in the People's Liberation Army or Ministry of Public Security. Hence, US firms may have to be content working through a number of middlemen organizations. Political considerations will also affect China's foreign military purchases. Over the past few years, the PRC has shown a clear preference for US technology, and military shopping trips to European countries have been designed in large measure as a bargaining chip with the US government and US military vendors. With the removal of arms sales to Taiwan as a front-page issue and the Reagan Administration's liberalized Commodity Control List Guidelines for dual-use technology, has come a new willingness on the PRC side to begin serious talks with the US government about military sales. Pressure from either China or Taiwan to terminate military sales to the other has occurred in the past

and will probably continue. Companies interested in selling to both China and Taiwan will have to weigh carefully the prospective gains against the risks involved in these sales.

Marketing guidelines

Firms must first determine through independent analysis what the Chinese truly wish to procure. It is especially important to pinpoint the likely time frames and available funds for these purchases. The items the Chinese have discussed in their past "fishing expeditions" to foreign countries—British-made Lynx helicopters, Chieftain tanks, and Harrier VSTOL fighters; and French Mirage 2,000 fighters, Hot and Milan antitank missiles, and Alouette, Super-Frelon, and Dauphin II helicopters—were chosen by the Chinese in large measure to prompt a loosening in US military sales restrictions. By the same token, companies should not be overly concerned about not knowing which munitions list items the Chinese Defense Ministry has been discussing with the US Defense Department, since this may also represent a fishing expedition to see what the US government will permit. This is only natural from the Chinese standpoint, as they do not wish to be embarrassed by having the US government rebuff their requests.

Before too long, however, the Chinese should be ready to talk about what they really want to buy. In fact, serious inquiries have already begun. These have concentrated solely on defensive weapons needed for use against the Soviet Union. Equipment that could be used primarily against Taiwan—amphibious craft, for example—have been avoided. China knows that these sales will not be allowed. In the meantime, US firms have not relied too heavily on DOD guidelines, since these will be changing.

The specific types of defensive systems and weapons the Chinese want can generally be determined by studying the PLA's military doctrine. Pursuing a "people's war under modern conditions" means, among other things, tightly coordinated infantry, armor, and air support operations. To achieve this, China's 3.3 million ground forces must overcome severe deficiencies in the area of antiarmor, antiair, and logistics through better armor-piercing ammunition, antitank and antiaircraft missiles, improved vehicular and helicopter mobility, and by upgrading China's current tanks through improved engines, turrets, fire control systems, and the like. In short, antitank missiles and helicopters come first on the Chinese shopping list.

The navy wants better defense against antiship missiles, a better underway refueling capability, more amphibious craft, and enhanced air defense and antisubmarine warfare systems. The 1982 Falklands campaign highlighted the need for better defensive armaments to withstand first strikes by aircraft equipped with weapons like the French Exocet missile. The electronics packed below deck on the British cruiser Sheffield proved to be highly susceptible to Argentine attacks with this surface-skimming missile. Chinese vessels are far more vulnerable in this regard than the British navy.

New air force interceptors

The air force wants new navigation and fire control systems for an all-weather interceptor. While China has talked about buying small numbers of specific advanced foreign combat aircraft for technology transfer purposes, its principle interest is in upgrading its present inventory. Improved military airlift—and possibly air surveillance aircraft—also are viewed as essential.

Newer command, control, communications and intelligence (C^3I) systems are also under scrutiny as China upgrades its military electronics generally. Better equipment for military training—audio-visual equipment for example—will certainly be needed. Also of interest are computers to upgrade logistics systems. China's shopping list for US military items, when fully revealed, could be substantial.

The key decision makers

Because it is so difficult to make contacts with Chinese endusers in the services, some foreign firms have found it best to concentrate on cultivating all appropriate PRC agencies involved in military production and procurement. There are many of these within the defense establishment. However, the least important is the Defense Ministry staff. It controls neither military operations nor procurement. Nor are the PLA's General Political Department and General Logistics Department particularly important, as neither have major procurement functions. The key agency is the PLA's General Staff Department. The department's former Vice Chief of Staff, Liu Huaqing (now Commander of the PLA Navy),

TOP CHINESE DEFENSE VISITORS TO US IN EARLY 1984

February delegation

Zhang Pin *Deputy Division Chief, NDSTIC Foreign Affairs Bureau, and Leader, Chinese Working Group, Sino–American Military Technical Cooperation Negotiations*

He Pengfei *Deputy Director, Equipment Department of PLA General Staff, and Vice Chairman of CITIC's China Polytechnic Corporation*

Ju Ji'an *Staff member and interpreter, NDSTIC Foreign Affairs Bureau*

He Ping *Staff member, Equipment Department, PLA General Staff, and President of CITIC's China Polytechnic Corporation*

May navy delegation

Chen Ming *Logistics Officer, PLA Naval Headquarters*

Wang Qianli *Procurement officer, PLA Naval Headquarters*

Mme. Wang Lurong *Procurement officer, PLA Naval Headquarters*

June defense ministry delegation

Zhang Aiping *State Councilor, and Minister of Defense*

Zhang Zhen *Deputy Chief, PLA General Staff*

Wu Shaozu *Vice Chairman, NDSTIC*

Nie Kuiju *Deputy Commander, PLA Navy*

Wang Hai *Deputy Commander, PLA Air Force*

Li Guang *Director, Equipment Department, PLA General Staff*

Yu Jianzhong *Deputy Director, Foreign Affairs Bureau, Ministry of Defense*

Zhang Wenpu *Deputy Director, American and Oceanic Affairs, Ministry of Foreign Affairs*

Zhang Wenxiao *Deputy Division Chief, Foreign Affairs Bureau, Ministry of Defense*

was in charge of PLA procurement during the last years of the Carter administration, and maintained cordial working relations with DOD. The present director of the General Staff's Equipment Department, Li Guang, is well known to foreign manufacturers.

China's defense industry is controlled by the National Defense Science, Technology, and Industry Commission (NDSTIC), rather than by the Central Military Commission or the PLA. Next in importance are the seven ministries involved in production or procurement of military hardware for the PLA, and their subordinate import–export agencies. While overtures to influential ministries such as the Ministry of Foreign Economic Relations and Trade and the Ministry of Electronics Industry undoubtedly have proved to be of some value, other companies have concentrated in the main on their trading arms. Foremost among these are the foreign trade corporations (FTCs) under MOFERT. These have handled the bulk of China's imports for the past three decades. Hence, US firms cannot afford to ignore FTCs such as the China National Technical Import Corporation (which imports systems and production lines and plants), China National Machinery Import–Export Corporation (which imports machinery), and the China National Instruments Import–Export Corporation (which imports electronics equipment), among others.

Some US companies have already negotiated with the China National Aerotechnology Import–Export Corporation (CATIC) for aircraft engines, avionics, parts, and heat-resistant forgings and castings. US firms have dealt with the China Electronics Import–Export Corporation, or CEIEC, which represents the factories under the Ministry of Electronics Industry that supply telecommunications and electronics equipment to the military. The North China Industries Corporation, or NORINCO, acts as a supply agent for the PLA ground forces for new weapons, support equipment, and retrofitting. It is a giant organization, controlling 120 factories and one million employees, and manufactures everything from trucks and machine tools to arms and ammunition. The Great Wall Corporation procures for the Ministry of Space, and the China State Shipbuilding Corporation supplies naval equipment. Even the China National Machinery and Equipment Import–Export Corporation, or EQUIMPEX, may be of assistance, although its parent ministry, the Ministry of Machine Building, manufactures primarily civilian products.

Other organizations handling military purchases are surfacing all the time. The China National Automotive Industry Corporation, which is

China's Ground Forces

Richard E. Gillespie

China's approximately 3,250,000 ground forces include 158 main force divisions, of which 119 are infantry, 12 armored, and the remainder largely field artillery and antiaircraft artillery divisions. The 119 main force divisions and assorted combat support units are controlled through 35 armies deployed in 11 ground forces military regions. These forces are essentially defensive in nature and lack the logistical support for prolonged operations beyond China's borders.

Roughly one million of China's ground forces face about 500,000 Soviet troops along a common border. The Chinese forces include 58 infantry and 8 armored divisions, supported by 2,000 aircraft. Arrayed on the Soviet side are approximately 52 divisions, of which 47 are posted close to the border. These include 41 mechanized and 6 tank divisions, which possess nearly five times the number of tanks and armored personnel carriers deployed on the Chinese side.

A defense in depth

China's defense strategy therefore undertakes defense in depth against militarily superior forces. Main force divisions have the most mobility, while China's regional forces, recruited locally by provinces and organized into 70 divisions, are assigned to defend fixed positions. The several-million-strong militia is expected to provide intelligence, logistical support, and reinforcements for the army's regional and main forces.

Most of the equipment used by China's ground forces is based on Soviet designs of the 1950s, according to a study by David L. Shambaugh that appeared last year in *The Chinese Defense Establishment: Continuity and Change in the 1980s,* published by Westview Press, and in the more recent report by the prestigious London Institute for Strategic Studies.

The durable AK 47 continues to serve the Chinese foot soldier as the standard assault rifle. Pistols, recoilless rifles, machine guns, and other semi-automatic and automatic weapons are also produced domestically. China's artillery inventory, according to the London study, include some 12,800 guns and howitzers. Gun calibers include 85 mm, 122 mm, and 130 mm, plus 122 mm and 152 mm self-propelled versions, while the howitzers include mainly 122 mm and 152 mm caliber towed and self-propelled weapons.

In addition, there are roughly 13,500 mortars in 82 mm, 120 mm, and 160 mm calibers; 3,900 multiple rocket launchers of mainly 107 mm, 132 mm, 140 mm caliber (both towed and self-propelled), and 320 mm caliber self-propelled launchers; as well as operational surface-to-surface missiles modeled after the Soviet FROG. About 10,000 antiaircraft guns in the 37-100 mm caliber range round out the PLA's ground forces armaments.

There are currently also some 11,450 heavy, medium-light, and amphibious tanks in the PLA inventory, according to Shambaugh. China still uses the World War II-vintage T-34 tank, but now manufactures a modified version, sometimes referred to as the T-34 AA, outfitted with twin 37 mm AA guns.

The T-59 medium tank, copied from the Soviet T-54, serves as the main battle tank, while the 25-ton T-62 light tank (with 85 mm cannon) has been deployed south of the Yangzi River. This tank proved effec-

controlled directly by the State Economic Commission, exercises certain responsibilities over military vehicle production and procurement. Agencies of the Chinese Academy of Sciences have also inquired about buying military hardware, especially in the aerospace area. A shadowy agency, the Yanshan (Swallow Mountain) Science and Technology Corporation, which operates under the Academy of Social Sciences, is one such agency. It operates the Beijing Computing Applications Center and is responsible for planning and coordinating a nationwide computer system for scientific data. Although it is often difficult to contact in Beijing, it has approached foreign firms for military or high-tech imports.

Of recent interest is the Polytechnic Corporation, which operates under the China International Trust and Investment Corporation, an organization formed to attract foreign civilian investment. Nevertheless, Polytechnic has approached US defense industries. Its chairman, Wang Jun, is the son of a former Politburo member. Key figures within the PLA General Staff also hold top Polytechnic posts. While Polytechnic and other middlemen add costs to any sale, companies may find themselves forced to deal with them. Marketing military equipment, as with any product, is sometimes facilitated through "old boy" or family networks, and it is sometimes wise to take advantage of them. Finally, US exports to the China Nuclear Energy Industry Corporation, which supplies both China's commercial nuclear industry and nuclear arms program, await the final signing of a US–China nuclear agreement.

China's defense industries

The PRC's defense establishment is far less structured than the US defense industry, with its complex interrelationships between OEMs, systems integrators, and specialized defense subcontractors. This is in part due to the Soviet influence and to two decades of strict self-reliance imposed on the military sector. China's defense plants are more advanced than their civilian counterparts, but produce weapons systems roughly a generation behind those of today's Western and Soviet military forces.

The principal military supply entities—the ministries in charge of nuclear energy, aviation, electronics, ordnance, plus the China State Shipbuilding Corporation—all control export–import corporations, factories, and research and development institutes. Although the Ministry of Machine Building Industry manufactures no military equipment as such, many of its products and designs are incorporated in military hardware.

It is essential to understand the organization and operations of these

tive in the rough terrain encountered during the 1979 Vietnam conflict. Also in production is the T-62 medium tank, developed from Soviet models supplied to China by Egypt after the latter's rupture with the USSR in 1973. The PLA's main light amphibious reconnaissance vehicles are the T-60 and T-63, modeled after the (76 mm gun) Soviet PT-76. The PT-76 has been altered by employing the PT-76 hull with an 85 mm gun turret similar to that on the T-62 light tank. The armor is welded, not cast. The Chinese further modified the amphibious propulsion system for the T-60, but the T-63 still uses the PT-76's water propulsion system.

Limited antiarmor systems

The army utilizes various antiarmor systems, but all are limited to rocket and recoilless launchers of 40 mm, 57 mm, 75 mm, 82 mm, and 90 mm caliber. An increasing number of units are equipped with Soviet-model Sagger antitank guided missiles and small numbers of French HOT missiles.

Finally, the Chinese ground forces have more than 4,800 armored personnel carriers (APCs). Most are domestic designs that look remarkably similar to the US M-113, according to Shambaugh. The M-1967 amphibious vehicle is China's main APC. The STR-60 and T-56 open-top APCs, which are strikingly similar to the Soviet BTR-60P and BTR-152, are also manufactured by the Chinese.

Although China's weapons are believed to be capable of performing well in combat, there are a number of serious deficiences when compared with the equipment available to the ground forces of the USSR and Western nations. The lack of antiarmor and antiaircraft systems is a case in point. The Chinese realize that it would be impossible to match the number and sophistication of Soviet tanks, and for the moment are only attempting to equip their tanks with better engines, turrets, and ammunition. Improved conventional artillery weapons and ammunition is also under examination, as are armor-piercing projectiles that can be fired from China's large caliber howitzers and cannons.

American and European antitank (AT) and antiair (AA) precision-guided missiles have received the greatest Chinese attention. The UK has shown them the Rapier AA and Swingfire AT missile, but the French Crotale AA, HOT, and Milan AT systems seem to be of greater interest. The Crotale can be mounted on either trucks or patrol boats, and is capable of shooting down low-flying supersonic fighters. Coproduced with West Germany, the Milan PGM shoots 24-pound projectiles in excess of 2,000 yards.

In the US, Chinese interest has centered on the tube-launched, optically tracked wire-guided AT missile—the TOW—and improved Hawk (I-Hawk) AA systems. On June 15 the Pentagon announced that US firms could sell these weapons to the Chinese.

The PLA's interest in foreign helicopters is still at an all-time high, largely due to its immobility exhibited in Vietnam in 1979. Another priority area is better infantry fighting vehicles, which China apparently wants to obtain through coproduction or some other form of technology transfer arrangment. In the short run, however, more and better trucks will probably remain the principal means of improving mobility.

Better intelligence, communications, and logistical systems are needed by China's ground forces. The army is aware that a sustained ground war would require more accurate and timely intelligence, not to mention more reliable, faster, and secure systems for transmitting reports and commands. The Chinese have also looked into computerizing ground forces logistics. It is not yet clear whether China will rely exclusively on its own electronics industry for the necessary technology and hardware, or look for foreign help.

CHINA'S SECOND ARTILLERY CORPS

The PLA's Second Artillery Corps—the Chinese equivalent to the USSR's Strategic Rocket Forces—controls China's small arsenal of nuclear missiles. In terms of formal organizational structure, it is controlled directly by the PLA General Staff, but actual control of the missile bases and the warheads is less clear.

China currently possesses about 50 CSS-1 medium-range ballistic missiles (MRBMs), which first became operational in the mid to late 1960s, at least 60 CSS-2 intermediate-range ballistic missiles (IRBMs), and at least 4 intercontinental ballistic missiles (ICBMs), according to London's Institute of Strategic Studies. The CSS-2 IRBMs are capable of carrying 200 kiloton warheads approximately 1,900 miles, or 3 megaton warheads up to 3,300 miles. A second generation solid fuel IRBM is under development, according to one source. Most CSS-1s and CSS-2s are deployed around the country in caves or concrete silos.

The Corps' limited number of ICBMs are deployed in two versions. The CSS-3 is a multistage rocket with a 6,000–7,000 mile range. It reportedly covers the western USSR. The full-range CSS-X-4, first successfully tested in 1980, is similar to the US Titan rocket and can carry a five multimegaton warhead more than 13,000 miles. China does not appear to have deployed multiple warhead missiles, but such a missile has been successfully used as a launcher for three space research satellites, according to the Institute of Strategic Studies.

China's first submarine launched ballistic missile (SLBM)—the Xia Class—is in trial operation, according to the Institute of Strategic Studies. Its SLBM reportedly is a CSS-NX-4, a variant of the CSS-2 IRBM. Two Han-class nuclear submarines, now in service, reportedly have test fired cruise-type missiles to a range of 1,000 miles. Ballistic missiles have all been liquid-fueled, but solid propellants have been tested successfully. When the Chinese navy's SLBM becomes operational, the PLA's nuclear deterrent will include bombers, ICBMs, and submarines. —REG

ministries. The Ministry of Aviation Industry, for example, supervises a far-flung industry that manufactures and maintains several thousand military aircraft plus another several hundred in the civilian air fleet. It operates aircraft manufacturing facilities in Shenyang, Xi'an, Beijing, Harbin, Nanchang, Chengdu, and Chongqing. The Ministry of Electronics Industry operates over 3,000 plants with more than 90,000 scientists and one million workers fabricating electronics, telecommunications, and navigation equipment. The 120-odd facilities under the Ordnance Ministry are controlled through NORINCO, and produce all kinds of munitions and conventional ground forces hardware. Shipyards of the State Shipbuilding Corporation are situated in Shanghai, Guangzhou, Guangzhi, Luda (Dalian), and Huludao. The Ministry of Space Industry's plants are responsible for ballistic missile production, and its facilities share satellite production responsibility with those of the Ministry of Electronics.

The Soviet connection of the 1950s continues to influence not only Chinese military equipment designs, but also the organization of the defense industry. Research and development institutes, for example, remain separated from production facilities. This presents special marketing problems for foreign companies.

In the materials sector, China can produce small quantities of superalloys, stainless steel, and electrical steel, but is experiencing problems with nonferrous alloys (aluminum, magnesium, titanium, and the like) needed for aircraft production. China now is receiving foreign help in nonferrous mining and processing, and Japan and Germany have furnished casting technology for jet engines, aircraft wings, brakes, bearings, and turbine blades. The Ministry of Electronics is soliciting foreign technology to produce large-scale integrated circuits and computers. The recent liberalization of US export controls for China should increase US exports of this type.

China's defense industry also faces the prospect of a rapidly dwindling supply of trained researchers and engineers. Many of its best engineers, trained in the US and Europe during the 1930s and 1940s, are now being retired. The corps of scientists and engineers trained by the Soviets in the 1950s is not large enough to satisfy China's needs in this crucial area. The Cultural Revolution destroyed China's system of higher education, and very few technically trained personnel emerged during this era. To meet this crisis, the government has dispatched thousands of physical sciences students abroad for advanced training, and continues to mobilize the nation's top technical talent on high priority projects in the fields of strategic missiles, weapons, aircraft, and naval weaponry.

The severe shortage of trained personnel will, of course, inhibit the absorption of foreign military technology by Chinese plants. Foreign firms involved in technology transfer will therefore have to develop numerous training, consulting, and other technical assistance programs. Otherwise, it will be impossible to maintain quality control, standardization, and the optimal use of labor, raw materials, and equipment.

Limited cash sales

Two main types of military sales possibilities exist, and most firms have tailored their marketing strategies accordingly. The first is straight sales of high priority items. These include quick-fix goods and equipment—helicopters, for example—embodying technology beyond China's manufacturing capability, or technology that the foreign supplier refuses to transfer. However, such cash sales are usually for small quantities of goods. Licensing and other forms of technology transfer are more common, owing to the importance that China's leaders still attach to self-reliance. In the area of weapons procurement, however, the Chinese are somewhat less insistent about technology transfer than in the civilian sector, where Chinese negotiators are adamant about coproduction and technology transfer in general. The willingness of foreign suppliers to include technology in any military sales package will probably enhance their sales effort, since the primary Chinese interest is in acquiring foreign military technology, and not merely individual pieces of equipment.

The 1975 purchase of Rolls Royce Spey jet engine technology offers a striking example of the sort of sales and technology transfer package the Chinese prefer. In this case the Chi-

nese wanted to minimize the number of Spey engines actually purchased, while the British wanted to maximize their up-front sales. Following the purchases, the British finally agreed to help modernize a Chinese aircraft manufacturing plant, and to train the Chinese to manufacture a military version of the engine that could presumably be used to modify the F-8 interceptor. But the engine has not proven suited for this purpose, nor could the Chinese develop an alternative airframe for the engine.

Assisting the civilian sector

Because of the high rate of idle capacity in most Chinese defense plants, foreign firms willing to engage in technology transfer will probably be called upon to help the Chinese increase *both* military and civilian goods production.

Today Chinese defense factories produce civilian goods ranging from bicycles, chairs, radios, washing machines, and other consumer products to computers and other sophisticated industrial machinery. These items currently account for about 20 percent of all "military" output—a 100 percent increase since 1979.

Yet China continues to push for an even closer integration of its civilian and military industries. Zhang Zhen, Vice Chief of Staff of the PLA, for example, serves as deputy director of the recently formed State Council Computer Leading Group. Defense Minister Zhang Aiping recently called upon civilian industrial enterprises to visit military factories and identify further ways for cooperation. He also urged military enterprises to help their civilian counterparts develop new products and train their personnel. Both the Ministry of Electronics Industry (formerly the Fourth Ministry of Machine Building) and the China State Shipbuilding Corporation (formerly the Sixth MMB) have launched pilot programs in military–civilian integration. Over the past two years, the ministries of Nuclear Industry, Aviation, Ordnance, and Space have built more than 300 assembly lines producing civilian goods. None of this would have occurred, of course, were it not for Beijing's decision in late 1978 to raise the priority of light industry and consumer goods production, which contributed to the idle capacity in the defense sector and heavy industry generally.

US companies will be increasingly called upon to help Chinese defense plants make this transition to increased civilian goods production. In some cases, a US firm might find it advantageous to sweeten its proposal with an offer to help set up a civilian electronic parts assembly line, for example, in a plant that wants to manufacture its military communications equipment. Should a supplier decide that such an offer is in its interest, it would be well advised to include such a proposal in its initial written contract to avoid having the Chinese partner demand this at some later date as a condition for fulfilling the contract.

Many suppliers should realize that a competitive price and a willingness to consider flexible trade methods—offsets or countertrade—will be a crucial part of any successful marketing effort. With few exceptions, the Chinese will continue to weigh the cost effectiveness of expensive military systems since they know that no single weapon will change the Soviet military balance. The high costs reportedly helped scuttle the French Mirage bomber and Harrier VSTOL aircraft deals. Suppliers should therefore try to keep costs as low as possible. If they are prepared to take back part of the plant production as payment, sales will be facilitated.

Finally, the experience of the French, British, and Italians in attempting to market military hardware to China reveals that there will be no quick payoffs. The British, in particular, seem to know how to mix persistence with patience. After their contract to equip China's Luda destroyers with Sea Dart missiles fell through, they are back at the negotiating table with a new package. The first order of business for US firms will be to convince the Chinese of their reliability and commitment to working together over a long term.

There will continue to be spirited foreign competition, but industry analysts believe the Chinese will probably buy from the US first and then look to Europe as a secondary source, provided US companies are willing to help China in areas such as metal working, machine building, electronics, CAD/CAM, armor, trucks, and ordnance. US defensive weapons sales are possible as early as 1985. Indeed, many interested firms are already positioning themselves for this eventuality. ✱

Defense Modernization

How China plans to rebuild its crumbling "Great Wall"

Christopher M. Clarke

The issue of modernizing the Chinese military has been a very difficult one for China's post-Mao leadership. Virtually everyone in the political leadership concedes that the People's Liberation Army (PLA), including its component air force and navy, suffers from outdated equipment, ill-trained and undereducated troops, aged and incompetent leaders, and severe logistical shortcomings, among other serious problems. But because the PLA is only one claimant on very tight resources, China's leaders have had a difficult time determining the relative priority of military modernization. This problem has been compounded by differing perceptions of the state of domestic preparedness and the nature of the foreign threat.

A major reassessment of China's foreign threat was carried out in the early and mid 1970s. It was then believed that the US, China's enemy since the 1950s, was not only politically and militarily in retreat, but was increasingly amenable to more normalized, even friendly relations. By contrast, the USSR was expanding its forces on the Chinese border, developing a blue water fleet in the Indian and Pacific oceans, and was seen as extending its influence in Africa, Southeast Asia, and the Middle East.

Clearly China was unprepared to face this growing Soviet threat. The PLA's training and readiness had been undermined through neglect and chaotic political campaigns since the early 1960s, and the army's prestige had been badly damaged by the failed military coup attempt of Defense Minister Lin Biao in 1971. Most of the PLA's considerable budget went simply to house, clothe, feed, and pay a severely bloated military force whose equipment and armaments were rapidly deteriorating and becoming obsolete.

When the ten-year program for the Four Modernizations was unveiled in early 1978, the PLA was able to include defense modernization as a third priority, behind agriculture and industry but ahead of science and technology. Very quickly, however, the Chinese leadership realized that the 1978 program was wildly overambitious. As a result, the Chinese not only scaled down their economic expectations, but also reversed the order of the last two modernizations—the military was then demoted to lowest priority.

Deng Xiaoping, China's paramount leader and then also the PLA's chief of staff, gave two reasons for this lower priority. First, military modernization would be too costly given the PLA's serious deficiencies, he explained. To modernize the armed forces first could bankrupt the country and seriously jeopardize the rest of the modernization program. Military modernization could only succeed by following, not leading, economic modernization, he argued. Secondly, the threat to China from the Soviet Union was a long-term, not a short-term, threat. In the short-term, the Sino–American relationship and China's modest nuclear deterrent would be sufficient to protect the nation while the PLA slowly modernized. His views gained credibility during China's February 1979 invasion of Vietnam, when the USSR showed great restraint in aiding its client.

Of course there are elements in the PLA leadership that are displeased with the budgetary status of the armed forces, and veiled complaints occasionally surface in military journals and newspapers. However, these complaints are less and less frequent, and certainly less strident, and it appears that the military establishment has reconciled itself to fourth priority, at least for now.

The military's tight budget

Low priority for military modernization does not, however, mean no priority. Deng agrees with his military colleagues that reform and modernization are necessary. Between 1977 and 1983, according to publicly released figures, China's military annually received some 15 percent of the national budget. This probably represents only about half of the total expenditures on the military, since a number of key items, apparently including much of China's defense research and development, military disability and retirement pay, and probably procurement, are not included in the publicly announced figures.

Despite this substantial share of the national budget, resources for the PLA are very tight. In fact, the military suffered budget cuts of about 13 percent in both 1980 and 1981, and received a slightly smaller percentage of the national budget in every year since 1979, except for 1982. This has forced the PLA to concentrate on low-cost options—and on adapting defensive strategies to reflect the military's budgetary realities.

People's war or conventional defense?

Under Mao, the Chinese devel-

Christopher M. Clarke edited and produced a number of publications at the National Council for US–China Trade before joining the State Department's Bureau of Intelligence and Research this June. The views expressed are solely those of the author.

oped a small strategic nuclear deterrent to prevent aggression against the PRC. Should this have failed, the Chinese were prepared to fight a "people's war" by luring an invader deep into China and surrounding him with an armed populace trained and led by the regular army, much as they had done to the Japanese in World War II.

The threat to China in the 1970s and 1980s, however, is a very modern, highly mechanized Soviet army poised across the flat, open north China plain within striking distance of much of China's industrial strength, nuclear facilities, and capital. In short, the threat is "modern war."

There is some evidence that the Chinese initially took a rather bleak view of their options, believing they had to either spend enormous amounts of money and other scarce resources to modernize the PLA quickly, or despair of defending north China by conventional means at all. Since 1979, however, military leaders in China have shown increasing sophistication about the need to take intermediate steps short of a full-scale military development program. One of these steps, repeatedly urged on the PLA by foreign military advisors as well as key military leaders in China, was to update their doctrine of "people's war."

Under the currently accepted formula of "people's war under modern conditions," PLA leaders expect that in a conventional attack they would still have to fall back under the weight of superior Soviet force, at least temporarily. But now the Chinese feel they must put up resistance closer to the border than the "people's war" doctrine would have called for, and so must be alert to react quickly and inflict the maximum damage possible in the process. This means developing a high-quality early warning system, reliable and effective antiaircraft and antitank systems, a capable defensive air force, and mobility, logistics, and command and control systems. The development of large-scale conventional forces capable of stopping an attack at the border, however, remains a dream of the future.

Training a new generation

Overpoliticization of the military in the past led to a deemphasis on training from the squad level up to the ranks of corps and army commanders. Most officers were promoted from the ranks, largely on political criteria, and lacked both a general education and the professional training required under modern conditions. The lack of training and experience of China's low and middle-ranking officers was conspicuously evident during the 1979 invasion of Vietnam.

Now, however, the PLA is moving toward a more regularized, professional military establishment. Increasingly, nonmilitary functions are being taken away from the armed forces. For example, a new People's Armed Police force was formed last year to relieve the army of guard duty at public facilities and foreign legations, and the PLA's railway construction corps was turned over to the civilian Ministry of Railways. Other signs of change include the return of military parades, issuance of new, snappier uniforms, the promulgation of a new discipline code and, probably by 1985, the reinstitution of ranks.

The Chinese may have taken a rather bleak view of their options initially, believing they had to either spend enormous amounts of money and other scarce resources to modernize the PLA quickly, or despair of defending north China by conventional means at all. Since 1979, however, military leaders in China have shown increasing sophistication about the need to take intermediate steps short of a full-scale military development program.

Above all, training has changed. As Chief-of-Staff Yang Dezhi said in 1983, the PLA has now shifted its stress in training from "antiinfantry to antitank warfare, from single-services to combined units, and from soldiers to officers." Military academies that were disbanded during the Cultural Revolution have been restored, and new ones established. About 20 military schools now have four-year, college-level courses for PLA officers, and by the end of this year, 70 percent of all officers from platoon commander up will be expected to have attended one of the hundreds of lesser academies. In the future, officers will not be eligible for promotion without attending some kind of formal military academy program.

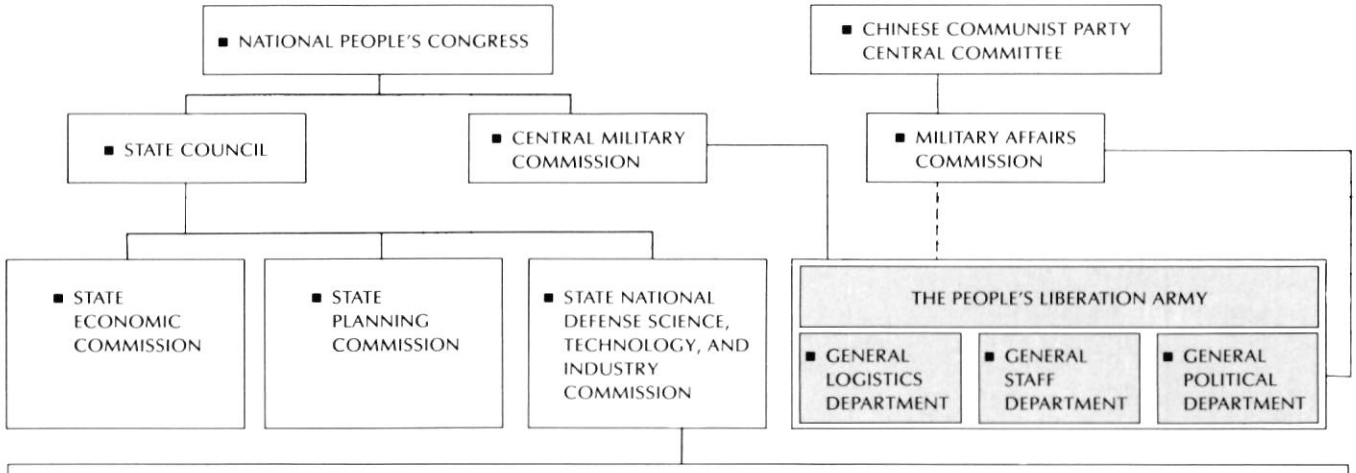
Recruitment patterns are also changing. In the past, joining the PLA was seen as an escape from the drudgery of rural life. Now peasants, increasingly able to stay at home and earn more income, are reluctant to join. At the same time, the PLA is recruiting more educated urban youth capable of handling the complex equipment of today's army. These urbanites tend to be less hardy and more demanding than yesterday's peasant youth. The PLA is also forced to compete with other ministries and state organizations for scientific and technical talent for its officer corps.

China's change in training priorities was most clearly shown in the massive war games outside Beijing in late 1981. During those exercises, between 1,000 and 2,000 military aircraft, including helicopters, transports, fighters, and bombers, reportedly provided support to a combined infantry-artillery-armored maneuver designed to demonstrate to the Soviets the high cost of any potential invasion. Since that time, several smaller regional combined-arms exercises have been held.

Staying awake

As Deng Xiaoping told China's elderly top commanders (mostly Long March and World War II veterans) at a 1980 meeting of the Party's Military Affairs Commission: "I am afraid that most of the people here, if not all, will find it difficult to carry on work (in five years). You will all be over 70 seven or eight years from now. Will you be able to clearly discern the outcome on the battlefield? If war should break out, would you be able to stay awake for three days and nights at a stretch?"

CHINA'S MILITARY INDUSTRY, SUPPLY AND PROCUREMENT SYSTEM



Major suppliers

■ MINISTRY OF NUCLEAR INDUSTRY (nuclear fuel and materials)	■ MINISTRY OF AVIATION (aircraft and avionics)	■ MINISTRY OF ELECTRONICS (electronics and telecommunications)	■ MINISTRY OF ORDNANCE (conventional weapons)	■ MINISTRY OF SPACE INDUSTRY (missiles)
CHINA NUCLEAR ENERGY INDUSTRY CORPORATION (CNEIC)	CHINA NATIONAL AEROTECHNOLOGY IMPORT-EXPORT CORPORATION (CATIC)	CHINA ELECTRONICS IMPORT-EXPORT CORPORATION (CEIEC)	CHINA NORTH INDUSTRIES CORPORATION (NORINCO)	CHINA GREAT WALL INDUSTRIAL CORPORATION (CGWIC)
■ MINISTRY OF MACHINE BUILDING INDUSTRY (general machinery)	■ CHINA STATE SHIPBUILDING CORPORATION (ships and naval equipment)	■ MINISTRY OF FOREIGN ECONOMIC RELATIONS AND TRADE	■ CHINA INTERNATIONAL TRUST AND INVESTMENT CORPORATION (investment services)	■ MINISTRY OF NATIONAL DEFENSE (foreign affairs liaison on behalf of the PLA)
CHINA NATIONAL MACHINERY AND EQUIPMENT IMPORT-EXPORT CORPORATION (EQUIMPEX)	CHINA SHIPBUILDING TRADING CORPORATION (CSTC)	MACHIMPEX, INSTRIMPEX, AND TECHIMPORT	CHINA POLYTECHNOLOGIES CORPORATION (CPC)	

Major logistics support

■ MINISTRY OF PETROLEUM INDUSTRY (petroleum products)	■ MINISTRY OF COMMUNICATIONS (land and river transport)	■ MINISTRY OF RAILROADS (rail transport)	■ CIVIL AVIATION ADMINISTRATION OF CHINA (back-up air transport)	■ CHINESE ACADEMY OF SCIENCES (basic science R&D)
■ CHINA PETROCHEMICAL CORPORATION (refined petroleum products)	■ MINISTRY OF FINANCE (budget disbursements)	■ CENTRAL METEOROLOGICAL BUREAU (weather forecasting)	■ STATE OCEANOGRAPHY BUREAU (ocean research)	

Table prepared by by Christopher M. Clarke.

Most of these old officers recognize the backwardness of China's equipment and weapons systems, but many question the need for changes in leadership or for a new military doctrine. In addition, many of these revolutionary veterans see current social and economic reforms as backsliding from the tenets of Marx and Mao. In particular, they view agricultural policy as threatening the social revolution in China's countryside for which the PLA was formed, and for which so many soldiers sacrificed their lives. They decry the ideological current of de-Maoization, dislike the deemphasis on heavy industry in favor of consumer goods, and are suspicious of foreign involvement in China's economy.

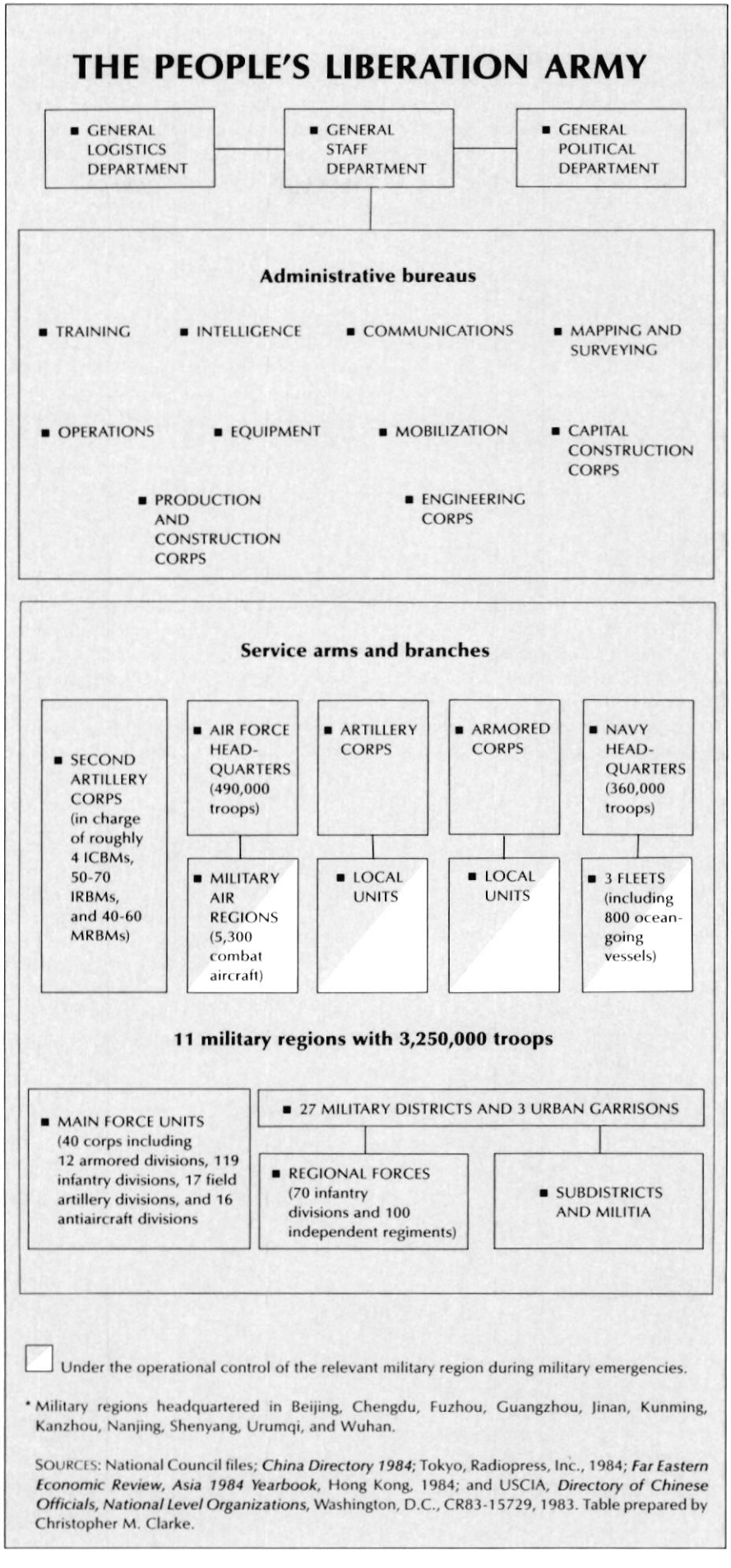
During 1983 and 1984 a major push has been underway to retire these individuals and replace them with younger, more technically competent and more professionally oriented officers. But this remains a sticky problem. Retirement of officers in China is seen as tantamount to dismissal. The civilian leadership has attempted to sweeten this bitter pill with all sorts of perquisites, but many old soldiers are refusing to fade away. The return of rank and other aspects of regularization will entail losses for some and gains for others. Who will get promoted? To what rank? Who will get appointed to what positions?

Despite the problems, there are signs that this uphill battle is being won. In September 1982, 43 top military leaders were elected to the new Party Central Advisory Commission, the first step toward retirement. Within months, 6 of 11 military region commanders, 7 of 11 regional political commissars, and at least 20 of 28 military district commanders were replaced. In the Beijing Military Region alone, more than 1,000 regimental officers, including 40 general officers, were retired on Army Day (August 1), 1983.

At the very top, however, little progress is yet apparent. Deng Xiaoping has not found an acceptable candidate to replace him as overall military commander. The top dozen officials in the PLA range in age from their late 60s to their mid-80s, and no obvious replacements have yet emerged. This will be a significant problem during the coming years.

Ensuring logistics support

Logistics seem to have been one of



* Military regions headquartered in Beijing, Chengdu, Fuzhou, Guangzhou, Jinan, Kunming, Kanzhou, Nanjing, Shenyang, Urumqi, and Wuhan.

SOURCES: National Council files; *China Directory 1984*; Tokyo, Radiopress, Inc., 1984; *Far Eastern Economic Review, Asia 1984 Yearbook*, Hong Kong, 1984; and USCIA, *Directory of Chinese Officials, National Level Organizations*, Washington, D.C., CR83-15729, 1983. Table prepared by Christopher M. Clarke.

the PLA's most severe handicaps during their attack on Vietnam in 1979. Equipment broke down and could not be fixed; rations, supplies, and ammunition were slow in arriving and often had to be delivered by horse-cart and human porter. In the event of a major war, these deficiencies would be magnified by the relatively backward state of China's long-distance rail, highway, water, and air transport systems.

As Defense Minister Zhang Aiping put it in late 1982, "As our national economy develops, the main characteristics of our army's modern weapons and equipment are: automation, high speed, flexibility, and complexity resulting from a high degree of mechanization and computerization. This sets ever more arduous and complicated tasks in ensuring logistics support."

According to the director of the PLA's General Logistics Department, "the key (to improving logistics work) lies in improving the organizational system so that it will be more streamlined, rational, and efficient." This will require better educated logistics personnel and the computerization of supply systems. Most difficult of all will be the long-term modernization of transport systems as well as the country's industrial plant and equipment needed to produce, repair, and maintain vehicles.

Upgrading defense industries

The cost of modernizing the PLA's weapons and equipment will be astronomical. Though China is basically self-sufficient in armaments, almost all of its weapons systems above the level of small arms are 10 to 20 years behind those of their adversary. The problems are especially serious in the fields of design, materials, tooling, and electronics, and in certain critical functional areas like antiaircraft, antitank, and antisubmarine technology.

Estimates of the cost of fully modernizing the PLA range from $60 billion to $200 billion, or from half to double China's entire 1983 state budget. With these constraints in mind, Defense Minister Zhang Aiping in August 1983 outlined China's current strategy for modernizing the nation's military industry by listing five key objectives:

▶ Reorganizing the PLA to eliminate outmoded and unsophisticated weaponry in order to concentrate funds on new weapons development. Development funds will likely center on upgrading artillery and tank ammunition to penetrate modern Soviet armor; fire control systems, radar and surveillance technology for tanks, armored vehicles, artillery, air, and naval forces; communications systems; ship-to-ship, ground-to-air, and air-to-air missiles; and transportation.

▶ Producing more civilian goods with idle military industrial capacity, and developing exports to earn the funds for defense modernization. Already civilian goods account for something like 20 percent of the output of China's military factories.

▶ Concentrating resources on key projects. Research and development will benefit heavily under Zhang's program, a change over past practice.

▶ Organizational reform and specifically the increased centralization of military R & D.

▶ Importing key items of advanced technology, setting up joint ventures and coproducing or licensing advanced military technology. Despite their public rhetoric about self-reliance, the Chinese are very interested in coproducing or licensing technology, and in buying other items that are too advanced or too sensitive to be approved for coproduction or licensing. The emphasis will be on filling in the big holes in China's defense: antitank and antiaircraft systems, new armor plating, new tank turrets, ammunition, and other similar items offering China a high payoff in terms of their deterrent capability.

Winners and losers

The PLA, like any other military bureaucracy, has the normal fights over the allocation of resources to the various service branches. In the long run, China's new military doctrine will probably favor the mechanized wing of the ground forces, artillery, antiaircraft, and the tactical air force. But in the short run, expenditure patterns seem to be somewhat different.

For the past few years, the navy has been gaining a disproportionate share of the budget as China attempts to assert its position of regional importance and its claims to disputed territories, and begins to project a counterpoise to the expansion of the Soviet Far Eastern fleet. The number of major warships on combat-ready duty has roughly tripled since 1980, and the PLA Navy reportedly now has plans for the construction of five new 20,000 ton aircraft carriers over the next five years.

The air force, by contrast, seems to have taken a relatively low priority despite the consensus that it is the weakest link in the PLA's defenses. Air force planes for the most part are incapable of operating at night or in inclement weather, and even China's best fighter aircraft are a generation or more behind those of the US and USSR.

There appear to be at least three major reasons for the air force's relatively low priority. First, the navy is much more suited to playing a regional role and showing the flag. For

CHINA'S DEFENSE BUDGET

Reliable estimates put actual spending at about double the official budgetary figures

	Military budget		Percent of national budget
	Billion ¥	Billion $	
1977	14.9	8.0	17.7
1978	16.9	10.0	15.2
1979	22.3*	14.3*	17.5
1980	19.4	13.0	16.9
1981	16.9	9.9	15.5
1982	17.9	9.5	15.8
1983	17.7	9.0	13.7
1984	17.9	9.0	13.1

* Most likely due to the rapid rearmament following the February–March 1979 Vietnam War.
Table prepared by Christopher M. Clarke.

example, last May a small flotilla of warships from the south China fleet based at Zhanjiang steamed through the South China Sea, past most of the disputed island chains, into the western Pacific near Iwo Jima, and back through the Ryukyu Islands and the Taiwan Strait.

Second, the air force was the most radicalized and politicized branch of the PLA between 1966 and 1976, and apparently not all of its political problems have yet been solved. The leadership is still concerned about its political reliability, and about the growing number of air force defections, complete with expensive aircraft, to Taiwan and South Korea. It is, after all, much more difficult to defect in a naval combat craft.

The sheer cost of replacing China's more than 5,000 combat aircraft with state-of-the-art models is of course a major reason for deferring the modernization of the air force. In the short term then, funds will probably be concentrated on improving the capabilities of existing aircraft, especially by purchasing, licensing, or developing better engines and avionics.

China's military has embarked on a new Long March, one that promises to be as arduous and challenging as the one on which they made their original reputation.

Most analysts believe that there is basic agreement within the ranks of the PLA, as far down as it matters, over key issues like the revision of military doctrine, priority of military development within the Four Modernizations, and the need for professionalism. Disagreements for the most part seem to be of the routine bureaucratic sort encountered within any military establishment, and between any army and its civilian government.

A few cautionary notes are in order, however. The military remains a very strong influence in the Chinese political system. Almost one-fifth of the Communist Party's Central Committee is made up of military representatives, and PLA officers occupy more than one-third of the Politburo.

Secondly, the PLA's officer corps is about to undergo a major generational transition. Outside observers know very little about the experiences, attitudes, and policy orientation of the colonels and brigadiers who will command China's armed forces in the 1990s. Of course, bureaucratic and economic factors will somewhat constrain their choice of options, but a new generation of military leaders could dramatically affect the direction of China's economic and foreign policies.

Significantly, this change in leadership will be taking place at the same time that a new generation of civilian leaders will be rising to the top. No one in this generation of political successors, including Party General Secretary Hu Yaobang and Premier Zhao Ziyang, has the prestige with the PLA of Mao or Deng Xiaoping.

If future conditions force the PLA's new commanders to reassess the threat to China's security, or the urgency of military modernization to meet that threat, the military could prove to be the "wild card" in Chinese politics. As of now, this seems to be a fairly low, but not insignificant, probability. Nevertheless, the transition of power in the military bears close watching throughout the 1980s.

Behind the Sino–Soviet Break

The epochal alienation of these two powers is rooted in long-standing, fundamental antagonism

Harold C. Hinton

The Soviet threat to China originated in a perception in Moscow that China was becoming a threat to the Soviet Union.

In April 1956, already doubtful of the reliability of the Sino–Soviet alliance, Mao Zedong decided to acquire nuclear weapons, and between the fall of 1957 and summer of 1959 Moscow agreed (under great political pressure) to help its Chinese ally toward that goal. By 1960, however, relations between them had become seriously strained, partly because of the termination of Soviet nuclear assistance to China, and Mao's radical anti-Soviet policies. Defense Minister Lin Biao began to send parties of Chinese troops across the border, presumably in a demonstration of defiance and contempt of the supposed paper bear on the other side.

Four years later, Khrushchev became alarmed at China's rapid march toward nuclear capability and its public references to the existence of a Sino–Soviet territorial dispute. He was particularly enraged by Beijing's denunciation of the test ban treaty, which he had agreed to in an effort to create a climate of confidence between the superpowers that would help prevent further confrontations like the Cuban missile crisis. As a result, Khrushchev apparently contemplated a military operation of some sort against China; his fall from power prevented it.

At that time, Mao gave an order that China's military research and development facilities, future missile sites, and the like, be "dispersed to mountain caves." By now this has been done, with an emphasis on the mountainous areas in south China, southwest China, and Tibet. These facilities are hard to locate and identify, even from satellites, and presumably would be difficult to destroy.

During the rest of the 1960s, China's military and especially nuclear development continued to be linked, in the person of Lin Biao and in other ways, to anti-Soviet and anti-American radicalism, a most disturbing combination in Moscow's eyes. In 1965 Beijing began to construct a launching site for testing ICBMs. In that same year, it rejected the post-Khrushchev Soviet leadership's earnest proposal for "united action" over Vietnam. Still more serious from Moscow's point of view was Mao's Cultural Revolution, which was aimed among other things at purging the leadership of the Communist Party apparatus and therefore any possible "healthy forces" (Moscow's term for pro-Soviet foreign communists). In January 1966 Moscow renewed its alliance with Ulan Bator and began to introduce armored units into Mongolia, whose southeastern frontier runs only four hundred miles from Beijing. Moscow's mood was not improved by large-scale demonstrations by Red Guards and other anti-Soviet militants that occurred along the border during the Cultural Revolution.

The Ussuri River incident

But the worst was still to come. The excesses of the Red Guards caused Mao in July 1968 to order their suppression by the army. But once the army had disposed of the Red Guards, Premier Zhou Enlai began to cut back its influence in the provinces gained since early 1967, a situation that was unacceptable to Beijing for many reasons. Seeing this putdown coming, Mao's heir apparent, Lin Biao, tried to avoid or at least delay it. In order to enhance his own prestige and that of the armed forces, he decided to strike a blow at the hated Russians. On March 2, 1969, a Chinese patrol ambushed and shot up a Soviet patrol on a disputed island in the Ussuri River, between Heilongjiang and the Soviet Maritime Province.

The Soviets, the military in particular, took this provocation very seriously and retaliated with a devastating attack on a Chinese unit on the same island on March 15 and a massive buildup of Soviet forces near the Sino–Soviet border that has caused serious concern to the Chinese leadership ever since. The Soviet military press rang with anti-Chinese propaganda.

Moscow's overreaction was probably due to the Soviet military's sense of being under political suspicion since the January 22, 1969, Red Square incident, when a sniper later adjudged to be insane used a Soviet army rifle to fire on a cosmonaut, whom he evidently mistook for Brezhnev. The opportunity to demonstrate the loyalty and patriotism of the Soviet military by thumping the detested Chinese was too tempting to pass up. The Soviet political leadership then demanded that Beijing come to the conference table for talks on the border crisis and the territorial dispute that underlay it.

Zhou Enlai's quick fix

The Sino–Soviet border crisis of 1969 initiated a rapid decline in the

Harold C. Hinton is professor of Political Science and International Affairs at the George Washington University in Washington, D.C. He has traveled widely in East Asia and has written many books and articles on the international politics of the region, especially Chinese foreign policy and Sino–Soviet relations.

political fortunes of Lin Biao and a corresponding rise in those of Premier Zhou Enlai. In December 1970 Mao told the American journalist Edgar Snow, off the record, that Zhou—not Lin—was running the country. At the very top of Zhou's agenda stood the urgent task of coping with the massive Soviet threat, not an easy task in view of China's marked military inferiority.

His first move was to launch a program of normalizing China's diplomatic relationships, which had been badly disrupted during the Cultural Revolution. He also sought and established new relationships, notably with Canada in 1970 and Japan and West Germany in 1972. He was helped by Beijing's entry into the United Nations in 1971. Most important of all, over the strong objections of Lin Biao and other radicals, including those later known as the Gang of Four, he initiated a quasi-diplomatic opening to the United States, the only possible adequate counterweight to the Soviet Union, and received a ready response from Nixon and Kissinger.

Then, also against radical opposition and under Soviet pressure, Zhou acceded in October 1969 to Moscow's demand for border talks. These have been going on intermittently ever since, with few observable results except that they have helped hold the Soviets in play and have given them an incentive—one among several—not to attack China. The Chinese have been demanding a ceasefire agreement and the creation of a demilitarized zone through the evacuation by both sides of disputed areas along the border, things that the Soviets are unwilling to concede without an overall political agreement. As conditions for such an agreement, Beijing demands a drastic reduction of Soviet forces (including SS-20s) along the common border and a complete Soviet military withdrawal from Mongolia, Vietnam, and Afghanistan. The Soviets will not accede to these demands under any foreseeable circumstances, except perhaps for some reduction of forces along the common border if a satisfactory political agreement can be reached. After all, the Soviet military presence in Asia, though avowedly directed against China, is also directed against the United States and its allies.

In September 1971, Zhou engineered, under conditions that are none too clear to this day, the purging and death of Lin Biao. Among Lin's many faults were his opposition to the opening to the United States and his extreme offensiveness in the eyes of the Soviets, who held him responsible for the border clash of 1969. The ultimate irony of Lin's life was a posthumous one: It was alleged that he, the most anti-Soviet of Chinese leaders, had died while attempting to defect to the Soviet Union. Lin's death, followed by the purging of his personal faction within the army, struck a heavy blow at the political power of the army. The process was completed at the end of 1973, when Zhou, with the approval of Mao and the support of the recently rehabilitated Deng Xiaoping, reshuffled the eight most powerful of the 11 Military Region commanders and deprived them in the process of all local political offices.

Virtually everything that Lin Biao had done, and some things that he was merely accused of having done, was denounced and repudiated. The one important exception was the concept of people's war, the subject of a famous tract by Lin published on September 3, 1965. Although often equated with guerrilla war, people's war is more than that. It means the nation in arms fighting with every available means on its own soil against an attacking enemy implicitly superior in weaponry.

Other, more conventional, military approaches were employed as well. The Inner Mongolia Military Region, a kind of military plateglass window along the Outer Mongolian border, was trisected in 1969, and each of the fragments was attached to the adjacent interior Military Region (Shenyang, Beijing, and Lanzhou) so as to make possible a defense in depth in the event of a Soviet invasion. The ground forces, generally held well back from the border, were redeployed from time to time in a series of blocking moves, depending on what the Soviets were doing on their side of the border.

In the nuclear area, a prompt halt was called to the loud publicity that in Lin Biao's day had accompanied Beijing's atomic and missile tests; it was considered too provocative to the Soviets. In fact, silence enveloped all military modernization efforts, so that this progress tended to be underestimated abroad—though not necessarily in the Soviet Union—as Beijing evidently wished. In the spring of 1973, Zhou indicated to the American journalist Marquis Childs that China had acquired a minimum nuclear deterrent against the Soviet Union. Moscow's behavior and some unofficial statements by Soviet military men since that time tend to confirm this report.

The longer haul under Deng Xiaoping

The death of Mao in September 1976, following that of Zhou eight months earlier, produced some Soviet hopes and overtures, but no Sino–Soviet reconciliation. By then Beijing was too fearful, resentful, and suspicious to be easily won over. Early in 1977 the Soviet media began to warn the noncommunist industrial countries against transferring arms to China. The attitude was understandable; the timing perhaps reflected resentment over Beijing's continuing hostility.

Deng Xiaoping's return to the leadership in 1977 soon generated not only a power struggle but a kind of policy competition between him and Hua Guofeng, who at that time headed both the party and the government as Mao's allegedly anointed successor. In February 1978, Hua made a dangerous move by demanding publicly—rather than in private as the Chinese side had been doing at the border talks for some time—a drastic Soviet military drawdown along the entire common border. This demand was totally unacceptable to the Soviet military, and touched off a period of tension dramatized by an anti-Chinese flagwaving trip by Brezhnev and Defense Minister Ustinov in April along the entire border as far as Vladivostok.

By that time Beijing's relations with Hanoi over Cambodia and other issues had approached the boiling point, and Hanoi moved ever closer into the waiting arms of Moscow. On November 3, 1978, the two signed what was almost a treaty of alliance. Hanoi was obviously preparing to invade Cambodia and overthrow Pol Pot's bloodstained regime, which was more or less a client of Beijing. In the midst of threats to teach Hanoi a lesson, Deng Xiaoping decided to proceed with diplomatic normalization with the United States, even in the knowledge that Washington

would continue selling arms to Taipei. This move was clearly a form of insurance against possible Soviet retaliation for the impending Chinese lesson to the Vietnamese.

Bleeding Vietnam white

China's Vietnam campaign from mid-February to mid-March 1979 was conducted in a limited, and militarily none too impressive, manner, and always with an eye on the Soviets. Moscow's only overt move was probably one that had been secretly agreed on with Hanoi at the time of the 1978 treaty: the establishment of Soviet air and naval bases at Danang and Cam Ranh Bay. Beijing's response to Hanoi's hospitality to Soviet bases and the continuing presence of Vietnamese forces in Cambodia has been to try to "bleed Vietnam white" by various means. These include maintaining a border force sufficient to keep Hanoi's best troops pinned there, actively supporting the unspeakable but doughty Pol Pot as well as anti-Vietnamese tribal insurgencies in the highlands of Vietnam and Laos, and preparing for a long-term naval struggle with Hanoi over the oil and islets of the South China Sea—all the while holding out for an accommodation should Hanoi decide to expel the Soviet military presence and withdraw from Cambodia.

In April 1979, Beijing proposed a new round of talks with Moscow. These began in the fall of that year, were interrupted by Beijing in January 1980, resumed in the fall of 1982, and have occurred at six-month intervals since then. As in the somewhat narrower border talks, Beijing's main purpose seems to be to hold Moscow in play, since its demands for a Soviet withdrawal from Mongolia, Vietnam, and Afghanistan, and for a drastic drawdown along the Sino–Soviet border, were already known to be unacceptable to the Soviets.

The Soviet invasion of Afghanistan was Beijing's announced reason for interrupting the talks. This new thrust did indeed confirm the belief, expressed by Zhou Enlai in 1974, that ever since the July 1973 coup in Kabul that brought Prince Daud to power with the help of Soviet-trained army officers, the main thrust of Soviet expansion has been toward southwest Asia, not China.

Relying on its analysis of Soviet intentions and the strength of its overall deterrent position, Beijing had in effect reverted to the view of Peng Dehuai, Lin Biao's predecessor as Defense Minister, that general industrial development should come first and military modernization later. What Bejing wanted from the United States, in addition to an abandonment of Taiwan, was a wide range of high technology, perhaps even more than arms. But the American side was still holding back on a wide range of "dual use" technology. Even the decision by the US in 1981 not to sell Taiwan the "F-X" fighter did not help much. Somewhat more relaxing was the US–Chinese agreement of August 17, 1982, under which the American side promised to hold its arms sales to Taiwan level for the time being and gradually to reduce them.

The death in January 1982 of the senior Soviet ideologue Suslov, with whom Deng had been on the worst possible terms, created the possibility for diplomatic initiatives. After several invitations from Brezhnev, the talks suspended by the Chinese in 1980 were resumed in the fall of 1982, but as yet with few results.

In mid-1983 Beijing serendipitously made a major breakthrough in its relations with the United States. The Reagan administration liberalized restrictions on the export of "dual use" technology to China. Now at last, Beijing apparently believed the US had its priorities right.

Accordingly, the visit of Secretary of Defense Weinberger to China in September and the return visit by his opposite number Zhang Aiping in June 1984 appeared to signal a serious intent to buy American arms. Sales could begin with strictly defensive items—antitank missiles, for example—that it was hoped would not unduly alarm the watchful Soviets or other Asian countries, which regard China's military modernization and the possibility of American support for it with considerable disfavor.

Meanwhile Deng, who retains the chairmanship of the party's Military Committee, has been pressing ahead with weapons development, the promotion of younger officers, large-scale maneuvers (notably in 1981 and 1982), and a general improvement in China's military readiness to cope with its only dangerous adversary. Moreover, successive defensive lines are being constructed in northeast China and probably in Inner Mongolia. According to some reports, these include, or may come to include, nuclear mines placed under likely invasion routes.

For a time in the late 1970s, Deng Xiaoping loudly proclaimed the necessity for the "widest possible united front" against Soviet "hegemonism." During his 1979 visit to the United States, he discovered that the Carter administration was not interested in the idea, and he dropped it. Instead, he told a visiting American delegation in June 1980 that the United States and China should pursue parallel strategies, so that Moscow could never feel certain of being able to fight one without also having to fight the other. He seemed to imply that a Soviet invasion might meet with a nuclear response, his reasoning apparently being that uncertainty about the American reaction would inhibit Moscow from full-scale nuclear retaliation.

The murky outlook

Some Chinese appear to expect an eventual war between the United States and the Soviet Union, in the course of which the Soviets would be likely to attack China in one way or another. The eminent military analyst Edward Luttwak has predicted a Soviet conventional invasion down to the Great Wall, and some Soviet officials have spoken informally of such a possibility. China's obvious task is to raise the cost of such an operation to the level of unacceptability.

A full-scale Sino–Soviet reconciliation appears out of the question; too much has happened between them for that. The Soviets apparently want a political agreement that would enable them to demobilize, say, their Category Three divisions near the Sino–Soviet border and so augment the sparse labor force of Siberia, the region whose minerals are perceived in Moscow as the long-term hope of the Soviet economy. But Beijing shows no interest in such an agreement. Presumably the Chinese reason that it is difficult for a neighbor of the Soviet Union to enter into a political relationship with it without becoming a satellite, something Beijing is determined to avoid.

The most likely outlook is for a continuation of the existing Sino–Soviet confrontation, with variations. To those who say this confrontation cannot go on indefinitely, the answer is, why not?

中外贸易

Jennifer Little
Research Assistant

The following tables contain recent press reports of business contracts and negotiations exclusive of those listed in previous issues. Joint ventures, licensing arrangements, and other forms of business arrangements are included if classified as such in Chinese and foreign media reports. For the most part, the accuracy of these reports is not independently confirmed by *The CBR*.

National Council members can contact the library to obtain a copy of news sources and other available background information concerning the business arrangements appearing below. Moreover, member firms whose sales and other business arrangements with China do not normally appear in press reports may have them published in *The CBR* by sending the information to the attention of Jennifer Little.

中外贸易

CHINA'S IMPORTS THROUGH MAY 31

Foreign Party/ Chinese Party	Product/Value/ Date Reported
Agricultural Commodities	
(Canada)	45,000 tons of wheat flour under the World Food Programme. 2/14/84.
Oregon, Washington, and Montana (US)	Donated 40 tons of flour for use in an instant noodle plant. 3/1/84.
Interwood (France)	Order for 23,000 cu. meters of pine logs. 3/28/84.
(US)	120,000 tons of wheat, bringing 1984 total to 2.7 million tons. 4/25/84.
Agricultural Technology	
Graan Elevator Maatschappij (Netherlands)/Ministry of Communications	Signed contract to advise on construction of a grain elevator at Dalian. 2/18/84.
W.R. and S. Pook Ltd. (UK)	Contract for flap valves and slide valves for installation in a Chinese feed mill. 2/21/84.
Minnesota Turkey Growers Assn. (US)	Order for turkey semen extender. 2/27/84.
Chemicals and Chemical Plants and Equipment	
(US)	100,000 tons of diammonium phospate for Jan-Feb 1984 shipment. 2/13/84.
Akzo Zout Chemie (Netherlands)	30,000 tons of soda ash. 2/13/84.
Atlantic Richfield Co. (US)/CNOOC	Plan to build a chemical fertilizer plant on Hainan using natural gas. 4/6/84.
Construction and Construction Materials & Equipment	
Tumac Hoists Ltd. (UK)	A twin-cage hoist for use in construction of the Shenzhen International Trade Center. 2/84.
Formac International Sales Corp. (US)/Fuzhou Synthetic Board Factory, Fujian	Sold set of equipment for medium-density fiberboard production. 3/84.
Linden-Alimak (Sweden)/ China State Construction Engineering Corp.	Order for 14 construction hoists. $1.1 million (SeK 8.5 million). 3/84.
Hitachi Construction Machinery Co. (Japan)	60 medium-sized excavators. $2.7 million (¥600 million). 3/27/84.
Mitsubishi Heavy Industries Ltd. (Japan)	20 small excavators. $620,000 (¥140 million). 3/27/84.
Komatsu Ltd. (Japan)	10 motor graders. $444,000 (¥100 million). 3/27/84.
Takenaka Komuten Co. and Ohbayashi-Bumi (Japan)	Will handle the design consulting and work management know-how for their Chang'an Center office and hotel complex in Beijing to be built by a Japanese consortium. 3/28/84.
Cooper MacDonald & Partners (UK)	Contract to design and engineer the first phase of the Silver Bay development project in Zhuhai. Cost of first phase: $168 million. 3/29/84.
Morrison-Knudsen Co. Inc. and S.A. Healy Co. (US)	Two used large boring machines to drill tunnels for the Tianshengziao hydro project. 3/29/84.
Everbright Industrial Co. (HK)	Will construct an industrial estate in Zhuhai. $100 million. 4/17/84.
Everbright Industrial Co. (HK)	Will build an offshore oil-support base in Shenzhen. 4/17/84.
Katahira & Engineers Inc. (Japan)	Will design the highway connecting Hong Kong, Shenzhen, Macao, and Zhuhai. Highway cost: $900 million. 4/25/84.
Leo A. Daly (HK)/China State Construction Engineering Corp.	Signed agreement to develop building projects in China, Hong Kong, and other locations. 5/7/84.
Consumer Goods	
S. Giorgio Elettrodomestici Ltd. (Italy)/Japan Washing Machine Factory	Signed technical transfer contract for washing machine production technology. 3/19/84.
Molins (UK)	Signed agrement to supply technical information for the manufacture of cigarette-making machines and machinery. $6.55 million (£4.5 million). 3/20/84.
Industrie Zanussi SpA (Italy)	Signed initial contract for sale of equipment and technology for a refrigerator production plant to be located in Zhangzhou. 5/4/84.
Electronics	
Allen Bradley (US)	Is discussing processing and marketing of thick film diaphragm resistors and metal diaphragm resistors. Also discussed production of frequency-regulated motor starters. 3/84.
Aydin Computer Systems (US)/Geographic Research Institute	Two computer systems to monitor and report graphic data on population, food production, and energy consumption. 3/15/84.
ITT World Communications Inc. (US)	Established a high-speed data communications link. 3/22/84.

NA = Not Available

NOTES: Contracts denominated in foreign currencies are converted into US dollars at the most recent monthly average rate quoted in *International Financial Statistics (IMF)*. Contracts concluded over two months ago are also included if they were not reported in the last issue of *The CBR*.

Unizon Corp. (Japan)	Contract to supply equipment and raw materials for production of germanium diodes in Shanghai. $887,000 (¥200 million). 4/84.
Francis Co. Ltd. (HK)/ Shenzhen Light Industrial Import-Export Co. and Nanhe Joint Enterprise Co.	Signed agreement to set up an electronic and plastics factory to produce video and magnetic tapes. Investment: $1 million. 4/84.
Burroughs Machines Ltd. (US)/Everbright Industrial Co.	Reached an agreement to build two computer-manufacturing factories in Hong Kong and Yunnan Province. 4/1/84.
Altos Computer Systems Inc. (US)/Alhua Electronic Co. Ltd. and Shaoguan Radio Factory, Guangdong	Microcomputer production lines for 16-bit micros. 4/2/84.
Fuji Electric Co. (Japan)	Signed contract to cooperate with Tianjin on electronic measuring instruments and semiconductors. 4/6/84.
Toshiba Corp. and Nichimen Corp. (Japan)/ Liaoning General Foreign Trade Corp.	Order for a TV picture tube-making plant to be located in Dalian. $11 million (¥2.5 billion). 4/10/84.
Yamatake-Honeywell Co. (Japan) and Honeywell Co. (US)/Sichuan General Meters Factory and TECHIMPORT	Set up a technical service center for automatic control systems. 4/12/84.
Honeywell Inc. (US)/ Great Wall Industrial Co. and Data Equipment Institute	Signed contract to sell DPS 6 small computer systems. $1.2 million. 4/16/84.
Ryoden Electric Enginering Co. Ltd. (HK)	Will supply the electrical and mechanical equipment necessary to reconstruct the Hongqiao Airport in Shanghai. 4/16/84.
Corning Glass Works (US)/Shanghai Instrumentation and Electronics Industry	Signed agreement to provide a fluorescent light tube production line to be installed in a Shanghai factory. 4/24/84.
General Robotics Corp. (US)	Was appointed exclusive dealer, distributor, representative, and agent for IBM compatible personal computers made by Future Computers (UK). 5/8/84.
General Robotics Corp. (US)/China Electronics Import & Export Corp.	Signed an agreement to provide finished units, kits, and technology for factory to produce DEC compatible minicomputer systems. $4 million+. 5/8/84.
Fanuc Ltd. (Japan)	Plans to produce numerically controlled equipment and control motors in China. 5/16/84.
Food Processing	
Russell Coil Co. (US)	Condensing units and unit coolers for a refrigerated storage facility in Guangzhou. 2/84.
Kalt Mfg. Co. (US)	Prefabricated building for a refrigerated storage facility in Guangzhou. 2/84.
Henry Simon Ltd. (UK)/ Beijing Food Bureau	Contract for a flour mill. $2.17 million (£1.5 million). 3/6/84.
Mitsubishi Corp., Q.P. Corp., Toyo Seikan Kaisha, Ltd., and Kyowa Seed Co. (Japan)	Assistance and technology for vegetable production and for construction of a canning plant to be located in Shanghai. 3/13/84.
Craig-Nichol (UK)	Order for 36 refrigerator display cases for a meat store in Guangzhou. $52,000 (£36,000). 3/27/84.
Belgian Engineering & Enterprises Ltd., unit of Tractionel (Belgium)/ Zhuhai Brewery (HK-PRC joint venture)	Will provide system design, equipment supply, building work, and technical support for the Zhuhai Brewery. 3/24/84.
Foreign Aid	
(Canada)/Ministry of Forestry	Money for China's 'greening fund.' $8,000 (¥16,000). 4/84.
(Canada)	Signed two memoranda of understanding to provide two grants for forest fire management and electric power research. $10.6 million (C$13.4 million).
Machinery	
Nissan Diesel Corp. (Japan)/State General Bureau of Goods and Materials and Dandong Motor Vehicle Works.	Parts to assemble the chassis of a 50-ton crane. 3/84.
P & W Co. (US)/Chengdu Measuring and Cutting Tools Plant	A production line to manufacture end-mills. 3/27/84.
Edwards High Vacuum (UK)	Received order for vacuum pumping equipment for a Shanghai TV plant. $167,500 (£115,000). 4/12/84.
Esab AB (Sweden)/Deyan Heavy Machinery Plant No. 2, Sichuan, and Harbin Boiler Works	Welding equipment. $1.4 million (SeK 11 million). 4/23/84.
General Electric Co. (US)/ Tianjin Machinery Import-Export Co.	Signed contract for technology and equipment for deoxidation welding rods. $2.5 million. 5/84.
Metals and Minerals	
Dickinson Laboratories Inc. (US)/China National Coal Development Corp.	Signed contract to provide quality testing at the Pingshuo coal mine. 1984.
Kobe Steel Ltd. (Japan)/ TECHIMPORT and Xiqu Coal Mine, Shanxi	Six sets of vibrating screens. $100,000. 2/24/84.
Nippon Steel Corp. and Nippon Kokan (Japan)	50,400 tons of steel rails. 2/28/84.
Wright Engineers Co. Ltd. (Canada)	Is working on a project to expand a gold mine in Shandong. 3/1/84.
CRA Corp. (Australia)/ Ministry of Metallurgical Industry	Signed agreement to extend their cooperation in steel technology. 3/9/84.
Continuus-Posperzi (Italy)/Tianjin First Wire Rope Works	Received order for a cold rolling steel mill. 3/9/84.
Merban Americos Corp. (US)/China Metallurgical Import-Export Corp., Guangdong Branch	Complete set of equipment and technology to produce aluminum windows, doors, and other extrusions. $5.55 million. 3/13/84.
(Brazil)	1.5 million tons of steel products during the next three years. 3/27/84.
BHP Minerals (Australia)/ MINMETALS	20,000 tons of manganese ore. 3/31/84.
Mitsubishi Light Metal Industries Ltd. and Ryoka Light Metal Industries Ltd. (Japan)/Qingtong Smeltery, Ningxia	Signed contract for aluminum smelting technology. 4/10/84.
Kobe Steel Ltd. (Japan)/ China Nonferrous Metals Industry General Corp.	Received order for an aluminum extruding press for a plant located in Zhuoxian, Hebei. $1.78 million (¥400 million). 4/13/84.
(Japan)/MINMETALS	585,000 tons of steel products, bringing the 1984 total for shipment in first half of 1984 to 3.387 million tons. 4/14/84.
(UK)/Ministry of Coal Industry	Signed an agreement to provide consultancy for the Tangshan Mine, Hebei. 4/20/84.
Shell Coal International Ltd. (UK)/China National Coal Development Corp.	Signed agreement to jointly undertake a feasibility study of the Jining No. 2 Mine, Shandong. 4/20/84.
(Australia)	Reached an agreement to jointly study the feasibility of iron and steel production cooperation. 4/20/84.
Mining Equipment	
Wabco Construction and Mining Equipment Co. (US)/Shanghai Tractor and Automotive Co.	Signed agreement for technology and equipment to manufacture 32-ton mining trucks. 5/16/84.

Petroleum

Gemco Equipment Co. (US)/TECHIMPORT and Petroleum Corp. of China	26 4-wheel drive off-road tractors and 34 top drive shot hole drills. $4 million. 4/9/84.
Continental Emsco Energy Products, subsidiary of LTV Corp. (US)/ MACHIMPEX	Order for 20 self-propelled rigs and related equipment. $22 million. 4/19/84.
Yiu Lian Machinery Repairing Works Ltd. (HK)/ Nanhai West Oil Co.	Contract to repair a jack-up drilling rig. $3.2 million. 5/84.
Total Chine, unit of Cie. Francaise des Petroles (France)/Nanhai West Oil Corp.	Agreed to begin trial production in the South China Sea. 5/31/84.

Pharmaceuticals

Taisho Pharmaceutical Co. Ltd. (Japan)/Academy of Medical Sciences, Institute of Medicine	Signed an agreement to develop new medicines from natural substances. 3/10/84.

Ports

Hopewell Holdings Ltd. (HK)/Nanhai Oil Shenzhen Development Joint Services Corp.	Signed letter of intent to jointly develop a deep water harbor in Shenzhen. First phase: $600 million. 3/23/84.
Jiahao Co. Ltd. (HK)/ Zhuhai SEZ and Nanhai Oilfield Joint Service Corp.	Signed a contract to construct a deep water port in Zhuhai. $65 million. 3/31/84.
Kobe Harbor Bureau (Japan)/Tianjin Harbor Administration	Signed agreement to improve Tianjin's harbor management. 4/16/84.

Power

Alsthom-Atlantique (France)	Will give China the technology for equipment needed for a nuclear power station (except for the reactors). 3/14/84.
Bechtel Power Corp. and Gibbs & Hill, Inc. (US) and Swiss Power (Switzerland)	Each company is providing engineering evaluations for the Guangdong nuclear power plant in a competition to be consultant for the project. 3/15/84.
Klein, Schanzlin and Becker (W. Germany)/ China Nuclear Energy Industry Corp.	Order for two main cooling pumps and two injection pumps for the Qingshan power station near Shanghai. 4/3/84.
ASEA (Sweden)/ TECHIMPORT	200 instrument transformers and auxiliary equipment. $3.64 million (£2.5 million). 4/5/84.
(W. Germany)	Will sign an agreement to cooperate in peaceful use of nuclear energy. 5/7/84.
Kyushu Electric Power Group and New Energy Development Organization (Japan)	Will cooperate to develop Chinese geothermal resources. 5/15/84.

Scientific Instruments

Energy Sciences Inc. (US)/Shanghai Electrical Machinery Corp., Shanghai University of Science and Technology and Radiation Research and Processing Society	An electronic beam processor. 2/84.
Hollis Geosystems (US)	Five photovoltaic-powered environmental monitoring systems. 3/84.
Cambridge Instruments (UK)/China North Instruments Import–Export Corp. and Shanghai Foreign Trade Bureau	Three image analysers. $291,000 (£200,000). 3/2/84.
Spex Industries Inc. (US)/ TECHIMPORT and Ministry of Education	Spectroscopy systems. $2 million. 3/20/84.
Waters Ltd. (Japan)/ INSTRIMPEX	Have opened the INSTRIMPEX Waters Service Center to install and maintain liquid chromatographs and related products. 3/22/84.
Gus Manufacturing, division of Grant Geophysical (US)/Ministry of Geology and INSTRIMPEX	A SGR-II seismic equipment system with 250 channels. 4/84.
Keithley Instruments (US) and Electronic Scientific Engineering Ltd. (HK)/ Guangzhou Institute of Metrology	Has established a service technical center. 4/30/84.
Baird Corp. and Unison International (US)/Tianjin Metallurgical Experimental Factory	Signed contract for direct-reading spectroscopes. $170,000. 5/84.

Shipping

Kirton Kayaks (UK)	Seven fiberglass racing canoes and kayaks. $4,000 (£3,000). 4/3/84.
Morgan Guaranty Trust (US)	Sold a containership formerly owned by Hellenic Lines. $5.25 million. 5/7/84.

Telecommunications

Television Technology Corp. (US)/Anshan Broadcasting Equipment Plant, Liaoning	TV transmitting equipment and technology. $700,000. 2/20/84.
DCM International Corp. (US)/Chengdu Telephone Cable Factory	Awarded contract to supply quality control and quality assurance test equipment. 3/84.
Siemens AG (W. Germany)/Guangzhou Foreign Trade Center	An EMS 12000 communications system. 3/26/84.
Standard Telephones and Cable (UK)/MACHIMPEX	Won contract to supply 240 kms of telephone cable. $1.75 million (£1.2 million). 4/6/84.
Philips Hong Kong Ltd.	Contract to install a private telephone switching system in Shenzhen. $200,000. 4/8/84.
Global Communication Equipment Corp. (US)	Will help to produce microwave communications facilities in Zhuhai. 4/17/84.
Arianespace (France)/ China Broadcasting Satellite Corp.	Signed an agreement to reserve two Arianne rockets to launch two Chinese TV satellites in 1987 and 1988. 4/26/84.
Systems & Applied Science Corp. (US)/Chinese Academy of Sciences	Will sell a Landsat ground station. $10 million. 5/10/84.

Textiles and Textile Plants and Equipment

Cobble (UK), subsidiary of Spencer Wright Industries	20 tufting or single-jersey knitting machines. 4/84.
Toyo Menka Kaisha Ltd. (Japan)/Changying Knitwear Mill, Shanxi	Silk dyeing and sewing machines. $170,000. 4/11/84.

Tourism

Hang Hing Gee Lum Co. Ltd. and Overseas Chinese Banking Corp. (HK)/ Xiamen Construction and Development Co., Bank of China, and the Lujiang Mansion	Will convert the Lujiang Mansion to a 2- or 3-star hotel. 4/2/84.
Japan Air Lines Development Co. (Japan)/Jing Lun Hotel, Beijing	Signed a management assistance agreement. 4/4/84.
Active Building and Civil Construction (Singapore) and Gustar (Switzerland)/ Tianjin Travel and Tourism Corp.	Will build a 300-room hotel. Management by the Swiss company. $25 million. 5/84.
Peninsular Group (HK)/ Garden Hotel Complex, Guangzhou (HK–PRC joint venture)	Signed a 5-year management agreement. 5/6/84.
Meisho (Far East) Co. (Japan)/Hangzhou Tourist Agency & others	Signed letter of intent to build an amusement park at West Lake, Hangzhou. 5/22/84.

Transportation

Hayden Drysys (UK)/ China Automotive Industry Corp.	Won contract to design three truck factories for painting cabs to be located in Changchun, Shiyan, and Jinan. 2/22/84.
Jardine Air Cargo (UK)/ SINOTRANS	Signed an air freight partnership agreement. 3/84.
Henderson Industries (US)/Chunghua Rubber Tire Plant	Signed a contract to design and manufacture tire control consoles and material handling equipment. 4/2/84.
Nitto Transportation Co. Ltd. (Japan)/SINOTRANS	Signed mutual agency agreement for intermodal transport between Japan and China. 4/16/84.
Aero Asahi (Japan)/China Marine Helicopter Corp.	Contract to provide two manned helicopters to work on offshore oil rig supply runs near Tianjin. 4/23/84.
Motor Holidays (US)	Negotiating the sale of motor homes for a park outside Beijing. $20–25 million. 5/84.

Miscellaneous

Longman Group (UK)/ China International Economic Consultants	Signed a contract for the publication of a *China Investment Guide*. 3/84.
Stanford University (US)/ Zhejiang University of Medical Science	Signed a cancer cooperation agreement. 3/5/84.
EEC and European Foundation for Management Development/China Enterprise Management Association and State Economic Commission	Will start an MBA program at the Beijing Management Center. $3 million. 3/7/84.
Australia & New Zealand Banking Group Ltd./Zhejiang International Trust & Investment Corp.	Signed a cooperation agreement. 3/14/84.
Cable Communications Unlimited (US)	Has been hire to sell American companies advertising during Chinese broadcasts of the Olympics. 3/12/84.
Japan Silver Volunteers, Inc./China Science and Technology Exchange Center	Agreed to send retired Japanese executives to assist China. 3/22/84.
Mitsubishi (Japan)/China Science and Technology Exchange Center	Signed a science and technology exchange agreement. 3/30/84.
Yamaichi Securities Co. and Yamaichi Research Institute of Securities & Economics Inc. (Japan)	Signed an agreement with Fujian to promote the province's modernization. 4/3/84.
ACL Consultants Ltd. (HK)	Has been hired by China to carry out studies on Hong Kong's economic conditions. 4/10/84.
Sun Hung Kai (China) Co. Ltd. (HK)/Hubei Foreign Economic Relations and Trade Dept.	Signed an economic and technological cooperation agreement. 4/15/84.
University of Massachusetts (US)/Beijing Institute of Foreign Languages	Will cooperate to produce a comprehensive Chinese–English dictionary using Wang character-processing system. 4/23/84.
Wing On Holdings Ltd. (HK)/Guangdong International Trust Co.	Signed a cooperation agreement. 5/13/84.

中外贸易 CHINA'S EXPORTS THROUGH MAY 31

Foreign Party/ Chinese Party	Product/Value/ Date Reported

Agriculture

Ministry of Agriculture, Forestry and Fisheries (Japan)	Has agreed to import 1,000 live cattle. 4/11/84.

Construction

(Bangladesh)	Signed protocol for construction of a bridge over the Buriganga River. 2/84.
Daimaru Stone Materials Co. Ltd. and Iwatani Industrial Co. Ltd. (Japan)/ Huanggang Granite Mine, Hubei	Signed contracts for trial marketing of the Chinese granite. 3/84.
(Nepal)	Signed agreement to have China construct part of the Pokhara-Mustang road. 3/23/84.
Winstar Development Ltd. (Macao)/Fujian Corp. for International Technical and Economic Cooperation	Signed a contract to construct a factory in Macao. $5.7 million. 3/26/84.
(Kuwait)/China Road and Bridge Engineering Co.	Signed a contract to build bridges and culverts in Sanaa ($620,000) and to provide labor for a teachers' training center ($10 million). 4/2/84.

Consumer Goods

NA (US)/Dalian Ball Pen Plant	1.08 million ballpoint pens. 3/84.

Electronics

Conic Investment (a HK–PRC owned co.)	Will set up a cathode tube factory in Shenzhen. $45 million. 1/29/84.

Food Processing

Atlantic Richfield Co. (US)/Nan Lian Food Co. (PRC–HK joint venture)	Trial contract to provide catering service to an offshore rig. 3/30/84.

Foreign Aid

(Cape Verde)/Chinese Red Cross Society	Drought relief. $10,000. 3/7/84.
(Togo)	Signed protocol for medical aid. 3/23/84.
(Yemen Arab Republic)	Free maintenance and renovation of a cotton ginning and oil pressing factory. 3/29/84.
Thai Red Cross Society/ Chinese Red Cross Society	Refugee relief supplies. $50,000. 4/19/84.
(Ethiopia)/Chinese Red Cross Society	Drought relief. $20,000. 4/23/84.

Machinery

Perkins Engines (UK)	Will import low-powered diesel engines for distribution worldwide. 2/23/84.

Petroleum

Chengbei Oil Development Corp. (PRC–Japan joint venture)/Shanghai Offshore Engineering Corp.	Contracted to design oil extraction and other projects at Chengbei. 1/84.

Pharmaceuticals

(Romania)/China Medical Corp. of Economic and Technical Cooperation	Signed a contract to transfer technology for production of sulphanilamide pyrimidine, vitamins B_6 and A, and methanol sodium. 4/84.

Shipping

Penrod (US)/China Ocean Engineering Services, Shanghai Branch	Towed a large semisubmersible drilling rig from Japan to Alaska. 3/20/84.

Textiles and Textile Equipment

(USSR)/Xinjiang	Nine million meters of cotton cloth. 3/19/84.
(Zimbabwe)	China will provide a complete set of machinery for a garment factory at Chitungwiza. 5/3/84.

Trade Agreements

(E. Germany), (Tanzania), (Cuba), (Bulgaria), and (Ethiopia)	Signed trade and technology cooperation agreements in March and April 1984.
(Colombia)	Signed cultural and science-technology cooperation agreements. 3/8/84.

(EEC)	Signed a textile agreement. 3/29/84.
Transportation	
British Aerospace (UK)/ NA	Is building the undercarriage doors for the 100-seat 'hush jet', BAe 146. 4/10/84.
Miscellaneous	
Tai Fung Bank (Macao)/ Bank of China	BOC acquired 50% of the Macao bank. $10 million (HK$80 million). 3/28/84.

中外贸易 DIRECT INVESTMENT/PROCESSING/ COUNTERTRADE THROUGH MAY 31

Foreign Party/ Chinese Party	Arrangement/Value/ Date Reported
JOINT VENTURES	
Agriculture	
Tanzania Wood Industries Corp./Chinese State Construction Furniture Co.	Set up the Ushirika Wood Products venture in Mang'ula to increase the saw mill's capacity. (PRC:49%-Tan.:51%). 2/84.
Ministry of Animal Husbandry & Fisheries (Uganda)/NA	Will set up a fisheries venture in Jinja, Uganda. 4/13/84.
American Conserving Co. and Western Sales Service (US) and Taimao Trading Co. (HK)/Dalian Canning Factory and Bank of China, Dalian Branch	Signed a probational contract to build an apple concentrate plant in Dalian. 5/4/84.
Construction	
International Bechtel Inc. (US)/China National Coal Development Corp.	Signed a 15-year engineering venture to set up China American International Engineering Inc., which will undertake coal, pipeline, and civil engineering projects. (50-50). Registered capital: $3 million. 4/11/84.
Kanematsu-Gosho (Japan) and Hopewell Holdings (HK)/Guangdong Province Superhighways Development Co.	Have formed the Guangzhou-Shenzhen-Zhuhai Super Highway Co. to construct a highway connecting Hong Kong to Zhuhai. (PRC:49%-Foreign:51%). Cost of highway: $900 million. 4/25/84.
Sino Land Co. (HK)/ Everbright Industrial Co.	Set up the Guang Xin (China) Housing Construction Investment Co. Ltd. to build housing estates for overseas Chinese staying in China. (50-50). Paid-up capital: $4 million 5/5/84.
Kumagai Gumi Co. Ltd. (Japan)/Everbright Industrial Co. Ltd.	Set up the Everbright-Kumagai Development Co. Ltd. to invest in and construct civil engineering projects. (50-50). Paid-up capital: $4 million. 5/5/84.
Consumer Goods	
Nissin Rubber Co. Ltd. (Japan)/Anshan No. 1 Rubber Factory, Liaoning	Will cooperate to jointly produce rubber shoes. 3/84.
NA (HK)/Songgang No. 2 Electronic Technology Factory, Guangdong	Signed a 10-year agreement to produce quartz clocks, toy cars, alarms, and telephone sets. Investment: $768,000 (HK$6 million). 3/28/84.
Yada Bedwares Factory (HK)/Shenzhen Hardware and Furniture Co.	Formed the Jiale Furniture Factory, which produces beds and sofas. 3/30/84.
Kanematsu-Gosho Co. and Koshuen (Japan)/ Yantai Zhangyu Winery Co.	Set up the Sino-Japanese Friendship Winery Co. to produce wine. Investment: $6 million. 4/84.
Pernod Ricard (France)/ Yifeng Vineyard, Henan	Signed a 12-year agreement to produce and market wines and other drinks. (50-50). Investment: $1.5 million. 5/7/84.
Gold Name Co. (HK)/ Jiangmen Washer Manufactures, Guangdong	Set up the Jiang Hong Co. Ltd. to produce washing machines. Investment: $5 million. 5/12/84.
Pearl Lamps Co. (HK)/ Guangzhou Lamps Factory and Guangzhou Trust and Investment Co.	Formed the Crystal Lamps Co. Ltd. to produce lamps in Guangzhou. 5/15/84.
R.J. Reynolds Tobacco International Inc. (US)/ Xiamen Cigarette Factory and Xiamen Construction Co.	Signed a final agreement to jointly produce a cigarette brand. Investment: $20 million. 5/30/84.
Electronics	
Wang Laboratories (US)/ Hubei Radio Factory	Set up a cooperation and development center to develop Chinese-language computers and office automation systems. 3/6/84.
Corning Glass Works (US)	Signed letters of intent to set up ventures in Shanghai, Beijing, and Nanjing to produce electronic parts, medical instruments, and optical fibers. 3/22/84.
Hewlett-Packard Co. (US)/China Electronics Import-Export Corp.	Signed a 10-year agreement in principle to set up the China Hewlett-Packard Co. Ltd. in Beijing to manufacture electronic measuring instruments and computers. (50-50). 4/21/84.
Lityan Development Co. (Singapore)/Guangzhou Audio and Electric Appliance Factory	Set up the Aily-Lityan Microcomputer Co. to manufacture computers. (50-50). 5/6/84.
ComputerLand Corp. (US)/Ministry of Electronics Industry	Signed letter of intent to form ComputerLand China to sell microcomputer products. 5/21/84.
Food Processing	
Hans Imhoff (W. Germany)/NA	Will build a chocolate factory in Beijing. Investment: $1.5 million (DM4 million). 2/84.
Exectrade Ltd. (HK)/ Shenzhen Catering Service Co., Tianjin Municipal Economic Development Co., and Tianjin Catering Service Co.	Reached an agreement to open the Tianjin Goubuli Restaurant in Shenzhen. 3/84.
Bigful Ltd. (HK and Macao)/Zhuhai Special Economic Zone Industrial Development Corp.	Will build and run a brewery and bottlemaking plant in Zhuhai. Investment: $50 million. 3/18/84.
Suntory Ltd. (Japan)/ CITIC; CITIC, Jiangsu Branch; and Lianyungang Light Industrial Corp.	Signed a 15-year agreement to set up the China Jiangsu Suntory Foods Co., Ltd. to modernize and enlarge Lianyungang brewery. (50-50). Registered equity capital: $12 million. 3/22/84.
Beatrice Foods Co. (US)/ Jingjiang Group, Shanghai	Concluded a memorandum of understanding to make dairy, meat, and bakery products geared toward Western tastes. 4/10/84.
Paulaner-Salvator-Thomasbrau Co. (W. Germany)/China Light Industry Engineering Consultancy Co. and Shenzhen Food and Beverage Industry Co.	Signed an agreement to build a brewery in Shenzhen. (50-50). Investment: $30 million. 4/16/84.
Universal Bakery & Confectionery (US)/Dongwan Starch Factory, Guangdong	Signed 15-year agreement to form the Dongwan Bakery & Confectionery. Investment $1.15 million. 4/16/84.
King Hwa Co. (US)/Tianjin No. 2 Bureau of Commerce and Tianjin Condiment Factory 5/84.	Signed a letter of intent to establish a joint soy sauce factory in Maryland. 5/84.
Chemicals	
Kalex Chemical Products (US)/Hangzhou Plastics Factory	Reached an initial agreement to jointly produce PVC for medical use. 3/84.

OMI International Ltd. (US)/Ministry of Electronics, Technology Research Institute	Signed a 10-year agreement to form the Hua-Mei Electro Plating Technology Co. to produce OMI-patented chemical additives used for electroplating at a factory in Shenzhen. (50-50). Investment: $2.95 million. 3/13/84.
Metals and Minerals	
Northern Traders Ltd. and Nizam Impex (Pakistan)/Tianjin Municipal International Economic and Technical Cooperation Corp.	Concluded a 10-year contract to produce welding rods in Pakistan. (PRC:49%-Pak.:51%). Registered capital: $1.1 million. 3/13/84.
SNC Group (Canada)/Ministry of Coal Industry	Signed an agreement for joint development of coal gasification technology. 4/25/84.
Occidental Petroleum Corp. and Peter Kiewit Sons Inc. (US)/China National Coal Development Co.	Signed a final agreement on development of the Antaibao open pit coal mine in Shanxi. (PRC:42%-US:58%). 4/30/84.
Petroleum	
Wimpol, subsidiary of George Wimpey (UK)/Nanhai West Oil Corp., Offshore Geophysical Co.	Set up China Nanhai Wimpol to provide two navigation chains for seismic and exploration drilling. 2/13/84.
ODS Trading Co. Ltd. (HK)/Shanghai Machine and Equipment Engineering Corp.	Have concluded a 12-year contract to set up the Hai Mao Engineering Service Co. to maintain and repair offshore oil rig platforms and contract engineering projects abroad and to Shanghai factories. (50-50). 3/19/84.
Dongmao Co. (HK)/Shanghai Municipal Mechanical and Electrical Engineering Industry Co.	Have set up the Shanghai Maritime Trade and Engineering Service Co. to maintain and repair offshore rigs and vessels and to repair and install power, telecommunications, electrical, and mechanical equipment. 4/14/84.
Wah Chang International Corp. (Singapore) and Raymond Offshore Constructors, Inc. (US)/Guangzhou Shipbuilding Co. Ltd. and Shenzhen Navigation Corp.	Signed a contract to set up the South China Sea, Raymond, Wah Chang Construction Corp., Ltd. located in Shenzhen involved in offshore construction and building of large steel structures. 4/17/84.
Power	
Alfred Kuhse (W. Germany)/Anhui Provincial Electrical Machinery and Appliances Industrial Corp.	Signed a letter of intent on joint production of diesel engines and power distribution units. 3/84.
Hopewell Holdings Ltd. (HK)/Shenzhen Development Co.	Signed a letter of intent to develop a 500-Mw coal-fired power plant in Shenzhen. 4/5/84.
Scientific Instruments	
TEMICA Electronics Ltd. (HK)/Chengdu Measuring and Cutting Tools Plant	Discussing a venture to produce electronic measuring tools. 3/27/84.
Shipping	
NA (HK)/Shantou SEZ Development Co.	Set up the Shantou-Thailand Shipping Co. to handle passenger and freight transport between Shantou and Hong Kong. 3/84.
Santa Fe Transport International Ltd. (HK)/China Nanhai Oil Joint Service Co.	Signed an agreement to form the China Nanhai Santa Fe International Moving Co. to provide cargo service for the offshore industry. 3/23/84.
Telecommunications	
Hans Kolbe (W. Germany)/Anhui Electronic Industry Co.	Signed an agreement to produce TV satellite receiving equipment. 3/84.
Textiles	
Victor Onward Ltd. (HK)/Shenzhen Light Textile Industrial Corp. and Hua Lian Co.	Joined to buy the LMK Nam San Dyeing Factory located in Shenzhen, which was put into receivership in 1983. 3/11/84.
San He International Corp. (US)/Guangan Silk Co., Sichuan	Have a 15-year agreement to form the Xuan Cheng San He Silk Co. $1.47 million investment. 4/16/84.
Tourism	
Ying Gee Investment Co. Ltd. (HK)/Xiamen Construction and Development Co. and Xiamen Tourist Corp.	Signed contract to jointly finance and construct the Jinqiao Hotel in Xiamen. $16.7 million (HK$130 million). 4/2/84.
Sun Island Development Co. Ltd. (HK)/Guangzhou Suburban Development Corp.	Will build and manage the Sun Island Paradise resort in northern Guangzhou. Investment: $5 million. 4/2/84.
Noble Chong and Associates (HK-Canada)/Beijing Travel and Tourism Corp.	Are developing the Jing Lun Hotel in Beijing. 4/4/84.
NA (Singapore)	Won a contract to build a 300-room hotel in Tianjin. $25 million. 4/22/84.
Garden Hotel (Holdings) Ltd. (HK)/Guangzhou Lingam Investment Co.	Constructing the Garden Hotel complex in Guangzhou. 5/6/84.
Hopewell China Development (Shenzhen) Ltd. (HK)/Shenzhen Special Economic Zone Development Co.	Will construct a 300-room hotel in Shenzhen. 5/10/84.
Transportation	
Isuzu Motors Ltd. (Japan)/Fuzhou Automobile Factory, Fujian, and Jiangxi Automobile Factory	Negotiating a venture to produce light commercial vehicles. 3/27/84.
Aloha Airlines (US)/Xiamen Aviation Co. Ltd.	Signed a memorandum of understanding to establish Xiamen Airlines to serve as a civil airline for Xiamen and cities in S.E. Asia, Japan, and Hong Kong. 4/23/84.
British Airports International and International Airradio Ltd. (UK)/Shenzhen SEZ Development Corp.	Negotiating construction of an airport in Shenzhen. 4/27/84.
Nissan Diesel Motor Co. (Japan)/Second Automotive Factory	Negotiating establishment of a factory in Hubei to produce large trucks. $216 million (¥50 billion). 5/22/84.
Miscellaneous	
Italian Fiction Cinematografic Co./Ministry of Culture	Are cooperating on the film production, "The Last Emperor." 3/30/84.
Ta Kung Pao (HK)/Heilongjiang International Economic and Technical Cooperation Co.	Established the Binggang Information and Development Corp. in Hong Kong to promote economic and technical cooperation between Hong Kong and Heilongjiang. 4/13/84.
Wuqiang Corp. (HK)/Heilongjiang Scientific and Technical Information Service Co.	Established the Heilongjiang International Economic and Technical Information Co. in Harbin to provide information on new technology and markets. 4/13/84.
LICENSING	
Horwood Bagshaw Ltd. (Australia)	Negotiating sale and manufacture of underground mining loaders. 2/29/84.
Ohana Industrial Corp. and Toyota (Japan)/China Automobile Industrial Import-Export Co. and Tianjin Automobile Industrial Co.	Signed an agreement for technology to produce minicars. 3/4/84.
Seitz Enzinger Noll and Holstein Und Kappert GmbH (W. Germany)/TECHIMPORT and Guangdong Light Industrial Machinery Factory	Signed contract for beer bottle filling and packing equipment. 3/15/84.
Toyo Engineering (Japan)/TECHIMPORT	Negotiating sale of a carbon black plant. 3/19/84.

Racal Marine Radar Co. (UK)/China Electronic Technology Import-Export Corp., Shanghai Branch and Shanghai Radio Equipment Factory	Signed contract for marine radar production technology. 4/84.
Occidental Petroleum Corp. (US)	Has been licensed Chinese hybrid rice technology. 4/84.
Yamatake-Honeywell Co. (Japan)/EQUIMPEX	Digital process control system technology. 5/22/84.
Ex-Cell-O Corp. (US)/ Ningjiang Machine Tool Works, Sichuan	A machining center and the technology to build machine tools, spare parts, and support equipment. 4/13/84.

COMPENSATION TRADE

Heidemann-Werke GmbH (W. Germany)/Anhui Provincial Light Industry Dept. and Hefei Bicycle Factory	Bicycle technology and equipment in exchange for bicycle parts. 3/14/84.
Sievert Co. (W. Germany)/Anhui Provincial Light Industrial Enterprises	Clothes-making equipment in exchange for work clothes. 3/14/84.
Capsule Technology International Ltd. (Canada)/ Guangzhou Pharmaceutical Packaging Material Factory	A drug capsule production line. $2.8 million. 3/28/84.
Kwok Fung Trading Co. (HK)/Fengzhou Eel-Breeding Farm, Guangdong	Investment of $640,000 (HK$5 million) which will be repaid with 290 tons of live eels. 4/4/84.

COPRODUCTION

Sperry Vickers (US)/China State Shipbuilding Corp.	Are coproducing valve cartridges and hydraulic cylinders. 2/3/84.
NA (Japan)/Taiyuan Medical Electronic Equipment Factory, Shanxi	Are producing automatic digital blood pressure measuring equipment, electrocardiographs, and electrocardiogram analyzers. 3/5/84.

LEASING

British Petroleum and others/Shanghai Offshore Vessel Services Co. Ltd.	The Shanghai company leased two cable-laying vessels to the BP-led consortium. 2/9/84.
Wellman Inc. (US)	A neon lamp production line for a bulb factory in Datong. $500,000. 4/11/84.

ASSEMBLY

Daihatsu Motor Corp. (Japan)/Tianjin Automotive Corp.	Signed agreement to assemble light commercial vehicles in Tianjin; parts will later be produced in China. 3/6/84.
Yaesu Musen Corp. (Japan)/Ministry of Electronics Industry	Has begun knockdown assembly of transceivers at four factories in China. 4/17/84.
Boeing Co. (US)	Discussing assembly of jetliners in Shanghai. 5/4/84.

书刊介绍

People's Republic of China Year-Book 1983. Beijing: Xinhua Publishing House; Hong Kong: Evergreen Publishing Co., 1983. Distributed by Prentice-Hall, Inc., 200 Old Tappan Road, Old Tappan, NJ 07675. 1046 pp. $125 prepaid.

The third yearbook to be issued by the People's Republic of China, this excellent reference book reports on events in China in 1982. While the format remains the same, the volume is bigger and better than earlier editions; the copy has been set in a much more attractive style. Contents include an introduction on the land, people, and provinces and municipalities; special features: major speeches and reports, including the text of the Sixth Five-Year Plan; a chronology of events; politics; law; military; foreign relations; finance; economy; science and technology; culture, health and education; sports; society and life; and names in the news. In most cases the material included is new or updated; duplication of earlier material is minimal. A new and welcome feature is a table of contents for each section of the volume; an unfortunate change is the elimination of an index. —MG

US–China Trade Statistics 1983. Washington: The National Council for US–China Trade, 1984. 154 pp. $25; free to National Council members upon request.

The National Council's annual compilation of trade statistics lists US exports to China by 7-digit Schedule B number and US imports from China by TSUSA number. Both US dollar value and quantity figures are given. Additional tables include US–China trade 1971–1983, leading items in US–China trade, US imports and exports by category, China's total world trade and trade with selected countries. —MG

Commercial Laws & Business Regulations of the People's Republic of China 1949-1983, edited by Victor F. S. Sit. Hong Kong: Tai Dao Publishing, 1983. Distributed in the US by Eurasia Press, Inc., 302 Fifth Avenue, New York, NY 10001. 600 pp. $78.00 plus $2.07 postage.

This single-volume compilation is intended to bring together laws and regulations, decisions and circulars that apply specifically to foreign business interests and to all businesses in China along with those laws and regulations that are not directly related to business but that affect business operations in China. Included are the texts of all legislation promulgated between 1949 and May 1983 that is still in force.

The volume provides a broader scope for business law than that of other similar legal collections. While the reader cannot be sure that all relevant rules and regulations are included, the volume certainly includes many laws not published elsewhere. The arrangement of the book is by sector, alphabetical by subtopic, then chronological. There are no cross-references or index. This requires close study of the table of contents since, for example, labor insurance is under "insurance" rather than under "labor welfare and organization." Despite this minor problem, the collection is a useful addition to the growing body of Chinese legal research materials. —MG

Agriculture in China's Economic Development, by Nicholas Lardy. New York: Cambridge University Press, 1983. 285 pp. $37.50.

In this most impressive book, Professor Nicholas Lardy seeks answers to some of the pivotal questions currently facing Chinese economic planners. Is it possible to accelerate agricultural growth in China? Are Chinese planners likely to commit the necessary investment resources to this task? Will they really allow market incentives to operate? And finally, will Bejing be able to cope with the sharp rise in agricultural procurement prices that a free market would trigger?

Lardy's answers are profoundly pessimistic on all counts. He concludes that there are only minor differences between the economic goals of Chairman Mao and Deng Xiaoping. Both placed an overwhelming emphasis on urban industrialization, despite their rhetoric about improving rural conditions. He writes: "The relatively slow pace of development of agriculture since 1949 was more the consequence of deliberate policy choice than of the aberrant influence of a small group." Lardy argues that Chinese planners will probably continue to favor industry, may never allow market forces to threaten the stability of agricultural prices, and are more than likely to back away from raising rural incomes if it means cutting into the gigantic food subsidies enjoyed by urban residents.

Two cautions about Lardy's conclusions are in order. His analysis is built on painstaking research, but his information remains extremely incomplete. In some cases, it is built on relatively weak assumptions. Unfortunately, Lardy's book was completed just before much new relevant information became available.

Also, Lardy is writing in the middle of what some observers believe is a far reaching restructuring of China's agricultural production and marketing system. In fact, the reform effort has accelerated since his book was completed. Its effects are evident to anyone who has traveled to China's rural areas and been caught in the massive traffic jams that clog the roads of Chinese rural "free markets." These more recent developments suggest that Lardy may be unduly pessimistic, particularly in his belief that no significant systemic changes in China are likely in the

Books and business guides submitted for possible review in The China Business Review *should be sent to the National Council's book editor, Marianna Graham.*

forseeable future. Despite these caveats, *Agriculture in China's Economic Development* is unquestionably the most thorough and penetrating view of China's agricultural problems available today. —DD

Urban Life in Contemporary China, by Martin King Whyte and William L. Parrish. Chicago: The University of Chicago Press, 1984. 401 pp. $30.00.

Whyte and Parrish have again marshaled an impressive array of sources and techniques for describing and analyzing life in modern China. Following their 1977 collaborative effort on life in rural China, these two sociologists have extensively interviewed former residents of several dozen cities ranging in size from Shanghai down, and have combed the literature on pre-Communist China, the PRC, Taiwan, Hong Kong, the Soviet Union, and other developing societies. As a result, their analyses and conclusions are strengthened by comparisons.

Part I of the book looks at the "urban political economy," focusing on the structure of life in urban China (city size, bureaucratic control mechanisms); the impact of the Communist Party's quest for equality and security (such as employment, income, migration policies); and the system of social services and supplies.

Part II examines in some detail issues of family behavior, including mate choice and marriage patterns, urban family organization, and the position of women in urban Chinese family life.

The final section, Part III, assesses the quality of life in modern urban China in four respects: crime and control, political control, religion and social values, and personal relations. This last part of the book examines three explanations for social deviance and crime. The "solidarity" or "social integration" school of thought assumes that close interaction, local homogeneity, and low mobility contribute to low levels of social deviance and crime. The "deterrence" school of thought posits that fear of detection and punishment is what causes low rates of crime, while the "legitimate opportunity" school believes that people with clear and predictable opportunities for social and economic advancement have little incentive or desire for committing socially deviant behavior.

Interestingly, Whyte and Parrish find little evidence to support the "solidarity" and "deterrence" schools, despite the highly integrated nature of Chinese urban life and the pervasiveness of social and political control mechanisms. Their evidence leads them to conclude that feelings of powerlessness and alienation due to lack of opportunity, especially for the "lost generation" of the Cultural Revolution, are one of the most serious social issues facing China today, and that much of the post-Mao reform program has been directed at addressing this problem. —CMC

The White-Boned Demon: A Biography of Madame Mao Zedong, by Ross Terrill. NY: William Morrow & Co., 1984. 446 pp. $18.95.

Veteran China-watcher Ross Terrill has produced a highly readable and fascinating account of the life of one of modern China's most influential women. Jiang Qing, the fourth and last wife of Mao Zedong, was a prime mover behind the calamitous Cultural Revolution and the leader of the radical faction in the leadership later dubbed the "Gang of Four."

Unfortunately, the book fails to provide the larger political, economic, and social context within which his subject operated, especially after 1949. Largely anecdotal in style, little attention is devoted to the issues involved in such momentous periods as the Great Leap Forward, or even the Cultural Revolution. Jiang Qing comes across as unidimensional: a scheming, power-hungry shrew for whom policy and issues held little, if any, relevance. Revenge and self-aggrandizement appear to have been her only motivations. While this may in fact have been close to the truth, Terrill draws the conclusion that these are the dominant motives in all high-level politics in China. As a result, much of the book has a cynical, almost snide, tone. Terrill's concentration on the personalistic nature of Chinese politics at the expense of policy content also fails to account for the resonance of Jiang Qing's appeals to certain elements of Chinese society during the Cultural Revolution, and the continued appeal of "leftist" policies to some elements today.

The book's second shortcoming ironically stems from one of its major strengths. Terrill has unearthed numerous previously untapped sources, including both new documents and interviews with people who knew Jiang Qing at various stages of her career. However, the author has failed to account for the reliability of his sources, or to assess the interests being served by the release of certain information at a certain time. For example, we are asked to believe that a former sports figure exactly remembered a conversation from 1934 with Jiang when she was a relatively obscure actress, and we are expected to accept uncritically accusations against Jiang after the fall of the "Gang of Four."

In short, Mr. Terrill has given us a richly documented and enthralling account of a major figure in modern Chinese history, but an account of uncertain reliability and questionable analytical insight. —CMC

NEW CIA PUBLICATIONS

China: International Trade Annual Statistical Supplement. March 1984. Distributed by the National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161, (703) 487-4650. NTIS Order #PB 84-928201. $13.50.

This annual trade compendium contains 1982 commodity trade statistics by one- through five-digit SITC, Revision 1 numbers, based trading partner statistics.

China: International Trade, Third Quarter, 1983. March 1984. NTIS Order #PB 84-928202. $9.50.

Based on trading partner data, third quarter 1983 statistics are provided for China's imports and exports by world area and country; by two-digit SITC, Revision 1 for commodities; and by commodity for Japan, the US, Hong Kong, West Germany, and Canada.

Military Organizations of the People's Republic of China. December, 1983. Wall-sized organization chart 2' x 3'. NTIS Order #PB 83-928219. $7.50.

Chinese Ministry of Foreign Affairs. February, 1984. Organization chart, 24" x 18". NTIS Order #PB 84-928203. $7.50.

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Address
1050 17th Street, NW, Suite 350
Washington, DC 20036 USA
(202) 429–0340
Telex: 64517 NCUSCTUW
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In addition to the wide range of basic core services covered by membership dues, the National Council offers optional services designed to meet the special needs of individual companies. We will provide these services, some of which are listed below, to the extent staff resources permit, charging a fee to cover Council expenses.

On-Site Briefings. Apart from our Washington briefings, which cover topics of general interest to the membership, we can prepare briefings tailored to individual company needs. Staff experts can visit corporate home offices to assist firms in developing marketing plans. We can also brief sales staff on selling products and technology to the Chinese, and advise corporate executives on all aspects of conducting business, and living and working in China.

Market Studies and Surveys. The Council provides general reports on industrial sectors as a membership service. We can also analyze a firm's product line with an eye toward China's development plans, assess the potential market in China for a specific product or service and provide background material for a firm hoping to penetrate the market. This information can take the form of complete, confidential market studies or short surveys of potential Chinese buyers.

Trip Arrangements and Escort Services. In addition to normal assistance provided to member companies for delegation trips, the Council can take responsibility for making complete arrangements for individual company missions to China, including providing Chinese-speaking escorts. Arrangements can include identifying potential Chinese hosts, establishing common areas of interest, preparing briefing materials, procuring visas, making travel arrangements, accompanying firms to meetings, and assisting in producing meeting and trip reports.

Receptions and Banquets. China-based Council staff members can make arrangements for corporate functions to be staged in China, including securing meeting space, selecting restaurants, planning menus, developing guest lists, issuing invitations and preparing place cards.

Direct Mail Marketing. Council staff members can assemble bilingual lists of Chinese enduser organizations and trading organs for use by member firms in disseminating promotional information in China. We can also arrange for Chinese typewriting and artistic calligraphy. Envelopes can be addressed in Chinese and mailed in China.

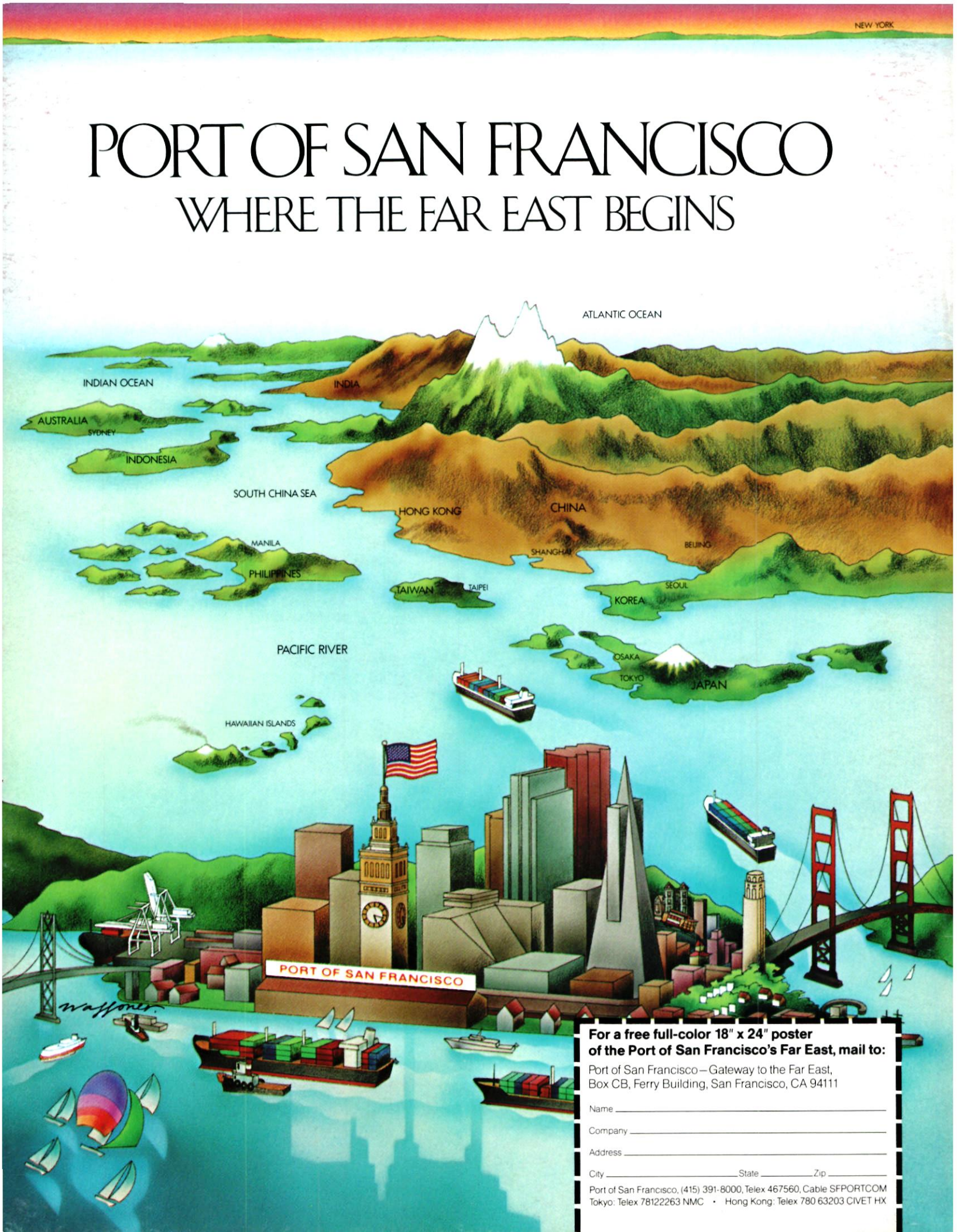
Technical Seminars. The Council can make all necessary arrangements for firms to conduct technical seminars in China on their products, processes and services. These include identifying appropriate Chinese hosts and suggesting seminar attendees, locating and renting seminar rooms and providing audio-visual equipment.

Organizational and Statistical Profiles. Detailed descriptions of Chinese foreign trade and production entities can be assembled for companies requesting them. These can include organization charts, scopes of business, trade and production figures and personnel information.

Sales Proposals and Negotiating Teams. Council staff members can advise firms on format and contents of sales proposals which our experience suggests will be most acceptable to the Chinese. We can also counsel member firms on the composition of negotiating teams and on appropriate strategies for negotiating with the Chinese.

Assistance in Dispute Resolution. The Council can help firms resolve trade and investment problems by a combination of advice, representation of the firm's position to Chinese counterparts, and intervention at higher levels of the Chinese government when exceptional difficulties are encountered.

Companies interested in further information on these optional fee services or on basic core services offered by the National Council should contact us at (202) 429-0340 or write us at 1050 17th Street, N.W., Suite 350, Washington, D.C. 20036.



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