

Y 4
Sci 2
96/88

1025-A

96Y4
Sci 2
96/88

TECHNOLOGY TRANSFER TO CHINA

GOVERNMENT

Storage

HEARINGS
BEFORE THE
SUBCOMMITTEE ON
SCIENCE, RESEARCH AND TECHNOLOGY
AND THE
SUBCOMMITTEE ON
INVESTIGATIONS AND OVERSIGHT
OF THE
COMMITTEE ON
SCIENCE AND TECHNOLOGY
U.S. HOUSE OF REPRESENTATIVES
NINETY-SIXTH CONGRESS
FIRST SESSION

NOVEMBER 13 AND 15, 1979

[No. 88]

Printed for the use of the
Committee on Science and Technology

DOCUMENTS

MAY 1980

FARRELL LIBRARY
KANSAS STATE UNIVERSITY

U.S. GOVERNMENT PRINTING OFFICE
WASHINGTON : 1980

58-034 O

AUTHENTICATED
U.S. GOVERNMENT
INFORMATION

GPO



COMMITTEE ON SCIENCE AND TECHNOLOGY

DON FUQUA, Florida, *Chairman*

ROBERT A. ROE, New Jersey
MIKE McCORMACK, Washington
GEORGE E. BROWN, Jr., California
JAMES H. SCHEUER, New York
RICHARD L. OTTINGER, New York
TOM HARKIN, Iowa
JIM LLOYD, California
JEROME A. AMBRO, New York
MARILYN LLOYD BOUQUARD, Tennessee
JAMES J. BLANCHARD, Michigan
DOUG WALGREN, Pennsylvania
RONNIE G. FLIPPO, Alabama
DAN GLICKMAN, Kansas
ALBERT GORE, Jr., Tennessee
WES WATKINS, Oklahoma
ROBERT A. YOUNG, Missouri
RICHARD C. WHITE, Texas
HAROLD L. VOLKMER, Missouri
DONALD J. PEASE, Ohio
HOWARD WOLPE, Michigan
NICHOLAS MAVROULES, Massachusetts
BILL NELSON, Florida
BERYL ANTHONY, Jr., Arkansas
STANLEY N. LUNDINE, New York
ALLEN E. ERTEL, Pennsylvania
KENT HANCE, Texas

JOHN W. WYDLER, New York
LARRY WINN, Jr., Kansas
BARRY M. GOLDWATER, Jr., California
HAMILTON FISH, Jr., New York
MANUEL LUJAN, Jr., New Mexico
HAROLD C. HOLLENBECK, New Jersey
ROBERT K. DORNAN, California
ROBERT S. WALKER, Pennsylvania
EDWIN B. FORSYTHE, New Jersey
KEN KRAMER, Colorado
WILLIAM CARNEY, New York
ROBERT W. DAVIS, Michigan
TOBY ROTH, Wisconsin
DONALD LAWRENCE RITTER,
Pennsylvania
BILL ROYER, California

HAROLD A. GOULD, *Executive Director*

PHILIP B. YEAGER, *General Counsel*

REGINA A. DAVIS, *Chief Clerk*

PAUL A. VANDER MYDE, *Minority Staff Director*

SUBCOMMITTEE ON SCIENCE, RESEARCH AND TECHNOLOGY

GEORGE E. BROWN, Jr., California, *Chairman*

JAMES H. SCHEUER, New York
DONALD J. PEASE, Ohio
TOM HARKIN, Iowa
ALLEN E. ERTEL, Pennsylvania
KENT HANCE, Texas
WES WATKINS, Oklahoma

HAROLD C. HOLLENBECK, New Jersey
ROBERT W. DAVIS, Michigan
DONALD LAWRENCE RITTER,
Pennsylvania

SUBCOMMITTEE ON INVESTIGATIONS AND OVERSIGHT

JIM LLOYD, California, *Chairman*

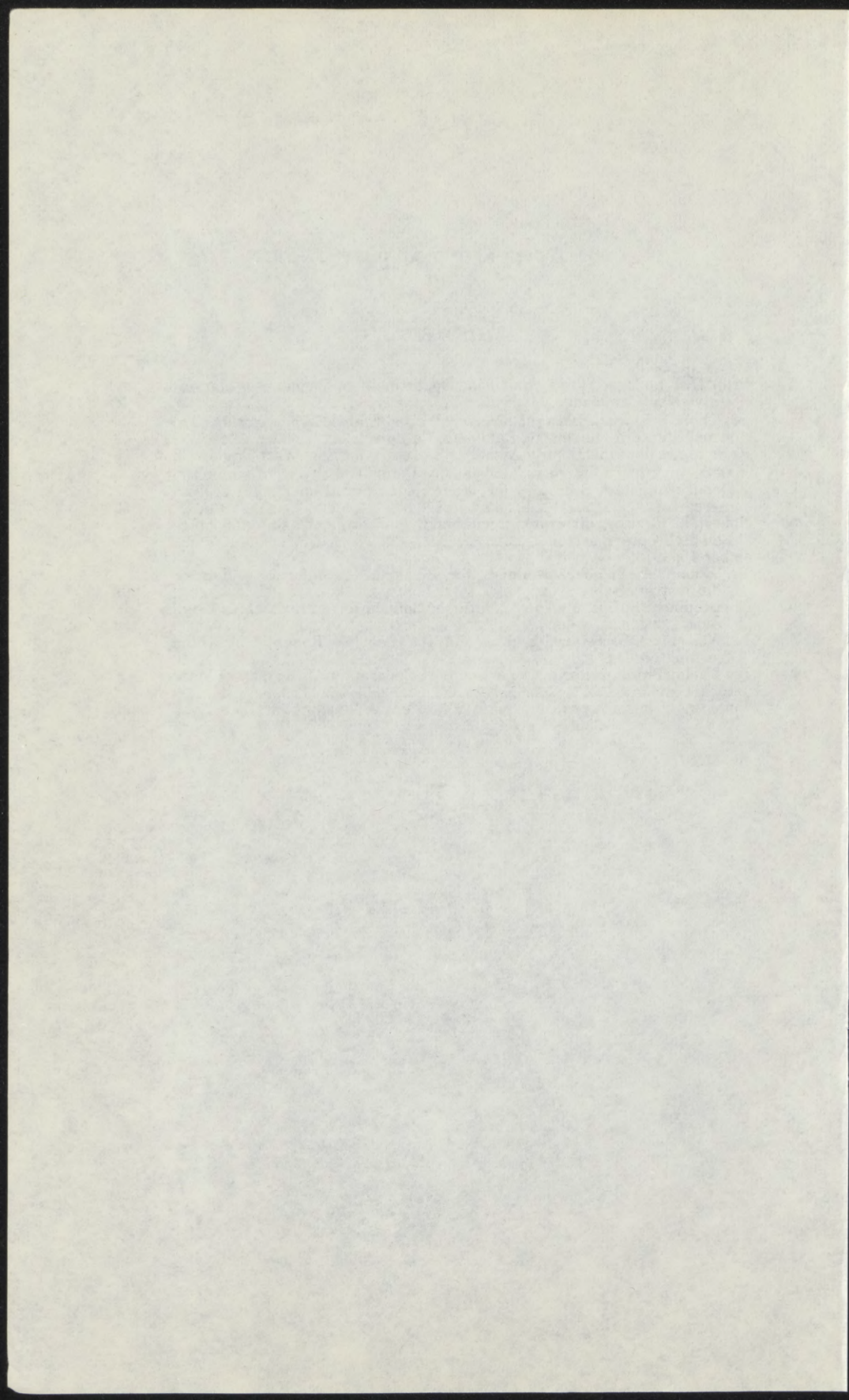
JEROME A. AMBRO, New York
RONNIE G. FLIPPO, Alabama
ALBERT GORE, Jr., Tennessee
BILL NELSON, Florida

MANUEL LUJAN, Jr., New Mexico
WILLIAM CARNEY, New York
TOBY ROTH, Wisconsin

CONTENTS

WITNESSES

November 13, 1979:	Page
Prof. Dwight H. Perkins, chairman, Department of Economics, Harvard University, Cambridge, Mass	2
Dr. Thomas Fingar, assistant director, United States-China relations program, Stanford University, Palo Alto, California	19
Kempton B. Jenkins, Deputy Assistant Secretary for East-West Trade, U.S. Department of Commerce, assisted by Robin B. Schwartzman, Acting Deputy Assistant Secretary for Trade Regulation, Department of Commerce	62
Robert L. Ramsey, director, international marketing, Washington office, Bell Helicopter Textron	81
November 15, 1979:	
Dr. Robert A. Frosch, Administrator, National Aeronautics and Space Administration	92
Christopher Phillips, president, National Council for United States/China Trade	113
Li Wei, First Secretary, Embassy of the People's Republic of China, Washington, D.C	178
Dr. Vaclav Smil, professor, Department of Geography, University of Manitoba, Canada	179
Eugene A. Theroux, partner, Baker & McKenzie, Washington, D.C.	211



TECHNOLOGY TRANSFER TO CHINA

TUESDAY, NOVEMBER 13, 1979

HOUSE OF REPRESENTATIVES, COMMITTEE ON SCIENCE AND
TECHNOLOGY, SUBCOMMITTEE ON SCIENCE, RESEARCH
AND TECHNOLOGY AND THE SUBCOMMITTEE ON INVESTIGATIONS AND OVERSIGHT,

Washington, D.C.

The subcommittees met, pursuant to notice, at 9:30 a.m., in room 2318, Rayburn House Office Building, Hon. Allen E. Ertel presiding.

Mr. ERTEL. I am pleased to call to order this joint hearing on technology transfer to China.

For the Science, Research, and Technology Subcommittee this hearing represents a continuation of a longstanding interest in science and technology in China, going back to 1976 when the subcommittee's first background study on this subject was published.

In May of this year we held hearings on the exchange programs in science between the United States and China. It was my privilege to chair those hearings on behalf of our subcommittee chairman, George E. Brown, Jr., and I am glad to have been asked again by Chairman Brown to wield the gavel at these hearings.

I share that privilege with our distinguished colleague from California, the chairman of the Investigations and Oversight Committee, Mr. Jim Lloyd. Mr. Lloyd's recognized expertise in the advanced technology field in general and in the aviation field in particular, has served our committee well. I look forward to having the benefit of his wisdom and experience as the cochairman of these hearings.

Mr. Lloyd and I have both but separately, visited China within the last year. We share with many of the members of this committee a strong interest in the issues that surround the growing transfer of technology to China.

China has only recently pulled aside the Bamboo Curtain which for several decades reduced communications with most of the rest of the world. A major factor in their decision to do so appears to have been the realization that in order not to fall further behind the rest of the world, China must become a major industrial power. It must have a strong technology base in the heavy industries, in energy productions, in transportation and in communications.

Imports of a wide range of advanced technologies form a significant component of this modernization effort. The United States is contributing to this through sales of the wide range of technologies.

During these hearings we will explore the short term problems associated with these sales such as the difficulties encountered by

some companies in selling their products in China. We will also examine the longer term implications of the massive technology transfer to China. That includes a consideration of China's policies with respect to the protection of patent rights and proprietary information, their ability to honor through exports the credits now being extended, and their future role in the world market.

We look forward to exploring these and many other questions with the outstanding witnesses who have agreed to give us their views and knowledge. They represent some of the best expertise we have on our subject, and I am glad to welcome each of them to our hearing today.

We have the privilege of having with us the chairman of the subcommittee, Mr. George Brown, and we welcome him here today.

Our first witness for today is Prof. Dwight H. Perkins, the chairman of the Department of Economics, Harvard University. We welcome you, Professor Perkins, and ask that you join us at the table. Your written comments will be incorporated in the record without objection, and you may proceed to either summarize your testimony or read it as you prepared it.

[The biographical sketch of Mr. Perkins follows:]

DWIGHT HEALD PERKINS

Born: Chicago, Illinois, October 20, 1934. Married 1957; three Children. Education: Cornell University, Bachelor of Arts, 1956; Harvard University, Masters of Art, 1961, Ph. D. (Economics), 1964. Professional Experience: From Instructor to Associate Professor of Economics, Harvard University, 1963-1969, Associate Director, East Asian Research Center, 1973-1977, Professor of Economics, Harvard University, 1969—Chairman of the Department, 1977—, Concurrent Position: National Science Foundation Science Faculty—Teaching Fellows, Institute of Economic Research, Hitotsubashi University, Japan, 1968-1969; Consultant, Economic Planning Unit, Government Malaysia, 1968-1969; Chairman, Subcommittee for Research on Chinese Economics, Social Science Research Counsel, 1977-1977; Consultant, Korean Development Institute, Seoul, 1975-1977. Member: American Economic Association; Association of Asian Studies. Researched: Economic History and Development of China, Economic History and Development of East Asia.

STATEMENT OF PROF. DWIGHT H. PERKINS, CHAIRMAN, DEPARTMENT OF ECONOMICS, HARVARD UNIVERSITY, CAMBRIDGE, MASS.

Mr. PERKINS. The past 2 years have been a unique period in the history of relations between China and the Western World. For the first time in half a millenia a strong Chinese Government has voluntarily opened up to the West and Japan in a broad based effort to accelerate economic development and to improve the conditions of life in the nation.

China, of course, was open to the West for a century prior to 1949 but that opening was not in the least voluntary. In the 1950's China was opened to the Soviet Union and Eastern Europe as part of a broad based effort to recreate in China the Stalinist industrialization drive of the 1930's. In 1960, however, the door to Russia was closed and China turned inward for much of the next decade and a half.

No one today, either in China or the United States, knows whether or not the process of opening up in China will continue and expand or whether the door will once again be closed when China has acquired or reacquired the capacity to import technology

and earn foreign exchange without remaining open. What we do know is that the United States as the leader of the Western World, has an unprecedented opportunity to demonstrate to the Chinese that increasing ties to the West can bring with those ties benefits to Chinese society that far outweigh the dangers to stability and sovereignty that history has led China's leaders to believe are the result of contact with the West.

This unprecedented opportunity is far too important to the United States and for the prospects for a stable and peaceful world for America to fritter the opportunity away in short term tactical maneuvers in our global foreign policy or in vague fears about future Chinese economic competition. In the former category I would include efforts by some to do for China only what we are also willing to do for the Soviet Union or to delay certain efforts to establish closer connections with China until we have gotten over one or another hurdle in our relations with the Soviets.

In certain mainly military areas, linkage between Soviet-Chinese-American interests is so close that those linkages cannot be ignored. Any sale of weapons to China clearly must first take Soviet interests and actions carefully into account. But the Soviet Union has no legitimate interest in steps to slow the transfer of technology to China for the purpose of accelerated economic development. Or if the Soviet Union, fearing a war, does have such interests, those interests in no way parallel those of the United States.

Outside the military area, the United States should be attempting to avoid linkages between policies toward China and those toward the U.S.S.R., not seeking them out. China is not a card to be played or not played depending on what the Russians do in Cuba, or Ethiopia.

Within two decades China is likely to be one of the three most powerful nations in the world, and American efforts should be primarily directed at building a relationship with China that hopefully will avoid in the future the kind of adversary position we currently find ourselves in vis-a-vis the Soviet Union.

It would be equally unfortunate if the United States allowed short term domestic political considerations to interfere in a major way with efforts by China to earn the foreign exchange without which it would have to slow its imports of advanced technology. This statement is not a naive plea for the abandonment of all restrictions on imports from China, whether on textiles or anything else. Some quotas are necessary, if for no other reason than to keep Chinese imports in politically highly sensitive areas from generally undermining the basis for freer Sino-American trade. The issue instead is one of the basic attitude or posture toward the rapid development of trade with the People's Republic of China.

From the way that some individuals discuss these issues, one could get the impression that by allowing and aiding Japan to develop rapidly we created a monster that is devouring the U.S. economy and that there is a danger we might do the same vis-a-vis China. Surely a more considered view is that modern Japan, to the extent that the United States had some responsibility for its present position, is one of the outstanding successes of American foreign policy.

The United States is not in a position to have a comparable influence over the direction of Chinese development, but if we did help China to become a major trading nation that, too, would be seen as an enormous plus on many different grounds.

The other extreme of a China that follows the inward looking policies of the U.S.S.R. would take some of the pressure off our domestic textile or television industries, but at what a price.

Do the above remarks overdramatize the significance of the changes that occurred after Mao's death in 1976 or their potential implications for the United States? Few who have experienced China both before and after 1976, or have studied events in those two periods, would deny the enormous magnitude of the transformation in Chinese policies toward the use of technology and ideas in general abroad.

For much of the decade plus, from 1966 through 1976, technology from abroad was either to be avoided entirely or restricted to a few limited areas of extremely high priority. There were positive elements to this deemphasis on foreign technology. The rural small scale industry program, for example, was pushed to the forefront in this period and succeeded in developing techniques in selected industries that are extensively used in China's countryside today.

But much, perhaps most, of the antiforeign technology bias had a distinctly Luddite quality. Universities and research institutes were either closed down entirely or were prevented from doing serious research. Scientists and engineers spent years doing labor in the countryside or in solitary confinement with access to few books or to none at all. Young people who studied English, even if only in their spare time were criticized for putting expertise ahead of redness, a serious charge in the late 1960's.

The situation improved somewhat in the early 1970's, but planners who called for the importation of chemical and steel plants were subject to criticism from the radicals. The universities were reopened but entrance examinations or examinations to measure progress through the system were still eschewed.

Chinese policies in 1977 and 1978 represented an almost complete reversal of those of the Cultural Revolution. Instead of being told to hold advanced technology imports to a minimum, enterprises were encouraged to seek out foreign plant and equipment on a broad front. Enterprises responded with alacrity and began signing letters of intent to do business with hundreds of foreign firms. One source estimates that the total value of these letters of intent by late 1978 may have surpassed US\$500 billion. Since China's total foreign exchange earnings in 1978 were just over US\$10 billion, it is clear that the desires of Chinese enterprises were far greater than what the Chinese pocketbook could afford.

One reason for the readjustment in economic policies in late 1978 and 1979, therefore, resulted from a clearer recognition of the limited nature of China's foreign exchange resources and the need for the Bank of China, the nation's foreign exchange bank, to keep tight control over such exchange resources as they did have.

In the field of education, the reversal in policy after 1976 was, if anything, even more dramatic. Normal academic criteria once again became the criteria for admission into the universities and for promotion up through the system. National entrance exams

have become the vehicle for enforcing these admissions criteria, just as exams within the university have become the basis for judging performance there.

Scientists purged during the Cultural Revolution have been sought out and restored to their old positions or to ones newly created. Given that many millions of people were incarcerated or sent down during the Cultural Revolution, it has taken 2 years and more to locate all of them and return those that survived to positions where they can use their skills and experience.

It was not until the middle of 1978 that China's top leadership decided that the rapid upgrading of Chinese capacity in science and technology required that thousands of individuals be sent abroad for advanced training. We in the United States do not have a complete picture of how that decision was made, but it seems to illustrate how a clear statement of American willingness to be supportive of Chinese efforts in science and technology met with a dramatic Chinese response.

In early 1978 China's leadership seems to have felt, with some reason, that American foreign policymakers had a limited interest in or appreciation of China's potential world role. The visit of the President's National Security Adviser, followed by the visit of his Science Adviser in the first half of 1978, however, did much to dispel the notion that this American administration had little interest in China. The trip of Frank Press, in particular, indicated to the Chinese that the United States was willing and even eager to do what it could to help upgrade China's capacities in the areas of science and technology.

The Chinese leadership, realizing that initiatives on its part would not be turned aside or rebuffed, made the decision in the summer of 1978 to send thousands of its ablest scientists abroad to upgrade their skills to international levels. Many of these scientists abroad are already studying and working in the laboratories of the United States, Western Europe and Japan. Others are in the process of upgrading their English language facility or overcoming specific shortcomings in their technical training prior to going abroad.

Mistakes were made during the rush in 1977 and 1978 to reverse the policies of the Cultural Revolution and its aftermath. The tendency for enterprises to look abroad for far more technology than China's limited foreign exchange earnings could possibly pay for has already been mentioned.

A more serious problem was the tendency in 1977 and 1978 to neglect the living conditions of the Chinese people, thereby undermining worker and peasant incentives that were crucial for the success of the development effort. It is not widely known but it is nevertheless a fact that the real wages of China's urban work force stagnated between 1957 and 1977. Regular factory workers were rarely fired, a phenomenon that the Chinese now refer to as the iron rice bowl, but promotions were equally rare so that there was little incentive to work hard. In the countryside incomes also grew slowly, if at all, and per capita grain consumption in the late 1970's was exactly where it was in the mid-1950's.

Chinese gross national product per capita did grow at between 2 and 3 percent a year over the past 2 decades—in per capita,

terms—but the increase in output went mainly into investment and, to a lesser degree, into increased military spending. China's rate of accumulation as a percent of material product rose from 25 percent in the 1950's to an average of 33 percent in the 1970's and the extraordinarily high figure of 36 percent in 1978. Normally a high rate of accumulation means a high rate of growth, but China pushed the rate so high that because of incentive and other problems, the growth rate may actually have been lowered.

Another problem facing China's economic planners results from the return of millions of youth from the countryside. For more than a decade most graduates of the nation's middle schools had been required to go live in rural areas and, for the most part, to do unskilled manual labor. In the majority of cases residence in the countryside was to be permanent.

In 1978 and 1979 this policy was gradually relaxed and finally abandoned, and the result has been a flood of youth back into the cities. To employ these youth the state is busily trying to create millions of new jobs. Only a few have been absorbed into existing state enterprises while the majority have entered the collective sector by setting up small restaurants or other service activities on a cooperative basis.

The accumulating problems of stagnant living conditions, weak incentives, and inadequate employment opportunities all contributed to the reappraisal of economic strategy that occurred in late 1978 and early 1979. In the investment budget the key changes involved arise in funding for agriculture and a slight increase in consumer goods industry, all at the expense of heavy industry, which was cut back, but which was still by far the largest item in the budget. Consumer goods industry also received increased allocations of electric power and raw materials. The original target of 60 million tons of steel output by 1985 was in effect abandoned.

The other changes in economic strategy that were announced at the National Peoples Congress meetings in 1979 were largely in response to specific bottlenecks that had begun to hamper development efforts. A common refrain now heard when visiting factories in China is that electricity shortages are a major cause of shortfalls in production. It is also apparent that China's port facilities are clogged and its transportation system in general overburdened. The revised plan, therefore, calls for an even greater emphasis on electric power and transport development.

None of the revisions in plan targets in 1979, however, involve China's turning its back on the outward looking strategy it introduced in 1977. Inevitably a shift toward agriculture and consumer goods involves some reduction in imported technology. Agricultural techniques in particular must be adapted to local conditions and hence are not as readily imported as some industrial techniques. But even in the agricultural area China has expanded its overseas contacts by such activities as joining the board of the International Rice Research Institute.

In the sphere of consumer goods industry, Hong Kong businessmen and others have been brought in to upgrade the quality and marketing skills in an effort to expand exports of these items. Offshore oil exploration is now largely in the hands of foreign oil companies. A new joint venture law, albeit one lacking in many

specifics, has been promulgated and is designed to provide a basis for expanded international involvement in China's economy in the future.

In short, the readjustment in China's economic policies is in no way a reversal of the change in direction started in 1977. China has modified some targets that were unrealistically high and has altered certain priorities as specific bottlenecks become apparent. But Chinese planners remain determined to turn the nation into an industrial power by the year 2000 and to do so by accelerating the importation of advanced science and technology from the West and from Japan.

To import more technology China will also have to export more in order to earn the necessary foreign exchange. To make the best use of scientific developments abroad, China's own scientific establishment will have to be upgraded and its international contacts increased even more than has occurred to date. Thus, China's level of contact with the outside world, despite the cancellation of various deals due to inadequate supplies of foreign exchange, is still very much on the upswing.

Are there risks entailed in American support for China's turn outward? One issue is whether a change in China's leadership might reverse the present course. The nation's leaders after all, are old and some change in personnel at the top is inevitable in the coming 5 to 10 years.

From the American point of view, however, what do we have to lose? Failure to be supportive toward the policies of the current leaders can only reinforce those who were reluctant to turn outward in the first place and would accelerate the demise of those leaders and those policies that best serve our own interests.

Will we create an economic rival that will cause us difficulties a decade or two from now? The obvious answer is yes. Some individual American firms will lose out in competition with Chinese firms while other U.S. companies will see their markets expand. Similar developments have occurred in the past in our economic relations with Western Europe, with Japan, and most recently, with such new industrializing states as Korea and Mexico. In general, economic development on an international scale benefits far more people, including Americans, than it hurts and there is no reason to think that China's emergence on the world economic scene will be any different.

Will American support help turn China into a military superpower that we shall end up confronting at some future time? While American and Chinese foreign policy interests at the moment run parallel in many parts of the world, that may not always be the case. And on the Korean Peninsula and vis-a-vis Taiwan, our interests are not parallel today.

The choice facing Americans, however, is not whether we prefer a powerful China to a weak China unable to threaten its neighbors. China, if it continues on its present course, is going to be a world superpower whether the United States contributes to the process or not. What Americans can influence is whether a powerful China sees itself as having a major stake in strong international contacts in a peaceful environment or whether China feels it has little to lose by breaking contacts and pushing instability around the world.

American science and technology won't be the primary force determining the outcome of that choice, but they can play a supporting role.

Mr. ERTEL. I must admit it was rather rapid. Thank you very much, it was a very informative statement and very good. We do have some questions we might want to ask you. I have some specifically.

I noted in the last conclusion of our statement you said "from the American point of view, however, what do we have to lose? Failure to be supportive" and you go on and say "China is going to reach superpower status."

Does it not follow from that, with our supportive policies and high technology transfers and our scientific transfers, whether high technology or not, we are pushing them faster toward that superpower status and in fact, don't we have to make a judgment as to whether or not it is in our interest to see that they reach that status sooner rather than later? If so, do you suggest that we should be pushing to make them a superpower in the context of the world community?

Mr. PERKINS. The specifics of superpower status involve military weapons, as well as general science and technology and economic development but I shall only deal with the latter. I think the kind of choices that face the United States are not a question, as I indicated here, of whether China becomes a superpower, but whether it becomes one, in say 1995 or the year 2000.

Mr. ERTEL. Or the time lag may be much larger than the 5-year span? It could be?

Mr. PERKINS. If the United States were in a position to close down the transfer of technology to China from all of the countries of Western Europe and Japan as well as the United States, then I think you could make a credible case we could have a major influence on the pace of development.

But given the very considerable domestic technological capacities of China, not to mention their machine building capacity and so on, and the fact that they have access to a great many different country's technologies, which in many cases may have originally come from the United States, they have access to the world's high technology whether we participate or not. If the United States does not participate I think the difference is not much longer, say, than 5 years. I am picking 5 years out of a hat. But a very long difference is not what is at stake. A more modest difference is what is at stake.

Mr. ERTEL. I guess that brings us to the question, we have really engaged in technology transfer to Western Europe and Japan. Some would argue that would be part of a long range planning on our part and a very conscious policy. However, the transfers and the really inception of our transfer to China is not really long range policy planning but really is just a short range viewpoint at this point.

Would you agree with that, and if so, what should be our long range planning possibility potential?

Mr. PERKINS. I think it is correct to say about many parts of our Government that the approach to Chinese science and technology transfers tends to be very short term. I addressed this in my

opening remarks when I spoke of treating China as an element in short-term tactical negotiations of various kinds, particularly vis-a-vis the Soviet Union.

The essential point of my remarks is that we have a unique opportunity. If we continue to treat this as a short-term tactical affair to be turned on and off at our leisure, we can blow probably the best opportunity of the past 30 years to establish a much more stable and outward looking China.

China has not turned this way to the West any time in the past. It may be a temporary phenomenon. It may be that they will close down again in a very short period of time, but I don't think there is any indication that is their intention at the moment, and we have an opportunity to say that, yes, China can become a normal part of the international economic community and can benefit from it and will get substantial benefits from it and much more so than closing down and keeping the society free of the kind of outside thrust that the Soviet Union has feared in the past and China has also feared in the past.

I think there is an opportunity to blow it on short-term tactical considerations that is not desirable. That is the thrust of my remarks.

Mr. ERTEL. Well, I think we understand generally what you mean by short-term tactical, whether you call it the China card or whatever you call it, but one other thing that you indicate in your testimony which gives me pause, and I guess when I was there I had that same feeling, is that the Chinese were overcommitting themselves to the importation of really high technology from the West, with tremendous, I guess views, I guess desires, and then when it came to the practicality of implementing those desires, there seemed to be a pulling back, at least I saw that, that they could not perform.

What kind of policy should we have as far as restraint in trying to develop those relationships, because quite frankly, we have some implementation in their domestic policy in how much we will provide to them, and if we overburden them with a lot of high technology, wouldn't that be to our detriment as well?

Mr. PERKINS. I think there is a danger that China will buy a lot of irrelevant technology, technology that is too expensive, is not suitable for Chinese needs. I have my doubts that the U.S. Government is in a position to do very much to prevent China from making mistakes in that area. I think the mistakes will probably be corrected most readily if the trade is fairly open on both sides and the companies themselves, that is, the American companies themselves can go in and battle it out with each other over what is really appropriate. But ultimately it is going to be the Chinese planners, the Chinese industrialists that will have to decide what is appropriate.

They clearly made a series of mistakes in 1977-78. They also clearly realized they made mistakes and they reversed those mistakes in late of 1978 and through 1979 as they realized that they had gotten carried away with the advantages of foreign technology and they cut back rather sharply. If they want advice in this area we ought to give it to them from time to time even gratuitously, I suppose, but I don't think we are going to have a great deal of

influence on that kind of decision which is made by the internal economic planning apparatus of China.

Mr. ERTEL. Thank you.

Congressman Brown.

Mr. BROWN. Mr. Perkins, I don't have any very extensive questions but there are a couple of areas that I am interested in. One is the matter of scholarly exchange in the area of science and technology, which seems to me in the long run is the best way for making technology transfer to China, and I am concerned about the effectiveness of that program and whether there may be alterations or changes that could make it more useful?

I would like to ask you to comment on that. But, in particular, this problem which you referred to peripherally of developing an improved English capability in the Chinese scholars, and it applies to Chinese speaking capability for the American scholars also—the question of whether we can't work more closely within each country in developing that capability before we actually engage in the exchange?

In other words, what I am thinking of is improving the quality of their English, speaking English and our Chinese language teaching over here as a way of improving this overall exchange. Is that a matter of major significance or am I misreading?

Let me mention why I do that. Apparently we have an arrangement whereby we pay the cost or the Chinese, pay the complete cost of their scholars in this country, and we do likewise, but it is much more expensive for them to reside over here than for our people to reside over there, hence if they have to spend a year acquiring their English before they can go on to the technological aspects, it puts a heavy burden on their foreign exchange.

Mr. PERKINS. The English problem is a very real one and the Chinese have been doing a variety of things trying to upgrade including through English lessons on television. But a lot of what they have done is in the category of inappropriate technology, if you like. They have been making mistakes there. They brought over a variety of people whose only claim to knowledge of how to teach English is that they speak the language, and I think they are beginning to realize what they need are people who really have experience in teaching English as a second language.

Conceivably there would be ways of accelerating the improvement of their English once they came to the United States. In the economics field we have something called the Economics Institute at Boulder, which is designed precisely to teach English, but in this case only to economists and business school people, not to natural scientists and the like. It was set up under the American Economics Association for the purpose of bringing people from all over the world, upgrading their English before sending them into our universities. In other fields I suspect it is cheaper to continue to upgrade the English in China rather than to bring them over here.

There is no question it is a very serious problem. It is my understanding that many of the natural scientists who have been selected are in effect trying to get their English upgraded so that they can come abroad. They have been delayed. There have been two problems in getting a larger number of people abroad. One is lack of a large number of qualified people in terms of adequate

scientific background and two, the English language problem has been a very severe one.

A third problem is they tend to send older people because the younger people don't have the training.

Mr. BROWN. Let me ask you about the point you made about refocusing of their activities on certain infrastructure problems such as the development of electric power and improved transport. That raises a question in my mind about our role in developing markets over there.

The Chinese seem to take the position—I think quite rightly—that they have a tremendous potential for hydroelectric development of various kinds, and that they want to give that the highest priority. We, on the other hand, bypassed hydro years ago and we have almost quit building good hydro plants, unless it is an exceptional opportunity, and it provides a mismatch in our electrological exchange. We want to sell them nuclear, they want to buy hydro, and never the twain shall meet.

I am wondering if that doesn't indicate the need for us to work more closely with the Chinese economic planners, policy planners, in order to identify markets and to adapt to their needs rather than trying to put our capabilities into their framework?

Mr. BROWN. Otherwise they are going to go to Europe. The Swiss still build hydro equipment and some of the other Europeans. They are going to get the market.

Mr. PERKINS. I won't get into a discussion on a subject I don't feel qualified to talk about, namely American capacities in the area of development of large dams for hydroelectric purposes and so on. I know that the Corps of Engineers and others have been over there talking to the Chinese, and that the Chinese have been building a dam on the Yangtze River near Ichang as an experimental start prior to maybe really developing the Yangtze River electric power resources.

But at a more even level I would agree with your remark that one of the problems we have—it is not unique to the United States, it is also true of Germany and France and of Japan as well—is that the Chinese have not been very forthcoming as to what they are doing and, therefore, it has been very hard for outside people to have a clear understanding of what they need and to in effect match up American capacities, as you say, with what they really need.

The economic planning process, up until 2 years ago, was extremely secret. Now it has opened up very considerably, particularly in the last year or two, but I would say China has a long way to go and it would be in China's interest to be a great deal more open in this process than they have been to date.

I hesitate to say this because it is so clearly in the self-interest of an economist who spends a lot of time studying China to have China open up and say more about what they are doing. But I think it is something that would clearly be in the Chinese interest as well and would make it much easier at all levels to have systematic discussions, whether by companies or government organs, about what China does need from us and where the United States can play a major role.

Mr. BROWN. I have no further questions.

Mr. ERTEL. Thank you, Congressman Brown.
Congressman Lujan.

Mr. LUJAN. Thank you, Mr. Chairman.

From going over your statement it seems like the educational exchange is going pretty well, or at least better than the industrial and technological exchange, that perhaps it would be easier to have educational exchange than the other two. What specifically is happening in that area?

Mr. PERKINS. In the educational exchange?

Mr. LUJAN. Yes.

Mr. PERKINS. I believe the Chinese now have about 500 people in the United States, I think it is something over 2,000 in Western Europe and the United States and Japan combined. Anyway it is 500 in the United States. The great majority of them in the natural sciences and engineering and the like.

Mr. LUJAN. What about the United States?

Mr. PERKINS. The United States has 50 students abroad, or thereabouts, and, of course, a fair number of delegations, people going for a month or two at a time to lecture and the like.

The interests of the United States in China are very different from the Chinese interests in the United States. The Chinese are sending overwhelmingly natural scientists and engineers and are going to move into fields like economics. But in fields like history and so on, very few people have gone abroad, whereas a very large part of our interest is among people who want to study China. A few of our natural sciences like seismology, where there is something very specific to be learned from China, have something to gain, but in large part it is people in history and political science and economics and so on who are really interested in going to study China's experiences in one way or the other. That has just gotten started.

We have lots of problems on our side. We have very few Americans who have really good Chinese. It is very difficult to operate in China and learn very much without having good Chinese.

Mr. LUJAN. I was going into that. But I was thinking of students going over there to look at opportunities, the economic system, how we can—

Mr. PERKINS. The fields that would benefit most from study in China are in the social sciences or in the humanities. There is obviously a rich cultural heritage of China, from which historians and parts of the humanities can learn. In the social sciences, particularly among those who are interested in economic development problems, the Chinese have very rich experiences and one can learn from both their mistakes and their successes.

On the American side the serious exchange process has just barely begun. It is very much in the rudimentary stage.

Mr. LUJAN. What about industry scouting the scene, so to speak? Is that substantial?

Mr. PERKINS. That is much more substantial. The individual companies that have gone to explore the China market in one form or another are numerous.

Mr. LUJAN. Can you give us some specifics? We all know about Coca Cola.

Mr. PERKINS. Well, the biggest sales have been things like ammonia—the urea complexes of the Kellogg Co. Those plants are now going into production, or have been going into production over the last year or two. They have been a major element in the increase in nutrients for Chinese grain production.

The Boeing sales of a year ago is another example. Others testifying later will be able to give you a list with more specifics. The bulk of our trade at the moment is still dominated by agricultural products, but I believe once the trade agreement is passed and ratified one will see more high technology. There has been up until recently a bias against U.S. technology where you could get similar technology elsewhere.

Mr. LUJAN. Why?

Mr. PERKINS. Well, the lack of normalized relations over the last couple of years has been the major reason. Presumably now that the trade-agreement barrier has been removed, one can expect an acceleration. This acceleration will take place within the context of China's limited foreign exchange reserves. They aren't all of a sudden going to be earning \$50 or \$100 billion in foreign exchange, they are going to have to take \$15 or \$20 billion and divide it up between their various suppliers of high technology and other goods.

A lot of what they use their foreign exchange for is not high technology. They use it for steel, they use it for fertilizer, agricultural crops, a whole series of other things. The amount left over for the high-technology area is not that large. One shouldn't anticipate a great bonanza that would solve the American balance-of-payments problems. One shouldn't anticipate a substantial increase in high-technology sales.

Mr. LUJAN. You have indicated we don't expect any big improvement in the ability of China to pay for their goods through the foreign exchange medium. Where do you expect China to develop so that they will have the capital or the capacity to pay for the massive imports of technology that we are expecting to develop over the next 20 years?

For instance, certainly we are not going to expect them to be doing this through the textile trade or trades like that, which are really in serious trouble in the United States, and probably there is an awful lot of political pressure here to prevent the importation of Chinese materials in that area.

Is it within the energy field? Do you expect the development of energy as an export product or what?

Mr. PERKINS. When you look at the export prospects, Chinese exports traditionally have been heavily dependent on agriculture. Agricultural exports are not going to be a major source of growth. China has a very serious agricultural problem of its own and exporting any substantial fraction of what they produce over and above what they are already exporting isn't in the cards, in my opinion.

Petroleum could become a much larger export than it is today, if the offshore exploration is very successful. But current development, in effect for the next several years, China anticipates a rather low rate of growth in its petroleum production and there seems to be little doubt that the bulk of that production will be used at home. There may be an expansion of exports but any major

expansion of exports will depend on what happens in the offshore exploration, and it will be 4 or 5 years or more down the road before there is going to be major production from there.

Therefore, petroleum is not going to get them out of the box anytime soon. It could be an important element in 5 or 10 years down the road. That leaves manufactured items for export. It is difficult to be specific about such items because they include a wide range of things, the kind of things that Hong Kong and Korea and Taiwan exported outside of the textile area such as in the electronics field. In fact Japan in the twenties and thirties built its industrial development in part on such manufactures.

Right now the Chinese quality of television sets is terrible. They are very expensive and they are not any good. But that could change dramatically within a very short period of time, if, say, various kinds of agreements were worked out with the Japanese or with others to improve the quality of those sets.

I realize that is a sensitive area, too, in the United States, although in a sense the other East Asian countries have already destroyed American production and, therefore, it is competition between China and the other countries rather than China with American producers. Another item is machinery. China is a tremendous producer of machinery. The problem is quality. Can they get the quality of the various kinds of machinery up to a level where they can penetrate the U.S. market?

None of this it seems to me, is going to turn China into an exporter of massive proportions anytime soon. You can anticipate any overall GNP growth rate in China rising at 7 or 8 percent a year. Almost anybody would agree it would rise to at least 6 percent if they continue present policies. Given that they are at the same time pushing exports more than they have in the past, one can assume in real terms exports will grow at least that fast and maybe a little faster, than GNP. Growth in money terms depends on what kind of inflation rate you want to put in. The real value of their exports could double every 10 years or so, maybe even grow somewhat more rapidly than that. That means in something less than 10 years they will have \$20 plus billion or \$30 billion in exports in terms of 1978 prices.

It isn't going to be massive for a long time. China isn't going to have \$100 billion per year 5 years from now to spend on foreign technology imports.

Mr. ERTEL. I thank the gentleman for yielding.

Mr. LUJAN. I have one final question, and that is on your impression. You talk in the end of your statement about whether it is in our interests to be particularly cooperative and then build up competition. You addressed it somewhat in your last statement, where you discussed whether we are contributing to a super-military power. Is it your impression, as it is mine, that those things are going to happen anyway, and that the only question is whether we are going to be a participant or not in the whole process?

Mr. PERKINS. Before I picked a figure out of the hat that we could make a difference of 5 years. I don't know whether it is three or seven. But China has a rate of investment that even after they cut it back in order to make possible more consumer goods it is by world standards a very high rate of investment.

They are supplying most of the construction goods and capital equipment for this economic expansion from domestic resources. Their investment rate is \$70 to \$100 billion depending on how you want to convert Chinese currencies into United States. It is a very large figure. China already has an industrial establishment that is equivalent in absolute size to that of Japan of the early 1960's. Now, its production is divided by a whole lot more people, so that in terms of per capital standards of living, it is much, much lower than Japan in the sixties.

But in absolute terms, and when you are talking about power, you are talking more about absolute size than per capita, and China is already quite large. If it grows at anything like 7 or 8 percent a year, which means its industry will be growing substantially faster than that, that industrial establishment is going to be doubling every 7 years or so. Those are reasonably conservative projections. China could grow faster than that. China's economy is going to double whether we have a major high technology trade with them or not. I do think China will grow somewhat faster if we have a high-technology trade with them.

Mr. LUJAN. Do you see China 20 or 25 years from now in the same competitive position that we see Japan today?

Mr. PERKINS. Well, I would say less. The big problem facing China with its exports is not its ability to produce the equipment and the like, it is the ability to produce equipment of the proper quality and with the proper consciousness of style and so on that makes it able to penetrate world markets.

Mr. LUJAN. If you could see it 25 years from now, would you see that—

Mr. PERKINS. If the Chinese modify their present system of planning and control enough, it is possible, but the Japanese after all, had a system that was geared toward really learning as much as possible about foreign markets and getting competitively involved in those international markets in a very elaborate way that the Chinese up to now, or up until this year, really had not done at all.

The Chinese have a much longer road to go than the Japanese had in 1950. The Japanese had already had experience abroad. The Chinese industrial establishment is geared to producing for the Chinese domestic market and changing that into an establishment for the foreign market is not going to be easy. China will have a GNP larger than Japan's of today, but its trade share will be smaller partly because China is a large country and large countries don't trade as much anyway. That is true of the U.S. trade as a percentage of GNP.

The other reason for a smaller share is that the planning system will probably inhibit trade development comparable to what has occurred say, in Japan or South Korea.

Mr. LUJAN. Thank you, Mr. Chairman.

Mr. BROWN. May I follow up just briefly on this question?

Mr. ERTEL. Certainly, Mr. Brown.

Mr. BROWN. We sometimes tend to think in stereotypes about the threats to global markets which certain countries pose. We thought that way about Japan and now we are thinking that way about China. I want to ask you to comment on the differences here as you just started to basically, as you commented. Some countries,

if they are smaller, and are lacking in resources, must trade in order to survive. Other countries, China and the United States are excellent examples, are continental in size, have available resources, a market that represents a quarter of the human population, and trading becomes an incidental to, you might say, finishing off certain areas that maybe it is more desirable to get other resources they don't have, maybe to some degree technologies they don't have, in most cases these are overcome.

Is there such a thing as a standard or ideal or goal or target for international trade that fits all nations? The obvious answer is no. But what does this mean in terms of our worrying about the threat of Chinese competition in penetrating global markets?

Mr. PERKINS. Well, I would agree with the first part of your statement. China has substantial natural resources, it is not in a situation like Japan where it has to trade simply to get its basic raw materials and natural resources.

Much of China's trade is not essential in the sense that if they didn't have it the economy would have to cut back drastically, say the way Japan would if it didn't have natural resource imports of various sorts. The most essential part of China's trade on the import side is the imports of high technology equipment, things like the petrochemical industry where they cannot produce key items at any reasonable cost.

Much of the rest, like steel, they can probably produce, but it is cheaper to import a certain fraction of high quality steel for the time being. China trade is not as essential as it is for some of these other countries. It is still important.

When you are talking about competition from China, we think about it related to the export side. There I would agree there will be competition from China. An awful lot of competition, as I have indicated earlier, will be with other East Asian countries, and if we maintain quotas, of course, we can prevent that competition, like we do with textiles now. There can't be competition between East Asian countries because it is all determined or a very large part is determined by quotas, and these countries keep the quotas, as Japan keeps its quota, even though its textile industry has become a sick industry and it is not really a viable exporter of many lines without the quotas.

But there are other areas where China competes with the United States. The ideal is, of course, free trade modified to take account of temporary disruptions of the kind that put people out of work at a time when they can't retrain and the like, but that is an ideal that to talk about in general terms is so general that it is very difficult to say anything very intelligent about China in that context. China, for example, does not have free trade, it has a state trading system.

Mr. BROWN. I just want to surface the situation more than anything else. I suspect as China proceeds to a development course, and the need to have exports to pay for absolutely essential imports decreases as they develop their own internal capability, that the percentage of foreign trade represents of their overall economy will tend to stabilize at some fairly low figure.

Mr. PERKINS. I think it will stabilize at a fairly low figure, but one that is, if they continue present policies, one that is significantly higher than it is today.

Mr. BROWN. Yes. But never as high as Japan, for example?

Mr. PERKINS. Japan isn't very high if you compare it with small countries like The Netherlands or Britain, or for that matter, South Korea. These countries have a much higher foreign trade ratio than Japan. Japan in these terms is a fairly large country, it has very large GNP, so a smaller percentage of that is a substantial amount of trade.

In the same sense, China will have a substantial trade, but it will be a small share of its GNP, a much smaller share than Japan, I would guess.

Mr. BROWN. Thank you.

Mr. ERTEL. Thank you very much, Professor Perkins, for being with us and giving us your statement and responding to our questions.

Our next witness is Dr. Thomas Fingar, assistant director, United States-China relations program at Stanford University.

We welcome you, Dr. Fingar, and we have, I believe, your written statement and we will incorporate that in the record, without objection, and you may proceed to testify as you see fit.

[The biographical sketch of Dr. Fingar follows:]

Biographical Sketch

THOMAS FINGAR

Positions

1979- Assistant Director, US-China Relations Program, Stanford University
 1975- Research Associate, US-China Relations Program, Stanford University
 1970-72 German Translator and Intelligence Analyst, Office of the Deputy
 Chief of Staff, Intelligence, Headquarters, United States Army,
 Europe

Education

A.B. (With Distinction in all subjects, Phi Beta Kappa), Cornell
 University, 1968 (Government/History)
 M.A. Stanford University, 1969 (Political Science)
 Ph.D. Stanford University, 1977 (Political Science)

Non-degree Programs

Columbia University, Summer 1967 (Intensive Chinese Language)
 Defense Language Institute, West Coast, 1969-70 (German)
 Inter-University Program for Chinese Language Studies in Taipei,
 1973-74

Other Relevant Experience

Participant in the January 1979 Bermuda Workshop on the Development of
 Industrial Science and Technology in the PRC: Implications for US
 Policy sponsored by the Joint Committee on Contemporary China and the
 Committee on Scholarly Communication with the People's Republic of
 China, January 3-7, 1979.

Member, Office of Technology Assessment Advisory Panel on East-West Technology
 Transfer (1978-79).

Participant in the January 1978 Aspen Arms Control Consortium Workshop
 on "Prospects for Security and Arms Control in the Pacific and Asian
 Area," Punalu'u, Hawaii, January 3-7, 1978.

Investigator (with John Lewis, Victor Li, Harry Harding, Jr., and Douglas
 Murray) and research co-ordinator of a two-year study entitled "Chinese
 Foreign Policy in the Decade Ahead: The Interplay of Domestic and
 External Factors" funded by the U.S. Department of State, Bureau of
 External Research (1976-78).

Co-ordinator of the Wingspread Conference on Energy Development in the PRC
 supported by The Johnson Foundation, July 1977.

Selected Publications

"Mass Campaigns, Past and Present." Problems of Communism, XXV: 4
 (July-August 1976).

China's Energy Policies and Resource Development. Stanford: United
 States-China Relations Program, 1977.

Developments in PRC Science and Technology Policy. Stanford: United
 States-China Relations Program. (Published quarterly since January
 1977; some issues with Genevieve Dean).

Scientific and Technical Chinese, Volumes I and II. Stanford: United States-China Relations Program, 1978. (With Kung-yi Kao, Carl Crook, and Ernest Chin)

Review of Technology and Communist Culture: The Socio-Cultural Impact of Technology Under Socialism. Journal of Asian Studies, Vol. 38, No. 2 (February 1979)

China's Quest for Independence: Policy Evolution in the 1970s. Boulder: Westview Press, forthcoming. (Editor and contributor)

"Recent Trends in Industrial Science and Technology Policy: An Overview," in Richard Baum, editor, China's Technological Modernization: Problems and Prospects. Boulder: Westview Press, forthcoming.

"China's Quest for Technology: Implications for 'Arms Control II'" in John Barton and Ryukichi Imai, editors, Arms Control II. Forthcoming.

Personal Data

Born: Long Branch, New Jersey, January 11, 1946

Marital Status: Married (Orlene King Fingar), two children (Kristen and Craig)

STATEMENT OF DR. THOMAS FINGAR, ASSISTANT DIRECTOR, UNITED STATES-CHINA RELATIONS PROGRAM, STANFORD UNIVERSITY, PALO ALTO, CALIF.

Dr. FINGAR. Thank you, Mr. Chairman.

I am grateful for this opportunity to present my views on the transfer of technology to China because I believe that the way technology transfer issues are decided will have a very significant impact on the future of United States-China relations. Since my prepared statement is too long to read, I propose to summarize the analysis presented there and to highlight those points which merit special attention. In the discussion which follows, I will address the following general questions relating to the transfer of technology to China:

First, what is China's view of technology acquisition, why does it hold that view, and what kind of technology transfer policies does China want the United States to adopt?

Second, what policies has China employed to acquire technology in the 1970's and what consequences have those policies had for the United States and for American corporations?

Third, what policies is China likely to pursue in the 1980's and how will they affect the United States and United States-China relations?

I would like to begin by endorsing and building upon the analysis that has just been given by Professor Perkins. I agree that the United States has a chance to influence Chinese policies in the decades ahead and that the opportunity should not be squandered for short-term objectives. That U.S. policies governing the transfer of technology will play an especially important role in this regard is readily apparent if one looks at the assumptions and expectations of Chinese officials.

Chinese officials assert that technology is part of the universal heritage of mankind, and that any efforts to restrict, control, or attach conditions to the transfer of technology are inappropriate, unacceptable, and unjustified. I will return to this theme in a moment. First, however, I wish to emphasize that China is more interested in acquiring technology, than in obtaining "products" of technology such as industrial equipment. Too many discussions of technology transfer fail to distinguish between products and tech-

nologies. Very briefly, a product is a physical article that results from the application of design and manufacturing know-how. Technology is the detailed knowledge of how to do things. China wants technology, not merely products. One of the points that I want to emphasize today is that, rhetoric and conventional wisdom to the contrary, relatively little technology, as opposed to products, was transferred to China in the 1970's.

A number of reasons underlie China's attitude on questions of technology transfer. The most important, I believe, is the way in which Chinese leaders think about security, independence, and China's rightful role in the international community. Chinese leaders have concluded that to be secure and to enjoy political influence, a nation must possess up-to-date technologies. This is true not only in the military realm, but also in terms of industrial capacity, and work at the frontiers of science. Countries that are relatively secure and exert real influence all have advanced capabilities in science and technology. According to Chinese leaders, this relationship is not accidental. Therefore, if China is to play its proper role, it, too, must possess advanced technologies.

The quest for technology is not merely a chauvinistic pursuit of superpower status. Chinese history, particularly in the last 100 years, has taught officials that technological weakness leads to victimization and dependency—situations that they certainly hope to avoid in the future. Therefore, imposition of controls which hinder the acquisition of technology will be viewed as an attempt to keep China weak and without influence.

A second reason why Chinese leaders are very sensitive about controls on the transfer of technology, has to do with the political risk which they have incurred. The ambitious plans announced after the death of Mao Zedong in 1976 are, in an important sense, the basis of regime legitimacy. To win support, the ruling coalition has made relatively specific promises to many interests and constituencies in China. Fulfillment of these promises depends upon success in the economic realm, and this, in turn, is predicated on the acquisition and absorption of many different technologies. Thus, China's leaders view their own continued tenure in office and the stability of the policies and programs that they have adopted—policies which benefit the United States—as dependent on the acquisition of technology. As a result, any effort to block the acquisition of technology will be opposed vigorously and those who impose controls will be suspected of trying to interfere in China's domestic politics.

A third, but much less important, reason underlying China's insistence that all technologies should be available to peoples and countries everywhere is that such a stance is very popular in the Third World. As a developing country, China would benefit from any general relaxation of restraints. Since economic constraints will remain even if political obstacles are removed, the situation desired by the developing countries is not likely to come about in the near future. For the time being, however, China has little to lose by championing a position with much support in the Third World.

As we move from a discussion of factors underlying China's position on technology transfer to an overview of the policies which

were pursued in the 1970's, it is important to bear in mind that these policies were shaped by considerations and conditions that have changed substantially in the past year. The pattern of trade and technology acquisition which resulted from those policies—for example, seeming discrimination against American firms—was also the product of a particular historical period. It would be a mistake, therefore, to base predictions and U.S. policies for the 1980's on simple analogies or the extrapolation of trends based on the 1970's.

Part of the general pattern one finds in the 1970's—going all the way back to 1970-71, when the decision was made to seek advanced foreign technology—results from an effort to diversify sources of supply. This was done for at least three reasons. One was to reap political benefits. By awarding contracts to many corporations and many countries, China hoped to solidify and strengthen the respectability and influence, that it had begun to acquire in the early 1970's. It should be noted that newfound respectability and opportunities to open new contacts with many countries were direct results of the 1971 announcement that President Nixon would visit China. One of the reasons China decided to normalize relations was to gain access to advanced products and technology.

A second factor shaping policies and trade patterns was the desire to avoid dependence on a single supplier. China learned some very painful lessons as a result of its relationship with the Soviet Union in the 1950's when it became heavily dependent on Soviet technology, spare parts, and supplies. Since 1960 China's leaders have expressed a strong desire to avoid dependencies which would enable a single supplier to exercise political and economic influence by threatening to turn off the flow of essential equipment or know-how.

A third and perhaps less important factor was the desire to take advantage of greed and competition in the international marketplace. By going to many countries and numerous corporations, China hoped to obtain the best deal possible. The objective was not merely to obtain products at low prices, but, more importantly, to acquire proprietary technologies as well as modern equipment. In negotiations with corporations from around the world the Chinese have pressed very hard for technical information, often with the implication that failure to provide such information would jeopardize the corporation's chances to gain a share of the China market.

To summarize, in the 1970's there was a wide dispersal of contacts and contracts which produced patterns of trade and technology acquisition which one would not have predicted on the basis of relative strength in other markets.

Policies and patterns were shaped by other factors as well. One has already been mentioned by Professor Perkins, namely, the slow pace of normalization. For reasons the Chinese could not really understand—that is, the Watergate catharsis and the dynamics of the 1976 Presidential campaign—normalization was delayed for several years. China was unhappy and this unhappiness made it more difficult for American corporations to compete. Although China continued to negotiate with United States firms and did sign a few large contracts, officials went out of their way to call attention to the contracts signed with other countries and to suggest that the competitive position of American companies would im-

prove after the normalization of relations. Patterns of trade and technology acquisition were therefore skewed in the 1970's because the United States did not normalize until December 1978.

Patterns were also shaped by the fact that in the 1970's China evinced a conservative desire for bilateral trade balances. In the case of the United States, imports from China were limited by such normalization linked factors as the frozen assets problem and the absence of most favored nation status. China found it easier to sell to other nations than to the United States, and the resultant trade skewed the pattern of technology acquisition and the purchase of advanced products.

The pattern of technology acquisition was also shaped by the fact that China had to purchase large quantities of grain in 1973 and 1974. Much of that grain came from the United States. As a result, a portion of China's foreign exchange and the China market that had been earmarked for the United States and for U.S. producers and suppliers of technology was reallocated for the purchase of grain.

The summary presented thus far has noted many factors which limited the role of American firms. There is a widespread and I believe erroneous impression that, because of the reasons cited previously and others still to be mentioned, U.S. companies and technologies played an extremely minor role in China's efforts to modernize during the 1970's. Indeed, if one looks only at gross figures, and at lists indicating which countries signed agreements with the Chinese, one would naturally conclude that the United States played a very limited role. In fact, the position of American corporations was considerably stronger than implied by such listings or than is generally recognized. For example, many American corporations provided equipment or know-how as subcontractors on projects awarded to Japanese and European companies. For a variety of reasons, American firms did not go out of their way to call attention to this fact.

A second misconception concerns the amount of technology that has been transferred to China. As noted above, it is widely assumed that China has acquired massive amounts of technology and that most has come from our allies and competitors. Both assumptions are wrong. From China's perspective, its efforts to acquire advanced technology met with very limited success in the 1970's. In most cases, it obtained products but not technology. Moreover, the technologies that were acquired tended to be rather ordinary and, in the view of China's leaders, of relatively low priority in the quest for security through modernization. By and large, they failed to obtain critical technologies.

What was the origin of those technologies that were transferred to China? It is my impression that a very substantial portion of the technology that has been transferred is American technology that has been sold or licensed through subcontracts with West European and Japanese firms.

A related point concerns the role that has been played by our allies and competitors around the world. It has been alleged that Japan and our allies in Europe have wittingly or unwittingly violated CoCom and other export controls in order to obtain a larger share of the China market by providing technology which Ameri-

can firms were prevented from supplying. A forthcoming Office of Technology Assessment study will examine that question in some detail. It is my impression that our allies have been maligned unjustifiably. I have not seen any evidence that existing export controls have been deliberately or significantly violated, or that sensitive and sophisticated technologies have been transferred as a result of approved exemptions.

Professor Perkins has noted the recent reassessment of developmental plans and the resetting of priorities that occurred in mid-1979. I want to focus on the technology transfer implications of the revised program. Chinese leaders appear to have concluded that even though the scattershot approach to technology acquisition which was employed in the 1970's may have had certain political and economic benefits, it was irrational from a technical standpoint. In the words of a Chinese commentator, "China was becoming a country of everybody's technology." Mismatched technology would be difficult to absorb, could not be used efficiently, and would be difficult to duplicate if political developments led to disruption of supplies and technical contacts. There was a danger that China would become a technological junkyard full of incompatible equipment and processes. To preclude such a development, efforts to acquire technology would have to be coordinated and focused.

Part of the reassessment and focus on what the Chinese call weak links has resulted in decisions to concentrate on acquiring technologies in a relatively small number of areas, including petroleum, building materials, telecommunications, and electric power. These areas have very high priority in the developmental program announced last summer. They are seen as holding the key to enhanced security through technical modernization. Moreover, advances must be made in these areas if the leadership is to fulfill its promises and retain credibility.

Concentrating on these areas will have a number of consequences. One is that the range of suppliers will narrow, in terms of both the number of countries and the number of corporations involved.

The areas that have been singled out for highest priority entail special opportunities and advantages for the United States and for American corporations. They also raise new dilemmas and difficulties because the technologies involved are among the most sensitive and tightly controlled by the United States and/or by CoCom. American firms will have a comparative advantage in virtually all of the high priority fields, but controls must be relaxed if they—and the Chinese—are to benefit. The opportunity—commercial and political—is great, but it will be extremely difficult to take advantage of that opportunity under existing regulations.

Existing or more stringent regulations will become an increasingly important irritant in United States-China relations if, as seems likely, the Chinese leadership feels compelled to demonstrate the concrete benefits of current policies.

The leadership must deliver. To do so, it will concentrate on acquiring technologies in the areas of highest priority and will use all of the political pressure it can to persuade corporations and the United States Government to provide technology as well as product.

The United States is seen as playing the key role in determining whether or not China will obtain desired technologies. The series of developments outlined by Professor Perkins has led China's leaders to assume that U.S. cooperation will enable them to realize their ambitious developmental goals. Any behavior on our part that blocks fulfillment of expectations raised in the last few years will be viewed as betrayal on the part of the United States.

I am not suggesting that we should simply acquiesce in any Chinese request for technology, to train more Chinese scientists and engineers in this country, or for anything else. My point is simply to make it clear that this is an issue on which the Chinese are extremely sensitive and to note that efforts to impose restrictions will entail high political costs. Such costs should be incurred only if there are commensurate benefits for the United States.

I draw two implications from the foregoing analysis. One is that we should do everything possible to promote trade and to enable China to acquire and absorb technology so long as the steps taken are consistent with our own national and corporate interests. The absence of most favored nation status, the problem of textile quotas that restrict the amount that China can sell to the United States and hence the amount that it can buy from American firms, the terms under which students and mid-career scientists and engineers come to this country for training and so forth are all simmering, sensitive, and problematic areas that must be resolved. I believe that they can be resolved in a way that will further strengthen United States-Chinese relations.

A second and more contentious implication is that we should relax and simplify controls which impede the transfer of technology. Every effort to impose new constraints will be viewed with alarm, dismay, and outrage by Chinese leaders, and will work against Chinese participation in the international community in ways that are consistent with U.S. interests. In other words, they will make it increasingly difficult to build the kind of relationship described by Professor Perkins.

I have avoided direct mention of military technologies because I am not well qualified in that area. I believe that we should maintain controls on the transfer of weapons, weapons systems and clearly military technologies. The Chinese understand our reasons for withholding such technologies, and although they might not like the controls, they can accept them. That is not the case with controls on sensitive or dual purpose technology with military as well as civilian applications. For reasons outlined earlier, the Chinese strongly object to all such controls. I believe, therefore, that we should adopt a more flexible approach. In most cases, we should allow the private sector to exercise greater authority in determining whether or not particular proprietary technologies should be transferred. Corporations are better able to judge the economic consequences of such transfers, and they should be permitted greater latitude than is the case now.

Certain technologies clearly do require a degree of government control * * * avionics, advanced electronics, and certain metallurgical techniques, for example. When imposing controls, the United States should try to be responsive to Chinese wishes and to minimize the likelihood that officials in Beijing will interpret the con-

trols as designed to thwart China's efforts to become a strong, independent, and influential nation. Even more undesirable would be for Chinese leaders to view the manipulation of controls as calculated to undermine their own positions and the legitimacy of rule by the Chinese Communist Party. To repeat, we should do whatever we can, consistent with our own national interest, to facilitate the transfer of many technologies that are currently proscribed.

The final point I would like to make—I believe this differs somewhat from the assessment of Professor Perkins—is that our technology transfer policies should reflect an evenhanded approach to China and the Soviet Union. It would be a foolish mistake to make technologies available to China which we deny to the Soviet Union. Rather than define evenhandedness in a way which requires that we assess the capabilities and potential—and intentions—of China and the Soviet Union, and that we attempt to draw up different lists of commodities that might be transferred to each, we should liberalize the controls applied to both nations. I believe that the strategic balance is sufficiently stable to permit the transfer of many, perhaps most, dual use technologies without jeopardising the security of the United States and its allies. Conversely, to interpret evenhandedness in a way that prevents the transfer of particular technologies to China on the grounds that we would not make them available to the Soviet Union would be counter to our own interests and completely unacceptable to the Chinese.

Thank you.

[The prepared statement of Dr. Fingar follows:]

TRANSFERRING TECHNOLOGY TO CHINA:
PATTERNS, PROSPECTS, AND POLICY IMPLICATIONS

Thomasingar
Stanford University

Précis

This paper examines the origin, political sensitivity, and consequences of People's Republic of China (PRC) views on questions of technology transfer. It argues that PRC leaders regard the acquisition and absorption of technology (rather than merely plant and equipment) as essential for the realization of high priority national objectives, and for the continuation of current domestic and foreign policies. As a result, they are extremely sensitive about national and international (e.g., COCOM) attempts to restrict or impose conditions on the transfer of particular technologies. Whereas we generally think of such restrictions in terms of our own security, Chinese officials tend to see them as deliberate efforts to perpetuate China's weakness and to undermine the Chinese Communist Party. In order to predict the course and consequences of future PRC efforts to obtain advanced technology, the paper examines the pattern of plant and technology acquisition in the 1970s and indicates how and why that pattern will change in the 1980s. It also notes how and why the changes will pose new challenges and opportunities for the United States. The major points of the paper are summarized below.

I. Technology Transfer: The Chinese View

PRC leaders maintain that technology is part of the "universal human heritage" and oppose all efforts to block the transfer of "sensitive" technologies or to impose conditions on the way technologies are used. Three mutually supportive arguments underlie this position:

- * In the contemporary world, security, independence, and political influence are heavily dependent upon the state of a nation's technology. If China is to enhance its security and gain its "rightful" position in international affairs, it must first obtain advanced civilian and military technologies.
- * Legitimacy in post-Mao China is based on performance. The authority of the dominant coalition and support for its policies rest on promises to enhance security and raise living standards through a technology-based strategy of modernization. Thus, the stability of the regime and its policies are dependent, in part, on the ability to acquire needed technology.
- * As a developing country, China would benefit from any general relaxation of controls on the transfer of technology. Moreover, by supporting a position that is popular with other developing countries, China is able to bolster its pretensions to Third World leadership.

II. The Evolution of PRC Policies Governing the Acquisition of Technology and Their Consequences for the United States

During the 1970s the PRC sought a wide array of technologies as well as plant and equipment, and turned to many different nations and corporations in the hope of acquiring as much and as advanced technology as possible while minimizing the degree of dependence on individual suppliers. Political and financial considerations shaped decisions on the choice of technology and of

trading partners. Policies during this period were relatively successful from a political standpoint, but they failed to generate hoped for acquisitions of technology. The policies and patterns of the 1970s may be summarized as follows:

- * Contacts and contracts were spread among many suppliers in an effort to take advantage of competition and greed in the international marketplace and to reap maximum political benefit. It was hoped that competition and the lure of the "China market" would induce suppliers to offer technology as well as equipment.
- * Contracts were awarded on the basis of considerations other than the quality of the product or the expected political benefit. Other factors included:
 - the slow pace of normalization which resulted in deliberate and derivative disadvantages for American firms;
 - limited foreign exchange, conservative financial policies, and a desire for bilateral trade balances; and
 - the need to purchase large quantities of grain in 1973 and 1974 which used up portions of the "China market" that might otherwise have gone to American exporters of equipment and technology.
- * Despite the problems noted above, American firms obtained a larger and more significant share of the market for products and technology than is generally assumed. Many important sales were made through subcontracts with foreign corporations which held the primary contract with China.
- * The amount of technology (as opposed to plant and equipment) actually transferred to China was relatively small--certainly much smaller than China had hoped or anticipated. With a few notable exceptions such as the Spey engines, little of the transferred technology has been of direct military significance.
- * Much of the technology that has been transferred (e.g., in petrochemicals) has come through sale or license arrangements with American firms acting through foreign contractors.

III. Prospects and Policy Implications

Reassessment of overly ambitious goals and the limited success of previous policies to acquire and absorb technology have led China to adopt new tactics of technology acquisition. For several reasons, the new approach will create new opportunities and new dilemmas for American firms and the US government. The new approach and its implications may be summarized as follows:

- * China will concentrate on obtaining those technologies which are judged most critical for the realization of national objectives. American firms will enjoy a comparative advantage in many of the high priority fields (e.g., petroleum, electric power, and telecommunications).
- * Because the technologies are considered so important and because domestic pressures to demonstrate tangible results are mounting, PRC leaders will press extremely hard to obtain desired technologies. This pressure will be directed at political officials as well as corporate negotiators.
- * Rightly or wrongly, PRC leaders regard COCOM as an American puppet and will blame the United States every time that a technology is blocked by Washington or by an international agency. As China's developmental plans run into difficulty (as they inevitably will), there will be a strong temptation for PRC officials to blame the failure on the obstructionist policies of the United States.

The paper's final recommendation is to relax or remove restrictions on all but military technology and to apply exactly the same criteria to the PRC as are applied to the Soviet Union. It argues that there is little military danger in relaxing the controls applied to both nations.

TRANSFERRING TECHNOLOGY TO CHINA:
PATTERNS, PROSPECTS, AND POLICY IMPLICATIONS

Thomas Fingar
US-China Relations Program
Stanford University

Prepared for the hearings on Technology Transfer to China held by the Subcommittees on Science, Research and Technology and on Investigations and Oversight of the House Committee on Science and Technology, November 13-15, 1979.

Despite recently announced decisions to "readjust" their overly ambitious plans to modernize the country, China's leaders remain committed to a technology-based strategy of development. Although certain tactics have changed in the post-Mao period, the basic objective and underlying premise of that strategy are the same today as they were thirty years ago when the newly formed People's Republic of China (PRC) turned to the Soviet Union for developmental assistance, and in the late nineteenth century when Qing dynasty officials began to import "barbarian" technology. Then, as now, the primary objective was to enhance China's security, independence, and political influence. In the view that again prevails in Beijing, the quickest--if not the only--way to achieve that goal is through acquisition and absorption of advanced technology. As a result, PRC officials have embarked on what can only be characterized as a quest for technical know-how.

In China, as perhaps nowhere else, requisition and absorption of technology are matters of central concern to senior political leaders. Convinced that their country will remain dangerously weak and vulnerable unless it can close a steadily widening "technology gap," they have adopted a series of carefully integrated measures to facilitate acquisition and absorption, but they are also painfully aware that China is at the mercy of those with the power to grant or withhold technical information. As a result, they have devised a variety of inducements and economic cum political tactics to speed the acquisition process. Those tactics have shaped both specific policies and overall trade patterns throughout the 1970s and seem likely to remain important well into the next decade. This paper will attempt to clarify why questions of technology transfer are so important to PRC officials; to describe how their

assumptions, tactics and priorities have affected trade patterns; and to assess the past and future consequences for American business and US-China relations.

I. Technology Transfer: The Chinese View

PRC officials maintain that technology is part of the "universal human heritage which should be shared by all countries," and that all efforts to limit its transfer or impose restrictions on the recipient country are unreasonable and unacceptable.¹ They have denounced existing controls as violating the sovereignty and impeding the modernization of developing countries and endorsed the call for creation of a new economic order that would permit easier and less expensive access to technology of all kinds. Their stand on this matter may be designed, in part, to win friends and supporters in the Third World, but it is also motivated by continued and growing concern about China's security and their own political futures. To understand the reasons for this concern, it is necessary to examine the way in which PRC leaders think about security and at the nature of political legitimacy in post-Mao China.

According to the Chinese view, a nation can be neither secure nor independent unless it controls its own destiny and is immune to threats, blandishments,

¹For representative statements, see the Xinhua News Agency broadcast (in English) on the address by Chinese representative An Zhiyuan at the October 18, 1978, session of the United Nations Conference on Drafting an International Code of Conduct on the Transfer of Technology, October 18, 1978, in Foreign Broadcast Information Service, Daily Report: People's Republic of China (hereafter FBIS), October 20, 1978, p. A1; and Xinhua News Agency broadcast (in Chinese), "International Reference Material: The Transfer of Technology," August 21, 1979, translated in FBIS, August 24, 1979, p. A1.

and all other forms of external interference. National security, in this view, is a function not only of a country's military strength, but also of the strength and invulnerability of its economy, and the autonomy of its decision-making bodies. In other words, national security requires high levels of political, economic, military, and cultural independence.²

In China, as elsewhere, officials have disagreed over the relative priority to be accorded different components of security as well as over the kind of trade-offs that could or must be made. Despite such disagreements, there seems to be a general consensus that economic strength is an absolute prerequisite for lasting security. Thus, for a nation to be politically independent and militarily strong, its economy must be comprehensive and immune to dislocation by external forces.

Chinese commentaries on national independence emphasize sovereignty (zhuchuan) and self-reliance (zili gengsheng). Sovereignty, in the Chinese formulation, is more than a legal construct or abstract "right;" it presupposes the capacity to exercise specified prerogatives in a meaningful way. For example, political sovereignty requires that a country and its leaders be immune to pressures and inducements from abroad. Under this view, it would be a violation of national sovereignty to attach restrictions or exact political concessions for technology.

Most PRC commentators argue that sovereignty (and hence independence and security) can be attained or increased only through self-reliance, but the definition of self-reliance has changed over time and from one situation to

² In Chinese, culture (wenhua) subsumes science and technology as well as elements of education and ideology in addition to the visual and performing arts. The acquisition of foreign technology is therefore at least partially a cultural issue--can the know-how be separated from the cultural and social setting in which it developed? Foreign efforts to transfer managerial techniques, educational requirements, and other concomitants of a technology tend to be viewed by the Chinese as manifestations of a kind of cultural imperialism.

another. Some officials have advocated extreme forms that border on autarky; others have endorsed substantial imports of equipment and technical know-how. The key seems to be that the extent to which a nation takes advantage of external opportunities (e.g., to purchase plant and equipment, obtain scientific information, or to benefit from tacit alliances) is less important than maintaining absolute control over all decisions. Current policies reflect a liberal definition of self-reliance and permit substantial imports of equipment and technology, but they also reflect determination to retain maximum control over China's own destiny.

Over the past decade, and especially since the death of Mao, Chinese leaders have emphasized the critical role that "modernization" (xiandaihua) plays in the attainment of independence and security. Without modernization of agriculture, industry, national defense, science and technology, and all other sectors, it is now argued, China will remain weak and vulnerable. The key to modernization, in this view, is technology. The relationship between technology and security became more salient in the early 1970s as officials began to reassess China's capabilities after the cultural Revolution, and to see the results of new advances in civilian and military technology. They were dismayed and frightened by what they found: China was further behind technologically than it had been one or even two decades earlier. Advances elsewhere and China's relative technical stagnation in the 1960s badly eroded the gains made during the 1950s. As a result, China was more vulnerable than at any time since 1949.

A part of China's concern about the technology gap derived from increased fear of the Soviet Union following the 1969 border clashes and the build up of Soviet forces along the border. Despite ritualistic paeans to people's war,

political and military leaders were deeply impressed by the awesome new military technologies displayed in the 1973 Middle East War and the final stages of the Vietnam conflict. Vulnerability sparked concern not only because of the danger of attack, but also because pressures to strengthen the military threatened to derail plans for comprehensive modernization of the country. For reasons of military security and to assure that more resources could be devoted to other sectors, the technology gap had to be closed as quickly as possible.

PRC leaders were concerned about the technology gap for other reasons as well. As they began to think about ways to strengthen China's voice in international affairs, officials realized that nations which lacked modern science and technology (and the industries, weapons, and communications systems that they could produce) commanded little respect or influence. In their view, such a situation was not only humiliating, it was dangerous. Given China's history of victimization at the hands of states with more highly developed technologies, their concern is easy to understand. Technological inferiority had led, among other consequences, to violation of China's sovereignty. Even though gunboats and extraterritoriality were not likely to return, officials feared other forms of pressure and abuse. They also feared a kind of multiplier effect whereby weakness would invite disrespect and attempts to exact political and economic concessions in exchange for badly needed technologies which would, in turn, spark further demands. The priority attached to enhancing security and increasing PRC influence around the globe combines with concern to protect China's sovereignty in ways that make officials extremely sensitive about controls on the transfer of technology. Any effort to prevent the PRC from acquiring technology is certain to be regarded as an attempt to keep China weak and to prevent it from attaining its "rightful" international position.

Another and equally important reason for PRC opposition to technology controls derives from the political vulnerability of key leaders and, perhaps, of the entire regime. Individual leaders are vulnerable because they have run high risks in promoting the current strategy of development. In order to forge a stable coalition in the course of struggle with opponents now grouped under the "gang of four" label, they made promises to many different interests or constituencies. To fulfill those promises and retain support, they must demonstrate the viability and advantages of their developmental program. That program is predicated on the assumption that rapid acquisition and absorption of advanced technology will generate new surpluses and myriad benefits for all. Without new technology, the program cannot succeed; without foreign technology, it cannot produce benefits quickly enough to satisfy skeptical supporters. If things begin to go wrong and expected benefits are not forthcoming, there will surely be a search for scapegoats; leading political figures are prime candidates.

There is another and perhaps more important element of political risk in the current program. Whereas the danger discussed above is primarily an intra-elite matter involving the stability of a ruling coalition, the second element involves the way the regime is perceived by the Chinese people. If present policies are judged to have "failed," the Chinese Communist Party (CCP) could well lose the "right" or "mandate" to rule. To explain this assessment, it is necessary to comment briefly on the sources of authority in post-Mao China.

At the time of Mao's death, regime legitimacy rested heavily on the late Chairman's charismatic authority and, to a lesser extent, on the role of the Party in the Chinese Revolution. Earlier claims to legitimacy based on economic achievements had ceased to be very important by 1976. When Mao died, the

mantle of authority passed to his chosen successor, Hua Guofeng, but subsequent efforts to debunk the myth of Mao's infallibility undercut Hua's claim to authority. Moreover, the fact that a different age cohort was coming to prominence both inside and outside of the Party meant that people forty years old or younger had little or no memory of the "bad days before liberation," and that younger officials could not base their claim to rule on participation in pre-1949 successes. Younger generations seem unwilling to accept the regime or its policies on faith alone--especially without the legitimizing myth of Mao. An increasing number of people apparently believe that authority should be performance-based.

Since 1977, Hua, Deng Xiaoping, and indeed the CCP have all based their claims to authority on their ability to enhance national security, modernize the country, and to improve the well-being of the people. More than that, they have claimed that they can achieve dramatic results within a very short time if "the whole nation" works enthusiastically for the "four modernizations." The political risk derives from the fact that both leaders and led have identified performance as the basis of legitimacy. As PRC commentators have noted, rapid modernization is necessary to "solidify the dictatorship of the proletariat." Without large inputs of advanced foreign technology, China cannot realize the goals which its leaders--and the Party--have promised, and the people may well become completely disillusioned with the regime, or so the leaders imply.

When Chinese leaders talk about importing technology, they mean precisely that--they want technical know-how even more than they want products of or embodying new technology. After reviewing China's own history and the experience of other developing countries, they have concluded that continued weakness

and dependence are inevitable if a nation imports equipment but does not master the technology on which it is based. The following excerpts illustrate China's stand on this important question.

The import of advanced technology is an important condition for improving our production, scientific research and management and for putting our national economy as rapidly as possible on a new, modernized technological basis. But there must be some point of emphasis in our imports, that is, we should import more technology, relatively speaking, and less equipment, or, to put it figuratively, we should buy "hens" for them to "lay eggs" if we want to increase our machine-building capacity.³

...[T]here are many drawbacks to importing complete sets of equipment, not the least being the great expense incurred, and it is not likely to help raise the levels of domestic research and production. Although in the process some technology may be brought in, such technology is mainly confined to data concerning production capabilities and not related to the technological processes essential to manufacture. This is because the vendors alone have access to basic designs and vital aspects of production technology while the buyers have no way to acquire technological and production know-how beyond certain engineering particulars on the manufacture of required components and accessories for replacement purposes. This is an important reason why for a long time China was unable to manufacture sets of equipment identical to those it had imported in the past....[We

³ Shi Zhengwen, "Readjusting the National Economy: Why and How?," Beijing Review, No. 26 (June 29), 1979, pp. 13-23; excerpt from p. 17, emphasis added.

must not lose] sight of the long-range interests and immediate advantages in importing advanced technology and acquiring advanced experience. Even if it is desirable to import complete sets of equipment, we must also acquire the advanced technologies necessary for manufacturing equipment. This is aimed at raising our country's level of scientific research, design, manufacture and management, besides assimilating and developing the acquired technologies and enhancing China's initiative and radically improving its self-reliance and capabilities.⁴

Even though PRC officials and informed observers in this country recognize that there are fundamental differences between the sale/purchase of a product and the transfer of technology, much of the public discussion about "transferring technology to China" has failed to make such a distinction or to acknowledge its importance. Since the distinction is important--to us and to the Chinese-- I wish to comment briefly on the difference between "products" and "technology," and to outline some of the ways in which "technology transfer" can be achieved.

Oversimplifying somewhat, a product is a physical article that results from the application of design and manufacturing know-how; technology is the detailed knowledge of how to do things (e.g., how to design and manufacture products). In most cases, the sale of products that do not help to design or manufacture other products does not entail the transfer of technology. China is interested in acquiring a wide range of products, but it is far more interested in acquiring technologies. In the view of PRC officials, the purchase of "products" leaves the recipient in a position of dependence relative to the supplier and of weakness relative to all countries with the capacity to manufacture the item in question. By acquiring the relevant technology,

⁴ Jing Wen, "Importing Technology Must Not Follow 'A Single Pattern,'" Guangming Ribao, December 2, 1978, in FBIS, December 8, 1978, pp. E25-27; excerpt from p. E26, emphasis added.

however, a country becomes more independent. By extension, the more technology a nation acquires, the more independent and hence the more secure it becomes.

Transfers of technology may be effected through a variety of means ranging from deliberate and highly active mechanisms involving intensive training and transmittal of detailed technical information to more passive mechanisms such as "reverse engineering" and the "demonstration effect" of factory visits. Turnkey plants and joint ventures are highly effective means for transferring technologies; reverse engineering is rarely very successful. Sending students and engineers to study and work in foreign countries and recruiting scientists and engineers to work and teach in the recipient country constitute intermediate transfer mechanisms.⁵

China has attempted to employ all of these mechanisms. During the 1950s the Russians provided a wide range of industrial and military technologies, and although the Chinese regularly carp about Soviet malevolence and the retention of blueprints for certain installations, the fact remains that the PRC benefitted from one of the most extensive technology transfers in history. Reverse engineering and the purchase of prototypes were attempted during the 1960s, but the results were largely unsatisfactory. Since the early 1970s, Beijing has sought to use more active mechanisms. This effort has involved pressing companies for technical drawings and detailed specifications with the suggestion that future sales will depend on how forthcoming the companies are. By playing to the lure of the "China Market" and the desire to reap short-term profits, PRC negotiators hope to win concessions that would be denied other buyers.

⁵ For a more extensive discussion of these points see US Congress, House, Committee on International Relations, Subcommittee on International Trade and Commerce, Hearings on Export Licensing of Advanced Technologies: A Review, 94th Cong., 2nd Sess., 1976; and US Congress, House, Committee on International Relations, Subcommittee on International Security and Scientific Affairs, International Transfer of Technology: Report of the President to the Congress, 95th Cong., 2nd Sess., 1978.

The precise situation and consequences will, of course, differ from case to case, but it is generally true that sales of products that are not accompanied by the transfer of technology entail low economic risk to the seller and only limited danger to the security of other nations. The obvious exception is the sale of advanced military hardware which may endanger third party states. However, since China is extremely eager for technology and is taking carefully calculated steps to obtain and absorb advanced technical information, it poses a series of difficult questions for corporate executives and government officials. I shall return to this point and to the question of just how successful the PRC has been in its drive to acquire technology as well as products. First, however, I wish to summarize the steps that Beijing has taken to facilitate acquisition and absorption of technical know-how.⁶

Over the past decade China has devised a number of complementary policies to improve its access to foreign technology. For analytical purposes, it is possible to divide those policies into two broad categories: those associated with "normalization," and those designed to promote trade and investment. The decision to improve relations with the United States--and hence with Japan, West Germany, and other American allies--was made at a time (1969-70) when PRC leaders saw both a need and an opportunity to press for rapid modernization and greater security. Detailed steps had yet to be worked out, but it was apparent to key officials that it would be impossible to achieve their developmental and security objectives without active cooperation from the industrialized democracies. "Normalization" was an essential prerequisite for such cooperation.

⁶ The repeated pairing of acquisition and absorption is deliberate. PRC officials recognize very clearly that obtaining new technology is only the first, and in many ways the easiest, step. In a sense, technology is not fully transferred until it is absorbed by the recipient country. Until it is, its impact on the country will be minimal. For that reason, Chinese leaders have placed equal emphasis on acquisition and absorption.

PRC leaders apparently hoped (and expected) that normalization would facilitate acquisition of advanced technology and equipment in a number of different ways. At one end of the spectrum, they seem to have envisioned de facto or de jure relaxation of COCOM restrictions on the transfer of "sensitive" hardware and technical know-how. Anti-Soviet diatribes and calls for common action to check hegemonic aspirations were designed, in part, to provide a rationale that would encourage Americans and their allies to adopt more lenient policies toward China than were applied to the USSR and Eastern Europe. As a maximum objective they probably hoped for formal changes in US and COCOM regulations, but it would suffice if the US "allowed" its allies to provide equipment and technologies that were formally proscribed and not supplied by American corporations.

Other benefits expected to flow from normalization include access to substantial low-interest loans to finance imports of technology and equipment, and an expanded market for PRC exports. Joint ventures, commodity buy-back arrangements, and access to colleges and industrial training facilities were also seen as likely fruits of improved relations. In short, normalization was viewed as the sine qua non for acquiring sophisticated plant and know-how. President Nixon's visit to China in 1972, improved relations with West Germany and the European Economic Community (EEC) as a whole, and the Sino-Japanese Peace Treaty should all be viewed as designed, in part, to facilitate acquisition of technology.

"Promotion of trade and investment" subsumes a variety of measures ranging from Beijing's new willingness to enter into longer-term trade agreements (e.g., those with Japan and the EEC), to changes in domestic policy designed to attract investment by overseas Chinese. Changes in China's tax and commercial codes, the new joint venture law, and renewed emphasis on worker discipline are designed, again only in part, to attract foreign investment of a type that will result in substantial transfers of technology. In addition, the multi-year trade agreements

that have been signed generally provide for exports of PRC raw materials and light manufactures and imports of complete plants and advanced equipment. These agreements appear to envision some transfers of technology, but it is not yet clear whether the result will be as extensive as Chinese leaders would like.

China's policies to acquire advanced equipment and technology are designed to take advantage of competition, the generally sluggish world economy, and of special fascination with the PRC (the "China differential"). This involves efforts to play nations and firms one against another for a share of the present and future China market, but the objective is not merely to purchase goods at the lowest possible price. On the contrary, an even more important objective seems to be to acquire know-how as well as products.

Although detailed analysis of the steps China has taken to facilitate absorption of advanced technologies falls beyond the scope of this paper, it is important to note that PRC officials have prescribed a broad set of integrated measures to increase the likelihood of successful transfer. These measures range from organizational changes to new educational, fiscal, and managerial policies, and though they have multiple objectives, one purpose is to speed the absorption of new technology.⁷ The fact that they have taken these steps must be taken into consideration when assessing the potential consequences of particular transfers.

II. The Evolution of PRC Policies Governing the Acquisition of Technology and Their Consequences for the United States

China has pursued a different strategy to acquire technology in each of the three decades since 1949. During the 1950s, the basic strategy was one of extensive

⁷ These measures are examined at greater length in Thomas Fingar, "Recent Trends in Industrial Science and Technology Policy: An Overview," in Richard Baum, editor, China's Technological Modernization: Problems and Prospects (Boulder: Westview, forthcoming); and Thomas Fingar, "China's Quest for Technology: Implications for 'Arms Control II,'" in John Barton and Ryukichi Imai, editors, Arms Control II (forthcoming).

reliance on the Soviet Union and its East European allies for both technology and help to absorb that technology. China had little choice but to rely on the Soviet Union since American policy forbade US corporations and allied nations to engage in most forms of trade with the PRC and proscribed transfers of technology on the twin assumptions that such an embargo would cause the new Communist regime to collapse, and that any technology which was transferred to China would automatically be retransferred to the Soviet Union. The first assumption was dubious at best; the second was much more reasonable given the state of Sino-Soviet relations and the cold war climate of the time.

Soviet advisors and technicians supervised the transfer of substantial quantities of equipment and related technologies. In addition, thousands of Chinese students travelled to the USSR and Eastern Europe for training in fields related to the technologies that were being transferred. Post-hoc Chinese allegations that the Russians provided only outdated equipment and obsolete technologies are largely without foundation. Much of the technology transferred in the 1950s was state-of-the-art at the time of transfer and continues to provide the basis for China's industrial and military capacity. For all the shortcomings of the arrangement -- and there were many -- it did constitute a comprehensive program to facilitate rapid and intensive acquisition and absorption of critical technologies. The transfer of Soviet technology and the efforts of Chinese scientists and engineers trained in the West and Japan before 1949 enabled China to narrow the gap between itself and the advanced industrial states between 1950 and 1960. The results, in short, proved that the model had much to recommend it. Current Chinese policies reflect a desire to restore and improve that model.

Economic difficulties after the Great Leap Forward (1958-59) and the split with the Soviet Union ushered in a decade of extreme self-reliance. The break

with Moscow and continued Sino-American hostility effectively precluded access to foreign technology so Chinese leaders had little choice but to make a virtue of necessity and attempt to acquire technology in the only ways possible; i.e., indigenous development or "rediscovery," and reverse engineering.

Reverse engineering was possible, on a limited scale, because changes in PRC policy during the early 1960s and a slight improvement in relations with the West and Japan made it possible to buy products but not technologies. The effort was probably doomed anyway, but its fate was sealed by the anti-technocratic bias of the Cultural Revolution (1966-68). By the end of the decade, China lagged further behind than it had in 1960 and the gap was widening at an ever increasing pace. A key group of officials apparently recognized this fact and, galvanized into action by changes in the international environment (e.g., the Soviet invasion of Czechoslovakia, border clashes with the Soviet Union, the beginning of de-escalation in Vietnam, the first signs of detente between the US and the USSR, and signs from the United States that it was prepared to improve relations), they began to pave the way for a new and comprehensive effort to acquire technology. The new effort was modelled on that of the 1950s but with two important differences: for the first time China could reasonably hope to tap the resources of both the industrial democracies and the Soviet bloc, and, in contrast to the 1950s, policies were formulated to ensure that China would not become heavily dependent on a single nation.

Opposition and obstruction by leaders who disapproved of the strategy hammered out in 1970-71 and almost continuous political maneuver in anticipation of Mao's death impeded implementation of important parts of the new program, but the basic strategy being followed today was hammered out in the early 1970s.⁸ Previous

⁸ The evolution of current policies and the nature of political maneuver in the 1970s are described in Thomas Fingar, "Domestic Policy and the Quest for Independence," in Thomas Fingar, editor, China's Quest for Independence: Policy Evolution in the 1970s (Boulder: Westview, forthcoming), pp. 25-92.

pages have described the underlying assumptions of this strategy; those which follow will examine some of the tactics that have been employed.

To minimize the dangers of dependency, PRC leaders decided to obtain equipment and technology from a variety of sources. They were greatly helped in this regard by the July 1971 announcement that President Nixon would visit China the following year. De facto recognition by the United States meant that America's allies could expand their commercial relations with Beijing without incurring the wrath of US officials. Even more important, from China's perspective, was the fact that the new political climate made it possible to discuss the transfer of technologies as well as products. Since many nations and corporations were eager to expand ties with China, PRC officials suddenly had a broad choice of trading partners and potential sources of advanced technology.

Responding to the new situation, PRC leaders decided they could reap maximum political and economic benefit by purchasing goods -- and hopefully technology -- from many different suppliers. The principal objective throughout most of the 1970s was to minimize dependence on individual countries or corporations by obtaining similar products and technologies from a variety of sources. By early 1979 they had begun to recognize the technical drawbacks to such a policy, but the pattern of trade and technology acquisition for the past decade was strongly shaped by the desire to limit reliance on individual suppliers.⁹

Spreading contacts and contracts broadly was also seen to have certain political advantages. For one thing, it might help to solidify the new respectability and support which China had begun to enjoy in technically advanced countries. Such support was important to PRC leaders not only for nationalistic and egotistical

⁹ For a discussion of the current policy restricting the number of suppliers for technical reasons, see Liang Yuan, "The Nine Principles of Importing Technology and Equipment Into the PRC," Qishi Niandai, No. 109 (February 1979), in FBIS, February 27, 1979, pp. N5-6.

reasons, but also because it might make it increasingly easy to obtain badly needed technology. By winning new friends and taking advantage of greed and competition in the international marketplace, China hoped to win special concessions from corporate negotiators and from political leaders who were becoming increasingly concerned about the Soviet Union.

Available evidence shows that contracts for major purchases of plant and equipment were in fact distributed among several countries in the 1970s, but the actual distribution is neither egalitarian nor what one might expect purely on the basis of product quality, technical sophistication, or commercial advantages.¹⁰ The US share, for example, seems at first glance to be surprisingly low.

The pattern of contracts and technology acquisition that emerged in the 1970s has been explained in terms of deliberate Chinese decisions to discriminate against American firms, violation of technology controls by other nations, and unreasonable restraints imposed by the US Government. The first explanation has some validity, the latter two much less. On closer examination it is not even clear that American firms fared all that badly. Each of these points will be discussed below; first I wish to suggest other factors which influenced the choice of trading partners.

One of the most important factors affecting American corporations was the slow pace of normalization. As noted above, PRC leaders decided to improve relations with the United States, in part, because they hoped to gain access to American and American-controlled technology. They had incurred substantial

¹⁰ For summaries listing major sales to China by different countries and in different fields, see Hans Heymann, Jr., "Acquisition and Diffusion of Technology in China," in US Congress, Joint Economic Committee, China: A Reassessment of the Economy, 94th Cong., 1st Sess, 1974, pp. 712-729; and Central Intelligence Agency, National Foreign Assessment Center, China: International Trade, 1977-78, 1978, pp. 20-21.

political risks by pursuing normalization and the technology-based strategy of development which rested on certain expectations about the likely fruits of improved relations. When normalization did not proceed as anticipated (first because of Watergate, then because of the Reagan challenge to President Ford and the dynamics of the 1976 presidential campaign), those leaders felt vulnerable and betrayed. To show their displeasure at the slow pace of normalization and to build support within the American business community, officials called special attention to contracts signed with other nations and alluded to the upsurge in sales by US firms that could be expected after full normalization. Lacking other bargaining chips (except to make unacceptable concessions on Taiwan) and frustrated by delays which they found inexplicable, they attempted to use major purchases of plant and technology as both a carrot and a stick. (It should be noted in passing that their efforts were relatively unsuccessful because the causes of delay were not susceptible to business pressure, because most major corporations already favored normalization, and because many companies benefited almost as much from the contracts which China signed with foreign corporations as they would have had the principal award gone to an American firm.)

Some contracts that might have gone to American companies if normalization had occurred earlier probably were awarded to other nations, but how many is uncertain. Since many other factors were involved (e.g., the particular sectors being developed in the early and mid 1970s; the strong competitive position in certain industries of Japanese, West German, and French firms, funding problems, and China's desire for bilateral trade balances) it would be foolhardy to assert that contracts were frequently withheld from the United States solely in order to prod Washington to proceed with normalization. Still, decisions to "punish" the US for dragging its feet probably did play at least some role. The

proposition seems even more certain when one considers the domestic political situation in the PRC during the mid 1970s. Forced to respond to several challenges by their radical opponents, advocates of technology-based modernization were probably reluctant to take actions toward the US that would have provoked new challenges and debate unless the benefits clearly outweighed the costs. At the time, the "extra" benefits of American technology (compared to those obtainable from other sources) seldom justified the political cost. Limited foreign exchange reserves and self-imposed financial constraints also affected -- skewed -- the pattern of plant and technology sales in the 1970s. Although I cannot delineate the precise consequences, it seems likely that plans to distribute contracts among many suppliers and the desire to obtain the latest and/or the most appropriate technology and equipment had to be tempered by the availability of acceptable funding to cover specific purchases. During this period, the PRC still refused to accept normal commercial loans -- indeed, it made a point of boasting that imports were financed on a pay-as-you-go basis. The fact that deferred payment arrangements were really loans in disguise adds to the importance of this factor. In at least some cases, the choice of technology and supplier was probably influenced by the ability of vendors to put together acceptable financial packages. As a result, what China obtained and from whom were decided on criteria other than (or in addition to) which products or technologies were "best."

A third factor affecting the distribution of contracts, particularly to the United States, was the need to import substantial quantities of grain, particularly in 1973 and 1974. Even with medium-term credits, the purchase of grain reduced the amount of foreign exchange that could be used to purchase equipment and technology. This is relevant here because Chinese policy at the time -- and to

some extent to the present day -- sought to achieve rough bilateral balances. Nations which supplied large amounts of grain -- and here we are talking primarily about the United States and Canada -- could not expect to sell large quantities of plant and equipment because grain purchases had "used up" their slice of China's trade budget. Since agricultural commodities and industrial products were considered together when calculating the amount of trade to conduct with each nation, PRC officials authorized fewer purchases of plant and technology from the United States than might have been made under other conditions.

The net result of these factors was that foreign companies seemed to do better than American firms in the scramble for Chinese contracts. "Seemed to" is an important qualification, and I will return to it in a moment. The point I wish to make here is that Chinese purchases during the 1970-78 period reflect a particular constellation of factors which was important at the time but no longer exists in quite the same form. Indeed, as will be argued below, key factors may have changed substantially in the past year. It would be misleading, therefore, to predict future developments by simply extrapolating from the patterns of the past.

The discussion thus far has focused on Chinese policy and politics as the principal determinant of trade and technology transfer patterns, but the PRC decisions were also influenced by the terms offered by competing suppliers. Over the past few years there have been a number of complaints and allegations about the commercial and technology transfer practices of American allies/competitors, and about the constraints imposed by the US Government. Taken together, their complaints raise important questions about the efficacy and desirability of government controls. Before those questions can be properly considered, however, it is necessary to clear up a number of misconceptions about what has already occurred.

One of the most frequently voiced complaints asserts that government policies (i.e., those of the United States and other industrial democracies) work to the detriment of American corporations. This complaint has several referants ranging from the climate or political atmosphere associated with the state of government to government relations, to the enforcement of restrictions on the flow of "sensitive" technology. Some have claimed that the number of contracts signed by American firms would have been higher if Washington had normalized sooner or pressed for trade fairs, Most Favored Nation (MFN) status, easier credits, and other trade-promoting measures. This assertion is probably correct, both in terms of the advantages which accrued to other nations because they could offer more favorable credit rates, relatively larger markets for Chinese goods, and better access to end-users, but it is also probably irrelevant. Given all of the factors noted here, it seems unlikely that earlier resolution of the frozen assets problem, granting of MFN, or other normalization-linked actions would have made an appreciable difference in terms of the number or value of contracts awarded to American firms. Moreover, normalization and the steady removal of remaining obstacles have or soon will erode whatever advantages may have been enjoyed by other countries.

A far more serious complaint involves the degree to which export controls have or have not been enforced by different nations. This is a two-sided question. On the one hand, we must ask whether or not US and COCOM regulations have unfairly and unnecessarily restricted American corporations; on the other, we must ask whether or not deliberate violation of COCOM controls has given other countries an edge in the China market. Since others know far more than I about relations between American firms and the Office of Export Administration, I will simply report that many corporate officials with whom I have spoken consider US

regulations to be unduly restrictive. As to whether or not other nations have allowed or encouraged their nationals to violate COCOM restrictions in order to sell equipment or technology to the PRC, I have seen no evidence that such was the case. If, as I believe, the allegation is unfounded, our allies in Europe and Japan have been unfairly maligned. A forthcoming report by the Office of Technology Assessment will examine both sides of the question in greater detail than I can provide.¹¹

Two additional misconceptions remain to be addressed, namely, that the United States has done much worse than have other trading nations and that American corporations have not received a "fair" share of the China market, and that substantial amounts of technology have been transferred to the PRC, most of it from foreign companies. Neither of these impressions is correct.

Conventional wisdom about the relative market share which has gone to the United States or American companies rests primarily on aggregate data showing the principal parties to a contract and/or the country-to-country flow of goods and services. Both types of data understate the importance of the role played by American firms. For example, many contracts signed by foreign companies actually include substantial components provided by American companies or their overseas subsidiaries, but this fact gets lost in the recording process.¹² In addition, the way in which we record trade statistics masks the fact that a portion of what we show as exports to third countries is destined ultimately for the PRC. Thus, for example, the 170 ton trucks which Daimler Benz sold to China earlier this year will be manufactured by Euclid (a U.S. subsidiary of Daimler Benz AG) in Cleveland

¹¹Office of Technology Assessment, Technology and East-West Trade, forthcoming, late November 1979.

¹²Examples include the \$540 million contract signed by Lurgi Kohle and Mineral-oeltechnik G.m.b.H. of West Germany to build five petrochemical plants. Union Oil, the UOP unit of Signal, and Standard Oil (Indiana) are all providing technology for the plants (Wall Street Journal, January 11, 1979, p. 37:1). A second example is the sale of four ethylene plants by the Toyo Engineering Corporation of Japan. The plants will use proprietary technology provided by C-E Lummus, a subsidiary of Combustion Engineering (Wall Street Journal, January 12, 1979, p. 6:3).

but assembled at Euclid's plant in Guelph, Ontario for export to China.¹³ When the trucks are delivered, the sale will be recorded as part of Sino-Canadian trade. The number of examples can be multiplied several fold. My point is not to untangle the complexities of transnational corporations and contemporary business operations, it is merely to caution against reaching conclusions purely on the basis of raw trade data as it is presently compiled.

Given the fact that PRC leaders have repeatedly stressed how important it is for China to acquire foreign technology and the frequent failure of commentators in this country to distinguish between the sale of products and the transfer of technology, it is not surprising that conventional wisdom overestimates the amount and importance of technical know-how that has been transferred to the PRC. The amount of technology (as opposed to plant and equipment) that has been transferred to China is still very small. Even more significantly, transferred technology is limited to a small number of fields with most being in the area of petrochemicals. This technology is extremely important to China, but it is my impression that little of the technology which has been transferred to date has serious military or economic implications for the United States or its allies. There is a tendency to point to the sale of Spey engines and related technology and to draw sweeping conclusions about China's military capabilities and aspirations, but such sales and transfers are exceptions to the general pattern. It is also worth noting that much of the technology that has been acquired by China has been obtained from American sources. Foreign companies are providing plant and equipment, but many of the process technologies are American. Proprietary technologies are being sold or licensed by the companies which hold title to the technology.

¹³ See Wall Street Journal, January 8, 1979, p. 6:4.

The trade and technology transfer relationships that evolved in the 1970s resulted from a particular set of circumstances that no longer exist. Despite a variety of obstacles which probably reduced the number of sales made by American firms, the United States did not do all that badly in the competition for contracts with China. On the other hand, however, China did not do all that well in its efforts to acquire technology as well as products. As we enter the 1980s, the removal of old barriers and redoubled PRC efforts to acquire selected technologies will increase the opportunities and the dilemmas for American firms which possess those technologies.

III. Projections and Policy Implications

Prognosticating about China is always challenging and uncertain, but despite the pitfalls and the need for qualification, it is both possible and necessary to make certain predictions about the future course and consequences of PRC efforts to acquire plant and technology. The key predictions may be summarized as follows:

- (1) For the next few years and possibly well into the 1980s, Chinese efforts to acquire foreign technology will be concentrated in fewer fields and involve fewer national and corporate competitors than in the 1970s. Purchases of equipment and technologies in other (i.e., lower priority) areas will continue to be made from a variety of nations, but the number of such purchases will probably level off for a while.
- (2) The areas which have been assigned highest priority for the acquisition and absorption of technology entail or bestow differential advantages on the nations which trade with China. Many of the highest priority areas accord special advantages to American corporations; other nations may benefit disproportionately in other fields.

(3) As measures to facilitate absorption of technology begin to take hold and as the political and economic pressures for tangible benefits from the present developmental strategy increase, Chinese leaders will intensify their efforts to obtain technology and will take an increasingly hostile view of export controls or "extraneous" conditions which block the flow of technology.

(4) With normalization behind us and given the special advantages which American firms will enjoy in key technical areas as well as the special political role which PRC leaders expect the United States to play, China is likely to press much harder than in the past for relaxation of US and COCOM controls, and for active assistance in its quest for modern technology.

China's rush to "do everything at once" is over. Following the death of Mao and the removal of policy opponents grouped under the "gang of four" label, the PRC went on a euphoric and probably necessary modernization binge. Simultaneous motion--if not always movement--on several fronts was necessary to release pent up emotions, enlist the support of persons with badly needed skills, and to solidify the triumphant coalition of leaders and policy preferences. To give credibility to regime promises and in response to the fact that China really did need "everything" if it was to achieve security through comprehensive modernization, ministries, state trading corporations, provincial organs, and even end-users were encouraged to prepare ambitious plans and to open discussions on the purchase of equipment and technical know-how. Contacts and contracts increased and expectations soared both inside and outside of China. A kind of starry-eyed optimism prevailed for several months, but beginning in late 1978 it became increasingly clear to officials in Beijing and in boardrooms around the world that promises, plans, and expectations had lost all touch with reality. Inevitably, the bubble burst.

In late 1978, PRC officials began to recognize the perils of a headlong rush for modernity and to rethink the tactics of development. This reassessment resulted, among other consequences, in a decision to focus efforts on the acquisition and absorption of particularly critical technologies. The areas accorded highest priority are the so-called "weak links" of coal, petroleum, electric power, transport and communications, and building materials. In addition, officials decided to restore a greater degree of central control over the acquisition of equipment and know-how. Although it is still not clear precisely what the consequences of these changes will be, it seems probable that resources will be used primarily in the areas of highest priority and that Beijing will use maximum political leverage to obtain the desired technologies.

What do these changes mean for American firms and for US-China relations? Combined with the removal of pre-normalization impediments and the special importance which China seems to assign to the United States, they probably foreshadow increased contracts for American corporations. This is a matter of some concern to other nations. Indeed, as a British trade publication stated in July, "Composition of China's imports in the next few years will objectively favor US business even without any conscious effort by Chinese authorities to reestablish trade links with America."¹⁴

China's desire--and in many cases need--to "buy American" is not an unmixed blessing, however. Many of the areas in which US industry is likely to be most competitive are also areas with "sensitive" or restricted technology. PRC negotiators and political leaders can be expected to push very hard for know-how which corporations and/or Washington and our COCOM partners may not wish to provide. This puts the US in a very difficult position. China's general sensitivity about efforts to control the transfer of technology increases

¹⁴ China Trade and Economic Newsletter, No. 285 (July 1979), p. 4.

when the United States is involved. At least three reasons contribute to this increased sensitivity. One is the fact that many of the technologies which PRC leaders see as most critical to the success of their developmental program--and continued tenure in office--are American or American controlled. Thus, we are talking about matters of central importance, not technologies that can be obtained elsewhere or foregone with little real impact. Second, correctly or incorrectly, PRC officials regard COCOM as an American puppet. If our allies want to block the transfer of particular technologies which the US would be willing to provide, Washington will bear the brunt of PRC dissatisfaction.

The third reason is more difficult to articulate since it derives from an implied but never stated assumption that the United States has a special "obligation" or "motivation" to strengthen the PRC as a counter against the Soviet Union. China believes that it should receive special treatment and rejects the validity of restrictions imposed in the name of "evenhanded treatment of the PRC and the Soviet Union.

What are the policy implications of this prediction? At the very least they imply that US-China relations could be in for some very difficult times if Beijing perceives or wishes to believe that the United States is deliberately attempting to prevent the modernization of China or to interfere in PRC domestic politics by restricting access to certain technologies. Every effort to impose new controls and refusal to waive or relax existing regulations will be interpreted in the worst possible light. The potential impact on US-China relations is heightened by the fact that China and China's leaders are almost certain to fall short of their announced goals and to be unable to deliver on the myriad promises they have made. In other words, there is the very real possibility that the US will be blamed for "failure" of the modernization program. Every restriction that is imposed will add to the likelihood and impact of such an accusation.

-28-

My own recommendation is to reduce the number of restrictions to the absolute minimum. This paper has not considered military technology per se, but I should note that I think it proper and necessary to maintain controls on the transfer of weapons and military technologies. Chinese officials might not like such controls, but they can understand and live with them. As for other sensitive or "dual purpose" technologies, I believe that virtually all can be transferred to the PRC without endangering the security of the United States or its allies. In most cases, decisions on whether or not to provide proprietary technologies should be left to the private sector. If corporations wish to sell the technology, they should be permitted to do so. Conversely, if corporations do not want to sell or license a technology, they should have to admit that such is the case and not have the option of hiding behind US or COCOM regulations,

These recommendations raise the question of evenhandedness. I strongly believe that equal treatment of China and the Soviet Union is the only sensible policy for the United States, but I would go further. Given my understanding of the present strategic balance, I think that we should be willing to provide any technology to the Soviet Union which we are willing to sell to China. Elaborate attempts to set different standards for China and the Soviet Union and to define evenhandedness in terms of relative capabilities strike me as futile and foolish. The political risks and complexity of such a scheme are enormous; acquisition of one or another technology by either the Soviet Union or the PRC will have little impact on the strategic balance or our own security. We cannot preserve our technological advantages by being overly protective of our current capabilities; we must provide the conditions, challenges, and resources that make further advances possible. Transfer of technology will help, not hinder, continued advance. Imposition of restrictions on the transfer of technology involves high potential costs and dangers for the still fragile relationship with China and removing such restrictions for both the USSR and the PRC entails very low military risk. Therefore, I recommend reducing existing restrictions and doing everything possible to preclude accusations and suspicions that we have attempted to thwart Chinese development.

Mr. ERTEL. Thank you very much for your eloquent and comprehensive statement.

I am curious. I think the general thrust of your statement was to basically open up our transfer of technology to China and you basically said without restriction. But what kind of guarantees or what kind of position has China given us for the protection of, for instance, patent rights or proprietary rights that American companies have? They have got, in my judgment, at least from the little bit I know of their system—a rather primitive legal system which gives us a very difficult situation in protecting what really belongs to American companies, maybe even the American Government, through patent rights.

How do you envision us protecting ourselves in those regards?

Dr. FINGAR. Let me preface the answer with a bit of history. During the 1960's, China attempted to modernize through reverse engineering by buying prototypes and duplicating them, often in a handcrafted fashion. This violated all kinds of patent and copyright agreements, but it also proved to be a very inefficient way to acquire technology. I am confident that the Chinese will continue to attempt reverse engineering in certain fields even if they do not intend to put the resultant products on the market. Their objective would be to master the technology in case deteriorating political relations made it impossible to maintain commercial contacts. This could conflict with certain patent accords and licensing arrangements. However, I think that because reverse engineering didn't work very well, and because the Chinese now recognize that to absorb technologies and to obtain the cooperation of foreign corporations—cooperation which is essential to the realization of their developmental goals—they must observe patent, copyright, and licensing requirements.

I understand that China has already agreed to observe patent and copyright requirements. That is a precondition, as I understand it, for the granting of most-favored-nation status. The issue was raised during the June 1979 meeting of the joint United States-Chinese Committee on High Energy Physics. This committee oversees, among other things, the project to construct a 50 BEV proton synchrotron in Beijing. The United States is to play a major role in the construction of this facility and transfers of technology will be extremely important. The United States used that concrete case, which is very important to the Chinese, to insist on resolution of patent and copyright questions. I understand that China has now accepted certain restrictions that it had refused to observe in the past.

The legal system in China, which is primitive at best, has only some 10-20,000 lawyers—

Mr. ERTEL. People in the United States would say that is an advantage, if you have less lawyers.

Dr. FINGAR. They may be correct. But the question is whether or not the new laws which China has passed in the last 6 months can be enforced. No structure is yet in place to insure that the joint ventures law, for example, can be enforced in a way that protects American corporate interests.

We are in for a period of experimentation. My impression, and I don't believe that it is overly naive, is that China is not looking for

loopholes at this stage. Officials want to set up a structure and legal arrangements that they and American and other foreign corporations can live with, and they are prepared to work out the problems that inevitably will arise.

Many decisions on whether or not a particular proprietary technology can or cannot safely be transferred, should rest with the corporations that own the technology. Their judgment as to whether or not they would obtain sufficient protection in the China context, or derivatively whether it makes a significant difference if patent laws are violated in specific cases, should be decisive. If there is a violation, we will have a test case.

Mr. ERTEL. You indicated those judgments ought to be left to American corporations. You would signify there is national objective here today, too, if in fact there is no protection or there are violations without a legal mechanism for enforcement by either American corporations or whatever American proprietary interest would be involved that, in fact, that will reflect on our national policy to China because a couple of bad instances like that will then basically cut off the technology transfer which may be against or contrary to our policy of technology transfer.

So, I think we, as a Government, have a very decided stake in seeing that there are appropriate types of patent protection, whether it is through conventions and having the Chinese enter into international patent conventions, or any other technique. And the legal system in China—I don't know how we foster that, I don't know how we push that and encourage the Chinese to do it, but I think that is something that our national policy has to be concerned about.

Dr. FINGAR. I agree completely with the characterization of this question as a matter of considerable interest to the United States. The representative from the Commerce Department will, I am sure, comment on the efforts that have been made in this regard. From my perspective as an outsider, these efforts are commendable and adequate to obtain the required guarantees from China. I do not fault the Government at all in the steps it has taken thus far to obtain patent protection. It is an area in which we have considerable leverage. I think that leverage ought to be exercised.

Mr. ERTEL. If I might turn to one other area. You talk about an evenhanded policy in relation to China and the Soviets. Have I interpreted your remarks as evenhanded means basically the transfer of technology equally, but don't we have different considerations between China and the Soviet Union, the Soviet Union being a much more highly technical society and much more developed society than China?

I am not sure what you mean by evenhanded. Is that equality of transfer? In fact, maybe China needs more transfers of technology. Maybe we want to develop the Chinese society from our own national perspective more so than we do the Soviets?

Dr. FINGAR. I am not sure that I would agree that we want to develop China more so than the Soviet Union. As a basic starting point, I think that to strengthen China and to make it a more competent international actor is clearly in the interest of the United States. Since transfers of technology will facilitate realization of this objective, we should certainly promote the process.

However, in terms of quantitative and qualitative constraints on what technologies may be transferred, we should note that many of the technologies which China wants are already possessed by the Soviet Union. To impose restraints which require that we do not provide a technology to either nation because making it available to the U.S.S.R. would marginally improve Soviet capabilities—even though it would significantly increase China's capabilities—would be unnecessarily constraining. Marginal changes in Soviet capabilities will, by and large, have minimal impact on the overall strategic balance. Professor Perkins referred to a time differential of roughly 5 years when noting the rate at which China would modernize with or without U.S. assistance. Whatever the actual difference in the case of China, it is surely much less for the Soviet Union. If the Russians really want to develop a particular technology, they can probably do so if they are willing to bear the opportunity cost.

Withholding many technologies is not going to make that much difference in terms of our own security, but to set up a series of parallel but different criteria for sales to China and the Soviet Union will lead to more problems and more ill will in both Moscow and Beijing than is warranted or desirable. There are technologies which we do not want the Soviet Union to acquire. However, we probably don't want China to obtain those technologies either. Controls should be enforced at a level where the difference to the security of the United States and its allies is truly significant.

Mr. ERTEL. I appreciate your comments. I am not sure I am in full agreement with the previous comment, because quite frankly I see trying to treat two nations so diverse, so different, equally may not be in our own national interests, and maybe we accept the ill will that goes along with it. Maybe that is a tradeoff to consider the different economic structure, the different advances in their society, and even their different governmental systems and their influence, but I guess that is one we could argue for a substantial period of time.

Dr. FINGAR. And disagreement is entirely appropriate.

Mr. ERTEL. Thank you very much for your testimony and having the benefit of your knowledge in this area.

Our next witness is Mr. Kempton B. Jenkins, Deputy Assistant Secretary for East-West Trade, U.S. Department of Commerce, and he will be ably assisted by Robin Schwartzman, Acting Deputy Assistant Secretary for Trade Relations. We welcome both of you and your written testimony will be incorporated into the record, without objection, and you may proceed as you desire.

[The biographical sketch of Mr. Jenkins and Ms. Schwartzman follows:]

KEMPTON B. JENKINS

Kempton B. Jenkins was born June 8, 1926 in Jacksonville Florida. He received a B.A. in 1948 from Bowling Green University, an M.A. from George Washington University in 1950, and an M.P.A. from Harvard University in 1958.

As a career Foreign Service Officer, Mr. Jenkins' diplomatic career has included assignments in Bangkok, Berlin, Moscow and Caracas. He has also served in the State Department's Office of Soviet Affairs, and as Assistant Director for Soviet and Eastern European Affairs at the United States Information Agency. Before coming to the Commerce Department, Mr. Jenkins was Deputy Assistant Secretary of State for Congressional Relations.

In his present position, Mr. Jenkins serves as Deputy Assistant Secretary of Commerce for East-West Trade and as Director of the Bureau of East West Trade in the Industry and Trade Administration. The Bureau is responsible for developing and promoting the orderly expansion of commercial relations between the United States and the centrally planned economies, including the Soviet Union, the People's Republic of China, and the countries of Eastern Europe.

Mr. Jenkins, his wife, the former Lucy Cabill, and their family live in Washington, D. C.. They are residents of Florida.

ROBIN BERMAN SCHWARTZMAN

Acting Deputy Assistant Secretary for Trade Regulation
 Department of Commerce
 Room 3814
 (202) 377-5491

As Acting Deputy Assistant Secretary for Trade Regulation, and as permanent Deputy Director of the Bureau of Trade Regulation, Ms. Schwartzman is responsible for the Office of Export Administration, Office of Industrial Mobilization, Foreign-Trade Zone Staff, and Special Import Programs Staff of the Industry and Trade Administration, U.S. Department of Commerce.

Ms. Schwartzman was born August 22, 1941, in Mobile, Alabama. She received a B.A. magna cum laude from Bryn Mawr College in 1961, an M.A. in Slavic Languages and Literatures from Harvard University in 1963, and a J.D. from New York University School of Law in 1975. She was a Junior Fellow of the Center for International Studies at New York University School of Law and an editor of the New York University Journal of International Law and Politics. She held a Woodrow Wilson Fellowship and National Defense Foreign Language Fellowships in Russian and Serbo-Croatian at Harvard University.

Before becoming a lawyer, Ms. Schwartzman worked at the Library of Congress, the Council on Foreign Relations, and the International Research and Exchanges Board. Ms. Schwartzman was an Associate Attorney with Fried, Frank, Harris, Shriver & Jacobson in New York prior to her appointment, specializing in tax planning for domestic and international transactions and corporate pension planning. From 1975 to 1977, she was an Associate Attorney in the Labor Department of Morgan, Lewis & Bockius in New York. She is the author of law journal articles on employee benefit plans and fiscal oversight of intelligence agencies.

Ms. Schwartzman is a member of American Bar Association sections on Business and Corporate Law and International Law and the Subcommittee on Technology Transfer, A.B.A. Committee on East-West Trade and Investment. She has been admitted to practice in New York and before the Federal Courts of that state.

Ms. Schwartzman and her husband, Edward, live in Chevy Chase, Maryland.

STATEMENT OF KEMPTON B. JENKINS, DEPUTY ASSISTANT SECRETARY FOR EAST-WEST TRADE, U.S. DEPARTMENT OF COMMERCE, ACCOMPANIED BY ROBIN B. SCHWARTZMAN, ACTING DEPUTY ASSISTANT SECRETARY FOR TRADE REGULATION, DEPARTMENT OF COMMERCE

Mr. JENKINS. Thank you.

I want to open by praising the presentations of Professor Perkins and Professor Fingar. I found much of, if not practically everything they said, are things that we agree with. It is reassuring to know that the academic community and Commerce Department are in reasonable step as we approach this very important subject.

Mr. ERTEL. If I may interrupt, sometimes that gives me pause, I am sure. If people are in total agreement, that seems to indicate to me maybe we are missing something. I don't know.

Mr. JENKINS. You noticed I hedged and didn't say total, I said virtually.

I know we are running a little late in the morning and I will summarize my statement and then take the liberty of adding some comments on some of the dialogue which has occurred between the committee and the two earlier witnesses.

I am pleased to appear before these subcommittees to offer the Commerce Department's cooperation in your review of technology transfer to China. You have recognized in establishing the agenda for these hearings, that the transfer of technology is not limited to scholarly exchanges, but goes to the heart of commercial and economic relations and ultimately affects political relationships.

My statement will focus on the commercial transfer of technology to China, our competitive strengths and weaknesses in this area, and the impact of such transfers on our relations with the People's Republic of China and our competitiveness abroad.

I would like to mention briefly some of the initiatives we have taken in recent months to insure American technological leadership and improve our ability to meet foreign competition in sales of technology. We talked a lot this morning, Mr. Chairman, about the protection of our technology, and the questions about the propriety of selling technology abroad, but we haven't really focused on something which I think is of even as great an importance, if not even more pressing, and that is our ability to compete technologically in the world markets.

We have a twofold challenge here of protecting our technological leadership while at the same time we have to strive to maintain it, and to maintain our position and improve our position sharply in the very serious balance-of-payments problem, balance-of-trade problem we face as a nation.

We have been the world leader in developing new products, new processes, and new technologies, and in insuring their wide dissemination and use. We are still the world's leader. But we are encountering increased competition from abroad in both the development of new technologies and their commercial export.

The establishment of diplomatic relations on January 11, opened a new vista for United States-China ties, heralding a relationship based for the first time on equality, mutual interest, and respect. These are also the principles upon which we are seeking to forge our commercial ties. We have made considerable progress this year

toward removing the impediments built up over 30 years and developing a framework for the constructive trade ties we seek with China for the 1980's and beyond. The trade agreement which is currently before the Congress is central to this process.

Considerable benefits also will be derived from the agreement's trade facilitation measures. Those provisions are particularly important since it is in these areas that American and Chinese business trade practices have differed most.

I might diverge here for a second, Mr. Chairman, and recount for you some of the experiences we had negotiating the trade agreement which, I think are relevant because they reveal the different philosophy with which we have approached this issue with the Chinese.

We first tabled our draft. It was some 30 pages roughly. The Chinese' counterdraft was roughly three pages. Your earlier allusions to lawyers came up in this meeting as the Chinese looked at our draft very carefully and said it is very interesting and we find much here to agree with. "We also find a reflection of the fact that you still suffer from the vagaries of lawyers where we in China with our 3 page draft have avoided that."

We accepted that in good humor and went on to negotiate article by article, word by word, and ended up with a final agreement which is approximately 15 pages. It covers, in our judgment, all the requirements of the Trade Act of 1974 and it covers specifically the question of patents, trademarks, and other things which you raised earlier, and I get into that in a little more detail.

In the end, it was an interesting negotiating experience. Our Chinese partners not only asked us what we meant by our language but what if we were in their shoes they should do about dealing with this particular question, and it was a sort of two-way scenario. We explained why we have certain things in the Trade Act and they explained to us why they don't have a patent law, and so forth, and there were good historic explanations on both sides.

I think the negotiations were a remarkable tribute to those who participated in them. On the team were C. L. Haslam, the Commerce Department's General Counsel, and representatives from the State Department, STR and Treasury, through whose efforts we were able to complete this mutual educational process and come up with a trade agreement of which we are all very proud.

The articles covering Government trade offices and U.S. trade promotion activities will improve our ability to assist American firms to compete in this market. As I mentioned earlier, it does cover the patent, trademark, copyright questions.

Based on the understanding reached in the trade agreement negotiations, we were able to conclude an agreement on trade exhibits, and are now in the process of planning for our first national trade exhibition in Beijing in November, 1980. This will be a joint effort. The Departments of Commerce and Agriculture, and the International Communication Agency will all participate in a combined effort and we have managed, I think, to do it in a fairly rational way.

It is the first time in my experience—and I go back to 1968 when I was with USIA, then part of the State Department dealing with

trade fair activities, among other things. I have never seen the three agencies get their act together and combine it in one effort, and we have done it this time, and I am very proud of that fact.

It should be a very successful program. We have seen intense interest by the American business community to participate, buy space, and to join us in this first national exhibit in China.

There will be a Chinese exhibit in this country at roughly the same time, and then from then on the exhibits will be done on a sectoral basis with the Department of Commerce participating and some others being organized by industry or the National Council on U.S.-China Trade without perhaps our financial participation in every instance.

This should be, I think, a very good opportunity for American firms, many of which are totally unfamiliar with the China market, to get their feet wet and to meet their Chinese counterparts first hand.

We believe if U.S. exporters are to be competitive with foreign exporters, then it is vital that the U.S. Government also provide appropriate export financing support. As you know, substantial export credits have already been extended to China by other nations. To meet this challenge, Vice President Mondale, during his visit to China in August, advised the Chinese that we are prepared to make available Eximbank credit arrangements of up to a total of \$2 billion over a 5-year period on a case by case basis, and are willing to consider additional credit arrangements as developments warrant. The importance of such Eximbank credits to the competitiveness of American products and technology cannot be overstated.

We expect new trade opportunities to develop also as a result of a number of the protocols that have been concluded pursuant to the Agreement on Cooperation in Science and Technology. The Agreement on Hydropower and Water Conservancy offers particularly good prospects in this regard.

I frequently find problems in discussing Exim practices in public speaking engagements. For example, Mr. Chairman, there seems to be an absence of understanding that Exim loans are not loans to China, they are loans to support American exports and essentially loans to American firms and, of course, the Eximbank's recovery rate has been virtually perfect.

There is a problem which one hears a good deal about—namely interest rates—and we are in a very competitive situation with our allies in that regard. John Moore, the Chairman of the Eximbank, is looking at this question very seriously with, I think, a remarkable degree of innovativeness and has successfully put us into markets where we have been constrained in the past. I hope the Bank's role can be allowed to continue to grow in this respect.

We expect new trade opportunities to develop also as a result of a number of the protocols that have been concluded pursuant to the Agreement on Cooperation in Science and Technology. The Agreement on Hydropower and Water Conservancy offers particularly good prospects in this regard. This is one point where I think I would disagree with Professor Perkins about the match of our technology and the Chinese interests.

I guess it was Congressman Brown who made the point that the Chinese want hydro and we want to sell nuclear. That is not quite correct. In fact, a number of major American corporations are actively bidding and some have been successful participating in hydroelectric, harbor renewal and other construction projects in China. We look for one of our major market opportunities in precisely that area.

The long range development program adopted last year calls for thoroughgoing modernization of China's agriculture and industry. The plan calls for an increase in the share of state investment in both agriculture and light industry. The goal is eventually to create a domestic production capacity in a wide range of industries, a goal which we consider realistic in light of China's varied and abundant natural resources.

In the immediate future, however, high priority will continue to be given to coal, oil, electric power, transport, communications, and building materials, since the slow progress of these sectors has acted as a brake on China's industrial growth.

When Secretary Kreps was in China last May, we met with Deng Xiaoping. He went to some lengths to insist to us this reorganization or readjustment of the four modernizations did not represent a cutback, it represented an increasing rationally approach on their part as they hadn't gotten their priorities straight.

The change really helps American competitors in the market because they have elevated those precise areas where we are most competitive, and they have reduced the priority of heavy industry, particularly their steel and iron efforts, to make way for more progress in transportation and energy fields.

We were reassured that our own Government analysts within the China watching community in this town felt the original four modernizations program was somewhat unrealistic, that the priorities did not take account of the necessity to synchronize the plan and schedule economic development. We are much heartened and reassured by this readjustment which Deng Xiaoping described to us and has now become a matter of considerable public discussion.

Even the moderated development program will require large imports of capital goods and technology. China's imports are likely to grow by 65 percent this year to about \$17 billion, one-fifth of which will be for imports of technology and complete plants. Over the course of 1979-1985 plan period, Chinese imports of technology and capital equipment and machinery should exceed \$40 billion.

These developments in Chinese foreign trade have been reflected in our own trade with China. U.S. exports of machinery, transport equipment, and instrumentation increased by 67 percent in 1978 to \$93 million. This year's total will be almost double that. Since the middle of last year, American companies have contracted to sell trucks, construction and roadbuilding equipment, mining equipment, machine tools, and aircraft to the People's Republic. They have also been awarded contracts and letters of intent for iron ore, copper and aluminum mines and processing facilities and for chemical installations.

The most successful of U.S. manufactured exports to China over the years has been petroleum exploration, drilling, and production equipment. Last year drilling equipment and parts sales totaled

\$46.5 million. American companies are currently involved in seismic exploration of petroleum deposits. The statistics cited above cover only the exports of products that embody technology and do not include the sales of licenses, plans, and know-how in other forms.

For the future, we see good prospects not only in currently leading items, but also in hydroelectric power facilities, transport and communication equipment, and electronics instrumentation.

A major drive is now underway in China to expand production of export products and to improve their quality and competitiveness in Western markets. About 85 percent of China's trade is with the non-Communist countries. In addition to Japan and Hong Kong, the dynamic, modernizing nations on the rim of Asia—countries such as Singapore, Malaysia, the Philippines, Indonesia, and Thailand—serve as her principal markets. Demand for many of her principal exports—food products, crude materials, minerals, fossil fuels, and light industrial products will continue to grow. Tourism, overseas remittances, and PRC business activities in Hong Kong also will contribute to hard currency earnings.

Nevertheless, efforts to increase earnings will be insufficient to cover costs in the short run, since a large quantity of capital goods required to implement the modernization plan must be imported over the next several years. To cover the difference between income and expenditures, China's foreign debt may grow to between \$15 billion and \$20 billion by 1985.

In light of this, China has begun to seek both official and private lines of credit. As of mid-1979, Beijing had reached major credit agreements with Western government credit agencies and private banks totaling some \$23 billion. It should be noted that almost none of these have so far been drawn upon.

At the same time that China is pursuing these credit possibilities, she has begun experimenting in new types of business ventures, such as export processing projects, compensation trade, and joint ventures, to attract additional foreign exchange or to reduce cash outflows. With the joint venture law adopted this past summer, negotiations on a variety of projects, involving from 25 percent to 100 percent foreign investment, have gained momentum. The recently established China International Trust and Investment Co. is vigorously seeking to attract venture capital and facilitate direct investment in China's economy.

I might point out that the chairman of that corporation has just toured the United States for approximately a month and has concluded a number of letters of intent with large American corporations while he has been explaining the new joint venture law to American firms. He is a very impressive gentleman, as was his entire team. They talk our language, they understand what American corporations are interested in and what they regard to be essential, and he was a very good salesman for China's new joint venture approach.

Financial considerations, however, will not be the sole constraint on China's ability to acquire technology or on our competitiveness to supply it. I am frequently asked in question-and-answer periods about this. "This is all very nice, but how can China possibly pay for all this, even allowing for their credit?"

I think it is very important to realize that perhaps the most pressing constraint on China's ability to import is not really financing. That is important, but even more difficult for them and even a trip wire which will be set off before they reach the limit of their ability to pay for things, is their ability to absorb it.

There has been a good deal of discussion in the press about this, and again, in our talks with the Chinese they were very candid with us, Deng particularly, pointing out that for almost 10 years China's educational system has been closed down, they not only have that gap but their historic backwardness to deal with it, and this is manifested by the figure Professor Perkins said of some 2,000 Chinese are now studying abroad.

Congressman Brown emphasized that this is not something that is overcome in a hurry, for it takes a year of English language training before you can get ready to study in English. That is true. This is a 4- to 5-year program before anything begins to come out of the other end of the pipeline.

I think it is heartening and realistic that the Chinese have recognized the dimensions of their problem, but we tend to forget it when we talk about how can the Chinese pay for things? I think they will be able to pay for everything they can reasonably absorb. It is their ability to absorb which is the real bottleneck.

Many of the American firms doing business in China find it is essential for them to talk to the plant foreman type technicians if they are going to construct something in accordance with the plans that they have agreed with with the Chinese. This is a problem for both sides. It is a serious one. As I say, it is heartening that it is recognized by both sides.

One objective of the plan is to build a force of 800,000 scientists and technicians by 1985. That is a massive undertaking. I can't judge their capacity to meet that target by that date, but it is clear that they have embarked in a massive way on what is in our judgment perhaps the most serious bottlenecks to modernization and by definition, also trade between our two countries.

American competitiveness abroad rests on our prolific agriculture and our technological leadership. Both are highly respected and sought after by the Chinese. And in selling to China, we should not be deterred by a nebulous fear of creating a monstrous competitor for our domestic and foreign markets. Such a fear is justified only if we do nothing to maintain our long technological lead, if we do not take advantage of our earnings from these sales to further improve our technology, and if we abdicated from an aggressive development of world markets.

In sum, our policies regarding technology transfer to China must not be grounded in fear of competition from others, but rather in a concern for the ability of our industry to remain at the forefront of technological innovation and commercial competitiveness.

At the same time, we must continue to fulfill fundamental requirements that we safeguard for the national security interest by means of an effective export license system.

My colleague, Robin Schwartzman, will add a few comments at the end and we will be happy to entertain any comments you may have on this aspect of our presentation.

We believe that trade is the cement of many relationships. The trade we build up with China today and the technological cooperation we succeed in establishing, will redound positively not only to our trade account, but also our political relationship with the most populous nation in the world.

I would like to comment, if I may, Mr. Chairman, on a few of the questions and dialogue that you had with some of the other witnesses. When questioning Dr. Perkins you suggested that the choice before us is whether we aid China to become a superpower or let it go along on its own.

I believe the choice before us is rather whether we participate in the modernization of China or sit on the sidelines while our allies do the job. That is precisely what was happening before normalization. We now have an advantage as a result of normalization.

The Chinese are interested in seeing the American share of their market rise. Deng told us in our meeting that his objective would be to have the United States and the Japanese trade with China roughly the same level. That is very attractive to the Department of Commerce and to American firms. We don't look for that to happen overnight. I like the fact that it is an expressed objective on their part.

There was some question about whether our approach is in the short run or long run, whether we are looking at the possible danger of creating in fact a superpower which 25 years down the road will be a threat to all of us, and I believe that that is something that has been very heavily thought about in this administration and actually by previous administrations, as we look at the desirability of trade, commercial cooperation with controlled economy countries, and particularly with China.

China is a unique case in point because it is so large. It has a very solid work ethic, it has a trade tradition which is certainly effective over history, and it is something that has to be considered. But our approach has not been short run; it has been calculated, and even influential in some regards based on an assumption we reached after a lot of calculations that it is in the U.S. national interest to cooperate with China at this time as it moves to join the world community.

It includes full recognition of the need to protect our national security through export licenses, and it has wrestled with the problem of evenhandedness or parallelism—a term I prefer. I was very interested in your dialogues with Professor Fingar, and I think I sense more community of understanding with you perhaps than I do with the professor in that regard.

I think there is a distinction there between the two countries which it is important to underline. I think it is also beneficial to the United States to pursue our economic and commercial ties with both of these countries simultaneously, and if opportunities develop in one faster than they do in the other, we should exploit those opportunities.

I think the process has a side benefit in that the more progress we make with one, the more appetite there is with the other to make progress in that regard as well. We have seen concrete examples of this. I think that is exactly the way we should contin-

ue to play this. I think the United States serves to benefit most if we pursue aggressively the markets in both instances.

The nature of the markets differ, as you pointed out. What constitutes modern technology in one is not modern technology in the other and, therefore, we have to look at these things on a case-by-case basis, not in isolation, but certainly not in lockstep. So, if I understand your exchanges with Professor Fingar, I think I would share your approach to that.

Congressman Brown asked Professor Fingar about the need for English language training, and Professor Perkins also mentioned this. We have a large number of Chinese coming here under the Science and Technology Management Agreement. There is a Chinese patent delegation here working with our own patent people, and we see this kind of cooperation in the trade and in the management team as being very important.

When we went into China in May, Secretary Kreps took five very prominent management specialists from the United States, three from the academic world and two from the practicing world, if I can say that, including one, General Tom Hayes, who is a hydroelectric expert. These five gentlemen spent the entire trip meeting with representatives of Chinese counterpart institutions interested in the same thing. They have now established a permanent relationship in an ongoing way.

They have talked about such things as a graduate school of business and management being established perhaps with a joint Chinese-United States venture which could be established in Hong Kong or conceivably in China itself.

Congressman Brown also—I guess I covered this mismatching of commercial efforts in hydroelectric power, and we also talked a little bit about financing. There was some discussion or suggestion I guess it was, by Professor Fingar, that Chinese export possibilities the next 5 to 10 years are pretty grim, and I mentioned that they will be relying increasingly heavily on international financing, but at the same time, I think it is important that we recognize what they do have for export which we are very impressed with.

The Minister of Metallurgy was here and spent 3 days in the Department of Commerce. We ran down a 10-year projection of the metals and minerals needs of the United States from abroad and in every single category the Chinese have very impressive deposits of those things which we are going to need the most.

Mr. ERTEL. What is the potential, if I may interrupt, for the development of those particular minerals within the Chinese sphere? How soon can they be onstream?

He was talking about the fact a lot of these things would take a period of time for development. As we well know, lead times are very long in many of those areas.

Mr. JENKINS. There is already some significant Chinese production of bauxite, Mr. Chairman, and they are talking with principal aluminum firms in this country to broaden that activity, modernize their existing two projects and establish three new ones. This program in its entirety will run some 15 years, but they are on line now. The process will increase as they modernize what they have. Their bauxite deposits, with one exception, are not in very difficult places in terms of accessibility. They have had some technological

experience already in exploiting it, and they hire in this particular case the best management that we can offer.

I think they will be able to quickly begin to reap benefits from increased bauxite alumina exports and quickly get into the actual exporting of alumina. The American corporations who are bidding on this are extremely optimistic about it and see tremendous possibilities for the Chinese.

Of course, they are right now in the business of exporting and selling oil to Japan and a little bit to us. Our oil companies describe China as a potential Venezuela, possibly an Iran, but certainly a Venezuela, in terms of international market capacity. Their ability to bring in their offshore wells is going to depend heavily on the findings that are now taking place in the seismic explorations, but their ability to generate hard currency with oil exports is already at work and will increase, I think, a lot more rapidly than it was suggested in the earlier dialogue.

To reach peak level, of course, we are talking about a 10-year time frame. But our oil company people feel in 5 years they will already see some fairly significant increases over their present general level of production, and there is a good deal of excitement about the potential. They don't see a Saudi Arabia, but they do see the possibility of an Iran and very likely a Venezuela.

There is one other comment I want to make. Congressman Lujan asked about the opportunity for U.S. companies now that normalization has occurred. Our feeling is—we found this in our visit there and in our talks with the Chinese here in our negotiations with them—that we do have not only equal opportunity with the other Western companies but a leg up at this time, because we are the new boy on the block.

There is a determination on the part of the Chinese Government to increase our share, so it is more proportionate with the other Western suppliers, and furthermore, their modernization program happens to dovetail very nicely with our capacity. We are the best in the world in large projects, harbor development. Looking at our railroads, it may not seem that way here, but it is true in major rail network development, aviation, communications in general. And those are where the greatest opportunities are going to be.

We think the trade agreement which we expect and hope will be approved by Congress by the first of the year will be a significant step in this process, and we think that in fact we are not only going to be in an equal position but have an advantage over our competitors for a while and we hope American corporations exploit it effectively.

The patent question—I might say just a few things about that, Mr. Chairman. The trade agreement does specifically cover that, as required by the Trade Act of 1974. In the trade agreement the Chinese and ourselves agree to extend reciprocal protection to each other. The Chinese are disadvantaged in the sense that they don't have a patent law yet. They have relied on a contract by contract basis for patent protection.

I think it is important to recognize that Western firms, and even American firms, traded heavily with China before normalization. There was a good deal of trade—almost a billion dollars both ways. We have no single case that I know of—I think the Department of

Commerce would hear about it—of patent infringements or patent difficulty in dealing with the Chinese to date, even in the absence of the trade agreement. So I think what the trade agreement does is enshrines what the Chinese have worked very hard to make that practice to be.

They have, for example, in an individual case put up a bond deposit to make sure that if there is a violation there is an immediate recourse to satisfaction. But the experience of the American firms has been very, very good in this regard and I think the trade agreement will nail it down once and for all.

I am sorry for taking so long but I was interested in your dialogue with the professors more than I was in my own presentation. It is very stimulating.

[The prepared statement of Hon. Kempton B. Jenkins follows:]

STATEMENT OF HON. KEMPTON B. JENKINS, DEPUTY ASSISTANT SECRETARY OF
COMMERCE FOR EAST-WEST TRADE

Mr. Chairman, I am pleased to appear before these subcommittees to offer the Commerce Department's cooperation in your review of technology transfer to China. You have recognized in establishing the agenda for these hearings, that the transfer of technology is not limited to scholarly exchanges, but goes to the heart of commercial and economic relations and ultimately affects political relationships. My statement will focus on the commercial transfer of technology to China, our competitive strengths and weaknesses in this area, and the impact of such transfers on our relations with the People's Republic of China and our competitiveness abroad.

Before I address the transfer of technology to China specifically, I would like to mention briefly some of the initiatives we have taken in recent months to ensure American technological leadership and improve our ability to meet foreign competition in sales of technology.

Our Nation has been the world leader in developing new products, new processes, and new technologies, and in ensuring their wide dissemination and use. We are still the world's leader. But we are encountering increased competition from abroad in both the development of new technologies and their commercial export.

Historically the private sector of the United States has established a competitive advantage and built a strong economy by advancing the state of the art of production processes and available products. This continues to be the only long-term answer to the intensified technology-based competition from other countries. It is this concern for the competitiveness of United States industry which inspired the President's recent Message to the Congress on Industrial Innovation. This nine-point program is an important first step in strengthening our domestic base for technological competition.

American ability to compete with other countries in the transfer of technology abroad has been addressed in both the comprehensive National Export Policy the President announced in September of last year and in the more recently proposed plan for the reorganization of the trade functions of the Executive Branch. Under the Export Policy we are working to reduce the barriers hindering U.S. exports and to create new incentives for expanded exports. These efforts will receive greater focus and force with the reorganization. The added concentration of policymaking, more timely and efficient administration of our trade laws, and strengthening our export promotion capabilities which this reorganization promises should enhance the confidence of the business community in pursuing export opportunities more aggressively.

We look forward to working even more closely with industry in meeting its needs. By consolidating policy implementation in the Commerce Department, the plan places under one roof the day-to-day handling of export promotion matters, MTN monitoring and implementation, industry sector analysis, export controls and import remedies. U.S. exporters will be able to avail themselves of several tools aimed at helping American industry sell U.S. products in foreign markets: a U.S. domestic commercial service, a Foreign Commercial Service, a Washington-based Trade Development Bureau, and a specialized East-West trade unit to deal with the complexities associated with trading in nonmarket economy countries such as China.

The establishment of diplomatic relations on January 11 opened a new vista for U.S.-China ties, heralding a relationship based for the first time on equality, mutual interest, and respect. These are also the principles upon which we are seeking to forge our commercial ties. We have made considerable progress this year toward removing the impediments built up over thirty years and developing a framework for the constructive trade ties we seek with China for the 1980's and beyond.

The Trade Agreement which is currently before the Congress is central to this process. We are at present the only major trading partner with which China does not have some form of trade agreement providing for reciprocal non-discriminatory treatment. The Trade Agreement will rectify this situation. China's commitment, in this context, to base its purchasing decisions on customary international trade practice and on commercial considerations such as price, quality, delivery and terms of payment is particularly important and should assure that U.S. firms are in a position to compete effectively with the firms of other countries.

Considerable benefits also will be derived from the Agreement's trade facilitation measures. These provisions are particularly important since it is in these areas that American and Chinese business trade practices have differed most. Of particular note are the provisions concerning patent and copyright protection, third country arbitration of commercial disputes, business offices, and financial transactions. Articles covering government trade offices and U.S. trade promotion activities will improve our ability to assist American firms to compete in this market. Inclusion of all these provisions in the Agreement should enable American companies to do business in China with added ease and confidence.

Based on the understanding reached in the Trade Agreement negotiations, we were able to conclude an Agreement on Trade Exhibitions, and are now in the process of planning for our first National Trade Exhibition in Beijing in November, 1980. Joining the Commerce Department in this endeavor will be the U.S. Department of Agriculture, displaying modern techniques in agricultural production, and the U.S. International Communication Agency, with an audio-visual presentation on "Creative America." In the industrial exhibition sponsored by the Commerce Department, American companies will be able to show their expertise in five industrial sectors receiving priority in China's modernization efforts: (1) agricultural machinery and farm equipment; (2) power generation and distribution equipment; (3) petroleum exploration and extraction equipment; (4) transportation equipment; and (5) textile machinery and equipment for production of consumer goods. It will be one of the largest exhibitions ever sponsored by the Commerce Department abroad.

If U.S. exporters are to be competitive with foreign exporters, then it is vital that the U.S. Government also provide appropriate export financing support. As you know, substantial export credits have already been extended to China by other nations. To meet this challenge, Vice President Mondale during his visit to China in August advised the Chinese that we are prepared to make available Eximbank credit arrangements of up to a total of \$2 billion over a 5-year period on a case-by-case basis, and are willing to consider additional credit arrangements as developments warrant. The importance of such Eximbank credits to the competitiveness of American products and technology cannot be overrated.

Another program we want to activate in support of our business in China is the guarantee system of the Overseas Private Investment Corporation. Making OPIC's program available for use in China can enhance not only the competitiveness of American technology, but also the security with which it is transferred. Steps have already been taken by the Administration and Congress toward this end.

We expect new trade opportunities to develop also as a result of a number of the protocols that have been concluded pursuant to the Agreement on Cooperation in Science and Technology. The Agreement on Hydropower and Water Conservancy offers particularly good prospects in this regard.

Taken together, these agreements and measures which I have outlined promise an improved climate and broader relationship in which trade and technological exchange can flourish.

This improvement in Sino-American relations comes at a time when China has shown renewed interest in using foreign trade to promote its own modernization. The long-range development program adopted last year calls for thorough-going modernization of China's agriculture and industry. The plan calls for an increase in the share of state investment in both agriculture and light industry. The goal is eventually to create a domestic production capacity in a wide range of industries, a goal which we consider realistic in light of China's varied and abundant natural resources. In the immediate future, however, high priority will continue to be given to coal, oil, electric power, transport communications, and building materials, since the slow progress of these sectors has acted as a brake on China's industrial growth.

Nonferrous metals also will be allocated considerable resources as they will not only meet growing domestic demand but also serve as a major source of export income.

Even the moderated development program will require large imports of capital goods and technology. China's imports are likely to grow by 65 percent this year to about \$17 billion, one-fifth of which will be for imports of technology and complete plants. Over the course of the 1979-1985 plan period, Chinese imports of technology and capital equipment and machinery should exceed \$40 billion.

These developments in Chinese foreign trade have been reflected in our own trade with China. U.S. exports of machinery, transport equipment, and instrumentation increased by 67 percent in 1978 to \$93 million. This year's total will be almost double that. Since the middle of last year, American companies have contracted to sell trucks, construction and roadbuilding equipment, mining equipment, machine tools, and aircraft to the People's Republic. They have also been awarded contracts and letters of intent for iron ore, copper and aluminum mines and processing facilities, and for chemical installations. The most successful area of U.S. manufactured exports to China over the years has been petroleum exploration, drilling, and production equipment. Last year drilling equipment and parts sales totalled \$46.5 million. American companies are currently involved in seismic exploration of petroleum deposits. The statistics cited above cover only the exports of products that embody technology and do not include the sales of licenses, plans, and know-how in other forms. For the future, we see good prospects not only in currently leading items, but also in hydroelectric power facilities, transport and communication equipment, and electronics and instrumentation.

In addition to purchasing complete plants and technology, China in the coming years will be purchasing increased quantities of industrial consumables and agricultural commodities. Total Chinese imports in the 7-year period between 1979 and 1985 could amount to some \$175 billion. Paying for this great expansion of imports will require a substantial increase in China's hard currency earnings.

A major drive is now underway in China to expand production of export products and to improve their quality and competitiveness in Western markets. About 85 percent of China's trade is with the non-communist countries. In addition to Japan and Hong Kong, the dynamic, modernizing nations on the rim of Asia—countries such as Singapore, Malaysia, the Philippines, Indonesia, and Thailand—serve as her principal markets. Demand for many of her principal exports—food products, crude materials, minerals, fossil fuels, and light industrial products will continue to grow. Tourism, overseas remittances, and PRC business activities in Hong Kong also will contribute to hard-currency earnings. Nevertheless, efforts to increase earnings will not be sufficient to cover costs in the short run, since a large quantity of capital goods required to implement the modernization plan must be imported over the next several years. To cover the difference between income and expenditures, China's foreign debt may grow to between \$15 billion and \$20 billion by 1985.

In light of this, China has begun to seek both official and private lines of credit. As of mid-1979, Beijing had reached major credit agreements with Western government credit agencies and private banks totalling some \$23 billion. It should be noted that almost none of these have so far been drawn upon. Private credits, primarily syndicated Eurodollar loans, account for 20-30 percent of the total. The focus of China's effort to secure lines of credit, however, has been directed toward official government sources. China has negotiated officially supported export credits with France for \$7 billion, Great Britain for \$5 billion, Canada for \$1.9 billion, and Italy for \$1 billion. In addition, Japan and China have agreed to an untied \$2 billion resource development loan, and most recently, China has approached Japan for \$3.5 billion in aid loans to finance nine development projects.

At the same time that China is pursuing these credit possibilities, she has begun experimenting in new types of business ventures, such as export processing projects, compensation trade, and joint ventures, to attract additional foreign exchange or to reduce cash outflows. With the joint venture law adopted this past summer, negotiations on a variety of projects, involving from 25 percent to 100 percent foreign investment, have gained momentum. The recently established China International Trust and Investment Company is vigorously seeking to attract venture capital and facilitate direct investment in China's economy. These various measures taken together fairly well assure that China will have available the resources to acquire the technology and capital equipment needed for her modernization.

Financial considerations, however, will not be the sole constraint on China's ability to acquire technology or on our competitiveness to supply it. Other important constraints on China's ability to absorb technology include infrastructure bottlenecks, trained manpower limitations, and the general level of technological sophistication. The human element, as always, will be foremost. In this regard, the posting

of thousands of topflight students abroad has received most publicity. Equally important have been other measures to upgrade education and scientific research. An 8-year science plan was issued last year, and priority research areas were identified. One objective of the plan is to build a force of 800,000 scientists and technicians by 1985. These measures include the restoration of postgraduate study, the reopening and establishment of 169 specialized colleges, and the establishment of cooperation programs with foreign institutions.

We are pleased that four of the protocols entered into between the United States and the People's Republic of China pursuant to the Agreement on Cooperation in Science and Technology signed by President Carter on January 31, 1979, involve agencies of the Commerce Department. The success of the Chinese in improving their technological capability is critical to the success of our long-term economic relationship with them. A sophisticated technological infrastructure, a growing economy, and an ability to manage industrial change are all necessary if our two economies are to be sufficiently compatible to assure a sound trading relationship.

American competitiveness abroad rests on our prolific agriculture and our technological leadership. Both are highly respected and sought after by the Chinese. And in selling to China, we should not be deterred by a nebulous fear of creating a monstrous competitor for our domestic and foreign markets. Such a fear is justified only if we do nothing to maintain our long technological lead, if we do not take advantage of our earnings from these sales to further improve our technology, and if we abdicate from an aggressive development of world markets. In sum, our policies regarding technology transfer to China must not be grounded in fear of competition from others, but rather in a concern for the ability of our industry to remain at the forefront of technological innovation and commercial competitiveness. This is the mission of our programs for industrial innovation and export expansion.

Trade is the cement of many relationships. The trade we build up with China today and the technological cooperation we succeed in establishing, will redound positively not only to our trade account, but also our political relationship with the most populous nation of the world.

Mr. ERTEL. I am not sure if that was stimulating or not, but we appreciate your comment.

Ms. Schwartzman, you had something that you wanted to add to Mr. Jenkins' statement?

Ms. SCHWARTZMAN. Yes. Our emphasis today basically is on fostering US-Chinese trade, but I do want to add a few words on an important aspect of the subject, which is export controls.

The Office of Export Administration in the Commerce Department Bureau of Trade Regulations administers export controls for three purposes: national security, foreign policy, and short supply. The national security controls have a particular impact on the subject of today's hearing, and I will limit my remarks to those.

It is important to note that the Department of Commerce administers only one category of national security export controls—those which cover dual-use items having both civilian and significant potential military applications, along with technical data relating to those items. Therefore, my remarks do not apply to two other categories of export controls: The Department of State has primary responsibility for military items which are on the munitions list, and the Nuclear Regulatory Commission and the Energy Department have primary responsibility for certain nuclear related items.

I believe that you are generally familiar with the export control process, so I do not intend to describe it in detail, but I will, of course answer any questions that you might wish to ask about it.

I would like instead to turn right away to some specific points that I understand are of concern to the subcommittees. First, your staff asked whether the United States imposes more obstacles to trade with China than do our Western competitors.

The answer is that we have no particular barriers directed at China, but on the other hand, we do have certain export controls, not specifically aimed at China, which are more stringent than those of our Western competitors.

The vast majority of items on the control list are controlled in conjunction with our partners in CoCom. I believe you are familiar with CoCom. It is a group composed of the NATO countries less Iceland, plus Japan. In addition to that large joint list, we control unilaterally about 38 commodities on the national security control list. Most of these are there because they are items that are uniquely available in the United States.

There is also another important category of exports which we control but some of our CoCom partners do not. Our CoCom partners control technical data only to the extent that it is related to items on the CoCom lists. We, however, unilaterally control certain technical data in the form of unpublished information whether or not it is related to the CoCom-controlled items.

In this connection, I would like to note that under the Export Administration Act of 1979, the focus of export controls is intended to go more and more toward the control of technologies. Indeed, under the new Act the control list will eventually be focussed on critical technologies, a concept which, I believe, is familiar to you.

A list of such technologies is due to be published by the Defense Department in initial form by October 1, 1980. There will undoubtedly be some problems in implementing the critical technology concept fully in the export control context, but we hope that ultimately the result will be that many products will be able to be exported more freely at the same time our critical technological superiority is maintained.

Your staff also asked about any particular policy we might have on licensing goods and technology to China. For export licensing purposes, China is in the same country group with the Soviet Union and several other communist countries. The list of controlled items is the same for all of these countries.

We attempt to apply our controls to all these countries in a consistent manner. The controls are administered on a case by case basis and applications are approved or denied as the Export Administration Act provides:

... to the extent necessary—

(A) to restrict the export of goods and technology which would make a significant contribution to the military potential of any other country or combination of countries which would prove detrimental to the national security of the United States.

That is a quote from the statute.

In assessing each case, we consider the character of the technology involved and its normal use in the United States and the receiving country, the end use, the particular end user, the risk of diversion to military use, the possibility that advanced or unique technology of strategic significance could be extracted, the commercial significance of the export to the United States, and similar problems.

Our assessment of these issues might lead us to approve or deny an item for one end user but not for another, even in the same country. Thus, on a case by case basis, we may approve or deny the sale of items to one country without setting a precedent for sale of

the same item to another country, or even for the sale of the same item to the same country under different circumstances.

Finally, I want to share briefly with you a few of the things that we are doing to streamline the export control process and thereby to foster exports when they are found to be in the national interest.

One thing that our licensing officers routinely try to do when they can't approve a case in the form proposed is to suggest modifications which would allow the export to be approved. We have long done this as an administrative practice, and it is now required by law for cases submitted on or after October 1, 1979. This sometimes enables an exporter to redesign or reconfigure an originally unexportable system into one that can be approved.

Beginning next July 1, there will be statutory time limits on processing time for applications that we and our consulting agencies can take.

Mr. ERTEL. May I interrupt you?

Ms. SCHWARTZMAN. Sure.

Mr. ERTEL. I am curious about this modification of the design feature.

Ms. SCHWARTZMAN. Yes sir.

Mr. ERTEL. You tell a firm we will not give you an export license on x because it might violate the Export Act, because it can be used for military purposes within a country. Therefore, modify it, and we assume that the firm goes back and modifies it and then comes back and gets permission to export.

No. 1, that drives the firm crazy with that kind of thing but second, if we can modify it, to put it in a condition which is exportable, obviously the country that gets it, if they have got the same or at least nearly the same technical capability we have, can reconvert it back to the same thing it was originally.

Now, if that is true, what have we gained?

Ms. SCHWARTZMAN. Well, not necessarily. The way that this often arises is, for example, in designing computer systems. We will get an application that describes a system which could not be legally exported. Our licensing officers however will often be able to point out that, the company could design out a certain component, or could replace it with a component of lesser power, or whatever the problem is, and then we could permit that export to go. That is the kind of redesign that is involved that would merely be replacing an offensive component, for example.

Mr. JENKINS. An offensive component is one they don't have and don't have the capacity to make and it is precisely for that reason that we would make this modification, and that means ipso facto they cannot reengineer and overcome that problem on their own. This is a practice which has been going on, as Robin has pointed out, for sometime, and I think—

Mr. ERTEL. They cannot in fact replace that component?

Mr. JENKINS. In this case, we have to rely on the technological judgment available within this country, and that is where the Defense Department plays its principal role.

Ms. SCHWARTZMAN. Also, Commerce plays a very substantial role there. I should point out that in these cases, as in every case, availability from other sources plays a critical role. If they could

provide that component, if we limit it to components, if they could obtain that component, either through domestic production or through purchasing it from a foreign source which is not a member of CoCom, so that it would be available, we would not be controlling it in all likelihood in the first place. So the one they could obtain or produce themselves is not the one that has been offensive to us, it is the one that we have which is uniquely available in a CoCom country which we would not wish to let go.

Mr. ERTEL. I understand what you are saying.

Ms. SCHWARTZMAN. In fact, you point out—

Mr. ERTEL. The theory of what you say is correct. The question, of course, is always the practice. Whether or not that falls through into practical judgments, of course judgments are always subject to different interpretations. That is a value judgment and technological judgment.

Ms. SCHWARTZMAN. That is true. Of course, it should be pointed out, as you indicated, that sometimes this process is a very time-consuming one. The only thing to keep in mind here is that the alternative is a flat turndown. We don't try to negotiate down something that we would ultimately approve.

When we suggest a different configuration, the alternative would be simply rejecting the export.

Mr. ERTEL. Thank you. You may continue. I am sorry to interrupt you.

Ms. SCHWARTZMAN. I was nearly finished anyway. As a matter of fact, I was simply, I believe, pointing out that there will be statutory time limits beginning on July 1, on the amount of time we can take to process applications. In fact, even before those were imposed we had begun to implement some new administrative procedures. For example, we are putting in place a computerized application tracking capability which we hope and expect will help us to process cases more rapidly. We are running at a rate of about 80,000 total cases a year now and about 280 validated license cases a day, so there is an immense job to be done merely in keeping track of all of them and moving all of the paper. We are working very hard on that.

The final point that I want to make is that the new Export Administration Act does contain very strict provisions regarding foreign availability. This is the point we were getting into a little while ago. Under the Export Administration Act of 1979 there can be no controls in the face of availability in fact from non-CoCom foreign sources, unless the President determines that the absence of controls would be detrimental to the national security.

If he makes that determination, we have to publish that determination and its basis and its estimated economic impact on the United States. We are now working very hard to get a capability into the Office of Export Administration to have continuous access to the constant flow of up to date information on foreign availability that will be required so that we can properly implement that requirement.

I would like to stop there and answer any questions that you might like to raise.

Mr. ERTEL. Thank you very much for your statement and your help on the issues.

I did want to ask Mr. Jenkins a couple of questions, if I might, and possibly return to you.

I think on page 5 of your testimony you indicated the United States wants to remain competitive with foreign exporters, and you have indicated that we have gotten \$2 billion in Eximbank credits available. My understanding is France has negotiated export credits of \$7 billion with China, Great Britain has \$5 billion worth of credits with China——

Mr. JENKINS. My answer is we would like the figure to be bigger. There is a budget constraint.

Mr. ERTEL. Have we lost our competitive advantage right off the bat?

Mr. JENKINS. No; not right off the bat, but I think if this situation were allowed to continue for 4 or 5 years and the Chinese begin to draw these credits down, we could find ourselves unable to compete. There is no reason to assume—in fact I would assume the contrary—that that \$2 billion figure is upper limit, it is an initial commitment to the Chinese of the existing Exim authority over a given time frame and my hope would be that as our trade prospers, and I hope it will, particularly with the nonmarket economies, but with all of them, that the Exim Bank authority will be increased.

I frankly feel that we have been much too tight on constraints—the history of the activities of the Bank make that understandable. There were times when the Bank seemed to be going off without any control or oversight by Congress and the pendulum has swung back and it is now very tightly controlled.

Now, we also have additional concern of OMB, which as of 3 years ago, factored Exim authorization into our national budget and that has added another constriction to a tight budget situation. The Exim Bank is feeling that squeeze as everyone else is, I think.

Mr. ERTEL. Other people have problems with OMB as well.

Mr. JENKINS. I know we are not unique in that regard.

Mr. ERTEL. Going back to the question I had asked you earlier, and I believe Dr. Fingar indicated there would be a substantial period of time before the Chinese would be in the export market specifically with the types of goods that we might want, other than textiles. You said they had certain minerals that could be developed. You went back to bauxite or alumina, that is one?

Mr. JENKINS. Yes.

Mr. ERTEL. Do they have any others on-stream which will be able to be used for foreign exchange purposes?

Second, do they have a transport capability of moving those raw material products to the marketplace?

Mr. JENKINS. In the first instance, Mr. Chairman, there are other things that we specifically are interested in: copper, rare earths, titanium, tin and the other metals, the entire family of metals, really. But more importantly, the range of resources which they have available, they have excellent export possibilities to the hard currency world. It is not critical as I understand it, that they sell things to us in order to buy from us, but they have to sell it to Thailand, Tokyo, or Japan or some places.

Mr. ERTEL. They also have to have an ability to deliver that. The ability to produce them, and they have to have that ability within a relatively short period of time.

Mr. JENKINS. The second part of your questions is the communications network. They have a bottleneck there, there is no question about that. However, they do have a communications network. When I was talking to the vice president of a major American aluminum company about his projects, and the most way-out project of all, the biggest and most exciting in many regards, is out in Xinjiang, the western part of the country. It looks to me like nobody had ever been there before from the map—I haven't been in that part of China myself—but they said, no, there is an existing rail line there now, it is not in very good shape, but it is in good enough shape to do work that is being done today.

That rail line will have to be modernized. However, the time that is involved here for them to get that new project on line, they will have ample time to modernize the rail connection as well.

There is a lot of business in China in modernizing their communications network. They have made a decision to expand the resources to do that and our assumption is from what we know about the problem, that it is feasible to do that modernization in synchronization with the development of these resources.

Mr. ERTEL. If I may turn to another area which is something of interest to me, is the fact that we have been talking about exchanges and mainly scientific exchanges. Within those areas of exchange, have the Chinese indicated that they want any major input from us as far as management techniques and management personnel. Although that is not typically called science, I think it is a means of implementing a resource into development.

I know you said that we were talking about an institute in Hong Kong, or something of the sort. Have they sent people here specifically to study American management techniques?

Mr. JENKINS. The short answer is, "yes." If I may, I would like to call on Ted Schell, who is Assistant to Assistant Secretary for Science and Technology Jordon Baruch, who has been in charge of management contacts with China. He was there with Secretary Kreps and is going back to China next week. If I may ask Ted Schell.

Mr. SCHELL. One of the agreements signed with the Chinese during Secretary Kreps visit there, as I think Dr. Baruch testified this past spring, was an agreement on the management of science and technology and the exchange of scientific and technical information.

In negotiating the agreement, it was understood, and it is embodied within the agreement itself, that the major emphasis will be upon the management of industrial science and technology, upon which we will work with the Chinese over the first several years of the agreement, primarily to assist them in the development of their capabilities to manage the development of new technologies and the introduction of technologies from other countries into their industrial capability.

When we deal with this subject, we are defining it really as being management of science and technology as it affects the entire innovation continuum ranging from research and development, to the ability to successfully integrate new products and processes into production, and then to see their commercialization, realizing

that there has to be a recurring feedback from perceptions of market opportunity into the design and so forth.

Now, with regard to the level of interaction between the two countries, which has taken place since the signing of the agreement, I think we should look both within the context of that agreement and externally to some of the other activities.

In the context of the agreement itself, we will be bringing a delegation of management experts to China shortly after Thanksgiving where we will deal with conceptional and theoretical questions regarding management looking specifically at aspects of the U.S. management system and their applicability to the Chinese and at particular Chinese concerns with regard to management.

We will go beyond that to then define the specific exchanges which will take place in terms of personnel traveling back and forth, working with the Chinese to establish courses, etc. Some ideas which have been developed, could lead to our working on arrangements which would assist the Chinese—where we would bring people over to the United States who would return to China for the purpose of establishing, and then staffing schools of management within China.

We have been pursuing our activities in the management area with the State Scientific and Technology Commission, and the State Economic Commission of China. Some of the industrial ministries themselves have also expressed interest in the area of management. That has been manifested in recent visits. I think the State Economic Commission is currently traveling in China with one of their primary purposes being to learn about U.S. management practices and U.S. management techniques in a variety of industries, and I believe that under the Scholarly Exchange Agreement we look toward also expanding our activities with China in the management area.

I should go back to next week for the coming visit of our management delegation to China to say that one of the objectives which we have is to see on a government to government basis, an integration of all the activities which are going on in the management area, so that we can realize the most efficacious use of our resources, we would hope also to go beyond that to address what is one of the fundamental concerns which we have with regard to Chinese management, which is the division of responsibilities within China for aspects of economic and industrial development.

Mr. ERTEL. Thank you very much for a very comprehensive answer.

Mr. Brown, have you any questions?

Mr. BROWN. No questions.

Mr. ERTEL. Mr. Scoville?

Mr. SCOVILLE. Thank you, Mr. Chairman.

I have just one very brief question on this subject of evenhandedness that was raised earlier. That is, that certainly over the last couple of years our trade relationships with the Soviet Union has been in part affected by criteria of human rights, the whole issue of dissidents, for better and for worse.

My question is because there have been occasional reports of harassment of political dissidents, to what extent is or will the administration apply the same human rights criteria to its trade

with China as we have to the Soviet Union? I was curious about that, the administration policy relative to China on human rights and trade.

Mr. JENKINS. I appreciate your question. This is a question the State Department is responsible for dealing with, and in testimony before the Ways and Means Committee 2 weeks ago, Deputy Secretary of State Warren Christopher dealt with this at some length.

I think it is important to point out that under the Trade Act of 1974 there is no fundamental requirement for human rights considerations per se. The Jackson-Vanik amendment deals with emigration policy. On the trade agreement with China, which is now before both Houses, it is required that the President find that the emigration policies of China are consistent with the objectives of the Jackson-Vanik amendment, namely, free emigration.

The Chinese have in a number of conversations with us, emphasized that emigration is not restricted in the sense that we are concerned about, and in fact, Deng Xiaoping in public statements in this country, said that he would be willing to guarantee the emigration of anybody from China who wants to come to the United States or elsewhere and, furthermore, teased Scoop Jackson, Senator Jackson, by saying, "Senator, if you are concerned about the emigration of Chinese, I can have 10 million in Seattle on Monday morning, and that is the first shipment." Jackson told me that story himself, so I am sure it is not just a press account.

We do not find in submitting his request for a waiver—the President emphasized this—that there is any violation of the Jackson-Vanik amendment posed by Chinese emigration practices, namely, that the President is assured that the Chinese practice is either in conformity with or tending toward the objectives of the Jackson-Vanik amendment.

Mr. ERTEL. Thank you very much, Mr. Jenkins. Since we are running behind, I would appreciate it if you would respond if we take the privilege of sending you written questions?

Mr. JENKINS. With pleasure. Thank you for having us here.

Mr. ERTEL. Thank you very much for your testimony.

Our next witness is Mr. Robert L. Ramsey, director of International Marketing, Washington office, Bell Helicopter Textron.

I do not believe we have a prepared statement from you, so we are looking forward to hearing your statement in its entirety.

STATEMENT OF ROBERT L. RAMSEY, DIRECTOR, INTERNATIONAL MARKETING, WASHINGTON OFFICE, BELL HELICOPTER TEXTRON

Mr. RAMSEY. No; I do not have a prepared statement. I think the prepared statement to be made by an industry representative would be so long that probably we would be in trouble.

My understanding of what we are interested in is what industry up to this point, in terms of normalization has been able to accomplish with the People's Republic of China. We do have a program, an ongoing valid actual program with China. We do have at our plant at this time approximately 16 Chinese, which answers one of the questions of management techniques, and so forth, that was just raised.

We recently had a visit of 12 Chinese which resulted in a memorandum of understanding between our company and the Chinese Government representatives.

Mr. ERTEL. May I inquire, a memorandum of understanding in regard to what?

Mr. RAMSEY. I will explain that.

Mr. ERTEL. All right.

Mr. RAMSEY. We have a program for a purchase of 8 helicopters off the shelf approved by the U.S. Government and an option for 16 additional helicopters. Of the 8 original helicopters, 4 have already been accepted by the Chinese Government, 4 will be delivered by the end of December, and an option remains for 16 additional off the shelf buy helicopters.

The memorandum of understanding involves the basic understanding and agreement which we hope to reach for a coproduction, not joint venture, in China, to produce the various phases and degrees of production over a 5-year period of two of our helicopter types.

The helicopters that have been sold to date go back to, again, the mineral problems or questions that have been raised. They are to be used for geophysical survey type seismic surveys and so forth. It is purely a commercial FAA certified piece of equipment, as would the coproduction equipment be if it is finally approved by the U.S. Government.

We have no outstanding problems at this time. I guess if we had a problem I would have to go back to the lady from export control or Export Administration, and I agree with her statement completely that if they know they are ultimately going to approve a program, they are not really going to throw any roadblocks in it.

In 1973, we made our first contacts, late 1973 and early 1974, with the Chinese. We spent an awful lot of time and a lot of money because of normalization. In the interim, the Germans moved in and sold some helicopters, the French tried very hard to. Finally, after their own political problems, which delayed things for awhile, we did get our foot back in the door, and because of one small radio in our helicopters, we were delayed about 8 months in our attempt to get a U.S. Government license approval.

This delay, although it is very small in Government figures, cost us about a \$7 to \$10 million advance of money because we could not get U.S. Government approval to export our helicopters, although the helicopter itself was a general destination licensed piece of equipment, it did not require a validated license.

There was one high frequency radio which was required by the Chinese, which was a CoCom item, and as a result, we were about 8 months—we knew that we were going to get it approved but the Chinese did not know this.

I can't say that we have not had anything but assistance out of the Department of Commerce in our program. Mr. William Clark over in Commerce has been most helpful. He is no longer there. But our program as we see it, is moving along. We think that it has a great potential.

We have inspected the plant at Harbin. They, the Chinese, have built Russian helicopters in that factory, so they have the capability. There is, of course, some advance in technology that we feel

that we have the leg up, if you will, on a helicopter program, which we envision to be approximately 1,000 units ultimately. This goes back to your communications problems in-country. Certainly the helicopter is not a railroad but it will assist in the communications of the country.

But on the other hand, I think that we feel, I know that my own friends in industry feel that we cannot wave the flag, put out beautiful pamphlets from U.S. Government on how to do business with China, very nice, very good, very instructive, and say go get them boys, and then when you come down to push and shove, have to wait 8, 10, 12 months, while our competitors with equal technology, in some cases better which we will admit, move in and take over the marketplace.

Although we have a program, ongoing program, we, Bell Helicopter, by our own admission in fact are the largest helicopter manufacturer in the world. We have our helicopters in over 100 countries of the world, and we feel that we have a going situation within China, that with U.S. Government backing, and not just the backing for political purposes, if you will, but actual in fact performance, that we can capture that market over there.

If we do not have that, the French and the Germans, British, will take it over. I don't believe the Russians will because I don't believe they have the technology that we have to offer.

Again, though, from the operations that we have had since 1974, within Commerce, we have had no problems other than the delay between the time that you are more or less told to go and instructed to go, and then as for now, for example, we have a commitment from Bell to the Chinese Government that we will try to respond to them in a positive manner by December, and I know as well as I am sitting here that there is no way within the Department of Commerce we are going to have approval to respond by December. That was their request and we are going to attempt to do it.

I had no prepared statement, as I indicated as much, but we do have a good program an ongoing program, and we have had help from Commerce, we have had help from other Government agencies, and we appreciate the help, but we are to the point now that I think maybe other companies are also, that the door is going to be closed a little bit on us if we don't respond from a U.S. Government standpoint, of, yes, we really mean what we say, we really mean what we are promising.

Mr. ERTEL. As I understand it, you are going into a coproduction, as you testified, on certain type helicopters?

Mr. RAMSEY. Yes, sir.

Mr. ERTEL. Have you had any problems in negotiating that and have you had any problems in particular with the legal system as set up for the protection of what may be patent rights which you would have, or other proprietary rights?

Mr. RAMSEY. We have not up to this point. We have had many, many details to work out, of course. We have established pricing. Generally that has been accepted. We have stated our requirements. We are not new at this game, as are many of the industry people are not new to it. We do have coproduction facilities. We have had them in Germany, we have had them in Taiwan. We

have a licensee in Italy. We have a licensee in Japan. We have a licensee in England.

Mr. ERTEL. All of those are Western type countries, Western type systems?

Mr. RAMSEY. I don't know if any of them are any more unstable than Italy.

Mr. ERTEL. We are not talking about stability. I am talking about a legal system which is somewhat different, at least conceptually. We understand the legal system and legal protection you get in those countries. I want to know the answer, if the legal system problems that you would encounter in China would be a detriment?

Mr. RAMSEY. Well, we do not see it at the moment. I think as Secretary Jenkins said, the United States presented a paper or a proposal or a document of some 200 pages and the Chinese presented a position in four or five pages. I think that is what we have found in talking to them.

In our inquiries to people who have dealt with them, and we understand the fact that many, many things are done the way we used to do it years ago, it is by gentleman's agreement and handshake. We are going to have to face up to that as a company and we understand that. But so far at this point, we have not had any problems. We have had agreements on reserving our rights, there has been discussion on third country ultimately, third country distribution of that equipment.

Of course, that is a different ball of wax. That will be another U.S. Government decision, when the times comes, as it was with us in Iran. We have had questions and we feel to our benefit at this point, solved as to the guarantee of the use of the technology and the patent rights and so forth. So at this point in time, we feel confident that we have a good program.

Mr. ERTEL. You indicated that the factory that you are probably going to do the coproduction in was formerly for the production of what, Soviet type helicopters?

Mr. RAMSEY. Yes.

Mr. ERTEL. I understand the Soviet Union and the Chinese have had some problems—more than that, I guess. How long has it been since they have used that facility for the development and production of helicopters?

Mr. RAMSEY. They are still using it.

Mr. ERTEL. They are still producing the same type helicopters?

Mr. RAMSEY. Yes sir.

Mr. ERTEL. What happened with their coproduction arrangement? If they had the same type of arrangement with the Soviet Union, what happened to that with the rupture of the friendly ties between Soviet Union and China? What implications does that have if there were a rupture of relationships with the United States and China?

Mr. RAMSEY. Well, they have quite a large inventory of Russian helicopters. The plant is geared to produce or coproduce Russian helicopters and I am sure that even if the whole situation would rupture immediately there would still be a rather long time activity to maintain the inventory of helicopters that they have.

I think the reason that very simply they want to proceed not necessarily with the United States, but with the French, or the Germans, is their thrust to get into the Western orbit and to build their technology, which I think that is very clearly indicated that they feel is more compatible with their future than probably the line that they have been going.

I guess you could relate that to what happened to us and other people in Iran, and we didn't do badly there. The Iranians are in trouble because they have over 2,000 almost of our helicopters and they are not going to be able to be supported now, and so forth. So if you structure it correctly as a company you shouldn't be in trouble.

Mr. ERTEL. I guess maybe I wasn't clear in my question. There is a rupture in Soviet-Chinese relationships, at least on friendly terms, the production in that plant that you are going into, with the Soviets was a coproduction facility as well?

Mr. RAMSEY. Yes sir.

Mr. ERTEL. As a result of governmental rupture what happened in regard to that plant and the production commercially of those helicopters? When the basic breakup took place, what happened to that structure there and how did the Soviets come out of that as regards their input and their investment there, and what if any implications would that have with American firms who enter into coproduction facilities in China? What lessons do we learn from that, if any? Are there any to be learned?

Mr. RAMSEY. Well, I understand your question and, as I said, there is still activity in the plant. I think there will continue to be activity in the plant. There will be certain components and so forth which were available to the Chinese from Russia that undoubtedly will no longer be available.

Now, I think the Chinese would have to produce those. What it did to the Russian company, it did. Government, for example, that is involved in that, I have no way of knowing. I can only say that from our standpoint, in going in there, that we realize, we would be in the same position as we were when we went into Iran, where we had a coproduction program to produce 400 helicopters at the time that the floor fell out from under us over there. But we were structured in such a manner that except for 10 more years of production capability that would have accrued to us, we lost that, but as far as actual monetary loss, we didn't take that much of a loss.

In other words, again I think, although it was a coproduction program, you can look at Egypt and see the hundreds of airplanes and equipment and so forth sitting down there that when the Egyptian-Russian situation ruptured they were indeed in bad shape. They have established AOI, which is an industry jointly funded, but because of other political problems, that maybe isn't going to be, and the United States is probably going to bail it out ultimately.

So I guess that we hang our hat on it and that is why we say that we have had help from the U.S. Government and we are getting it today. I just wish it wouldn't take so long.

Mr. ERTEL. Mr. Brown, have you any questions?

Mr. BROWN. Let me see if I can just elucidate a little more explanation here, because frankly, I don't understand the way you operate. I don't understand what you mean by the term coproduction, although I am sure you have had lots of experience with it. Let me assume that it means that you license the production over there in the plant that you have indicated and you provide certain management personnel. Do you provide any components, fuselage, motors, engines, rotors, anything of that sort, or are they all produced locally? What do each of the parties, in other words, contribute to the coproduction?

It seems to me that this is a very valuable prototype of how to transfer technology and I need to know a little bit about how it works.

Mr. RAMSEY. All right, sir. As we are proposing now, we will set up in five stages—we have sold 8 helicopters and we will sell 16 more off the shelf.

Mr. BROWN. Phase 1.

Mr. RAMSEY. Four of those have already been delivered. Four more will be delivered by the end of December, phase 1.

We have Chinese people in our plant, also phase 1.

Mr. BROWN. Those are technical people?

Mr. RAMSEY. Yes, user people, FAA equivalent people and so forth.

That will be increased as time goes on. We will break down 10 helicopters, break them down and put them in boxes and ship them. They will go into the plant. Our people will be there. Their people who have been in our plant will be there. Those helicopters will be assembled. Then we have four phases that break out into helicopter panels, helicopters skids, communications, wiring, bundle wiring, the actual radios, the actual components, will come from us, but as we move along over the 5-year period, gradually they will pick up a phase of each of this, up to the point that we will not release the full technology on our gears and transmission cases, and so forth. we will still retain that.

Mr. BROWN. But that means then that they will acquire a capability to produce at that plant those items that you mentioned but we can continue to supply from here the other items, the gears and gear boxes?

Mr. RAMSEY. The main technology items, we will do that. That is why I said coproduction and not joint venture. Joint venture means that Bell Textron is going to lay in a pile of money on the table of cold hard cash, and we are going to get together and build helicopters. That isn't what we are going to do. We are going to supply management. We are going to supply our technology to the extent that we are allowed to, and we are going to let them build the helicopters. They are going to become an outlet for Bell helicopters in China, and to the extent that the U.S. Government allows, they are going to become an outlet for Third World countries, for third party countries.

Mr. BROWN. That seems to be an arrangement which protects both sides and is mutually beneficial?

Mr. RAMSEY. Absolutely. And in turn, we will buy back to an agreed position, parts that they may manufacture which meet our standards and meet our FAA standards.

Mr. BROWN. They provide the capital for all of the local plant necessary to do the work that they are going to do under the agreement?

Mr. RAMSEY. And they will pay for the tooling and so forth necessary to move into that plant to build our particular helicopter.

Mr. BROWN. Now I understand it much better. Thank you.

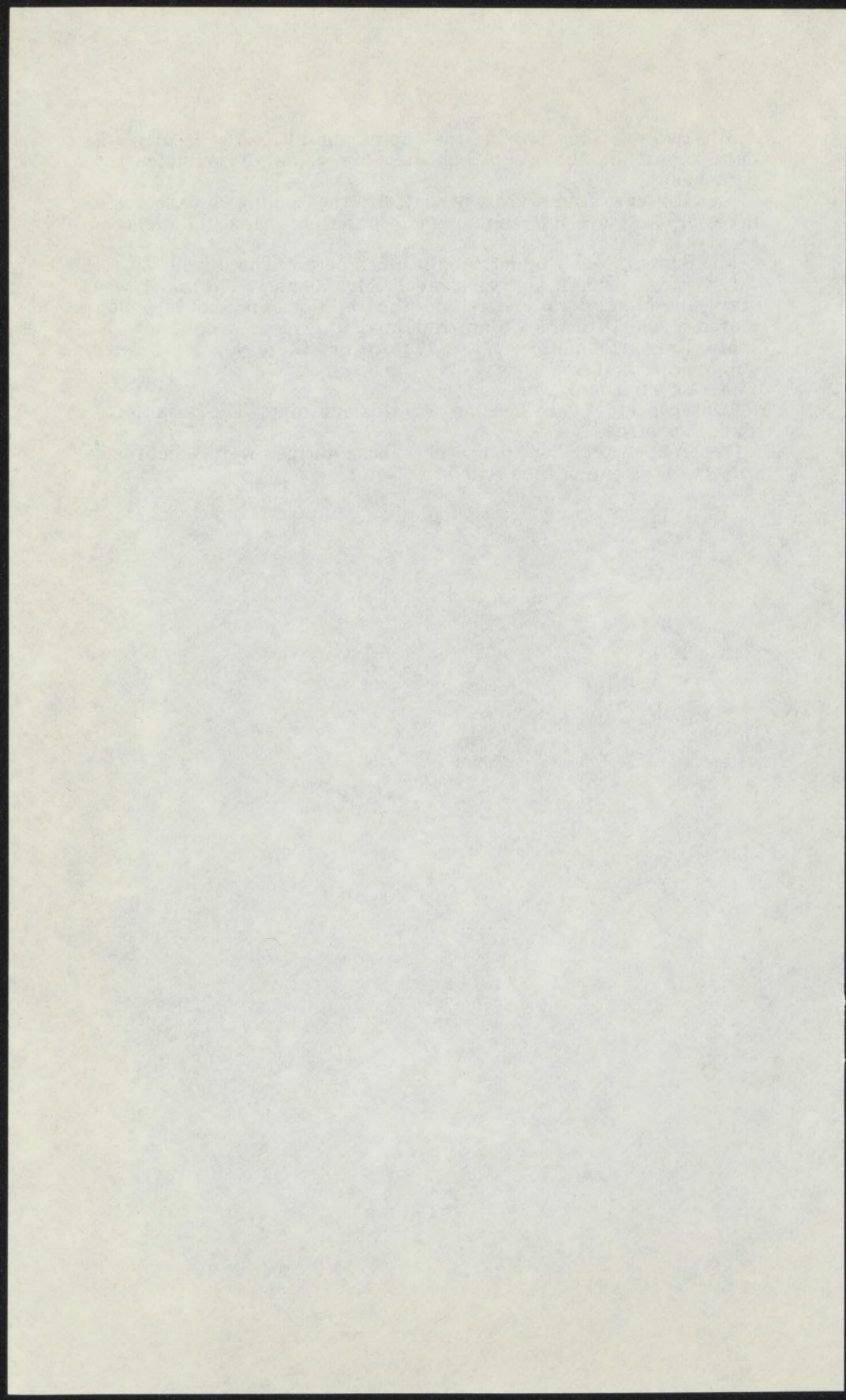
Mr. ERTEL. Thank you very much, Mr. Ramsey. I think it was very enlightening to understand the relationship and how you moved ahead with the China trade and to give us insight into it.

Mr. RAMSEY. Thank you, sir. We are not there yet but we are still kicking at it.

Mr. ERTEL. Thank you.

That concludes our hearing for this morning. The task force stands adjourned.

[Whereupon, at 12:30 p.m., the subcommittees were adjourned, subject to the call of the Chair.]



TECHNOLOGY TRANSFER TO CHINA

THURSDAY, NOVEMBER 15, 1979

HOUSE OF REPRESENTATIVES,
COMMITTEE ON SCIENCE AND TECHNOLOGY,
SUBCOMMITTEE ON INVESTIGATIONS AND OVERSIGHT,
Washington, D.C.

The subcommittee convened, pursuant to notice, at 9:30 a.m., in room 2325, Rayburn House Office Building, Hon. Jim Lloyd (chairman of the subcommittee) presiding.

Mr. LLOYD. The issue of our technological trade with China is part of a broader and very important issue—that is, our overall policy toward our balance of trade.

Currently, we are experiencing something on the order of a \$30 billion balance-of-trade deficit. This deficit is one of the prime factors fueling our rapid inflation rate.

Obviously, there is room for improvement.

The Congress needs to carefully scrutinize the current policy of the United States in the international marketplace to determine what improvements can be made in our overall competitive posture in technological trade.

The United States no longer enjoys the monopoly it issued to in the world marketplace, and, in fact, the character of the marketplace itself has changed. It is no longer free in the traditional sense of the word.

Our businessmen now find themselves competing against government-supported industries in Japan and Western Europe, and out-right cartels such as OPEC. The traditional rules of laissez-faire no longer apply, yet I am not certain that our Government has recognized this fact.

My subcommittee first became aware of this when we visited Mexico last spring. We observed firsthand the Japanese and Western European penetration of the Mexican oil market while our businessmen became more and more frustrated by the lack of support given them by their own U.S. Government.

Now, we are finding the same situation in the People's Republic of China. Again, our government-supported industries from Japan, France, and Germany are underbidding the U.S. firms, extending credit to China, cutting through bureaucratic redtape and generally beating us to the punch.

The irony is that the Chinese are bending over backward to do business with the United States for political as well as economic reasons. They have indicated to us, for example, that China, as well as the United States has huge coal deposits and that they need technology to convert this coal into clean, efficient fuel.

This is just one example of many areas where United States/China technological trade would be extremely beneficial to both countries. Yet, our Government does not seem to be taking full advantage of these opportunities.

I am hopeful that these hearings will enable us to better understand what the problems are with our current policy toward technological trade with China and how we might solve these problems.

Before commencing, I would like to ask the gentleman from California if he has any opening remarks.

Mr. BROWN. I'll pass.

Mr. LLOYD. In that case, our first witness is Dr. Robert A. Frosch, Administrator, National Aeronautics and Space Administration.

Dr. Frosch, thank you for sharing your morning with us.

Dr. FROSCHE. Thank you, Mr. Chairman.

[The biographical sketch of Dr. Frosch follows:]



Washington, D.C.
20546

Biographical Data

August 1977

DR. ROBERT A. FROSCH
Administrator, NASA

Dr. Robert A. Frosch was nominated by the President May 23, 1977, to become Administrator of the National Aeronautics and Space Administration. He is the fifth man to head the nation's civilian space agency. Dr. Frosch took his oath as head of the agency and entered the new post June 21, 1977.

Until he was chosen to head NASA, he was Associate Director for Applied Oceanography at Woods Hole Oceanographic Institution from 1975, continuing in that position until mid-1977.

From 1966 to 1973 Dr. Frosch was Assistant Secretary of the Navy for research and development. He served as Assistant Executive Director of the United Nations Environment Program from 1973 until 1975.

From 1963 to 1965 Dr. Frosch was director of nuclear test detection at the Defense Department's Advanced Research Projects Agency (ARPA) and from 1965 to 1966 he was Deputy Director of ARPA.

He was born May 22, 1928 in New York City. He earned a B. A. degree in 1947, M.A. degree in 1949 and a Ph.D. in 1952 in theoretical physics, all from Columbia University.

While completing his studies for the doctorate, he joined Columbia's Hudson Laboratories in 1951, working on naval research projects as a research scientist. He became Director of Hudson Laboratories in 1956, remaining in that post until 1963.

Since 1969 he served as Department of Defense member of the Committee for Policy Review of the National Council on Marine Resources and Engineering Development. In 1967 and 1970 he was chairman of the U.S. delegation to the Intergovernmental Oceanographic Commission meetings at UNESCO in Paris. He received the Arthur S. Flemming Award in 1966 and the Navy Distinguished Public Service award in 1969. He is a member of Phi Beta Kappa and Sigma Xi honorary fraternities. He is a fellow of the American Association for the Advancement of Science, the Acoustical Society of America and the Institute of Electrical and Electronics Engineers (IEEE). His memberships in professional societies include: American Physical Society, Seismological Society of America, Marine Technology Society, Society of Naval Architects and Marine Engineers, Society of Exploration Geophysicists, and the American Geophysical Union.

He is married to the former Jessica Rachael Denerstein of Brooklyn, N.Y. They are the parents of two teenage daughters.

STATEMENT OF DR. ROBERT A. FROSCH, ADMINISTRATOR,
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

Dr. FROSCH. I'm joined this morning in my testimony by Dr. William Raney who is Assistant Associate Administrator for Space and Terrestrial Applications; and, Mr. Peter Smith who is from our Office of International Affairs.

It is a pleasure to appear before you today to testify on NASA's activities in the area of cooperation and exchange in space technology between the United States and the People's Republic of China.

The functions NASA has been carrying out are confined to implementing the Government's role in pursuing the space technology portion of the Agreement for Scientific and Technological Cooperation signed between the two countries last January, shortly after the normalization of diplomatic relations. Specifically, it was agreed that, under suitable conditions, China would purchase from the U.S. industry a communications satellite system with associated ground equipment and, separately a ground station for the reception and processing of Landsat data.

Some of the equipment involved in such an export from the United States involves advanced civilian technology, which is subject to export control; and satellites themselves are subject to the international traffic in arms regulations. Most of the equipment will be subject to COCOM procedures. I can characterize our activities as a careful series of measured steps aimed at making progress toward the agreed equipment sales, while maintaining the sort of control that is required for exports to Communist countries.

A review of what we have done during the last 1½ years will provide some perspective on the process and will also lay the groundwork for what I believe may develop in the future.

In July 1978, I was among the Government officials who accompanied the President's Science and Technology Adviser, Frank Press, on a visit to China. During that trip, it was agreed by both sides that, to build closer relationships between the two countries, we should develop more substantive science and technology exchanges than could be effected merely by brief formal visits of high-level delegations. The Chinese officials expressed great interest in pursuing a number of aeronautical and space subjects, ranging from the purchase of satellites to help in the development of techniques for calibration and testing. In our subsequent contacts with China, we have engaged in extensive discussions on just two topics: the sale of a communications satellite system with associated ground equipment, and the sale of a ground station for reception and processing of Landsat data, including data from Landsat-D, both under export controls. NASA's role is to act as the Government spokesman to the PRC in these matters and to facilitate their contacts with the U.S. industries from which they will ultimately purchase the equipment.

Late in November 1978, a Chinese delegation, headed by Dr. Ren Xinmin, president of the Chinese Academy of Space Technology—CAST—arrived for a visit that lasted for several weeks. During that time, the delegation made brief stops at a number of NASA centers to gain a general appreciation of the scope of the U.S. civil space program and had a chance to discuss China's communications and remote sensing interests with most of the major space-

craft manufacturers and a few of the leading ground station suppliers. We gained a much clearer understanding of their needs and plans for using a satellite system for communications and TV broadcasting and their interests in using Landsat information for resource management.

Announcement of the normalization of diplomatic relations between the two countries occurred while that delegation was in the country, and our discussions with the delegation formed the basis of the understanding on space cooperation that was appended to the general science and technology agreement signed about 1 month later in January 1979. I remark in passing that there are many problems to overcome in reestablishing relations after a long hiatus, not the least of which is reaching a clear understanding in our negotiations about what the phrase "under suitable conditions" means to the two nations.

In May 1979, I headed a delegation on a return visit to the Chinese Academy of Space Technology and many of its institutions. I could not stay in China for the entire period, but NASA's Associate Administrator for space and terrestrial applications, Dr. Anthony J. Calio, took over leadership of the U.S. delegation during a series of discussions and visits to space installations in many parts of China. Some of these establishments, such as their launch complex in Gansu Province, had never before had a foreign visitor. The Chinese shared with us the accomplishments, the plans, and some of the problems of their civil space program.

China already had some experience with satellite communications. She has been a member of Intelsat for several years and has three ground stations in the eastern portion of the country. She has an agreement with West Germany, under which the Franco-German Symphonie satellite was moved so that it is in view of an experimental ground station in Nanjing. A certain amount of time on the satellite is available to China for experiments in TV broadcasting. In addition, there is a Chinese communications satellite program; in 1975 they filed orbital and frequency reservations with the ITU for two experimental C-band satellites, and they plan to launch the first of these within the next few years. In 1977, they reserved two Ku-band slots for TV broadcasting.

The communications satellite system they have been discussing with us is to serve a combination of purposes. It will have at least 3,000 half circuits for C-band telecommunications, serving several dozen communications and ground stations. In addition, it will have capability of Ku-band for voice and TV broadcasting with potentially several thousand ground stations for reception and re-broadcast of program material originating in the central TV station.

China has created a new organization, under CAST, to manage the acquisition of this communications and broadcasting system, the Chinese Communications Satellite Corp. Its first task is to refine the statement of requirements for the system as a preliminary to holding discussions with possible U.S. suppliers. We do not know yet whether the satellite and ground station procurements will be handled as one action or as separate contracts. Various U.S. communications system manufacturers have made formal and informal presentations to the Chinese, but no actual negotiations

have started, and, thus, no export license applications have been filed.

In preparation for this potential export, NASA chaired an inter-agency group that examined the technical, operational, and commercial implications involved. As the PRC desires and intentions become clearer, adjustments are made in our assessments. In due course, NASA will launch the satellite, and a U.S. contractor will be responsible for placing it in the proper geosynchronous orbit.

The most recent visit in our set of exchanges was completed about 1 month ago. A delegation from the Chinese Academy of Sciences was in this country for about a month to discuss a Landsat memorandum of understanding with NASA, to visit user organizations in the United States, and to discuss possible station equipment with ground station vendors. The memorandum of understanding, of the type we have with other foreign operators of Landsat ground stations, may be ready for signature within the next few months. Signing of this document is a precondition to formal negotiations between the Chinese procurement organization and U.S. equipment vendors.

Here, too, they have their own program, with plans for a 1986 launch of an earth resources satellite of their own design and construction; they also plan for additional ground stations for the reception of the remote sensing data. Purchase of a Landsat ground station will give them a head start in learning to receive and process the data and in developing a capability to use the resultant information in the several Government agencies that expect to profit thereby. From the very beginning of our discussions about a Landsat ground station, the Chinese have made it clear that, given the importance of small field agriculture in China, their agricultural studies will require a capability to receive data from the Landsat-D Thematic Mapper, which we still have under development.

Outside of the brief visits we have made to each other's institutions so as to establish a minimal base of understanding about our respective civil space activities, our serious discussions have been confined to the two potential procurements. No procurement negotiations have been started, and there are many issues still to be resolved. But despite the unresolved issues, the series of visits we have exchanged and our numerous discussions have clarified a number of points:

(a) The decision of the PRC to seek foreign contacts and assistance with space technology has at least two practical motivations: one, a desire to acquire immediate operating capabilities that are important to their economic development; and, two, a determination to use their outside contacts to help them develop an indigenous capability to go on to develop and deploy their own civil designs.

(b) Their planned procurements from us are in areas where there is a match between a serious need for additional capability and the existence of applicable space technology. Thus, they focus on civil communications, on education, and on resource management. The extent of the difficult terrain outside of their existing communications net makes the case for satellite communications rather than an expanded terrestrial net. Using this satellite system for dissemination of educational TV to the farthest reaches of the country is

one of the most effective ways we know to supplement the capacity of their school system, which languished during the years of the cultural revolution. Finally, the Landsat ground station can make an immediate contribution to their management of agricultural resources and the water that is critical to agricultural productivity. Adequate food supply continues to be a problem despite the fact that over 80 percent of the population is engaged in some kind of agricultural occupation. Other priority uses for Landsat information include petroleum and mineral prospecting. Both of these are critical for domestic consumption and as a source of income through foreign trade.

(c) The United States has made it clear, from our side, that our cooperation, the information we are willing to release, and the equipment we are willing to sell to China are exclusively for civil use. We have also made it clear that export controls will be applied. In that connection, we have repeatedly taken the position that the communications satellite and its backup would be turned over to China when we have launched them and they are in orbit.

(d) Finally, we have been consistent in our position that we would make progress one step at a time and defer negotiations on additional cooperative activities until after we have made progress with the two procurements.

As background to my repeated emphasis on the application of export controls to these procurements by China, I should explain that NASA has engaged in extensive consultation with other Government agencies in reviewing what technology is necessary to meet the Chinese operational requirements and in working to insure both that the equipment remains dedicated to civil uses and that the national security implications of these exports are well understood and of manageable proportions. Final decisions on U.S. export licenses will, of course, wait for applications from U.S. vendors to export particular configurations. However, most of the equipment will be subject to COCOM procedures. The actual technology involved is the property of the various firms in the private sector and the Government's role is to approve or disapprove what the vendor is willing to export.

Let me turn for a moment to Chinese discussions with other countries about space technology. They have searched for opportunities for technological cooperation and exchange, favoring countries where there appeared to be a chance that the arrangement would be of mutual benefit to the two countries. As serious students of what technology might be available in the free world, they are quite aware that Japan, France, Germany, and the United Kingdom are competitive with the United States in certain aspects of space technology and are ready to discuss exports. There now appear to be several understandings with these countries to continue negotiations with them aimed at the future exchange of technology and knowledge about manufacturing techniques, and at the training of Chinese scientists and technologists. Even given potential for gaining the desired sort of access to technology in these countries, I have the assurance of Vice Premier Yu Qiuli, during the visit in May, that China intends to take the first step by buying actual hardware from the United States.

The benefits to China in going ahead with these procurements are clear. The quality and depth of U.S. experience in space technology is beyond question. China will gain operating capabilities that are central to their development needs earlier than they could in any other way in communications, national education, agricultural resource management, and petroleum and mineral location and exploitation. In the process they will have managed to make some contact with a much more advanced civil space program than their own.

In terms of a direct benefit to the American space program from the acquisition of knowledge about the PRC space program, we and the Chinese agree there is little to expect for the moment.

But we can look forward to having the PRC increasingly able to engage in collaborative programs with us, to share data, and to provide scientific access to regions of geographical or geological interest that would otherwise be beyond reach, particularly in the Earth sciences and the management of Earth resources. We can be sure of this increasing opportunity, since the intrinsic quality of the Chinese scientists we have met is excellent; what is required is a chance to move to the forefront. However, the rate at which we develop new modes of interaction will depend on the progress we make in the present efforts and our assessment of the implications of initiating such additional activities.

From a national perspective, the benefits to the United States include the immediate dollar value to the aerospace and communications industries of the systems that are exported by us rather than by some other country. But there are other, less tangible, benefits to the United States. We will be contributing to building permanent links with another country by applying U.S. advance technology to real needs and to bettering the condition of hundreds of millions of people who need help in educating and feeding themselves. We will be contributing to establishing the pattern of mutual benefits that always results from friendly relationships between two countries.

As Vice President Mondale said in Beijing last August:

A modern China taking its place in the family of nations is engaged in a search not only for friendship, but also for security and development. An America deepening its relations with China does so not only out of genuine sentiment, and not only out of natural curiosity, it does so out of the same combination of principle and self-interest that is the engine of mature relations among all modern states.

Thank you, Mr. Chairman. I'm prepared to answer your questions.

[The prepared statement of Dr. Frosch follows:]

HOLD FOR RELEASE UNTIL
PRESENTED BY WITNESS

Statement of

Robert A. Frosch
Administrator

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

before the

Subcommittee on Science, Research and Technology
and the
Subcommittee on Investigations and Oversight
Committee on Science and Technology
House of Representatives

Good morning Mr. Brown, Mr. Lloyd, and Members of the Subcommittees. It is a pleasure to appear before you today to testify on NASA's activities in the area of cooperation and exchange in space technology between the United States and the People's Republic of China.

The functions NASA has been carrying out are confined to implementing the Government's role in pursuing the space technology portion of the agreement for scientific and technological cooperation signed between the two countries last January, shortly after the normalization of diplomatic relations. Specifically, it was agreed that under suitable conditions China would purchase from U.S. industry a communications satellite with associated ground equipment and a ground station for the reception and processing of Landsat data.

Some of the equipment involved in such an export from the United States involves advanced civilian technology, which is subject to export control; and satellites themselves are subject to the International Traffic in Arms Regulations. Most of the equipment will be subject to COCOM procedures. I can characterize our activities as a careful series of measured steps aimed at making progress toward the agreed equipment sales, while maintaining the sort of control that is required for exports to Communist countries.

A review of what we have done during the last year and a half will provide some perspective of the process and will also lay the groundwork for what I believe may develop in the future.

In July 1978, I was among the Government officials who accompanied the President's Science and Technology Advisor, Frank Press, on a visit to China. During that trip, it was agreed by both sides that, to build closer relationships between the two countries, we should develop more substantive science and technology exchanges than could be effected merely by brief formal visits of high level delegations. The Chinese officials expressed great interest in pursuing a number of aeronautical and space subjects, ranging from the purchase of satellites to help in the development of techniques for calibration and testing. In our subsequent contacts with China, we have engaged in extensive discussions on just two topics: The sale of a communications satellite with associated ground equipment, and the sale of a ground station for the reception and processing of Landsat data, including data from Landsat-D, both under export controls. NASA's role is to act as the Government spokesman to the PRC in these matters and to facilitate their contacts with the industries from which they will ultimately purchase the equipment.

Late in November 1978, a Chinese delegation, headed by Dr. Ren Xinmin, President of the Chinese Academy of Space Technology (CAST), arrived for a visit that lasted for several weeks. During that time, the delegation made brief stops at a number of NASA Centers to gain a general appreciation of the scope of the U.S. civil space program and had a chance to discuss China's communications and remote sensing interests with most of the major spacecraft manufacturers and a few of the leading ground station suppliers. We gained a much clearer understanding of their needs and plans for using a satellite system for communications and TV broadcasting and their interests in using Landsat information for resource management.

Announcement of the normalization of diplomatic relations between the two countries occurred while that delegation was in the country, and our discussions with the delegation formed the basis of the understanding on space cooperation that was appended to the general Science and Technology agreement signed about a month later in January 1979. I remark in passing that there are many problems to overcome in reestablishing relations after a long hiatus, not the least of which is reaching a clear understanding in our negotiations about what the phrase "under suitable conditions" means to the two nations.

In May 1979, I headed a delegation on a return visit to the Chinese Academy of Space Technology and many of its institutions. I could not stay in China for the entire period, but NASA's Associate Administrator for Space and Terrestrial Applications, Dr. Anthony J. Calio took over leadership of the U.S. delegation during a series of discussions and visits to space installations in many parts of China. Some of these establishments, such as their launch complex in Gansu Province, had never before had a foreign visitor. The Chinese shared with us the accomplishments, the plans, and some of the problems of their civil space program.

China already has some experience with satellite communications. She has been a member of Intelsat for several years and has three ground stations in the eastern portion of the country. She has an agreement with West Germany, under which the Franco-German Symphonie satellite was moved so that it is in view of an experimental ground station in Nanjing. A certain amount of time on the satellite is available to China for experiments in TV broadcasting. In addition, there is a Chinese communications satellite program; in 1975 they filed orbital and frequency reservations with the ITU for two experimental C-band satellites, and they plan to launch the first of these within the next few years. In 1977, they reserved two Ku-band slots for TV broadcasting.

The communications satellite they have been discussing with us is to serve a combination of purposes. It will have at least 3,000 half-circuits for C-band telecommunications, serving several dozen communications ground stations. In addition, it will have capability at Ku-band for voice and TV broadcasting with potentially several thousand ground stations for reception and rebroadcast of program material originating in the central TV station.

China has created a new organization, under CAST, to manage the acquisition of this communications and broadcasting system, the Chinese Communications Satellite Corp. (CHISAT). Its first task is to refine the statement of requirements for the system as a preliminary to holding discussions with possible U.S. suppliers. We do not know yet whether the satellite and ground station procurements will be handled as one action or as separate contracts. Various U.S. communications system manufacturers have made formal and informal presentations to the Chinese, but no actual negotiations have started, and thus no export license applications have been filed.

In preparation for this potential export, NASA chaired an interagency group that examined the technical, operational, and commercial implications involved. As the PRC desires and intentions become clearer, adjustments are made in our assessments. In due course, NASA will launch the satellite, and a U.S. contractor will be responsible for placing it in the proper geosynchronous orbit.

The most recent visit in our set of exchanges was completed about a month ago. A delegation from the Chinese Academy of Sciences was in this country for about a month to discuss a Landsat Memorandum of Understanding with NASA, to visit user organizations in the United States, and to discuss possible station equipment with ground station vendors. The Memorandum of Understanding, of the type we have with other foreign operators of Landsat ground stations, may be ready for signature within the next few months. Signing of this document is a precondition to formal negotiations between the Chinese procurement organization and U.S. equipment vendors.

Here, too, they have their own program, with plans for a 1986 launch of an earth resources satellite of their own design and construction; they also plan for additional ground stations for the reception of the remote sensing data. Purchase of a Landsat ground station will give them a head start in learning to receive and process the data and in developing a capability to use the resultant information in the several government agencies that expect to profit thereby. From the very beginning of our discussions about a Landsat ground station, the Chinese have made it clear that given the importance of small field agriculture in China, their agricultural studies will require a capability to receive data from the Landsat-D Thematic Mapper, which we still have under development.

Outside of the brief visits we have made to each other's institutions so as to establish a minimal base of understanding about our respective civil space activities, our serious discussions have been confined to the two potential procurements. No procurement negotiations have been started, and there are many issues still to be resolved. But despite the unresolved issues, the series of visits we have exchanged and our numerous discussions have clarified a number of points:

- a) The decision of the PRC to seek foreign contacts and assistance with space technology has at least two practical motivations: 1) a desire to acquire immediate operating capabilities that are important to their economic development and 2) a determination to use their outside contacts to help them develop an indigenous capability to go on to develop and deploy their own civil designs.

- b) Their planned procurements from us are in areas where there is a match between a serious need of additional capability and the existence of applicable space technology. Thus they focus on civil communications, on education, and on resource management. The extent of the difficult terrain outside of their existing communications net makes the case for satellite communications rather than an expanded terrestrial net. Using this satellite system for dissemination of educational TV to the farthest reaches of the country is one of the most effective ways we know to supplement the capacity of their school system, which languished during the years of the cultural revolution. Finally, the Landsat ground station can make an immediate contribution to their management of agricultural resources and the water that is critical to agricultural productivity. Adequate food supply continues to be a problem despite the fact that over 80% of the population is engaged in some kind of agricultural occupation. Other priority uses for Landsat information include petroleum and mineral prospecting. Both of these are critical for domestic consumption and as a source of income through foreign trade.
- c) The United States has made it clear, from our side, that our cooperation, the information we are willing to release, and the equipment we are willing to sell to China are exclusively for civil use. We have also made it clear that export controls will be applied. In that connection, we have repeatedly taken the position that the communications satellite and its backup would be turned over to China when we had launched them and they were in orbit.
- d) Finally, we have been consistent in our position that we would make progress one step at a time and defer negotiations on additional cooperative activities until after we had made progress with the two procurements.

As background to my repeated emphasis on the application of export controls to these procurements by China, I should explain that NASA has engaged in extensive consultation with other Government agencies in reviewing what technology is necessary to meet the Chinese operational requirements and in working to ensure both that the equipment remains dedicated to civil uses and that the national security implications of these exports are well understood and of manageable proportions. Final decisions on U.S. export licenses will, of course, wait for applications from U.S. vendors to export particular configurations. However, most of the equipment

will be subject to COCOM procedures. The actual technology involved is the property of various firms in the private sector and the Government's role is to approve or disapprove what the vendor is willing to export.

Let me turn for a moment to Chinese discussions with other countries about space technology. They have searched for opportunities for technological cooperation and exchange, favoring countries where there appeared to be a chance that the arrangement would be of mutual benefit to the two countries. As serious students of what technology might be available in the free world, they are quite aware that Japan, France, Germany, and the United Kingdom are competitive with the United States in certain aspects of space technology and ready to discuss exports. There now appear to be several understandings with these countries to continue negotiations with them aimed at future exchange of technology and knowledge about manufacturing techniques, and at the training of Chinese scientists and technologists. Even given the potential for gaining the desired sort of access to technology in these countries, I have the assurance of Vice Premier Yu Qiuli, during the visit in May, that China intends to take the first step by buying actual hardware from the United States.

The benefits to China in going ahead with these procurements are clear. The quality and depth of U.S. experience in space technology is beyond question. China will gain operating capabilities that are central to their development needs earlier than they could in any other way in communications, national education, agricultural resource management, and petroleum and mineral location and exploitation. In the process they will have managed to make some contact with a much more advanced civil space program than their own.

In terms of a direct benefit to the American space program from the acquisition of knowledge about the PRC space program, we and the Chinese agree there is little to expect for the moment. But we can look forward to having the PRC increasingly able to engage in collaborative programs with us, to share data, and to provide scientific access to regions of geographical or geological interest that would otherwise be beyond reach, particularly in the earth sciences and the management of earth resources. We can be sure of this increasing opportunity, since the intrinsic quality

of the Chinese scientists we have met is excellent; what is required is a chance to move to the forefront. However, the rate at which we develop new modes of interaction will depend on the progress we make in the present efforts and our assessment of the implications of initiating such additional activities.

From a national perspective, the benefits to the United States include the immediate dollar value to the aerospace and communications industries of the systems that are exported by us rather than by some other country. But there are other, less tangible, benefits to the United States. We will be contributing to building permanent links with another country by applying United States advanced technology to real needs and to bettering the condition of hundreds of millions of people who need help in educating and feeding themselves. We will be contributing to establishing the pattern of mutual benefits that always results from friendly relationships between two countries.

As Vice President Mondale said in Beijing last August: "A modern China taking its place in the family of nations is engaged in a search not only for friendship, but also for security and development. An America deepening its relations with China does so not only out of genuine sentiment, and not only out of natural curiosity, it does so out of the same combination of principle and self-interest that is the engine of mature relations among all modern states."

#

Mr. LLOYD. Thank you very much, Dr. Frosch.

Mr. Brown?

Mr. BROWN. Dr. Frosch, do you have any rough estimate of the potential value of the first two procurements that are discussed in here?

Dr. FROSCH. If it were to go through fully as we expect, the value of the communications satellite, the launch, and of a full ground system, if that is what they purchase, is approximately \$100 to \$150 million. The value of the Landsat ground station is much smaller, it is on the order of about \$10 to \$20 million.

Mr. BROWN. In the discussions so far, has there been any thought about whether the launch would take place from a U.S. facility or from a Chinese facility?

Dr. FROSCH. The launch would clearly take place from a U.S. facility.

Mr. BROWN. Has there been any—are these discussions being conducted in the framework of a specific time plan with benchmarks of progress? In other words, can we expect it to move along at a particular rate, or has that been set?

Dr. FROSCH. We have not set a set of milestones. The Chinese were extremely eager to proceed very rapidly, and I believe are proceeding as rapidly as they can, but I think they had underestimated at first some of the problems they would have in defining their requirements and in understanding how to do the process.

On the communications satellite system, we are expecting them to invite U.S. firms to make definite presentations on capabilities in China shortly, but we do not have a real date from them. The process of getting to an MOU agreement on the Landsat ground station is proceeding rapidly enough so that it is possible that an MOU would be signed very early in 1980. On the basis of that signature, the procurement could then proceed.

Mr. BROWN. You indicated that they were thinking in terms of the capability to utilize, or the need to utilize the thematic mapper of the Landsat-D in connection with their needs because of the small-scale agriculture, are we talking here about a capability that includes what I understand is the new resolution figures around 30 meters or something like that?

Dr. FROSCH. It would be around 30 meters with Landsat-D.

Mr. BROWN. They feel that would be adequate for their purposes?

Dr. FROSCH. I suspect that they would like a higher resolution, but that is the best resolution that we are doing with Landsat at this point. I think it would be adequate. Let me just add that the small-plot problem arises particularly when adjacent small plots are planted in different crops. In a situation where you have many small plots planted to rice or some similar crop where they are all the same, then the requirement is not so severe.

Mr. BROWN. I find it difficult to visualize what kind of analysis they are going to be able to do, or have a need for if they make an effort to analyze all the small plots in China.

Dr. FROSCH. I think the point really is to do a suitable sampling analysis. The question of resolution really has to do with being sure the resolution is adequate in order to obtain a good analysis of the sample. Since most of the samples would be small-plot samples, I think they still have the resolution problem. I'm not sure any of

us would face with equanimity the problem of doing all the agriculture in China today, the data would be too great.

Mr. BROWN. Along that same line, does the agreement contemplate, and are they not included in the Chinese scholars visiting in this country, an adequate base for trained personnel in this particular field—I'm talking about the whole field of space science and analytical and other skills that are going to be required in the program?

Dr. FROSCH. My impression of the Chinese scientific and engineering base on this subject is that they have a number of excellent and well-trained people, but very few of them. They have some experience in the use of Landsat data because they have purchased Landsat data for China and have been using it. They have several students in the United States at universities who are studying topics related to remote sensing. We have had some preliminary discussions bearing on the question of their sending more students specifically to study what is required for Landsat, but they have not, to date, pressed that point. I think, they are waiting to see how they would proceed on the Landsat ground station itself, and then I would expect that question to be raised.

Mr. BROWN. Is it reasonable to think that if everything proceeds smoothly along the lines it is proceeding that the Chinese will be able to deploy the system that they have in mind, say, within a 10-year time frame?

Dr. FROSCH. The communications system?

Mr. BROWN. Yes, the communications.

Dr. FROSCH. I think that would be quite reasonable. The possible time scale is probably somewhat shorter than that.

Mr. BROWN. And in an opinion question, do you think there is a possibility, even though remote, that having deployed such a system that the Chinese might claim to have, at least in part, a technologically superior communications system to the United States?

Dr. FROSCH. That is an interesting question. There is a sense in which that claim could be made, but it's a funny kind of sense. It's a sense in which what they would have would be in some ways fancier than ours but it would not provide them with the communications system that is nearly as good or as complete as the one we have.

Mr. BROWN. In the sense of looking at their total national communications system, that a larger portion of it would represent a higher technology than we have in this country?

Dr. FROSCH. Yes, I think that could be said.

Mr. BROWN. Thank you.

Mr. LLOYD. Thank you, Mr. Brown.

Mr. Ertel?

Mr. ERTEL. Thank you, Mr. Chairman.

Just following along the questions Mr. Brown asked, if we provide them these telecommunications or satellite communications system, the Chinese will be leapfrogging basically much of the development work Western technology has done in telecommunications systems; for instance, there won't be ground communications. Will this give them an advantage for the next generation development of communications equipment over the United States since

they haven't had to go through this whole process and get locked in basically with heavy capital investments in what now may be considered to be relatively obsolete technology in the United States?

Dr. FROSCH. What's happening, I think, in our communications systems is that we are less and less locked in, in the sense that I believe we are now on the verge of having a large commercial and business use of satellite communications in the next stage.

What purchasing the system would do for the Chinese would be to give them a modern system well matched to their needs. To the extent that it would give them experience with such a system and an understanding of what it could do, they could then proceed to the next step. I don't think in any real sense it would give them a position to be ahead of us in communications. It might give them an opportunity over a very long period to catch up to the capability that we have.

Mr. ERTEL. I don't remember the figure, but it was a relatively high figure, if I remember correctly, which it would cost Bell Telephone to modernize, bring up to date their communications system in the United States, changing just from the system they have today to a more advanced system.

You know, that always seems to be a problem that I see, as we develop, we get a very heavy capital investment in the existing systems; therefore, it makes it very hard for them to go ahead technologically into a new system because you have got that real capital you are trying to recover.

But the Chinese basically are going without that system. My question is, if by putting a much more modern system in, different technology, if you will, they could now have a base to really get ahead of us overall, and to utilize that technological base to then come back to the United States with a new system for us?

You don't see that though?

Dr. FROSCH. I believe they are starting from a technological position where it would be quite a long while before they can do such a thing, and meanwhile we will be refining our technology as well. We are not in a position where the large investment is preventing us from making technological progress. What it has tended to do is to prevent us from always using what we know how to do to the greatest extent, largely because of the capital investment in the plant and the fact that we already have an operating system. What seems to be happening now is that the competitive situation and the availability of the technology is making possible a major jump in the use of satellite technology with much smaller ground stations, much cheaper systems, and a much broader use.

So the idea that might be drawn from your question, namely, that we are staying static while others are moving, or could move, rapidly, could turn out to be wrong. Although, I would still expect that in 25 years we will have a lot of communications and technology that we would then regard as quite obsolete, but it would still be playing its function side by side with much newer communications technology.

Mr. ERTEL. I just might go on to two other areas that I am curious about.

Throughout this transfer basically of space technology to the Chinese, what protection do we have for proprietary and patent rights in this technology; inasmuch as China, as I understand it, is not a signator to any patent inventions and has a very difficult time, I guess, with protecting proprietary information?

Dr. FROSCH. Two points: One, there is some progress in China in their establishment of a patent system—whether that will happen on what time scale, I don't know. Two, it is important to note that what we expect to be transferring is not so much space technology as it is a product and the capability to use that product. That's why we have talked in the communications case of delivering the operational satellites in orbit with no direct transfer of the satellite on the ground. The communications ground stations are, of course, a different matter because they will have access to their own ground stations. It is really a matter of what the commercial sellers want to do that establishes what technology they are willing to build into the ground stations.

The Landsat ground station, of course, doesn't involve direct access to the satellite at all except by the reception of the data. The ground station itself has some technology in it, but it is a far cry from having the ground station equipment to having the technology in detail. That is a subject of discussion with the Chinese: How much transfer of technology, that is, ability to do it and what will actually be involved in these sales.

Mr. ERTEL. One other point; as I understand, the Chinese at this point held options on the SST and the Concorde and then they canceled those options.

Is there any suspicion or any evidence that we might be in a similar situation? I know you have gone down the road and you expect to go ahead and fulfill with the procurement here. Have there been any indications which might lead you to believe that there may be a cancellation either for economic conditions within China itself or for any other reason?

Dr. FROSCH. No. We have assurances at several levels, up to the Vice Premier level, that they are going to make this purchase. We do know that they are discussing similar projects with other countries. As far as we can now see, we are proceeding down a negotiating path that will lead to an agreement and contracts. But I presume that, as in commercial arrangements of that sort, until a contract is signed one is never quite sure.

Mr. ERTEL. Some people say even when a contract is signed you are not even sure until you have the money in hand and have the other part of the contract.

Thank you very much.

Mr. LLOYD. Thank you, Mr. Ertel.

Mr. Roth?

Mr. ROTH. Thank you, Mr. Chairman.

Doctor, the way I look at technological advances and exchanges I think sort of follows what our colleagues asked this morning, I always feel technology is transferred by governments as industry is by people.

I was wondering, do you have any idea how many students are studying engineering, exchange students studying engineering in the Western World?

Dr. FROSCH. I do not know how many there actually are. I believe at this point there would be several hundred. Many of them are studying engineering.

Mr. ROTH. You have traveled through China yourself, right?

Dr. FROSCH. I have only been in Beijing. My colleagues have traveled through China.

Mr. ROTH. I see. I was wondering, do you have any idea what kind of engineering schools they have in China, what kind of advances they're making there in the academic field, because I think that is going to determine to a great degree the direction we are going to be going in?

Dr. FROSCH. We have all discussed this, and I have discussed it with some people that have visited several of the universities in China. It's clear those universities are emerging from a period in which they were—I think the best word to describe them is—devastated. There has been a period of at least 8 to 10 years in which they were effectively not operating. The Chinese themselves say they are missing a generation of academic students and graduate students. There is a gap there.

It is clear that they have a relatively small but extremely competent group of engineers and scientists, and are rapidly trying to bring their educational institutions back into operation. I would presume that it would be at least 5 years before they really begin to produce graduate engineers in any numbers, and, more likely 10 years before they can really begin to do the kind of educational job they want to do in China, even with great attention and force-feeding. I think that's one of the reasons why they have wanted to send so many students overseas, because they realize how long it will take them to get their system going again properly. I would estimate that even with the best possible efforts they have quite a long way to go before they can catchup, as they put it. Their estimated time for catching up is somewhere around the year 2000 or beyond.

Mr. ROTH. Thank you.

Mr. LLOYD. Thank you very much.

I have a couple of questions, Dr. Frosch. In the transfer of this kind of a technology, and Mr. Ertel kind of touched on it, I want to make sure that we are protected, our own people are protected. You know, friends today seem to be not to friendly tomorrow, as evidenced by the world situation at the moment. And, as such, I don't like to use the analogy, it would be very bad to have F-14's or that classification of the degree of technology sitting around and all of a sudden we have a problem.

Do you foresee anything like this in the future with regards to any specific area that you deal in, space, space technology, space technology transfer?

Dr. FROSCH. This is a problem that we have had very much in mind. It is connected closely in this whole question of handling export control; that is, what are the potential other uses of any such system beyond the uses that are immediately contemplated? I, in fact, have been frank with the Chinese in explaining why we wanted to approach this with care, pointing out that some of the things that are involved in such a sale could be regarded as dual-use items. A communications system is a communications system

and can be used for many kinds of communications. That is not so much the problem as is the question of whether anything they get could be directly used for military purposes and what controls we would have on that.

We are approaching it in such a way that we believe we can devise adequate safeguards. Either the technology would be such that we would be willing for them to have it, or that it would be dealt with in a manner that we would have sufficient assurance that it would really be used for civil purposes. That's one reason for fairly intense consultation among a variety of agencies that have that interest.

Mr. LLOYD. Going to the next step, as you are, I'm sure, very much aware in what I touched on in my opening statement; other governmental agencies, in this case, say, Japan or France, are not only willing, they are aggressive in their sales policies of their equipment—and let me address, for instance, aviation, that I consider myself somewhat an expert in—expert means here in Congress, not necessarily in the aviation area—clearly the French intend to open up this market, they have no intention of backing down now, and even though, for instance, the Boeing Company has delivered some 747's, I'm sure Douglas is negotiating for the Dash 80 series, whatever it may be.

In my opinion we are at a disadvantage because there is nothing to prevent Japan from getting into this, and, certainly at this point, with the French-German A-300 and the state of the art that it's in, as a matter of fact, it would be a very fine system for the Chinese. I was over in China, they have the Tridents, and, you know, looking at the runs they have, at least in my own very, very limited experience, it would seem that the A-300 would be particularly well suited for the things they want; it has mass carrying capability, has very low fuel specifics, and then it has something else, it has a Government which is willing almost to overlook the first payment, or down payment with x-number of years to pay and, you know, you can sustain very well; whereas, Boeing, McDonald-Douglas and Lockheed simply are not in the running on that, they cannot finance the rest of the world.

Do you think our own policies here in the United States are debilitating in the application in these areas?

Dr. FROSCH. I think that in our normal system, it is difficult for a normal business arrangement to compete with the subsidized arrangement.

Mr. LLOYD. How would you change it?

Dr. FROSCH. That's basically what the problem is.

Mr. LLOYD. I realize the laws have to be changed and all of that, and I recognize you probably have not addressed yourself in depth to this.

Dr. FROSCH. I have not.

Mr. LLOYD. But how would you change it, you know, without hanging yourself out too far? I really need a solution to this.

Dr. FROSCH. The only thing that comes to my mind is the possibility that we might have to invent a kind of hybrid between our normal way of doing business and a governmental way of doing business.

Mr. LLOYD. Are we capable of that?

Dr. FROSC. We're capable of inventing all sorts of ingenious things, and I think we are perfectly capable of doing it in this case. For example, if we were to make a determination that as a national policy we wanted to push the sale of U.S. technological objects overseas—aircraft, satellites, whatever—then we could presumably change the present policy so that the Government would be strongly behind the sales in an active way rather than in a principally permissive way. One could think of ways in which the Government could back investments, guarantee investments, or expedite arrangements and so on; in effect, putting the financial or credit capability of the U.S. Government behind U.S. business entities—which is rather like what the French and the Japanese do, as I understand it.

Mr. LLOYD. Let's go one step further. In the hypothetical situation, we have decided that you, Dr. Frosch, as the head of NASA, are going to be that entity because; one, of your expertise, obviously, in the area of hardware, scientific and technological advancement—you deal pretty much in the state of the art of things, I mean even though the moment you get it it probably then is antiquated; nevertheless, it does represent the best of business, you have already commented on a communications system with my colleague, Mr. Brown, you were evaluating where it would be it as, quote, "In opposition or in comparison to communications systems which exist in the United States."

Now, what I'm saying is, we are going to make you the agency, a governmental agency to achieve this hybrid organization which can accommodate competitiveness nation to nation rather than business to business.

How would you begin to find a solution to that? Or better yet, while you're doing that, would you also comment "should we do that"? You see, we have also talked about possibilities, now I want not only the methodology but I want the philosophy.

Dr. FROSC. How to is always easier than should we. I think if NASA were to be asked to do such a thing, the first major set of things we would have to do would involve changing the agency in a significant way.

The least of the problems is likely to be the technological side for which we are presently equipped. The severe part of the problem has to do with the business and financial and contractual aspects, including the precise modes in which the Commerce Department and the Treasury would cooperate with or facilitate this. That's where I would see the problem, not in devising and arranging, or even marketing in the sense of the technology. It would be in providing business arrangements that could be competitive with the business arrangements that can be offered by a government that decides to subsidize. I think that it is a very different task, for which I would not consider NASA the right agency.

Mr. LLOYD. And my next question is: If not you, then who?

Dr. FROSC. I must say frankly that I don't really know enough about the details of how that kind of international business is handled now in the U.S. Government. However, I believe that it could, for example, be done with an agency with a brand new role in the Commerce Department, with some kind of special arrangement with Treasury or some of the banking entities that we have.

There would probably have to be some type of more blanket authority than the whole export licensing and control process that we now have. I would think one would have to have an early partnership between the selling corporation and the Government-control mechanisms so that it could be decided before the marketing began, what could be sold and what could not be sold.

I understand from friends in the business world that one of their problems has been that they feel somewhat hampered in marketing because they don't know at the beginning of the process what it is they will be allowed to sell at the end of the process. That's in the structure of the process, of course. So they presumably feel more hesitant as salesmen than do salesmen who would know from the very beginning what they can sell. That would have to be a part of the process.

As to whether we should do such a thing, I can only give a very personal opinion; which is, if we wished to continue to be strong in international markets with technological products, then we will have to find some way to make ourselves more competitive in cases where the problem is business arrangements backed by governments.

Now, either we talk our foreign friends out of doing that, in which we have not been very successful, or we find some way to do it ourselves. If we do neither, it will be very difficult for corporations to compete. It is true that some of the large corporations are very strong financially, but even so, they are not as strong as the Government.

Mr. LLOYD. Thank you very much, Dr. Frosch, and thank you for joining us.

Are there any further questions?

Mr. ERTEL. I have no more. Thank you.

Mr. LLOYD. I know that you have to go. We would once again reiterate our pleasure in having you bring your expertise to this committee and this subcommittee. And obviously we look forward to working with you in the future.

Dr. FROSCH. Thank you, Mr. Lloyd.

Mr. LLOYD. Our next witness will be Ambassador Christopher Phillips, who is president of the National Council for U.S.-China Trade in Washington, D.C.

Ambassador Phillips, we look forward to hearing from you. I would remind you that if you have a statement, we will be glad to include that statement in the record, and if you wish to paraphrase it in any way, please feel free to do so.

[The biographical sketch of Ambassador Phillips follows:]



BIOGRAPHIC SKETCH
OF
CHRISTOPHER H. PHILLIPS

Christopher H. Phillips, President, National Council for U.S.-China Trade, Washington, D.C., since 1973. Member National Council Delegations to the People's Republic of China, November, 1973, October, 1976, and June, 1979. Accompanied Secretary of Commerce Kreps on her trip to China in May, 1979.

Born on December 6, 1920, at the American Legation in Holland, where his father, William Phillips, was the United States Minister. Received Bachelor of Arts Degree from Harvard University, class of 1943.

Deputy Representative of the United States to the United Nations, with rank of Ambassador, 1969-1973. U.S. Representative to United Nations General Assembly, 1970, 1971, 1972, and 1973. U.S. Representative, Economic Commission for Europe plenary sessions, 1970-1973. U. S. Representative on the U.N. Sea-Bed Committee, 1969-1971.

President, U.S. Council of the International Chamber of Commerce, 1965-1969. Chase Manhattan Bank, Second Vice President, 1961-1965.

U.S. Representative on the Economic and Social Council of the United Nations, 1958-1961. U.S. Representative on the Governing Council of the U.N. Special Fund, 1959-1960. U.S. Representative to the 15th Session of the U.N. Economic Commission for Asia and the Far East, 1957.

Deputy Assistant Secretary of State for International Organization Affairs, 1953-1957. Massachusetts State Senator, 1948-1953.

Memberships: Council on Foreign Relations; World Affairs Council of Boston; Board Member, U.N. Association of the U.S.A.; American Academy of Arts and Sciences; Advisory Council, School of Advanced International Studies, Johns Hopkins University; Board of Visitors, Fletcher School of Law and Diplomacy, Tufts University.

**STATEMENT OF AMBASSADOR CHRISTOPHER H. PHILLIPS,
PRESIDENT, NATIONAL COUNCIL FOR U.S.-CHINA TRADE,
WASHINGTON, D.C., ACCOMPANIED BY NICHOLAS LUDLOW,
EXECUTIVE DIRECTOR FOR PUBLICATIONS, RESEARCH, AND
PLANNING**

Ambassador PHILLIPS. Thank you very much, Mr. Chairman. If I may, I would like to introduce my colleague, Mr. Nicholas Ludlow, who is our executive director for publications, research and planning, who will assist me today.

Mr. LLOYD. Thank you for being with us, Mr. Ludlow.

Ambassador PHILLIPS. I have, Mr. Chairman, as you suggested, submitted a fairly lengthy statement.

Mr. LLOYD. Without objection, it will be entered into the record.

Ambassador PHILLIPS. I want to commence by saying we greatly appreciate this opportunity to appear before you on this very important matter of technology transfer to the People's Republic of China.

If I may, by way of introduction, say that the National Council for United States-China Trade, which I head, is a nonprofit organization, established in 1973 to facilitate trade between the United States and People's Republic of China.

Since our inception, membership in the Council has quadrupled to about 650, at present, reflecting a vastly expanded involvement in American trade with China. Our membership includes both large and small companies, both exporters and importers.

In your request to me, Mr. Chairman, you indicated that you are particularly interested in hearing our views regarding the overall state of China's technology and the role that technology imports have in China's present economy. You also asked for comments we might have on U.S. export policy relating to the People's Republic of China and the administration of this policy.

I hope that you will find the written statement that I have submitted to the committee responsive to these requests.

In the few minutes available to me this morning, I would like to focus on the prospects for the sale of American technology to China, and how these prospects may be influenced by American export policies. And I believe that some of the questions you submitted to the previous witness relate very much to these subjects.

I think the most obvious thing that can be said about China today is that it is a country in a big hurry to make up for lost time.

It is a nation of striking contrast, as I'm sure you, Mr. Chairman, and your colleagues are aware, having visited that vast area of the world; it's 80 percent rural, technologically far behind the Western industrial world; yet a nuclear power; the fifth largest producer of primary energy, whose coal production and reserves rank third in the world; already an exporter of oil, with prospects for a very major expansion of oil production, as its offshore oil begins to flow with the help of American and other foreign oil companies.

As many Chinese have told us, whether in government offices, or in factories, or on the farms, "We have come a long way since liberation, but we have much yet to do."

Although China is currently going through a period of readjustment, reassessment, a reordering of its priorities, and some slow down in the speed with which it originally hoped to accomplish its

economic objectives, it has not stopped buying foreign technology equipment.

Last year Vice Premier Deng Xiaoping told us the period of readjustment would take approximately 3 years, but he made clear to us that he did not mean a 3-year halt in the acquisition of foreign technology and equipment. He said they could not afford to wait 3 years to proceed with their plans in this area.

The only effect he said that the process of readjustment would have on introduction of foreign technology would be in regard to working out priorities; what comes first, what comes later.

Now, in the context of these developments, what are the prospects for American technology sales to China, and how is American export policy responding to these prospects?

I think the first point to be made here is that foreign competition for China business has always been keen. But with the normalization of diplomatic relations between the United States and China the competition has greatly intensified. It is sometimes overlooked that China is an important and expanding market for foreign products. Last year the total two-way trade of the People's Republic of China was \$21.1 billion, an increase of 43 percent over the 1977 figures.

The United States had only about 6 percent of that trade, or \$1.2 billion. Japan, which has a long-term trade agreement with Beijing, captured nearly 25 percent of the China market. Its trade with China this year will be over \$6 billion.

Indeed, in terms of the exports of industrialized countries to China, Japan has consistently accounted for about half of all sales, followed by Germany, Canada, and France.

If we look at China's imports of manufactured goods from the industrialized world during the 1970's, Japan has captured 32 to 50 percent of all of China's machinery imports.

In 1977 which is the last year for which we have complete figures, the ranking of Western machinery suppliers to China was as follows:

No. 1, Japan, with 32 percent; No. 2, Germany, with 19 percent; No. 3, the United Kingdom, with 11 percent; No. 4, Norway, with 11 percent; and, No. 5, the United States, with 8 percent.

In other words, the United States could do a lot more to be competitive.

Looking to the future, we anticipate that China can afford to buy some \$40 billion worth of foreign plan and technology in the 7 years up to 1985. In doing so, we expect China will remain financially prudent, keeping its debt service ratio to a maximum of 15 percent. And that, we would estimate, would entail about \$15 billion worth of loan drawings during that period. Although we do not yet know the precise form of China's future technology priorities, some of the information I have provided with my written statement does give us a good picture of the scale and the scope of China's interest, as evidenced by its purchases.

Key purchases in 1978, for example, included chemical plants and equipment; electronic and mining equipment; petroleum development, and refinery equipment; port facilities; power; steel and steel products; steel plant, and transportation equipment, to mention a few.

China's current readjustment process is now playing down capital-intensive heavy industry in favor of light industry and infrastructure. Indeed, infrastructure is seen as the key to economic progress during the next decade.

The development of energy and energy resources, as well as transportation and communications are all being accorded a very high priority.

In all of these areas, American industry, American technology can play a very important role in helping China to meet its future needs. But our ability to do so will depend on how competitive we are in the China market.

In a number of important respects we are still prohibited from competing effectively with other major trading powers.

Let me mention just a few practical steps that I think can and should be taken promptly to remove these inhibitions.

First and foremost lack of Eximbank finances. The position of most American suppliers faced with potentially huge sales of mining equipment, offshore petroleum technology, hotels, or complete plants is that without Eximbank assistance they will have to secure their equipment from other countries which do have Eximbank facilities for China.

If they want to win the deals, they can get the financing but they will have to go to foreign Eximbanks to do it, and thereby source their exports to China from foreign countries. That is not something most companies would prefer to do.

Japanese Government guaranteed credits have been available to Japanese companies for sales to China since 1973. Western European exporters to China have also had access to Government backed credit, insurance, and guarantees, Government-guaranteed export credits of over \$13 billion have so far been offered to China by Britain, France, Italy and Japan.

All major China sales by industrial nations in recent years have been contingent on Government-backed loans, interest rate subsidies or guarantees.

Unquestionably, passage of the Sino-U.S. Trade Agreement, currently before the Congress, is the crucial step needed to make China eligible for Eximbank credits.

The other steps, a Presidential determination that Eximbank credits to China are in the national interest and settlement of outstanding Eximbank loans to China, should, in my judgment, not be too difficult to obtain.

Of course, the Eximbank will have to request Congress for an increase in its fiscal 1980 lending authority so that credits to China will not reduce funds available to other countries. And we urge Congress to approve such an increase.

The trade agreement contains a number of other provisions which will strengthen our competitive position. For example, it provides for protection of American patent rights to increase the incentive for American exporters to sell to the PRC—a matter which you were discussing with the previous witness.

The protection provided for patents, trademarks and copyrights is equivalent in this treaty to that offered by the U.S. Government. In a country that until recently had no system for the registration

of industrial or intellectual properties this is a significant step forward.

Provision is also made for the general facilitation of trade relations; for example, it commits the Chinese to reliance on commercial contracts and considerations, and eases the way for establishment of offices and representatives of U.S. companies in Beijing. There are 88 Japanese companies in residence there now, and this is nothing to be sneezed at.

The agreement also establishes a financial framework for normal banking operations, and allows for commercial disputes to be carried out in a third country if they can't be amicably settled in the first instance.

Overall, the U.S.-China Trade Agreement, which is for a 3-year term, will for the first time provide the basis for long-term marketing efforts to China by American firms, essential for the kind of major projects which are currently under negotiation.

Another area of importance where progress could be made if the necessary legislation were enacted, is the availability of OPIC—the Overseas Private Investment Corporation, through which financing guarantees and loans are made available. At least 20 American firms are currently discussing joint equity ventures with the Chinese. And I'm sure some of you gentlemen are aware that the Chinese recently have passed a new joint-venture law. So availability of OPIC facilities would be very helpful with respect to such investments, particularly for smaller companies that need OPIC's relatively low premiums and long-term coverage, inasmuch as favorable terms of that kind are normally provided by private insurance companies only to their larger customers.

Now finally, about export controls. Since trade with China began in June of 1971, over \$1 billion worth of export approvals have been granted for sales of American equipment and technology to China.

Almost a quarter of a billion dollars worth, to be precise, \$242 million, of licenses have been approved in the first 9 months of this year alone.

The principal categories approved were aircraft, about \$170 million through October of this year; seismic survey equipment including computers, some \$52 million; computers, \$11.5 million; and numerically controlled machine tools.

Now, while those figures may not represent actual sales, they are a clear indication of China's interest in U.S. technology.

Let me focus on two major points in connection with export controls; first, the adverse impact of U.S. export licensing delays on the ability of U.S. firms to present themselves as reliable suppliers to Communist markets; second, the need for the United States to map out a coherent policy concerning the transfer of high technology to China.

I think it is encouraging that the new Export Administration Act of 1979 requires the Secretary of Defense to develop a list of critical technologies for the purpose of facilitating national security export controls, to be effective as of October 1, 1980.

The lengthy delays associated with the progress of the approval or rejection of an application for a validated export license has been recognized widely as a critical problem by the U.S. Congress.

In an effort to simplify and expedite the export administration procedure the new Export Administration statute has established a timetable for export license reviews and created a new category of licenses which can be used for multiple shipments of a given item to a particular destination.

American exporters, of course, would like their license approval or rejection as promptly and expeditiously as possible. But they tend to regard 90 days as a reasonable time for cases which do not require interagency or CoCom review.

Mr. LLOYD. Mr. Phillips, may I interrupt for a moment? We obviously have a vote. We have a problem in trying to provide a quorum for the Whole Committee.

Would this be an acceptable place to break for—it's going to be about 15 minutes? And, with your indulgence we, of course, would return. These are the ills of Capitol Hill, which I know you are well acquainted with. Obviously, no personal insult is meant, it's just the way things go.

Would it be acceptable to break right here?

Ambassador PHILLIPS. Certainly. I understand very well.

Mr. LLOYD. We will break here.

[Whereupon, at 10:45 a.m., a short recess was taken.]

Mr. ERTEL. The committee will come to order. Until Mr. Lloyd returns as chairman of this subcommittee, I will be glad to sit and we will continue with your testimony, Mr. Phillips. We are very appreciative of your testimony. You can begin at this point.

Ambassador PHILLIPS. Thank you, Mr. Chairman.

I was talking about the problems of obtaining export licenses for various kinds of technology, and pointing out that this is an area of major concern to American companies who are engaged in sales to China.

It can today, under current procedures, take up to 30 months to get a validated export license for telecommunications, computer and electronic equipment.

The administration's approval last March of the digital resources sales of airborne infrared scanning equipment for use in geological survey work in China stretched over a period of nearly 3 years.

Now, for sales under multilateral control by CoCom, U.S. suppliers suffered considerably more paperwork and more delay than their Western European competitors.

Especially now, with about 15 percent of CoCom's cases for sales to the PRC so far in 1979, of which about 48 percent are being processed for U.S. companies, American businessmen are worried about their reputation for reliability with the Chinese.

Moreover, it is argued that the Chinese and other potential Eastern customers are showing a preference to buy from non-U.S. sources who can offer a similar product with a predictable shipment and a predictable delivery schedule.

For sales not requiring CoCom—full CoCom approval American companies also feel adversely affected by the length of the licensing cycle. Whereas a U.S. exporter can expect a licensing decision within 90 days under the most favorable circumstances, other Western Governments working hand in glove with their industries, grant licenses within approximately 30 days.

And West Germany, I understand, does not even make it legally binding for a private firm to obtain a Government license before commencing shipment abroad.

With the range of products and technology being equal among many U.S., European, and Japanese high-technology suppliers, the U.S. licensing system on both a technical and policy level has been a serious handicap to U.S. exporters vis-a-vis its competitors in other CoCom countries.

I very much hope that the new legislation will fulfill its goal and will result in expediting and clarifying the export licensing process.

In conclusion, Mr. Chairman, I think it is fair to say that the normalization of U.S./China relations has provided the U.S. with an unprecedented opportunity to cultivate a growing network of scientific, educational, and trade relationships with the People's Republic of China.

The influx of as many as 800 Chinese students to the U.S. and the proliferation of scientific, technical and industrial exchanges, reaching an estimated 450 this year, is just the tip of the iceberg of Sino-American cooperation now taking place on the private and public fronts.

The elements of the long-term Sino-U.S. technology transfer process are becoming more complex.

But in a strictly practical sense, approval of the Trade Agreement, Eximbank and the other facilities that I have noted will be critical in negotiating potentially in the massive ventures now under discussion with the Chinese.

These ventures include manufacturing of trucks and tractors, development mines, installation of powerplants, hydroelectric schemes, telecommunications projects and offshore oil development.

These contracts could perfectly well go to European or Japanese firms now in fierce competition with American companies for what could be multimillion dollar contracts.

Frankly, Mr. Chairman, I think it is time for American companies to be more competitive and more aggressive. It should be evident to everyone that the United States needs a clear-cut, pragmatic export policy.

If the American companies are going to be successful in the China market, they must be able to compete with competitors on equal terms.

Given those terms, if they are available, the prospects I believe for our future trade in technology and equipment to the People's Republic of China are very bright.

I thank you.

[The prepared statement of Ambassador Phillips follows:]



美中贸易全国委员会

The National Council for United States-China Trade

1050 Seventeenth Street, N.W., Washington, D.C. 20036 Cables: USCHINTRAD Telex: 89-7416 Telephone (202) 828-8300

TESTIMONY BY

CHRISTOPHER H. PHILLIPS, PRESIDENT

NATIONAL COUNCIL FOR US-CHINA TRADE

On Technology Transfer to the People's
Republic of China.

Before the Subcommittees on Science, Research
and Technology and on Investigations and Oversight of
the Committee on Science and Technology, United States
House of Representatives.

NOVEMBER 15, 1979

Mr. Chairman and members of the Subcommittees on Science, Research and Technology and on Investigations and Oversight of the House Committee of Science and Technology.

It is a privilege and pleasure to have this opportunity to address your subcommittees on the important matter of technology transfer to the People's Republic of China (the PRC).

By way of introduction, the National Council for US-China Trade is a non-profit organization established in 1973 to facilitate trade with the People's Republic of China. Since our inception, membership in the Council has quadrupled to about 650 at present reflecting a vastly expanded involvement in American trade with China. Our membership includes both large and small companies, both exporters and importers.

In your request to me, you indicated that you are particularly interested in hearing our views regarding the overall state of China's technology and the role that technology imports have in China's present economy. You also asked for comments on US export policy relating to the PRC and the administration of this policy.

China: A Developing Country

While it is easy to be carried away by the size and scope of China -- the nation of almost a billion people -- the fact is that China by its own admission is a developing country.

The best estimates put China's gross national product per capita last year at \$443. In contrast the GNP per capita of the

United States in 1978 was \$9,736, twenty-two times larger.

By the standards of some Asian developing countries, the Chinese are only modestly well off. South Korea and Malaysia for example have GNP's per head well over twice that of the Chinese. But the PRC, with about a quarter of the world's people, has done much better than its populous neighbor India (640 million people in 1978) which has a per capita GNP, according to latest figures, of about a third of China's, measured in US dollars.

Technologically: China an Enigma

The might of China's economy, which ranks sixth in the world today, is in one sense awesome, however.

China is the world's fifth largest producer of primary energy, and third largest coal producer. It has exploded atom bombs and built some relatively high-powered computers.

The Chinese gift for scientific and technological endeavor is well known. Indeed many of China's present top-ranking engineers were trained at MIT, Caltech or University of Illinois.

There is no doubt that China has made great strides in the past thirty years. Industrial products such as trucks, steel and electric power have all increased output at least 14 times since 1949 -- on a per capita basis.

Crude oil and chemical fertilizer production have advanced well over one hundred times on a per capita basis since the founding of the People's Republic.

For a nation that was nearly destitute thirty years ago these are significant achievements.

But in each category of technology one looks at, China is far behind the West. Now preparing for its "four modernizations" in agriculture, industry, science and technology and defense, the PRC is suffering the full impact of the constraints it has created for itself under the slogan of "self-reliance."

These constraints are primarily those of manpower and technical training, management, and financial limitations.

For ten years, from 1966 to 1976, China's technical and higher education programs were eliminated. Management development programs have not existed in China until last year.

Financially, while China has benefitted from foreign government-guaranteed credit facilities since 1973, and has had a good domestic capital investment ratio since 1970, the growth of China's exports and economy as a whole have not permitted its industrial development to flourish.

The Chinese themselves, whose chief economic objective is now to raise the general standard of living, compare their growth with that of Japan. Twenty years ago, the Chinese point out, Japan and China were producing the same amount of steel. Now China is producing 32 million tons a year, while Japan's steel output is 102 million tons. (1978)

(American production of steel was about 123 million tons last year, Soviet production 151 million tons).

Interestingly China has nevertheless long surpassed British and French steel output (20 and 22 million metric tons), and is approaching Germany's production (41 million metric tons).

China's steel industry, however, is not modern. It has only a handful of blown-oxygen furnaces, and no side-blown furnaces (so-called Q-BOP types). The industry suffers from low-grade (30%) ore, erratic power supplies and older equipment.

The PRC's steel target is for 45 million tons by 1985, with help from foreign technology such as German (Demag-Schloeman-Siemag) processing facilities and a Japanese (Nippon Steel) integrated production complex at Baoshan worth some \$2 billion.

Let me briefly look at the state of China's other industries.

Energy

China is now the world's ninth largest petroleum producer (at 2.1 million barrels/day as of August 1979), and has the fourth largest national gas output (1,804 billion cu ft, 1979 through August). But its petroleum industry has a serious lack of skilled manpower and is heavily dependent on foreign equipment and technology.

As you may have heard, 55 foreign oil companies including these from Europe, Brazil, Japan and Yugoslavia have been asked to bid for China's offshore oil surveys. The PRC has bought some \$500 million or so of foreign petroleum equipment from abroad during the 1970's including offshore and onshore rigs, supply vessels, vehicles, drilling technology and related technology.

China has the greatest hydropower potential in the world, estimated at 540-600 gigawatts (million kilowatts) of which only two percent has been developed.

I mentioned earlier that China is the world's third largest coal producer, after the US and USSR. Last year well over \$1 billion worth of open pit and deep shaft mining equipment was bought by the Chinese from the Germans and other European countries.

But despite China's enormous energy resources, this huge nation has no national electricity grid, its power stations work at peak loads most of the time, brown outs and shortages are common, and industry just does not have the energy supplies it needs for critical economic expansion.

The transportation sector is also overloaded and underdeveloped. On a recent trip to the United States, vice-chairman of China's prestigious State Economic Commission (Yuan Baohua), compared US locomotives with those in China. He noted that five steam locomotives are still at work in the US. In China, he said 90 percent of the locomotives presently in use are steam. Yuan stressed the need for electrification and other major improvements in the PRC's railway system.

China has no national highways. It has 65 times more bicycles than cars. Its plans for and progress in container ports are impeded because 40 ft and 20 ft containers cannot be transported inland -- the domestic road and rail network is not adequate to handle containers.

At Beijing's new international airport, there are fewer domestic and international flights a year (about 4,000) than there are in a week at John F. Kennedy Airport in New York, or at Chicago's O'Hare.

In telecommunications, China's billion people are served by only three million telephones or about three per thousand. The US figure is about 750 per thousand. The PRC has excellent facsimile transmission equipment, but old cross-bar style telephone exchanges -- in excellent condition. The need for a nationwide satellite-communication system is pressing.

China's chemical and petrochemical industries have expanded considerably in recent years. In 1978 the PRC produced about 8.7 million metric tons of chemical fertilizer, 285,000 metric tons of synthetic fibers, and 533,000 tons of insecticides.

Foreign technology has been critical to the development of China's chemical industry. During the past eight years the Chinese have bought nearly 150 chemical units worth over \$4.8 billion from West European, Japanese and American firms.

China's fertilizer industry has expanded enormously as a direct result of its 1973 decision to buy 13 large urea-ammonia complexes. These new plants, reportedly costing over \$650 million, should produce 3.5 million tons (in nutrients) of nitrogen fertilizer by 1980 -- close to the total of all nitrogen fertilizer produced in 1975.

In the three months November 1978 to January 1979 alone, China signed contracts for over \$2.5 billion worth of petroleum

processing and petrochemical plants -- including several units for a gigantic new synthetic fiber complex in Nanjing. Many of these units use US technology.

If one is looking at the state of China's technology as a whole we can generalize and say it is ten or twenty or thirty years behind that in the West. Each industry is different.

Agricultural chemical experts say, after seeing Chinese laboratories, that they are 20 years behind the US in insecticides, but very advanced in land-management and crop-strain selection.

Railway engineers say the Dalien locomotive works where they make diesel locos is among the most modern such works they've seen. But even so almost half locomotive production in China is steam.

Construction and mining equipment manufacturers consider Chinese equipment to be mainly of 1940s and 1950s vintage.

In optics the Chinese are advanced, and in some computer development, but generally speaking China has no serial production of computers in the same way the US has. In the past few years China has bought a number of American computers. The real problem here is the software -- experience cannot be bought.

The Role of Technology Imports

This thumbnail sketch of some of China's major industries should be sufficient to indicate that

- much of China's industrial technology is considerably behind that of the West; that
- China wants Western technology as an essential aid to its modernization program; and that
- there is a serious shortage of engineers and skilled manpower in the PRC.

Let me try to place in focus the role foreign technology has played in China's development to date. We are now in the fourth phase of China's technology imports.

In the late 1950's, as China sought to reconstitute industries broken by three decades of civil war and foreign invasion, the Soviet Union came to its aid with what one analyst calls "undoubtedly the most comprehensive transfer in modern industrial history." An estimated \$3.25 billion worth of plant and hardware, and a wealth of knowhow and advisory services were provided to China by the USSR in the years to 1960.

The sudden withdrawal of Soviet aid led China to stress "self-reliance." One of the effects of this policy was not to rely on any single country -- or even company -- as a supplier in any given industry.

A second effect was to put overdue emphasis on the idea of "self-reliance" itself. Intense xenophobic outbursts during the late 1960s and mid-1970's (the Cultural Revolution and Gang of Four period) excoriated almost all things foreign, including technology and credits in particular.

Coupled with this, unfortunately was the notion that anyone indulging in any form of higher education, especially technical education, was elitist. Schools were closed, those with initiative victimized.

In other words, the real self-reliance -- development of technical skills to lessen dependence on others -- diminished

to vanishing point. Ironically China became more dependent on foreign technology than ever before, rather than less. And it cost a generation of skilled manpower -- an incalculable loss.

In 1971-75, China's Fourth Five Year Plan period, the PRC bought some \$3.03 billion worth of turnkey plants from Japan, France, Britain, West Germany, and the US.

Then came the Gang of Four period in 1976 and 1977 in which China's economy came close to collapsing.

The third phase of China's technology import program began and ended in 1978. During that year some \$60-70 billion worth of projects were discussed by the Chinese with foreign suppliers.

These projects included massive iron and steel complexes, huge mine developments, offshore oil exploration, hotels, ports, hydro-electric schemes, power stations, coal mining equipment, and non-ferrous metal projects.

The magnitude of these imports under discussion, to be delivered in the eight years to 1985, was unprecedented in China's history. Not only that, the Chinese were discussing seven times as many imports as they were actually importing that year (\$70 billion against only \$11 billion).

While financially, managerially and technically there was no way China could absorb so much technology, it was clear that foreign technology had -- and still has -- an essential role to play in China's economic development, in nearly all major industrial categories.

There is now a lull.

After realizing it could not do everything at once, Beijing has embarked on a three-year readjustment period in which new institutions, laws and ways of doing business are paving the way for solid economic development.

- Cooperative production, compensation trade, design engineering and joint venture investments have now extended the lexicon of the China trade.
- Think-tanks are studying and experimenting with new economic systems, structures and theories.
- China's commissions are also studying how to effectively use foreign investment and introduce foreign technology, equipment and management experience.

A New Emphasis - Management and Renovation

The present preparatory period has already given new direction to China's technology import policies.

Self-reliance still figures in the equation. To quote China's Chairman Hua Guofeng in a recent interview (September 11, 1979 with Felix Greene)

"For a socialist country like China, the foremost and primary approach to achieving modernization must be self-reliance and tapping all our potentials. We have already built an industrial base of considerable scale. It is from this base that we have started on our march towards modernization. This is one aspect of the problem."

Hua went on to say "On the other hand, we will definitely

not close our door to the world, but will endeavour to learn all that is fine from other countries. We will import, in a planned way, urgently needed advanced scientific know-how and absorb foreign investments, for this will help us accelerate our modernization program."

Instead of imports of the best and brightest western technology, the emphasis now is on purchase strictly of what is suitable and appropriate for China, on renovation of older factories, on developing infrastructure, and on reorienting management to be more effective.

Cost-effective import of know-how is now emphasized.

Vice Minister Gu Ming of the PRC's State Planning Commission recently wrote --

"We must gradually change to importing mainly technologies (including the technology to manufacture key equipment), selectively purchasing key equipment and designing the engineering projects ourselves. We should not import complete plants, if importing key equipment will solve the problem.

"If importing technology will solve the problem, we should not import equipment. Only in this way can we enhance our designing and manufacturing skills and constantly increase our ability to do things by ourselves."

Another part of the strategy is to import equipment that will serve to enhance China's own exports. For only in this way will Peking be able to import the technology it wants.

Thus is China preparing for the Sixth Five-Year Plan (1981-85) during which we expect to see another round of major plant and technology purchases begin again.

I think it clear that the impact foreign technology has had on China's society as well as its economy has been considerable. Some four-to-five thousand foreign executives, engineers, and technicians have been stationed in China over the past five years or so. Many more will be in future.

We cannot quantify this impact, but it has, I am sure been a constructive element in the development of the US relationship with the People's Republic.

Prospects for American Technology Sales to China

What are the prospects for American Technology Sales to China? And how is American export policy responding to these prospects?

The first point to be made here is that the foreign competition for the considerable amount of China business I have described has always been severe. With the normalization of diplomatic relations between the US and China the competition has tended to intensify; no longer does the political element enter the picture.

To give you an idea of some of the stakes involved let me mention some of the larger purchases China has made in the past five years or so. These include:

- the Baoshan integrated steel plant
sold by the Japanese worth \$2 billion
- the \$267 million Spey engine technology
sale by Rolls-Royce
- the \$292 million petrochemical complex
sold by Technip-Speichim of France
- the \$251 million iron and steel processing
complex sold by Germany's Demag-Schloemann
- another \$223 million iron and steel complex
sold by the Japanese
- and \$205 million worth of American plants
sold to China by Pullman Kellogg

In other words we are talking about a lot of dollars and jobs.

If we look into the future, we project that China can afford to buy \$40 million worth of foreign plant and technology in the seven years to 1985. In doing so we expect China to remain financially prudent, keeping its debt-service ratio to a maximum of 15 percent, requiring borrowings of only \$15 billion over the seven year period.

We do not yet know the precise form of China's future technology import priorities but two of the attachments to this statement (China's Foreign Technology Budget, 1978-85 and Summary of Total Value of Sales to and Negotiations with China: 1978) will give a good picture of the scale and scope of China's interests last year.

Unquestionably, passage of the Sino-US Trade Agreement is the crucial step needed to make China eligible for US EximBank credits. The other steps--a Presidential determination that EximBank credits to China are in the national interest and settlement of outstanding EximBank loans to China--should not be as difficult to obtain.

Also, the EximBank will have to ask Congress for an increase in its fiscal 1980 lending authority so that credits to China do not reduce funds available to other countries. We urge Congress to approve such an increase.

Industrial Property Rights

Other aspects of the Trade Agreement will also be of significant practical benefit to US exporters to China. In particular the clauses in the Agreement providing for protection of American patent rights will increase the incentive for American exporters to sell to the PRC.

So far 121, mostly petrochemical, licenses have been sold to China by foreign companies during the 1970's, of which 34 represent American technology.

In Article VI of the Sino-US Trade Agreement, the Chinese have agreed to the protection of US patents, trademarks, and copyrights equivalent to that offered by the US government. In a country that until recently had no system for the registration of industrial or intellectual property, this is a significant step.

Facilitation of Long-Term Marketing

The US-China trade accord also provides for facilitation of trade relations, commits the Chinese to reliance on commercial contracts and considerations, and eases the way for establishment of offices and representatives of US companies in Beijing. With 88 Japanese companies now in residence in Beijing this is not to be sneezed at.

The Agreement also establishes a financial framework for normal banking operations, and allows for arbitration of commercial disputes to be carried out in a third country if they cannot be settled amicably first.

Overall, the Agreement, which has a three-year term, will for the first time provide the basis for long-term marketing efforts to China by American firms, essential for the major kinds of projects now under negotiation.

Investment Insurance

Availability of OPIC (Overseas Private Investment Corporation) insurance, guarantees and loans will also facilitate American investment in China under the terms of the PRC's new joint venture law. At least 20 American firms are discussing such ventures with the Chinese at this date.

We urge Congress and the Administration to take the steps necessary to make OPIC facilities available to US firms doing business with China.

Passage of an amendment to Section 620(f) of the Foreign Assistance Act would be especially beneficial to smaller companies that need OPIC's relatively low premiums and long-term coverage, inasmuch as these favorable terms are normally provided by private insurance companies only to their larger customers.

Export Controls

Finally a word about export controls. Since trade with China began in June 1971, over \$1 billion worth of export approvals have been granted for sales of American equipment and technology to China.

Almost a quarter of a billion dollars worth (\$242 million) of licenses have been approved in the first nine months of this year alone.

The principal categories approved were aircraft (\$170.5 million through October 10, 1979), seismic survey equipment including computers (\$51.8 million), computers (\$11.6 million), and numerically controlled machine tools.

While these figures may not represent actual sales, they are a clear indication of China's interest in US technology.

Let me confine my remarks to two major points -

1) The adverse impact of US export licensing delays on the ability of US firms to present themselves as reliable suppliers to communist markets, and 2) the need for the US to map out a coherent policy concerning the transfer of high technology to China.

We find it extremely encouraging that the new Export Administration Act of 1979 requires the Secretary of Defense to develop a list of critical technologies for the purpose of facilitating national security export controls by October 1, 1980.

The lengthy delays associated with the progress of the approval or rejection of an application for a validated export license has been recognized as a critical problem by the US Congress. In an effort to simplify and expedite the export administration procedure the new Export Administration statute has established a timetable for export license reviews and created a new category of licenses--the qualified general license--which can be used for multiple shipments of a given item to a particular destination.

American exporters, of course, would like a license approval or rejection as promptly and expeditiously as possible. But they tend to regard 90 days as reasonable for cases not requiring interagency or COCOM review.

Currently, though, it can take up to 30 months to get a validated export license for telecommunications, computer and electronic equipment. The Administration's approval last March of Digital Resources sales of airborne infrared scanning equipment for use in geological survey work in China stretched over a period of nearly three years.

In addition to the normal delays accompanying the US licensing procedure for sensitive goods and technology, American

suppliers suffer an extra layer of paper work for sales under multilateral control by COCOM. Especially now, with about 15 percent of COCOM's cases for sales to the PRC so far in 1979, of which 48 percent are being processed for US companies, American businessmen are worried about their reputation for reliability.

Moreover, it is argued that the Chinese and other potential Eastern customers are showing a preference to buy from non-US sources who can offer a similar product with a predictable shipment and delivery schedule.

For sales not requiring full COCOM approval American companies also feel adversely effected by the length of the licensing cycle. Whereas a US exporter can expect a licensing decision within 90 days under the most favorable circumstances, other Western governments--working hand in glove with their industries--grant licenses within 30 days.

West Germany does not even make it legally binding for a private firm to obtain a government license before commencing shipment abroad.

With the range of products and technology being equal among many US, European and Japanese high technology suppliers, the US licensing system on both a technical and policy level has in the past been a serious handicap to US exporters vis-a-vis its competitors in other COCOM countries.

We earnestly hope that the new legislation will fulfill its goal and result in expediting and clarifying the export licensing process.

Conclusion

The normalization of US-China relations has provided the US with an unprecedented opportunity to cultivate a growing network of scientific, educational and trade relations with the PRC.

The influx of as many as 800 Chinese students to the US and the proliferation of scientific, technical and industrial exchanges -- reaching an estimated 450 this year -- is just the tip of the iceberg of Sino-American cooperation now taking shape on the private and public fronts.

The elements of the long-term Sino-US technology transfer process are more complex than ever before.

But, in a strictly practical sense, if we look ahead, approval of the Trade Agreement, EximBank and the other facilities I have noted will be critical in negotiating potentially massive ventures now under discussion with the Chinese. These ventures include manufacturing of trucks and tractors, development of mines, installation of power plants, hydro-electric schemes, telecommunications projects and offshore oil development. These contracts could easily go to European and Japanese firms now in fierce competition with American companies for what could be multi-million dollar deals.

Frankly, it is time for American companies to be more aggressive. The United States needs a clear-cut, pragmatic export policy.

If American companies are going to be successful in the China market, they must be able to compete with competitors on equal terms.

If these terms are available, the prospects are very bright.

APPENDICES

1. "30 Years of the PRC" Then and Now
Source: The China Business Review, September/October 1979
2. "Sino-US Trade Agreement-July 1979"
Source: The China Business Review, July/August 1979
3. "China's Trade Through 1985"- CBR Forecast
Source: The China Business Review, May/June 1979
4. "Official PRC Statistics-1977-1978"
Source: The China Business Review, July/August 1979
5. "Now,Exim for China?"
Source: The China Business Review, September/October 1979
6. "China's Foreign Technology Budget, 1978-85(billion US \$)
Source: Sales to China and Negotiations for Sales, 1978(S.R.#23)
7. "Summary of Total Value of Sales to and Negotiations with China: 1978"
Source: Sales to China and Negotiations for Sales, 1978(S.R.#23)
8. "Analysis of Total Sino-US Trade, 1978"
Source: Sino-US Trade Statistics 1978 (S.R. #24)
9. "U.S. Domestic Exports to CPE's for January-August 1979"
Source: Department of Commerce - Bureau of Census
10. "Major US Sales to China 1973-1978"
Source: National Council for US-China Trade

Then and Now

30 YEARS OF THE PRC

October 1, 1949–October 1, 1979

The People's Republic of China's thirtieth birthday on October 1, 1979, celebrates many advances, some of which are charted opposite. Domestic progress has been facilitated by China's achievements in the community of world nations, the greatest of which was obtaining its rightful status as a fully recognized country. Long overdue, this will serve as the foundation for China's international policies and economic development for decades to come.

The familiar faces of China's leaders on the Tian An Men rostrum at this year's October 1 celebrations may give the impression that few upheavals have occurred since 1949. Not only do six Long March veterans sit in the Politburo, but prominent officials of two, and even three, decades ago, such as Deng Xiaoping, Chen Yun, Ye Jianying, and Li Xiannian still stand at the country's helm.

The appearance of continuity is the result of a coup d'état engineered by Chairman Hua Guofeng during the evening of October 6, 1976, against the "Gang of Four."

This event led to the return of China's staunch pragmatist, Deng Xiaoping, in July 1977. Since then banished government officials by the thousands have been summoned back from forced retirement and factory labor whence the radicals had sent them in the Cultural Revolution and in early party purges. A fresh breeze of tolerance, cultural revival, and renewed educational commitment has returned with them, and above all a pragmatic attitude toward development.

Swings in the economy have reflected the extreme

oscillations in the country's political life. The golden age of unified leadership and rapid growth, in Beijing's view, was the First Five Year Plan (1953–57). Even today, *People's Daily* editorials often cite the high growth rate of industry and other laudatory statistics of the 1950s.

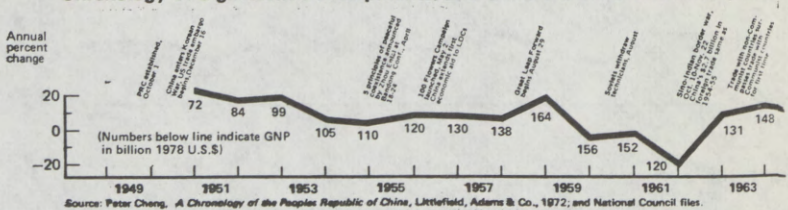
The low point in the nation's economic life came in 1959–61, the "three bad years" following Mao's ill-conceived Great Leap Forward in which every significant indicator plummeted.

Huge grain imports began in 1961 with the help of China's first Western credits. Borrowings from Communist countries ceased the same year, and by 1965 China had paid back its entire \$1.4 billion loan to its erstwhile friend, the USSR.

Overshadowing China's 30-year anniversary, however, is the legacy of the Cultural Revolution and subsequent "ten lost years" (1966–75). The struggle for succession which broke out during these years paralyzed education and civilian research, resulting in losses to the nation that have retarded economic modernization ever since.

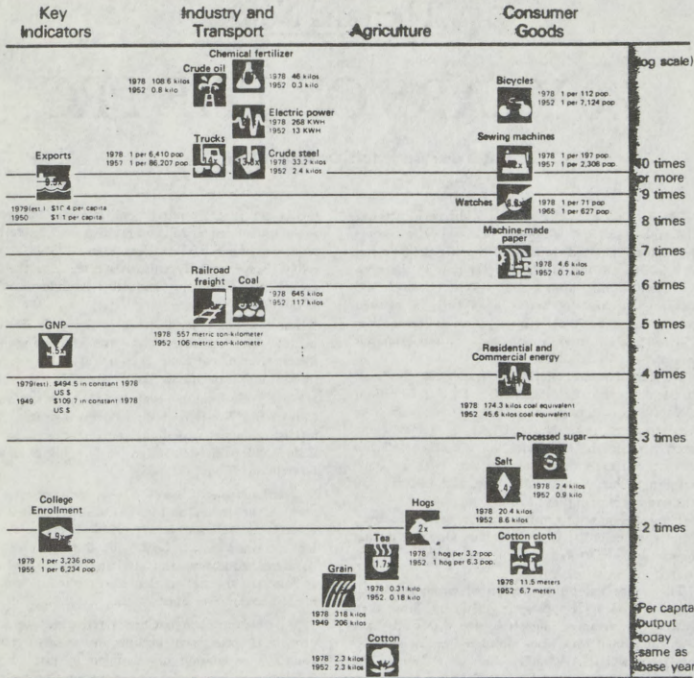
A second problem is China's relentless population growth. Despite recent declines in the birth rate, the country's population has doubled in just 30 years. This growth has wiped out many of China's otherwise impressive output statistics when calculated on a per capita basis. Recently Beijing has turned its attention to meeting the demographic challenge upon which China's prospects for the next 30 years depend.

Chronology of Significant Developments, and China's GNP Growth Rate, 1950–

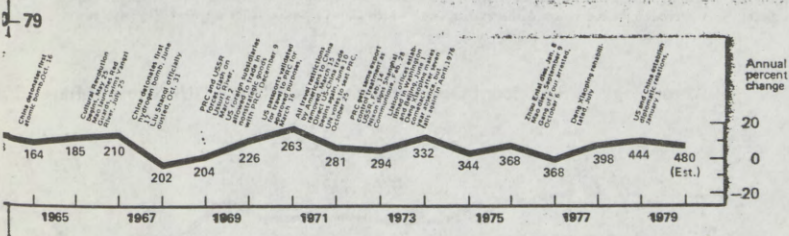


THE CHINA BUSINESS REVIEW

Per Capita Output Today Compared with Earliest Post-1949 Levels for which Statistics Are Available



Sources: National Foreign Assessment Center, China: A Statistical Compendium, July, 1979; Xinhua, June 27, 1979; and JEC (ed.), Chinese Economy Post-Mao, Table 2, p. 208, November, 1978.



THE CHINA BUSINESS REVIEW

The Sino-US Trade Agreement

July 7, 1979

The following is the US-China trade agreement, signed in Beijing on July 7, 1979. It incorporates mutual granting of most-favored-nation status and a provision to facilitate the availability of Exim Bank credits. The agreement will not become effective until it has been approved by both houses of Congress—probably before the end of the year.

Key points of the agreement include:

- The US "determined" that China is a developing country, clearing the way for possible granting of duty-free treatment through the Generalized System of Preferences (GSP), if China joins the IMF and the GATT. (II.3.)
- The accord sets up a framework for allowing the Bank of China to operate in the US, and for US banks to operate in China. (V.4.)
- China has agreed to protection of patents, trademarks, and copyrights equivalent to that accorded by the US. (VI.3.5.)
- A special provision allows the US to terminate the agreement if the President's waiver of the Jackson-Vanik amendment is not renewed in future years. (X.3.)

The Government of the United States of America and the Government of the People's Republic of China;

Acting in the spirit of the Joint Communiqué on the Establishment of Diplomatic Relations between the United States of America and the People's Republic of China;

Desiring to enhance friendship between both peoples;

Wishing to develop further economic and trade relations between both countries on the basis of the principles of equality and mutual benefit as well as nondiscriminatory treatment;

Have agreed as follows:

Article I

1. The Contracting Parties undertake to adopt all appropriate measures to create the most favorable conditions for strengthening, in all aspects, economic and trade relations between the two countries so as to promote the continuous, long-term development of trade between the two countries.

2. In order to strive for a balance in their economic interests, the Contracting Parties shall make every effort to foster the mutual expansion of their reciprocal trade and to contribute, each by its own means, to attaining the harmonious development of such trade.

3. Commercial transactions will be effected on the basis of contracts between firms, companies and corporations, and trading organizations of the two countries. They will be concluded on the basis of customary international trade practice and commercial considerations such as price, quality, delivery, and terms of payment.

Article II

1. With a view to establishing their trade relations on a nondiscriminatory basis, the Contracting Parties shall accord each other most-favored-nation treatment with respect to products originating in or destined for the other Contracting Party; i.e., any advantage, favor, privilege, or immunity they grant to like products originating in or destined for any other country or region, in all matters regarding:

- (a) Customs duties and charges of all kinds applied

to the import, export, re-export, or transit of products, including the rules, formalities, and procedures for collection of such duties and charges;

(b) Rules, formalities, and procedures concerning customs clearance, transit, warehousing, and transshipment of imported and exported products;

(c) Taxes and other internal charges levied directly or indirectly on imported or exported products or services;

(d) All laws, regulations and requirements affecting all aspects of internal sale, purchase, transportation, distribution or use of imported products; and

(e) Administrative formalities for the issuance of import and export licenses.

2. In the event either Contracting Party applies quantitative restrictions to certain products originating in or exported to any third country or region, it shall afford to all like products originating in or exported to the other country treatment which is equitable to that afforded to such third country or region.

3. The Contracting Parties note, and shall take into consideration in the handling of their bilateral trade relations, that, at its current state of economic development, China is a developing country.

4. The principles of Paragraph 1 of this Article will be applied by the Contracting Parties in the same way as they are applied under similar circumstances under any multilateral trade agreement to which either Contracting Party is a party on the date of entry into force of this Agreement.

5. The Contracting Parties agree to reciprocate satisfactorily concessions with regard to trade and services, particularly tariff and nontariff barriers to trade, during the term of this Agreement.

Article III

For the purpose of promoting economic and trade relations between their two countries, the Contracting Parties agree to:

A. Accord firms, companies and corporations, and trading organizations of the other Party treatment no less favorable than is afforded to any third country or region;

B. Promote visits by personnel, groups and delegations from economic, trade, and industrial circles; encourage commercial exchanges and contracts; and support the holding of fairs, exhibitions, and technical seminars in each other's country;

C. Permit and facilitate, subject to their respective laws and regulations and in accordance with physical possibilities, the stationing of representatives, or the establishment of business offices, by firms, companies and corporations, and trading organizations of the other Party in its own territory; and

D. Subject to their respective laws and regulations and physical possibilities, further support trade promotions and improve all conveniences, facilities, and related services for the favorable conduct of business

activities by firms, companies and corporations, and trading organizations of the two countries, including various facilities in respect of office space and residential housing, telecommunications, visa issuance, internal business travel, customs formalities for entry and reexport of personal effects, office articles and commercial samples, and observance of contracts.

Article IV

The Contracting Parties affirm that government trade offices contribute importantly to the development of their trade and economic relations. They agree to encourage and support the trade promotion activities of these offices. Each Party undertakes to provide facilities as favorable as possible for the operation of these offices in accordance with their respective physical possibilities.

Article V

1. Payments for transactions between the United States of America and the People's Republic of China shall either be effected in freely convertible currencies mutually accepted by firms, companies and corporations, and trading organizations of the two countries, or made otherwise in accordance with agreements signed by and between the two parties to the transaction. Neither Contracting Party may impose restrictions on such payments except in time of declared national emergency.

2. The Contracting Parties agree, in accordance with their respective laws, regulations and procedures, to facilitate the availability of official export credits on the most favorable terms appropriate under the circumstances for transactions in support of economic and technological projects and products between firms, companies and corporations, and trading organizations of the two countries. Such credits will be the subject of separate arrangements by the concerned authorities of the two Contracting Parties.

3. Each Contracting Party shall provide, on the basis of most-favored-nation treatment, and subject to its respective laws and regulations, all necessary facilities for financial, currency, and banking transactions by nationals, firms, companies and corporations, and trading organizations of the other Contracting Party on terms as favorable as possible. Such facilities shall include all required authorizations for international payments, remittances and transfers, and uniform application of rates of exchange.

4. Each Contracting Party will look with favor towards participation by financial institutions of the other country in appropriate aspects of banking services related to international trade and financial relations. Each Contracting Party will permit those financial institutions of the other country established in its territory to provide such services on a basis no less favorable than that accorded to financial institutions of other countries.

Article VI

1. Both Contracting Parties in their trade relations recognize the importance of effective protection of patents, trademarks and copyrights.

2. Both Contracting Parties agree that on the basis of reciprocity legal or natural persons of either Party may apply for registration of trademarks and acquire exclusive rights thereto in the territory of the other Party in accordance with its laws and regulations.

3. Both Contracting Parties agree that each Party shall seek, under its laws and with due regard to international practice, to ensure to legal or natural persons of the other Party protection of patents and trademarks equivalent to the patent and trademark protection correspondingly accorded by the other Party.

4. Both Contracting Parties shall permit and facilitate enforcement of provisions concerning protection of industrial property in contracts between firms, companies and corporations, and trading organizations of their respective countries, and shall provide means, in accordance with their respective laws, to restrict unfair competition involving unauthorized use of such rights.

5. Both Contracting Parties agree that each Party shall take appropriate measures, under its laws and regulations and with due regard to international practice, to ensure to legal or natural persons of the other Party protection of copyrights equivalent to the copyright protection correspondingly accorded by the other Party.

Article VII

1. The Contracting Parties shall exchange information on any problems that may arise from their bilateral trade, and shall promptly hold friendly consultations to seek mutually satisfactory solutions to such problems. No action shall be taken by either Contracting Party before such consultations are held.

2. However, if consultations do not result in a mutually satisfactory solution within a reasonable period of time, either Contracting Party may take such measures as it deems appropriate. In an exceptional case where a situation does not admit any delay, either Contracting Party may take preventive or remedial action provisionally, on the condition that consultation shall be effected immediately after taking such action.

3. When either Contracting Party takes measures under this Article, it shall ensure that the general objectives of this Agreement are not prejudiced.

Article VIII

1. The Contracting Parties encourage the prompt and equitable settlement of any disputes arising from or in relation to contracts between their respective firms, companies and corporations, and trading organizations, through friendly consultations, conciliation or other mutually acceptable means.

2. If such disputes cannot be settled promptly by any one of the above-mentioned means, the parties to the dispute may have recourse to arbitration for settlement in accordance with provisions specified in their contracts or other agreements to submit to arbitration. Such arbitration may be conducted by an arbitration institution in the People's Republic of China, the United States of America, or a third country. The arbitration rules of procedure of the relevant arbitration institution are applicable, and the arbitration rules of the United Nations Commission on International Trade Law recommended by the United Nations, or other international arbitration rules, may also be used where acceptable to the parties to the dispute and to the arbitration institution.

3. Each Contracting Party shall seek to ensure that arbitration awards are recognized and enforced by their competent authorities where enforcement is sought, in accordance with applicable laws and regulations.

Article IX

The provisions of this Agreement shall not limit the right of either Contracting Party to take any action for the protection of its security interests.

Article X

1. This Agreement shall come into force on the date on which the Contracting Parties have exchanged notifications that each has completed the legal procedures necessary for this purpose, and shall remain in force for three years.

2. This Agreement shall be extended for successive terms of three years if neither Contracting Party notifies the other of its intent to terminate this Agreement at least 30 days before the end of a term.

3. If either Contracting Party does not have domestic legal authority to carry out its obligations under this Agreement, either Contracting Party may suspend application of this Agreement, or, with the agreement of the other Contracting Party, any part of this Agreement. In that event, the Parties will seek, to the fullest extent practicable in accordance with domestic law, to minimize unfavorable effects on existing trade relations between the two countries.

4. The Contracting Parties agree to consult at the request of either Contracting Party to review the operation of this Agreement and other relevant aspects of the relations between the two Parties.

In witness whereof, the authorized representatives of the Contracting Parties have signed this Agreement.

Done at Beijing in two original copies this 7th day of July, 1979, in English and Chinese, both texts being equally authentic. *

Subject to approval by Congress.

THE CHINA BUSINESS REVIEW

"As far as the volume of trade between our countries is concerned, surely it would not be less than our trade with Japan."

Vice Premier Deng Xiaoping
to Secretary of Commerce,
Juanita Kreps, Beijing,
May 10, 1979.

1978

Sino-US trade \$1.15 billion

Sino-Japanese trade \$5.08 billion

- The National Council projects that China's total trade will reach \$63 billion by 1985, with the PRC's exports growing at an annual average rate of 17 percent, and imports by 18 percent during 1979-85.

- China's total import bill during 1979-85 is estimated at \$164 billion.

- China can remain financially prudent—borrowing only \$15 billion over the next seven years—and still import Western technology worth approximately \$40 billion while keeping its debt service ratio no higher than 15 percent.

- Invisible Items In China's balance of payments will probably net an additional \$12 billion in hard currency revenues during 1979-85, although grain purchases costing over \$1 billion annually are likely to continue through 1985.

- US-China trade will be at least \$3.5 billion by 1985, assuming the US share of China's total two-way trade remains the same as it is now, but could rise to as much as \$8 billion.

- China's accumulated imports from the US during 1979-85 are estimated at \$23 billion, while estimated total US imports from China over the same period add up to \$11 billion.

CBR Forecast

China's Trade Through 1985

CHINA'S EXPORTS AND IMPORTS THROUGH 1985

The National Council estimates that China's total foreign trade will increase at an annual average rate of 17 percent during 1979 through 1985, and that the PRC will achieve \$63 billion in two-way trade by 1985. This figure, which is based on an analysis of past trends and Chinese policy pronouncements through March 1979, assumes that exports will grow rapidly in the next two years in order to earn foreign exchange to meet China's growing capital goods import bill.

During 1981-82, however, exports are expected to slow as China turns its attention inward to the problem of absorbing approximately \$28 billion of capital goods and technology imports that will by then have entered the PRC.

About \$10 billion of these high-technology items were contracted for in 1978, according to a recently published National Council study. An equivalent value of contracts can be expected in 1979, if China is to reach its capital construction objective of importing, and setting up, a total of about \$50 billion in Western plant and equipment by 1985, the final year of the country's current 8-year development plan.

Imports are projected to grow faster than exports, and reach \$31 billion by 1985. As a result of China's

ambitious import program, the trade balance is likely to be in the red during 1979-84. In the past China rarely tolerated trade deficits for long, but the government has altered its self-reliant policies on loans, foreign investment, and tourism, to mention just a few recent examples, and a change of stance with regard to protracted—but modest—trade deficits is possible.

Trade deficits are expected to be covered by loan drawings, amounting to about \$15 billion during 1979-85. At this level of borrowing debt service payments will rise to 15 percent of China's hard currency exports in 1979—unless the \$6 billion short-term facility currently under negotiation with Japanese banks is rolled over next year, or converted to long-term credits. Otherwise, China's debt service ratio will remain under 10 percent, the same modest level as in 1978.

In the near future China can look forward to substantial foreign exchange earnings from tourism, transport services, and other credit items in its balance of payments that in past years contributed little hard currency income.

The magnitude of these invisible items is such that henceforth current account surpluses may be realized despite persistent deficits on China's trade account. These new revenues are the result of recent policy choices, reflecting the government's new determination to enlarge its merchant marine, exploit the country's tourist potential, and encourage overseas Chinese to increase their remittances, invest in factories, and buy homes for their relatives in China.

US-CHINA TRADE—\$3.5 TO \$8 BILLION BY 1985

Assuming that America's share of the China market remains unchanged, total US-China trade will increase by 17 percent per annum and reach \$3.5 billion by 1985. But the US share in China's exports and imports will undoubtedly increase in the years following the normalization of relations, and total Sino-American trade is more likely to approach \$8 billion by 1985.

This will occur if the US export share in China's trade doubles by 1985—a level that is still far short of parity with Japan's share in the China market which the PRC has indicated is the long-run level also desired with the US—then US exports to China would be around \$5 billion by 1985, comprising 16 percent of China's imports in that year.

US imports from China in 1985 should reach almost \$3.2 billion, assuming that China's exports increase at an annual average rate of 39 percent during 1979-85. (PRC exports to the US grew by 51 percent annually during 1973-78.) This figure is 10 percent of China's export market, also well below Japan's current share of 19 percent. Given these conservative growth parameters, total US-China trade of \$8 billion would represent an annual average rate of increase of 33 percent during 1979-85. Of the total, US food exports to the PRC will top \$2 billion by 1985, and US imports of Chinese manufactured goods will pass the \$1 billion mark, assuming these two categories have the same trade shares in 1985 that they do now, of 44 and 32 percent, respectively.

PROJECTED AMERICAN EXPORTS TO THE PRC, 1985, BY CATEGORY¹

Category	Total, 1985 (millions of US \$)	Percent
Food & Live Animals	\$2,190	44
Crude Materials, Inedible, Except Fuels	1,340	27
Machinery and Transport Equipment	550	11
Chemicals	350	7
Animal and Vegetable Oils and Fats	250	5
Manufactured Goods by Chief Materials	150	3
Miscellaneous Manufactured Articles, nec*	100	2
Mineral Fuels, Lubricants, and Related Products	10	.2
Items and Transactions Not Classified	40	.8
Totals	4,980	100 %

¹ The values and percentages for each category are based on 1978 export breakdowns published by the Department of Commerce and trade projections prepared by the National Council.

* not elsewhere classified

PROJECTED AMERICAN IMPORTS FROM THE PRC, 1985, BY CATEGORY¹

Category	Total, 1985 (millions of US \$)	Percent
Miscellaneous, Manufactured Articles, nec*	\$1,020	32
Manufactured Goods by Chief Materials	930	29
Crude Materials, Inedible, Except Fuel	570	18
Chemicals	350	11
Food and Live Animals	260	8
Animal and Vegetable Oil and Fats	30	1
Beverages, Tobacco, Machinery and Transport Equipment	10	.3
Items and Transactions Not Classified	20	.7
Totals	3,190	100 %

Total projected US-China Trade in 1985: \$6,170 million.

¹ The values and percentages for each category are based on 1978 import breakdowns published by the Department of Commerce and trade projections prepared by the National Council.

* not elsewhere classified

CHINA'S PROJECTED EXPORTS AND IMPORTS THROUGH 1985
(In million current US dollars)

Year	A China's Exports (fob)	Growth Rate (percent)	B China's Imports (fob)	Growth Rate (percent)	C Total Trade (A + B)	Growth Rate (percent)
1978	10,200	26	10,100	55	20,300	39
1979	12,800	25	13,200	31	26,000	28
1980	15,900	24	18,300	39	34,200	32
1981	17,500	10	22,100	21	39,600	16
1982	19,200	10	25,100	14	44,300	12
1983	22,100	15	26,100	4	48,200	9
1984	26,500	20	27,800	7	54,300	13
1985	31,900	20	31,100	12	63,000	16
TOTAL (1979-85)	145,800	17*	163,700	18*	309,600	17.6*

* Annual average growth rate, 1979-85.

**KEY FINANCIAL VARIABLES IN ESTIMATING CHINA'S
FOREIGN TRADE, 1978-85**
(In million current US dollars)

Year	Services and Transfers						J Current Account Balance (D + I)
	D	E	F	G	H	I	
	Trade Balance (fob) (A-B)	Net Tourist Revenue	Net Transport Revenue	Overseas Chinese Remittances	Net Foreign Aid	Net Services and Transfers (E + F + G + H)	
1978	100	300	240	400	- 220	720	820
1979	- 400	390	300	460	- 220	930	530
1980	- 2,400	500	360	520	- 220	1,160	-1,240
1981	- 4,600	570	400	590	- 220	1,340	-3,260
1982	- 5,900	660	440	680	- 220	1,560	-4,340
1983	- 4,000	800	500	770	- 220	1,850	-2,150
1984	- 1,300	1,010	600	880	- 220	2,270	970
1985	800	1,260	720	1,000	- 220	2,760	5,560
Total (1979-85)	-17,800	5,190	3,320	4,900	-1,540	11,870	-5,930

K	L	M	N		O	Year
Loan Drawings	Loan Repayments	Down Payment Credits	Cash Down Payments		Change in Foreign Exchange Reserves (Increase -) J + (K + L) + (M + N)	
			Progress Payments	Capital Good Imports on Credit		
830	- 750	—	-1,470	-370	940	1978
2,080	-1,660	500	-1,000	-250	- 200	1979
2,820	-1,620	1,080	- 670	-170	- 200	1980
3,080	- 790	1,500	- 270	- 60	- 200	1981
3,040	- 170	1,670	—	—	- 200	1982
2,230	- 790	1,210	—	—	- 500	1983
1,070	-1,920	580	—	—	- 700	1984
250	-2,780	170	—	—	-1,200	1985
14,570	-9,730	6,710	-1,940	-480	-3,200	TOTAL (1979-85)

Assumptions and Methodology

A Exports increase rapidly during 1979-80 in order to obtain hard-currency revenues needed to purchase capital good imports. During 1981-82, the rate of increase slackens owing to the greater domestic need for resources to complement high-technology imports that by then will be entering China's ports in larger volume. After 1983, exports again increase rapidly in order to overcome new shortages, and to meet 1985 targets.

B Imports constitute a residual category, dependent upon foreign exchange earnings from exports, invisibles, loans, and changes in monetary reserves. This approach coincides with the realities of centrally planned economies, in which imports are used to fill critical gaps in the state plan. The level of imports depends upon whether foreign exchange-generating sectors achieve their targets.

C Items A + B.

D The 1985 trade surplus is due mainly to a build up in foreign exchange reserves during 1984-85.

E The total number of tourists and overseas Chinese that visited China in 1978, according to two different official reports, was 400,000 and 700,000. Using the lower figure, total tourist expenditures were about \$300 million in 1978, assuming an average foreign exchange expenditure per person of \$50 per day over 15 days. During 1979-85, projected expenditures increase by 5 percent annually, while the number of tourists is assumed to increase at the same rate as exports.

F About 70 percent of China's foreign trade is currently carried in PRC-owned vessels, according to one authority. Based on this estimate, a figure for net revenues from transport services was obtained for 1978, and projected in line with export growth.

G Overseas Chinese remittances were estimated to be approximately \$400 million in 1978. The Chinese government wishes to increase this figure to \$1 billion, according to reports in Hong Kong. Assuming that this target is achieved by 1985, remittances will increase at an average annual rate of 17 percent.

H China's annual aid disbursements during 1975-77 averaged \$320 million. After declining from higher aid levels during 1970-74, aid outlays have remained fairly steady, and it is likely that these modest commitments will continue through 1985.

I Items E + F + G + H.

J Items D + I.

K Credits are assumed to be drawn at the time of delivery of capital good imports on a pro rata basis. During 1978-85, these imports will total at least \$40 billion, according to National Council estimates. Of this total, \$10 billion was contracted for in 1978, while the remainder will probably be contracted for during 1979-82. One-third of these imports were purchased on 5-year credits; it is further assumed that two-thirds involved progress payments.

L Repayments begin the fifth year after importation, followed by equal installments through year nine. Interest charges of 7.25 percent are compounded annually.

M In accordance with balance of payments procedures, down payments are entered in the capital account as deb. items, and as an equivalent positive change in reserves. (Decreases in foreign currency reserves are customarily indicated by a positive sign.) In later years, items previously paid for must be credited in the capital account in the year the imports are debited in the merchandise trade account.

N Ten percent down payments are calculated for capital goods imported on credit, and 20 percent for items involving progress payments.

O China's foreign currency reserves in 1978 were over \$2 billion, according to Vice Premier Li Xinnan. This study assumes that during 1984-85, if not earlier, China will endeavor to build up its reserves in order to restore the 15 percent ratio of reserves to imports it currently maintains. In keeping with standard balance of payments notation, increases in foreign currency reserves are indicated by a minus sign.

PROJECTED US-CHINA TRADE, 1978-85
(in billion current US dollars)

Year	US Exports to China	Share PRC Imports (percent)	US Imports from China	Share PRC Exports (percent)	Total US-China Trade	Growth Rate (percent)	Share of China's Total Trade (percent)	
							US	Japan *
1978	0.82	8	0.32	3	1.14	205	5.5	24
1979	1.37	10	0.53	4	1.90	66	7.1	24
1980	2.01	11	0.80	5	2.81	48	8.2	24
1981	2.65	12	1.05	6	3.70	32	9.3	24
1982	3.27	13	1.35	7	4.62	25	10.4	23
1983	3.65	14	1.77	8	5.42	17	11.2	22
1984	4.17	15	2.39	9	6.56	21	12.1	21
1985	4.98	16	3.19	10	8.17	25	13.0	20
TOTAL	22.92	—	11.40	—	34.32	33**	—	—

* Japan's 1979 share of two-way trade is projected in line with its average share during 1974-78. During 1980-85, its share is expected to decline 3-5 percent.

** Annual average growth rate, 1979-85.

Sources: Trade projections, and an explanation of underlying assumptions and methodology, may be obtained from the National Council.

Official PRC Statistics

1977-1978

On June 27, 1979, the newly reemerged State Statistical Bureau issued statistics on China's economic performance in 1977 and 1978. This is the first time since 1959 that China has released comprehensive economic data in tabular form. Numbers in *italics* under the official figures are previous US Government estimates. Values in yuan are accompanied by dollar equivalents in boldface type based on twelve-month average exchange rates of 1.852 yuan per US dollar in 1977, and 1.682 in 1978.

KEY INDICATORS	1977	1978	Percent Increase
Total industrial and agricultural output value (billion yuan) ¹	¥506.7 \$273.6	¥569.0 ² \$338.3	12.3 23.6
Total industrial output value (billion yuan) ¹	¥372.8 \$201.3	¥423.1 ³ \$251.5	13.5 24.9
Total agricultural output value (billion yuan) ¹	¥134.0 \$72.4	¥149.9 ⁴ \$88.7	8.9 19.8
Population (year-end, million)	946.87 983	958.23 1,004	1.2 2.1
State Budget (billion yuan)⁵			
State revenues	¥87.45 \$47.25	¥112.111 \$66.65	28.2 41.1
State expenditures	¥84.35 \$45.55	¥111.093 \$66.05	31.7 45.0
Budget surplus	¥3.1 \$1.7	¥1.018 \$0.605	-67.2 -64.4
Foreign Trade (billion yuan)			
Exports (fob)	¥13.97 \$7.54	¥16.76 \$9.96	20.0 32.1
Imports (cif)	¥13.28 \$7.17	¥18.74 \$11.14	41.1 55.4
Total trade (fob/cif)	¥27.25 \$14.71	¥35.5 \$21.1	30.3 43.4
Trade balance (Exports-Imports)	¥0.69 \$0.37	-¥1.98 -\$1.18	— —
Non-trade balance *	— —	¥2.1 \$1.25	— —
Current account balance (trade and invisibles)	— —	¥0.12 \$0.07	— —
INDUSTRIAL PRODUCTION (million metric tons unless otherwise indicated)			
Steel	23.74 24.0	31.78 31.7	33.9 32.1
Rolled steel	16.33 16.0	22.08 —	35.2 —
Pig iron	25.05 32.4	34.79 —	38.9 —
Coal	550.00 546.6	618.00 600.0	12.4 9.8

Crude oil	93.64	104.05	11.1
Electricity (billion kwh)	223.40 141.0	256.55 162.0	11.1 14.8
Timber (million cubic meters)	49.67 37.2	51.62 39.2	3.9 5.4
Cement	55.65 56.2	65.24 67.8	17.2 20.6
Sulfuric acid (thousand units)	5.375	6.61	23.0
Soda ash	1.077	1.329	23.4
Caustic soda	1.386	1.64	18.3
Ethylene (thousand MT)	302.7	380.3	25.6
Plastics (thousand MT)	524.00	679.00	29.6
Chemical medicine (thousand MT)	35.2	40.7	15.6

Equipment

Power generating equipment (million kw)	3.181	4.838	52.1
Machine tools (thousand units)	199.00	183.00	-8.0
Motor vehicles (thousand units)	125.40 150.0 ⁷	149.10 181.0 ⁸	18.9 20.7
Internal combustion engines (million hp)	27.41	28.18	2.8
Locomotives (units)	293.00 555.0 ⁸	521.00 —	77.8 —
Freight wagons (thousand units)	6.396 21.00	16.95 —	165.0 —
Steel ships (thousand tons, probably dwt)	634.30	865.90	36.5

Consumer Goods

Chemical fibers (thousand tons)	189.80	284.60	49.9
Cotton yarn	2.203	2.38	8.0
Cotton cloth (billion linear meters)	10.151 10.00	11.029 ⁹ 11.10	8.6 11.0
Machine-made paper and paperboard	3.77 7.10 ¹⁰	4.39 —	16.4 —
Sugar	1.816	2.267	24.8
Salt	17.10	19.53	14.2
Detergents (thousand MT)	257.00	324.00	26.1
Bicycles (million units)	7.43	8.54	14.9
Sewing machines (million units)	4.242	4.865	14.7
Wristwatches (million units)	11.04	13.51	22.4

AGRICULTURAL PRODUCTION (million metric tons unless otherwise indicated)

Grain	282.75 286.00	304.75 295.00	7.8 ¹¹ 3.1
Cotton	2.049	2.167	5.8
	2.05	2.15	4.9
Oil-bearing crops	4.015	5.218	30.0
Sugar cane	17.753	21.117	18.9
Beet root	2.456	2.702	10.0
Jute, ambari hemp	0.861	1.088	26.4

Silk cocoons (thousand MT)	216.00	228.00	5.6
Tea (thousand MT)	252.00	268.00	6.3
Hogs (million head)	291.78	301.29	3.3
Sheep (million head)	161.36	169.94	5.3
	96.00	—	—
Large animals (million head)	93.75	93.89	0.1
	96.00 ¹²	—	—
Aquatic products	4.70	4.66	-0.9
Reforestation (million hectares)	4.794	4.497	-6.2
Agricultural Inputs			
Chemical fertilizer (calculated on the basis of 100 percent effectiveness)	7.238	8.693	20.1
	38.00 ¹³	—	—
Application of chemical fertilizer per hectare of farm land (kilos, calculated on the basis of 100 percent effectiveness)	64.00	89.00	39.1
Insecticides (thousand MT)	457.00	533.00	16.6
Tractors (thousand units)	99.30	113.50 ¹⁴	14.3
Hand tractors (thousand units)	320.50	324.20 ¹⁵	1.2
Total stock of power- driven drainage and irrigation machines for rural use (million hp)	60.05	65.58	9.2
CAPITAL CONSTRUCTION			
Total investment in capital construction (billion yuan)	¥36.48	¥47.9	31.3
	¥19.70	¥28.48	44.6
Of which:			
State budget	¥29.48	¥39.5	34.0
	¥15.9	¥23.48	47.7
Local budget	¥7.0	¥8.4	20.0
	¥3.78	¥4.99	32.0
Total value of fixed assets made avail- able by capital construction depart- ments (billion yuan)	¥25.99	¥35.60	37.0
	¥14.03	¥21.17	50.9
Number of large- and medium-size projects completed and put into operation	—	99.00	—
Resulting increased capacity:			
Coal (million MT)	—	11.51	—
Crude oil (million MT)	—	9.996	—
Power generating capacity (million kw)	—	5.05	—
Steel (million MT)	—	1.12	—
Cement (million MT)	—	1.89	—
Sugar (thousand MT)	—	120.00	—
Railway lines (km)	—	806.00	—
Residential building ¹⁶ (million square meters)	27.8	37.00	33.1
Discoveries of new reserves			
Iron ore (billion MT)	—	2.2	—
Coal (billion MT)	—	8.8	—

JULY-AUGUST 1979

TRANSPORTATION AND COMMUNICATIONS

Railway lines completed (km)	—	806-900	—
Total length of railway network (thousand km) ¹⁷	—	50.00	—
New highways completed (thousand km)	—	35.00	—
Total length of highway network (thousand km)	—	890.00	—
	—	855.00	—
New civil aviation routes (thousand km)	—	17.00	—
Total length of civil aviation routes (thousand km)	—	149.00	—
Total length of navigable inland waterways (thousand km)	—	136.00	—
	170.00	—	—
Total value of posts and telecommunica- tions (billion yuan)	¥1.12	¥1.17	4.5
	\$0.60	\$0.70	16.7
Cargo Traffic (billion metric ton-kilometers unless otherwise indicated)			
Railways	455.80	533.30	17.0
	516.00	—	—
Highways	25.10	27.40	9.2
	18.30	—	—
Waterways	276.20	377.90	36.8
	165.00	—	—
Air (million ton- kilometers)	75.90	97.00	27.8
Major seaports (million ton- kilometers)	160.00	200.00	25.0
Domestic Trade			
Total value of commodities purchased by commercial departments (billion yuan)	¥156.60	¥174.00	11.1
	\$84.56	\$103.45	22.3
Of which:			
Manufactured goods	¥115.30	¥128.00	11.0
	\$62.26	\$76.10	22.2
Farm and sideline produce	¥41.30	¥46.00	11.3
	\$22.30	\$27.35	22.6
Total value of retail sales (billion yuan)	¥141.04	¥152.75	8.3
	\$76.16	\$90.81	19.2
Of which:			
Pork	—	—	15.0
Sugar	—	—	19.0
Cotton cloth	—	—	4.3
Machine-made paper	—	—	20.5
Synthetic cloth	—	—	13.9

EMPLOYMENT AND WAGES

Workers and staff (year-end national total, million persons)	91.12	94.99	4.2
Of which:			
Workers and staff in state-owned units	71.96	74.51	3.5
Workers and staff in urban collectively owned units	19.16	20.48	6.9

THE CHINA BUSINESS REVIEW

Total wage bill (billion yuan)	¥51.50 \$27.81	¥56.90 \$33.83	10.5 21.8
Of which:			
Total wages of workers and staff in state-owned units	¥42.60 \$23.00	¥46.90 \$27.88	10.1 21.2
Total wages of workers and staff in urban collectively owned units	¥8.90 \$4.81	¥10.00 \$5.95	12.4 23.7
Average wage of workers and staff in state-owned units (yuan) ^{1a}	¥602.00 \$325.00	¥644.00 \$383.00	7.0 17.8
Average wage of workers and staff in collectively owned units	¥464.51 \$250.82	¥488.28 \$290.30	5.1 16.7
Labor productivity of total work force in state-owned industrial enterprises	—	—	12.3

EDUCATION

Institutions of higher learning	398.00	598.00	50.3
Students in institutions of higher learning (thousand)	620.00	850.00	37.1
New enrollment in institutions of higher education (thousand)	270	400	48.1
Graduates from universities and colleges (thousand)	—	165.00	—
Students in secondary technical schools (thousand)	680.00	880.00	29.4
Middle school students (million)	—	65.48	—
Primary school pupils (million)	—	146.24	—
Kindergarten children (million)	—	7.87	—
People studying in factory-run colleges and spare-time universities (thousand)	—	550.00	—
Students receiving spare-time secondary and elementary school training (million)	—	68.00	—

CULTURE

Film projecting units (thousand)	—	110.00	—
Art troupes (thousand)	—	3.10	—
Cultural centers (thousand)	—	2.70	—
Public libraries (thousand)	—	1.256	—
Radio stations	—	93.00	—
TV stations	—	32.00	—
Proportion of rural households with loud-speakers connected to radio rediffusion system	—	63.00%	—
Circulation of national and provincial news-			

papers (billion copies annually)	10.54	10.94	3.8
Magazine circulation (million copies annually)	557.60	760.00	36.3
Books published (billion copies)	3.30	4.26	28.9
HEALTH			
Hospital beds (million)	1.77	1.85	4.5
Professional medical workers (million)	2.34	2.46	5.3
Of which (thousands):			
Doctors of the Chinese school of medicine	—	250.00	—
Senior doctors of the Western school of medicine	—	350.00	—
Junior doctors of the Western school of medicine	—	420.00	—
Proportion of rural production brigades with cooperative medical services		around 80%	
Barefoot doctors attached to rural production brigades (million)	—	1.60	—

Notes:¹ Probably in 1970 constant yuan.² Above 1978 plan target by 1.9 percent.³ 1.6 percent above plan.⁴ 2.7 percent above plan.⁵ China's budget figures were issued separately in a speech by Minister of Finance Zhang Jingfu to the second session of the Fifth National People's Congress on June 21. (Xinhua 6/29/79). Values are believed to be in current yuan.⁶ Includes overseas Chinese remittances, tourist revenues, interest on loans and eurocurrency bank deposits, post and telecommunication fees, and book exports, according to Ministry of Finance sources. Remittances constitute almost 50 percent of the non-trade balance.⁷ Includes truck output only.⁸ Includes 300 diesel, 250 steam, and 5 electric locomotives.⁹ Equal to 10,286 billion square meters of cotton cloth.¹⁰ Includes paper only.¹¹ Below 1978 plan target.¹² Includes draft animals only.¹³ Based on standard unit of 20 percent nitrogen, 18.7 percent phosphoric acid, and 40 percent potassium oxide.¹⁴ The State Statistical Bureau also reported that the stock of large- and medium-size tractors in 1978 was 557,000 units.¹⁵ The stock of hand tractors in 1978 was 1.37 million units.¹⁶ Includes housing construction completed with central and local government investment funds. Home construction by communes and other collective units are presumably excluded.¹⁷ Excludes double tracking, sidings, and railroad yards.¹⁸ If the total wage bill of workers and staff in state-owned units in 1978 (246.9 billion) is divided by the total number of workers and staff in state-owned sector (74.51 million), one obtains an average wage of ¥329.4. No explanation is given for the discrepancy between this derived figure and the official figures provided above.**Sources:** State Statistical Bureau, *Communique of the State Statistical Bureau of the People's Republic of China on Fulfillment of China's 1978 National Economic Plan*, Xinhua, June 27, 1979; and National Foreign Assessment Center, *China: Economic Indicators*, A Reference Aid (ER 78-10750), Washington, DC, December, 1978.**Legend:**

MT — metric tons
 km — kilometers
 hp — horsepower
 kw — kilowatt
 kw/h — kilowatt hour
 dwt — deadweight ton

Now, Exim for China?

Vice President Mondale's offer to China of \$2 billion in US Exim Bank credits over five years dramatically improves the competitive outlook of US exporters. The announcement was made during Mondale's August 27 Beijing University address, in which he promised additional credits "if the pace of development warrants it."

Preliminary discussions on loans to China have already begun, according to a July 13 *Asian Wall Street Journal* interview with Exim Bank President John L. Moore, Jr., the most likely being aircraft purchases and hotel, mining, and steel projects.

Such credits would become available to China following the passage of the US-China trade agreement, scheduled to go to Congress this fall, and after the fulfillment of three other statutory requirements: the Jackson-Vanik emigration provision (Section 402) of the 1974 Trade Act is either waived or amended; the president determines that Exim Bank credits to China are in the national interest; and finally, a settlement is reached on Exim Bank claims against China for unpaid loans dating back to 1946-47 valued at \$26,386,019.

July Preliminary discussions on the claims issue began ~~July~~ 11 when John Moore met with Zhang Jingfu, then China's finance minister, who was touring the US. Settlement of the dispute is expected sometime before January, when the Exim Bank presents its fiscal 1981 (October 1, 1980, to September 30, 1981) budget to Congress. This is the bank's last opportunity to ask Congress for an increase in its fiscal 1980 lending authority of \$4.1 billion which becomes effective on October 1. Within this ceiling there is no lending limit by country or project, but unless the overall ceiling is increased, credits to China would reduce the funds available to other countries.

Yugoslavia, Poland, and Romania, which together received \$59.2 million in loans in fiscal 1978, were the only Communist countries eligible to receive Exim Bank credits until August 18, 1978, when President Carter added Hungary to the list. The prohibition against Exim Bank loans to Communist countries, unless the Pres-

ident determines otherwise, was added to the bank's enabling legislation on March 13, 1968. Outstanding credits to the USSR total \$456.4 million, but further lending is barred by Soviet refusal to provide the written emigration assurances required under the Jackson-Vanik amendment.

Exim Banks of six Western countries have agreed to lend China \$13.187 billion as of August 1979. If the US offer of \$2 billion is approved, the total would exceed \$15 billion:

GOVERNMENT-GUARANTEED EXPORT CREDIT TO CHINA

Country	Amount (million US \$)	Projected annual loans as percent of 1978 total
UK (12/78)	\$ 1,200	16.7
France (12/78)	6,850	12.2
Italy (4/79)	1,000	3.7
Australia (4/79)	57	NA
Sweden (5/79)	350	NA
Japan (5/79)	2,000	1.8
Canada (8/79)	1,730	31.7
US (8/79)*	2,000	14.3
TOTAL	\$15,187	

* Date of unilateral announcement.

Sources: US Export-Import Bank, 1978 *Annual Report and Report to the US Congress on Export Credit Competition and the Export-Import Bank of the US*, March 1979; and National Council files.

The possibility of loans to China comes at a time when the US Exim Bank has liberalized its policies to cope with the growing use of "mixed credits," or loan packages arranged by foreign Exim Banks which combine official export credit with foreign aid. New flexibility was provided by last year's amendment to the 1945 Export-Import Bank Act, which authorized the bank to match the "rates and terms and other conditions" of its competitors, even if that meant going below the OECD minimum guidelines of 7.25 percent on official medium-term credits to developing countries. The November 10, 1978, amendment to the bank's charter also increased its loan, guarantee, and insurance authority from \$25 billion to \$40 billion. As a result, the bank's annual direct lending has increased almost sixfold since fiscal 1977:

US EXIM BANK DIRECT LENDING AUTHORITY

Fiscal Year	Amount* (million US \$)
1977	700.0
1978	2,872.4
1979	3,750.0
1980**	4,100.0

* Unutilized portion of loan authority may not be carried over to next fiscal year.

** Requested

Source: US Export-Import Bank.

The bank's more competitive posture is seen in the 3.75 percent interest rate charged on part of a \$100 million loan to Tunisia announced on August 20. Interest on most Exim Bank credits is normally much higher, however, since the bank is a self-sustaining institution that does not receive federal appropriations, although Congress does control its credit policies. In fiscal 1978 the average cost of the bank's credit was 8.25 percent, down from 8.53 percent the year before, which compares favorably with rates charged by other Exim Banks:

CREDIT TERMS OF SELECTED EXIM BANKS IN 1978

Country	Interest rate (percent per annum)
Canada	8.7
West Germany	8.6
US	8.3
UK	8.3
France	8.2
Japan	8.0

Source: US Export-Import Bank.

The Exim Bank's total credit and guarantees in fiscal 1978 increased 31.0 percent to \$7.38 billion. This financed about 6 percent of total US exports in 1978. Comparable figures for other countries in 1978 are France, 33 percent; the UK, 35 percent; and Japan, 37 percent.

Most of the US bank's recent activity has centered in Asia, where outstanding loans total \$7.9 billion as of September 30, 1978, or 29.9 percent of the bank's worldwide exposure. New loans to Asia ~~amounted to~~ in fiscal 1978 were an even larger 35.5 percent share of its total loan authorization, of which most went to South Korea (\$765.8 million), Taiwan (\$299.5 million), Japan (\$99 million), and Pakistan (\$25.5 million), according to the bank's most recent *Annual Report*.

—JS ¶

CHINA'S FOREIGN TECHNOLOGY BUDGET, 1978-85
(billion US \$)

Category	Contracted for in 1978* (Rounded estimates)	Under negotiation**
Iron & Steel	0.1	19.0
Coal	4.0	1.6
Other mining and processing	2.4	4.4
Ports	2.1	1.1
Petrochemical plants and equipment	0.5	2.3
Hotels	0.5	3.0
Shipping	0.5	—
Petroleum	0.4	3-5
Electronics	0.3	0.1
Agriculture-related plants and equipment	0.1	0.6
Power development	0.2	3.0
Fisheries	—	2.0
Aircraft	—	1.0
Other transportation	—	10-15
Construction plants and equipment	0.2	0.5
Textile plants and equipment	—	0.1
Miscellaneous machinery and machine tools	0.1	0.2
Total	\$11.4	\$52-59

Data as of April 15.

For previous projections see CBR 5.5, p. 65.

*Excludes approximately \$2.6 billion in projects contracted after mid-December, 1978, which were postponed until financing is arranged.

**Some projects under negotiation will be completed after 1985.

Source: National Council publication, *Sales to China, 1978, and Negotiations for Sales*, April, 1979, and other private sources.

SOURCE: Sales to China and Negotiations for Sales, 1978
S.R. #23

SUMMARY OF TOTAL VALUE OF SALES TO AND NEGOTIATIONS WITH CHINA: 1978

	(Millions of US \$)	
	Sales	Negotiations
Agricultural Commodities	643.4+	NVG
Agricultural Machinery	75.86+	NVG
Chemical Plants and Equipment	2,465.76+	210.6+
Chemicals	\$80.8+	NVG
Coal, Other Mineral Mining Development & Technology	NVG	1,807.6+
Construction Equipment	98.89+	NVG
Construction Materials and Plants	91.04+	188+
Electronics	404.33+	103.6+
Food Processing & Packaging	50.03+	50+
Iron Ore & Pig Iron Products	227.6+	76.9
Machinery	55.84+	212+
Machine Tools	36.75	—
Metal Mining & Processing	135.7+	157.6+
Military Equipment	NVG	990+
Mining Equipment	660.92+	30+
Non-Ferrous Metals & Products	94.84+	NVG
Petroleum & Natural Gas Development and Refining	374.04+	\$140.6+
Pharmaceuticals	1.4	—
Ports & Related Equipment	2,208.4+	1,100+
Power	192.15+	2,720+
Scientific Instruments	6.31+	NVG
Shipping	562.94+	5.9+
Steel & Steel Products	1,981.23+	NVG
Steel Plants & Equipment	1,192.98+	2,898.6+
Telecommunications	0.11	several hundred
Textile Plants & Equipment	80.92+	101.27+
Textile Products	13.6+	—
Tourism	—	1,500+
Transportation Equipment	571.96+	415+
Miscellaneous	555.74+	500.1+
TOTAL:	12,863.54+	13,007.77+

NVG—No value given

SOURCE: Sales to China and Negotiations for Sales, 1978
S.R. #23

ANALYSIS OF TOTAL SINO-US TRADE, 1978

Table 1
SINO-AMERICAN TRADE,
1971-1978

(\$ millions, % change)															
	1971*	1972	%	1973	%	1974	%	1975	%	1976	%	1977	%	1978	%
US Exports	-	63.5	-	740.2	+1066	819.1	+11	303.6	-83	135.4	-55	171.3	+27	823.6	+381
US Imports	4.9	32.4	+ 561	64.9	+ 100	114.7	+77	158.4	+38	201.0	+27	202.7	+ 1	324.1	+ 80
Total	4.9	95.9	+1857	805.1	+ 740	933.8	+16	461.9	-51	336.4	-27	374.0	+11	1147.7	+207

* 1971: No percentage

Table 2
AMERICAN EXPORTS TO THE PEOPLE'S REPUBLIC OF
CHINA 1977 AND 1978, BY CATEGORY
(\$ millions)

Category	Total 1978	Total 1977	% Change 1978 over 1977
Food and Live Animals	\$362.25	\$ 0.03	1,207,400.0
Beverages and Tobacco	0.0	0.0	-
Crude Materials, Inedible, Except Fuels	223.9	52.35	327.7
Mineral Fuels, Lubricants, and Related Products	1.77	0.6	195.0
Animal and Vegetable Oils and Fats	37.78	31.99	18.0
Chemicals	60.49	19.60	206.6
Manufactured Goods by Chief Materials	25.30	10.84	133.3
Machinery and Transport Equipment	93.01	51.58	80.3
Miscellaneous Manufactured Articles, nec*	13.71	4.54	201.9
Items and Transactions, Not Classified	0.04	0.03	33.3
TOTAL	\$818.241	\$171.32	377.6%

† The total corrected report figure is \$823.6 million; the values for each export category are based on uncorrected reports for individual commodity shipments. The discrepancy will be resolved in August when the US Census issues corrected figures.

* nec = not elsewhere classified

Source: Sino-US Trade Statistics 1978 (S.R. #24)

Table 3
AMERICAN IMPORTS FROM THE PEOPLE'S REPUBLIC OF
CHINA 1977 AND 1978, BY CATEGORY
 (\$ millions)

Category	Total 1978	Total 1977	% Change 1978 over 1977
Food and Live Animals	\$ 25.99	\$ 25.72	1.0
Beverages and Tobacco	0.61	0.32	90.6
Crude Materials, Inedible, Except Fuels	57.99	44.05	31.6
Mineral Fuels, Lubricants, and Related Products	negl.	0.95	-
Animal and Vegetable Oils and Fats	3.26	0.06	5,376.6
Chemicals	34.23	21.79	57.0
Manufactured Goods By Chief Materials	95.10	49.56	91.8
Machinery and Transport Equipment	0.48	0.55	-14.5
Miscellaneous Manufactured Articles, nec*	105.38	58.01	81.6
Items and Transactions, Not Classified	0.91	1.66	-82.4
TOTAL	\$323.95†	\$202.66	59.8%

† This total represents uncorrected Customs value data. The authoritative figure for total imports is based on FAS (Free Alongside Ship) values. This figure, which has been corrected, is \$324.1 million, but has not been broken down into product categories.

* nec - not elsewhere classified

Table 4
TOP FIFTEEN US EXPORTS TO CHINA, 1978

Category	Value	Percent of Total Exports
Wheat, unmilled, not donated	\$250,174,410	30.4
Cotton not carded, 1 inch to 1 1/8 inch	140,396,065	17.0
Yellow corn, not donated	111,725,822	13.6
Polyester fibers, noncontinuous form	44,299,341	5.4
Oil and gas drilling machinery parts, not specified	31,449,897	3.8
Soybean oil, crude, degummed	26,117,742	3.2
Diammonium phosphate fertilizer	19,748,952	2.4
Cotton, other, 1 1/8 inch or more	16,878,927	2.1
Soybeans, not specified	15,300,134	1.9
Urea	15,174,623	1.8
Rock drills, bits, core bits, and reamers	13,018,750	1.6
Tallow, inedible	11,657,449	1.4
Diesel engines, not specified, 1001-1500 horsepower	4,506,455	0.5
Copper, unalloyed, unwrought	4,369,715	0.5
Organophosphorous insecticides, not specified	3,818,538	0.5
TOTAL US EXPORTS	\$823.6 million*	

* nec = not elsewhere classified

Table 5
TOP FIFTEEN US IMPORTS FROM CHINA, 1978

Category	Value	Percent of Total Imports
Print cloth shirting, with cotton, not fancy, colored or bleached nec*	\$20,218,536	6.2
Tin other than alloys, unwrought	15,498,584	4.8
Feathers, not meeting federal standards	15,281,964	4.7
Fireworks	12,095,781	3.7
Antiques other than furniture or silverware	10,826,402	3.3
Downs not meeting federal standards	9,851,653	3.1
ABC sheeting, white cotton, not fancy, colored or bleached, carded	8,024,216	2.5
Baskets and bags, bamboo	7,269,499	2.3
Bristles, crude or processed	7,016,426	2.2
Cashews, shelled, blanched or otherwise preserved	6,599,621	2.0
Tungsten ore	5,832,284	1.8
Floor-covering pile, hand inserted, valued at over 66.27¢ per sq. ft.	5,777,925	1.8
Men's cotton shirts	5,664,241	1.8
Cotton gloves, no fourchettes	5,559,495	1.7
Tea, crude or processed	4,762,665	1.5
TOTAL US IMPORTS	\$324.1 million†	

* nec - not elsewhere classified

† Corrected figure

MAJOR US SALES TO CHINA 1973-1978

1. AGRICULTURAL COMMODITIES

Illinois Agricultural Services Co., (US)	Breeding swine (437)	\$0.17	10/78
(US)	Breeding swine (760)	NVG	10/78
(US)	Corn (1.1 million mt)	\$111.7	1978
(US)	Wheat (2.3 million mt)	\$291.2	1978
(US)	Cotton (126.9 thousand running bales)	\$157.3	1978
(US)	Soybeans (57,000 mt)	\$15.3	1978
(US)	Soybean oil (44,000 mt)	\$26.1	1978

2. AGRICULTURAL MACHINERY

Deere & Co. (US)	Tractors and farm implements	\$1	2/78
Caterpillar (US)	5 model D-9 tractors	\$1	2/78
	28 model D-7 tractors	NVG	9/78
Valmont Industries (US)	Center pivot irrigation systems, pumps, power units, spare parts	\$1	11/78

3. CHEMICAL PLANTS AND EQUIPMENT

Kellogg Continental (51% owned by Pullman's Kellogg division of the US) Dutch State Mines (DSM) Verenigde Machine Fabrieken	Three urea plants 480, 000 each (DSM's Stami-carbon process)	\$34	Late January 1973. Guilders. Payment to DSM over four years. Start up 1976.
---	--	------	---

NATIONAL COUNCIL FOR US-CHINA TRADE

M. W. Kellogg (Division of Pullman, Inc.)	Three Ammonia Plants 330,000 (Kellogg)	\$70	6/29/73. Completion 1976. Spot cash: no financing involved. Normal terms, approx. 20% down, 70% on completion, 10% on start up.
Kellogg Continental (51% owned by M.W. Kellogg of Houston) DSM	Five Urea Plants, 480,000 each (DSM's stam-carbon process)	\$56	Late August 1973. 1976-77 startup.
M.W. Kellogg	Five Ammonia Plants 330,000 (Kellogg)	\$130	11/8/73. Beginning 1976, startup to dovetail with previous Kellogg plant sales. Cash, as in earlier contract.
Marubeni Corp., JGC, Stone & Webster (Japan, US)	Ethylene plant at Daqing (300,000 ton/yr) Stone & Webster license for process engineering services and construction management	\$125	7/28/78
Davy Powergas; Johnson Matthey, Union Carbide (UK, US)	2 oxo-alcohol plants: 70,000 ton/yr, 1 at Daqing, site for second undisclosed	\$74.5	8/78

Pullman-Kellogg (US)	Engineering, procurement and construction advisory services for petrochemical processing facility (production of metacresol and butyl hydroxy toluene)	NVG	12/22/78
Constructors John Brown, Union Carbide (UK, US)	High-density polyethylene plant (140,000 mt/yr), Union Carbide's licensed gas-phase technology (Shandong)	\$51.5	12/19/78
4. <u>CHEMICALS</u>			
Phosphate Chemicals Exports Association, C. Itoh & Co. (US)	Phosphate fertilizer (90,000 tons concentrated super-phosphate 60,000 tons ammonia phosphate)	\$13.2	10/21/78
5. <u>COAL, OTHER MINERAL MINING DEVELOPMENT AND TECHNOLOGY</u>			
6. <u>CONSTRUCTION EQUIPMENT</u>			
Dupont (US)	2 metric tons of commercial explosives (Tovex water gel)	\$0.005	8/78
Caterpillar (US)	40 pipe layers, model 572; 20 pipe layers, model 571	\$9 (including tractors)	9/78
WABCO (US)	57 75-ton dump trucks	NVG	9/78

NATIONAL COUNCIL FOR US-CHINA TRADE

Ingersoll-Rand (US)	2 large, all purpose drills, accessories; also compactors for road construction	NVG	10/2/78
7. CONSTRUCTION MATERIALS AND PLANTS			
8. ELECTRONICS			
Fluke International (US)	Test and measurement	NVG	3/78
Analog Devices (US)	Integrated circuit components	\$0.5	1/78
Sperry Univac (US)	2 computer systems; 1100/11 unit processor and 1100/12 multiprocessor	\$6	6/29/78
Magnavox Marine Systems (US)	Electronics equipment	NVG	3-8/78
B&F Sales (US)	a) Data acquisition systems, associated transducers and instrumentation for gas turbine testing system b) Engineering study for specialized instrumentation to be added to data systems	\$2	10/78
Control Data Corp. (US)	12 CDC Cyber computers for geophysical exploration	\$69	12/28/78
IBM (US)	IBM 370/138 computer for compressor plant	\$2	5/78 (subject to COCOM)

NATIONAL COUNCIL FOR US-CHINA TRADE

Daedalus (US)	Airborne scanners for mineral resource exploration	\$2.8	12/24/78
Ebara-Infilco (US) and Japan Electrostatic Precipitation (Japan)	Factory drain treating system, electrostatic precipitation dust collector--to accompany TV picture tube plant	NVG	11/28/78
9. <u>FOOD PROCESSING AND PACKAGING</u>			
Coca-Cola (US)	Exclusive rights to sell NVG cola, shipment of bottled canned Coke, construction of bottling plant		12/13/78
10. <u>IRON ORE AND PIG IRON PRODUCTS</u>			
11. <u>MACHINERY</u>			
12. <u>MACHINE TOOLS</u>			
Gleason Works (US)	Machines, tooling for manufacturing automotive, tractor axle gears (47 units)	\$7.5	2/78
Bullard Co. (Division of White Consolidated) (US)	Machines, tooling (vertical boring mills)	\$3	3/78
Lees-Bradner (Subsidiary of White Consolidated) (US)	Model HT thread-milling machines	\$0.14	3/31/78
Barber-Colman Co. (US)	Horizontal gear-hobbing machine	\$0.13	3/78

13.	Lucas Division of Litton Industries (US)	Numerous contracts for machine tools	\$4.5	3/78
	Farrel Co. Rochester Division (Subsidiary of Emhart Corp.) (US)	Large, verticle boring mill	\$1	3/78
	<u>METAL MINING AND PROCESSING</u>			
	Kaiser Engineers (US)	Feasibility study for development of 2 iron ore mines (Nanfen, Shijiaiyang)	NVG (Total cost of project unknown)	11/20/78
	Bethlehem Steel (US)	Preliminary study for development of iron ore mine, beneficia-tion and pelletiza-tion plants (Shui-zhang)	NVG (Total cost of project over \$500 million)	11/20/78
	Fluor Corp. (US)	Planning agreement for design and man-agement of copper mines and concen-trator	\$10 (Total cost of project over \$800 million)	12/7/78
14.	<u>MILITARY EQUIPMENT</u>			
15.	<u>MINING EQUIPMENT</u>			
	Bucyrus-Erie (US)	a) 7 blasthole drills, other equip-ment; b) Spare parts for blasthole drills and electric power shovels	a) \$6 b) several hundred thou-sand \$	5/31/78 2/78

Orenstein & Koppel, (W. Germany), WABCO (US)	Ten RH75 hydraulic face shovels, 75 payload dump trucks	\$41.8	10/78
Joy Manufacturing Co. (US)	Continuous coal miners, shuttle cars	\$6	11/78
Joy Manufacturing Co. (US)	Coal loading machines, spare parts	\$1.25	12/27/78
16. NON-FERROUS METALS AND PRODUCTS			
17. PETROLEUM AND NATURAL GAS DEVELOPMENT AND REFINING			
Lurgi and Zimmer (West Germany) Amoco (US)	Petrochemical complex with 36,000-ton per year TPA unit and 40,000-ton per year polyester fiber unit. Amoco to supply tech- nology for TPA section with the construction by Lurgi. Zimmer to handle both construction and technology for poly- ester fiber section.	DM 92 mil. (39.1 mil.)	Contract signed 5/77 to be completed in 1978
Ingersoll-Rand (US)	Power recovery equip- ment, which converts waste gases from cat- alytic crackers into mechanical energy with an Ingersoll-Rand power recovery expansion tur- bine, an axial flow com- pressor, and auxiliary equipment.	\$3-4 mil.	Contract signed 7/77; delivery by late 1978

Hughes Tools (US)	Tool joints for attachment to oil field pipes	\$1	1/78
Grant Geophysical (US)	Geophysical survey vessel (subject to export controls)	NVG	1/78
Georex (subsidiary of French Co. CGG) (US, France)	Geophysical survey vessel (subject to export controls)	NVG	1/78
B-J Hughes Baker Trading Co. (US)	a) Petroleum handling tools (onshore and offshore) b) Cementing equipment for National Supply rig	a) slightly less than \$0.1 b) \$0.5	early 1978
Marathon LeTourneau (US)	2 jack-up rigs (Class 82-SD-S)	\$46	5/11/78
Bethlehem Singapore (US Singapore)	Jack-up rig (BethDrill JU-250)	\$20-25	4/10/78
Reed Tool, Baker Trading Co. (US)	Drill bits (3 other contracts)	\$4.5 NVG	5/78 1978
Hughes Tool (US)	Drill bits and cutters	\$10	5/78
Mertz, Inc. (US)	Servo-hydraulic vibrators for onshore drilling	\$7	6/78
Cameron Iron Works (US)	Drilling packages for 2 Chinese rigs under construction	\$0.7	7/78

Geosource, Inc. (US)	Geophysical equipment (4 contracts)	\$15	10/78
National Supply (Armco) (US)	Oil-well drilling equipment for Gulf of Bohai (5 electric-pow- ered offshore rigs, 2 jacking systems)	\$30	7/78
Ingersoll-Rand (US)	Power recovery system for refinery	\$3	8/78
Reda Pump Co., TRW (US)	Electric submersible pumps	\$1.25	early October 1978
Thermotecs, Baker Trading Co. (US)	Secondary recovery equipment	\$2	11/78
Texas Instruments (US)	5 seismic recording systems	\$4	11/78
Rolligon, Baker Trading Co. (US)	Rough terrain vehicles for oil field transport	\$5-10	11/78
Geospace Corp. (US)	Geophysical equipment, (assistance in training and installation)	\$2.7	11/78
Continental-Emsco (subsidiary of LTV) (US)	2 1,500 horsepower diesel-powered land rigs with 20,000-30,000 feet drilling capability and 5 offshore rigs	\$40	12/16/78
Greerco (US)	10 wax molders	\$6.8	12/20/78

Cameron Iron Works (US)	20 blowout preventers for land, jackup, work-over rigs	\$6	12/78
Kuster Co., Baker Trading Co. (US)	Downhole instruments (3 contracts)	NVG	1978
Baker Packing, Baker Trading Co. (US)	Well completion equipment	NVG	1978
Christensen Diamond Products, Baker Trading Co. (US)	Drilling equipment (3 contracts)	NVG	1978
Bowen Tools, Baker Trading Co. (US)	Fishing tools (4 contracts)	NVG	1978
Vector Cable Co., Baker Trading Co. (US)	Electric cable (2 contracts)	NVG	1978
BWT Technology, Baker Trading Co. (US)	Well testing equipment (2 contracts)	NVG	1978
Reed Tool Co. (Mining division), Baker Trading Co. (US)	Shaft boring equipment	NVG	1978
Gray Tool Co., Baker Trading Co. (US)	Well head equipment	NVG	1978
<u>18. PHARMACEUTICALS</u>			
<u>19. PORTS AND RELATED EQUIPMENT</u>			
Ellicott (US)	Dredgers	\$2.5	12/78
<u>20. POWER</u>			

21. SCIENTIFIC INSTRUMENTS

(US)			
	Medical instruments; ventilators and other equipment used in post-operative care; heart surgery equipment	NVG	3-10/78
Spectra-Physics (US)	Scientific equipment	\$0.05	Spring 1978
Bently Nevada (US)	Diagnostic equipment, rack systems for use on power-generating test stands	NVG	5/78

22. SHIPPING23. STEEL AND STEEL PRODUCTS24. STEEL PLANTS AND EQUIPMENT25. TELECOMMUNICATIONS

US Geological Survey (US)

Earth science information gathered by LANDSAT over USSR	\$0.105	10/78
---	---------	-------

26. TEXTILE PLANTS AND EQUIPMENT

Prestige Sportswear (US)

Continuous fusing machines and garment manufacturers forms for making women's wear	Buyback arrangement	11/78
--	---------------------	-------

Oxford Industries (US)		Apparel-finishing equipment, including fusing machines, for corduroy men's suits.	Buyback arrangement	11/78
27.	<u>TEXTILE PRODUCTS</u>			
28.	<u>TOURISM</u>			
29.	<u>TRANSPORTATION EQUIPMENT</u>			
	Calavar Corp. (US)	Firebird 150 fire engine	NVG	8/78
	Ford Motor Co. (US)	700 light and heavy-duty pick-up trucks	\$4-5	11/78
	Boeing Co. (US)	3 very-long-range 747 SP jetliners	\$156 (for 3)	12/15/79
		10 707-3205	\$125	1973
30.	<u>MISCELLANEOUS</u>			
	Technicolor Ltd.	35mm Motion Picture Processing Plant	\$8.5	7/19/73 Cash deal, 50% down, 40% on delivery, 10% on acceptance.
	Marine Office of American (MOAC) (Subsidiary of Continental Insurance) (US)	MOAC to be claims agent in US for People's Insurance Company of China	NVG	8/14/78
	Encyclopedia Britannica (US)	2,000 copies of 19 reference books	NVG	9/7/79

NATIONAL COUNCIL FOR US-CHINA TRADE

Mr. LLOYD. Thank you very much, Ambassador.

Mr. Brown?

Mr. BROWN. Mr. Phillips, I have not had a chance to hear or read as yet all of your report but it seems to me to be remarkably valuable in the detail it presents as to the kind of economic conditions.

I am particularly interested in the situation in one technology field, because it may serve as an example for others; and, that is, in the American capability to assess China with the development of their hydroelectric power sources.

You note in your statement that they have the largest hydroelectric potential of any country in the world, only about 2 percent of which it has developed.

And in occasional conversations I have had with the Chinese, they indicate they plan to give that the highest priority in their national energy development program.

It seems to me that this poses a substantial opportunity for U.S. technological cooperation with the Chinese for a considerable amount of trade. And yet, I have just difficulty seeing any occasions where we might take advantage of that.

Do you have any information that would indicate that American suppliers might be aware of the tremendous potential here, and might be taking steps to compete with other suppliers, European or Japanese, in meeting this demand of China?

Ambassador PHILLIPS. Yes, Mr. Brown, we do have indications of this. And I agree with you wholeheartedly, that the development of China's energy resources and its whole energy system is a very, very high priority in China today.

Currently, I know of one major American company that is in China, a major producer of power generating equipment with, I believe, some 50 of its people carrying on very extensive discussions with the Chinese. I cannot tell you to what extent, how far these have gone, but there are very clear interests on the part of the Chinese with some American companies, and I have no doubt that this will increase.

I believe the agreements reached during the Vice President's visit will certainly facilitate this process.

Obviously, the actual work, when it comes to providing technology, selling equipment, is going to be primarily in the private sector.

But I do think a framework has been established which will facilitate that.

Mr. BROWN. Well, it has been disturbing to me that we have even neglected our own hydroelectric potential here. And I guess it has tended to sort of dissipate over the past generation or so, as we found it easier to move ahead with coal, oil, nuclear, and other sources of energy. And we see a lot of attention being paid to the oil potential, the petroleum potential in China, but have seen relatively little mention of what I think is a much greater opportunity to assist them with the development of those tremendous hydroelectric resources—which at the same time tie into some of the other development problems, transportation and communication that you have indicated.

I won't belabor that.

I would like to move things on to one of the latter points you were making about the cumbersome nature of getting export clearance in this country.

Do you have any easy solution to that problem? I know it is a very complex one, but, would you offer some recommendations so that it might help in resolving that?

Ambassador PHILLIPS. I wish I had an easy, quick solution. I believe much can be done even within the existing governmental structures to expedite the process.

However, I referred in my testimony to examples of how long it has taken in specific instances. And I do know from conversation I have had with Chinese trade officials their sense of frustration, and their inability to get commitments with respect to timing and delivery.

I would recommend, for example—a small step perhaps—that the Office of Export Administration should be beefed up. A lot of the delay takes place right there.

Mr. BROWN. Well, you can look at that from two ways. It's conceivable that we would get faster action if we reduced the size of the operation and compelled them to simplify their procedures.

But your suggestion is a logical one, and a normal way of approaching a problem of this sort.

Ambassador PHILLIPS. It is a very complex procedure, and it seems to be that one of the problems is that there has to be a direction, a strong policy guidance from the top indicating that we want to move ahead in this direction. But the tendency for the little guy now down at the working level is to be very cautious, and it's much easier to say no than to say yes; and even better still to say, I can't make up my mind yet.

So what I think is needed is something positive, affirmative, some encouragement from the top which, frankly, up to this point I have not seen to any great extent.

Mr. BROWN. Well, that bothers me, too. I thought when I saw the reports that we had signed agreements with the Chinese, for example, in the area that Dr. Frosch was testifying on with regard to the communications satellites; that this meant that we were, in effect, given approval to this. But, apparently it doesn't, they still have to go through the same lengthy and detailed clearance process because of the requirement, presumably, to analyze each specific configuration of technology that we send over there, and it doesn't represent any short circuiting at all that we have agreed at the highest level that we're going to do it—which is unfortunate, in my view.

Ambassador PHILLIPS. Another area, in my view, in which there have been unnecessary delays which in some instances have been costly to the United States, has been in the area of petroleum, production of petroleum exploration equipment—seismic survey equipment involving the sale of computers, which admittedly could have dual-purpose uses. But where do you draw the line?

We say, on one hand, we think it is in our national interest to help China develop its offshore petroleum resources. Indeed, to the extent we help China produce more oil, to that extent it provides a greater world supply.

But when it comes to negotiating the sale of some of the sophisticated equipment needed for that purpose, it's more difficult.

Mr. BROWN. Well, the Landsat capability, for example, there's no question in my mind that it has military implications, particularly with the new generation of Landsat. And I would think that in signing an agreement we could recognize that that possibility exists, but we weighed the policy options and decided it was to go ahead. I can see the possibility might not occur; that it would still be disapproved at some level because it could be used for any number of reconnaissance operations possibly; and, likewise with the communications system, any updating of the communications system has vast implications for military systems.

And just as I say, I feel that these policy problems need to be resolved at the highest level before we begin the process of approving exchanges.

I have no further questions.

Mr. LLOYD. Thank you, Mr. Brown.

Mr. Ertel?

Mr. ERTEL. Thank you, Mr. Chairman.

Mr. Phillips, in your testimony you indicated our western allies had an easier time to go through CoCom, or CoCom—I don't know, all these acronyms, they sort of get me sometimes; but anyway, they have an easier time to get approval than we do. Why?

Ambassador PHILLIPS. The problem is we have kind of a double layer involved here, it's far more difficult in the first instance to get action within our own Government than it is for virtually all of our Western and European trading partners; so that you have kind of a second layer bureaucracy that you are coping with; not merely the CoCom, but you have the initial activity which involves the U.S. Government requirements which may be in some instances perhaps more demanding than the CoCom itself.

And, of course, there is the added factor which is very important, that in most other countries there seems to be a more cooperative relationship as between the government and the industry. There seems to be a mutual desire to facilitate, not to complicate or slow down the process—which, frankly, I don't think is typically the case here.

Mr. ERTEL. Well, they seem to get CoCom agreement on what many of us think are defense-related equipment—for instance, the Harrier aircraft and the space jet engines. How do you explain that they are free to export those through CoCom and we're having problems? I don't know what you do with the Harrier except use it for military aircraft.

Ambassador PHILLIPS. I'm not sure I could comment on that, but obviously the United States is a member of CoCom and we clearly have a strong voice in determining CoCom decisions.

I'm not in any sense—I don't want to have my remarks interpreted as critical of CoCom itself, I think this is a necessary function, but my concern has been the manner in which we implement some of the requirements with respect to CoCom, the time, the delay.

Mr. ERTEL. Are you suggesting maybe the American efforts in this field be basically eliminated; we only use CoCom as the clearing agency?

Ambassador PHILLIPS. I doubt we can eliminate some domestic provisions; I think they are required.

My main criticisms are inability to operate effectively and competitively within that system. And I don't see that the two are mutually exclusive at all. It seems to me that we could continue to have controls over obviously sensitive technology equipment, but operate in a way that is competitive and in a way that other governments appear able to operate.

Mr. ERTEL. I just think by definition when you have to clear two hurdles rather than one it almost follows that it is going to take more time, unless you are doing them simultaneously. But I don't think that is the nature of the beast, I don't know from what I heard of it, but I am not very well familiar with it.

Ambassador PHILLIPS. Well, I would imagine that steps could be taken, certainly, to reduce substantially the procedures now required in terms of domestic requirements, U.S. domestic requirements.

I'm afraid I am not sufficiently expert in the details of those procedures to make any concrete recommendations at this point. But I find it hard to believe that improvements cannot be made.

Mr. ERTEL. Let's turn to an area where I'm sure you have a better handle on the issue, and that is the trade agreement which we have going into effect with China, which is going to protect patent rights.

The agreement is going to protect our patent rights, I guess, and our proprietary rights, but how is that going to be enforced based upon China's legal system at the present time?

It's a legal system that really doesn't recognize those kinds of rights, proprietary rights. How do we do that?

Ambassador PHILLIPS. If I might, before replying to that, say that it has been our experience, up to this point that, with rare exceptions, the Chinese have carried out agreements with respect to patent protection and industrial property protection, that have been incorporated within contracts negotiated with individual companies.

Admittedly, there have been some isolated exceptions in the past with respect to that. But, generally speaking, the Chinese record for carrying out agreements they have negotiated with individual companies with respect to industrial property patents and so on has been good.

So I would start by making that observation. I think it is very important that the protection provided for in the trade agreement be made available. Now, how that is enforced in the final analysis, if there is a disagreement over the provisions, the Chinese have accepted arbitration proceedings in third countries. That, of course, is an ultimate recourse. That is provided for in the trade agreement.

Mr. ERTEL. Arbitration is provided in each one of the agreements?

Ambassador PHILLIPS. Yes. It is provided specifically in article 8 of the agreement.

Mr. ERTEL. Thank you very much. Thank you, Mr. Chairman.

Mr. LLOYD. Thank you, Mr. Ertel.

Mr. Roth?

Mr. ROTH. Thank you, Mr. Chairman.

At one of our discussions we had, not today but previously, we were told the reason Germany, France and so on are making such great strides, for example in Mexico, is because they could come up with their package deals; something we couldn't do.

From your testimony it seems that we have the same problem here in the sense that these other governments are helping their—they're working closer with their industry rather than the American government working with our industry.

Historically, that does not seem to have been the case. What is happening that has changed all that?

Ambassador PHILLIPS. That's changed for the better?

Mr. ROTH. Historically that was not the case. So what has happened to change that? Are these other Governments that much more interested in working with their industry, or——

Ambassador PHILLIPS. Well, I think one reason may relate to the role of exports in the economy of some of these countries. Now, in Great Britain, of course, exports have been of fundamental importance for years. Obviously, such has been the case for Japan and other countries.

Until recent years the United States has not been interested in promoting exports; individual companies have not been particularly interested. But with the massive trade deficit that we're experiencing today, which in my opinion is not likely to improve greatly under present circumstances, there is obviously a far greater sense of urgency about this.

We are belatedly beginning to pull our socks up, though we have a long way to go. But I would say that until recently this was perhaps one of the reasons for our failure to show more interest and seriousness in the development of our export trade.

We are beginning to show signs of awareness, but I have not yet seen many effective steps taken to change the situation.

Mr. ROTH. Do you think that our industry without Government encouragement and help and so on can meet this competition of other countries?

Ambassador PHILLIPS. I don't believe it can, not effectively. There is, for example, and I think this is now public knowledge, the prospective sale of aircraft which was recently reported in the press that Douglas is well along in negotiations with the Chinese to sell DC-9's, and to engage in what I suppose one could describe as coproduction of these planes in China.

Now, there will be a very large amount of money involved in this. And it seems to me to be absolutely clear that Eximbank financing will be necessary. If it is not available it could possibly sour that deal.

Mr. ROTH. Thank you very much.

Mr. LLOYD. I thank you very much, Mr. Ambassador, for being with us here today. You have heard my questions and the others. We have also read your statement. And you have addressed the problem that I think is very critical; and, that is, how does the U.S. Government integrate its past political, economic, social decisions

with the current situation that exists in the world? And I think you probably have addressed it as well as anyone. And we, of course, will be looking forward to working with you directly in the future as this subcommittee will be looking further into this situation. Thank you for joining us today.

Ambassador PHILLIPS. Thank you, Mr. Lloyd.

Mr. LLOYD. At the present moment we will have a very distinguished guest. And we are very happy to welcome Mr. Li Wei, who is the First Secretary of the Embassy of the People's Republic of China.

We would point out to the committee that this is, I believe, the first time that an official of the People's Republic of China has testified before Congress.

Mr. Li, would you take your seat. You are, I believe, the first person from China to appear before either body to make presentations. And we would, of course, welcome you because the subject at hand is, of course, your country; and, therefore, we can't find any reason why you shouldn't be probably one of our most prominent witnesses. And we take this opportunity to welcome you today.

STATEMENT OF LI WEI, FIRST SECRETARY, EMBASSY OF THE PEOPLE'S REPUBLIC OF CHINA, WASHINGTON, D.C.

Mr. LI. Thank you, Mr. Chairman. I am pleased to be given the opportunity to speak a few words. It is really not a presentation, only a few words.

Mr. Chairman, I am much delighted to be invited to the hearing, and glad to learn of the views of the speakers on the science and technology transfer to China.

With the normalization of relations between our two countries, the growth of economic and trade ties have been greatly speeded up. The Sino-U.S. Trade Relations Agreement was signed, the legal procedure of this agreement on the part of the United States has yet to be completed.

All of these signal a new period of economic and trade relations between our two countries.

It is expected with great interest that the legal procedure of the agreement would be finalized, certainly, so as to broaden the paths of the development of trade.

We believe that the prospect of Sino-U.S. trade is promising. And to this purpose, the Subcommittee on Science, Research, and Technology and the Subcommittee on Investigations and Oversight are holding hearings here on science and technology transfer to China.

This is certain to be conducive to the development of bilateral trade.

Frankly speaking, we all know that there exists certain artificial obstacles. The flow of some commodities and the technology from the United States to China have been discussed, and certain contracts agreed upon and signed by both sides remain pending.

It goes without saying, that this will not do any good to the expansion of trade. It should be brought to an end, in my opinion.

Mr. Chairman, China now throughout the country is sparing no efforts in propelling the normalization of agriculture, industry, science, technology, and national defense.

Our policy is to rely on our own efforts and to learn from abroad important advance technology and equipments. A number of countries have already surged ahead in their cooperation with China. I am hopeful that the United States will catch up with them by taking all necessary steps to remove obstacles in the interest of the people of the United States and China.

Thank you, Mr. Chairman. As I am guest speaker, I would not like to have some questions or clarifications.

Mr. LLOYD. We thank you very much for joining us today and we appreciate your presence.

Our next witness will be Dr. Smil, who is with the department of geography for the University of Manitoba in Canada.

[The biographical sketch of Dr. Smil follows:]

DR. VACLAV SMIL

Dr. Vaclav Smil was educated at the Carolinum University in Prague (Faculty of Natural Sciences) and at the Pennsylvania State University (College of Earth and Mineral Sciences). He worked as a consultant in energy and environmental affairs and since 1972 he has been with the University of Manitoba, Winnipeg, Canada, where he is currently an Associate Professor in the Department of Geography. His main research interests have been in interdisciplinary energy studies: energy and the environment, energy and economy relationships, energy in China, energy in the developing world, renewable energies for development. He has published or has in press about 80 papers in a wide variety of professional and trade journals, including *American Scientist*, *The China Quarterly*, *Long Range Planning*, *Energy Policy*, *Ambio*, *Current History*, *Bulletin of the Atomic Scientists* etc. He is a regular contributor to *Energy International*, *China Trade Report* and *Petroleum News*. He is the author of *Energy and the Environment* (University of Manitoba, Winnipeg, 1974), *China's Energy* (Praeger Publishers, New York, 1976) and an editor of *Energy in the Developing World* (Oxford University Press, Oxford, 1980).

STATEMENT OF DR. VACLAV SMIL, PROFESSOR, DEPARTMENT OF GEOGRAPHY, UNIVERSITY OF MANITOBA, WINNIPEG, CANADA

Dr. SMIL. Thank you, Mr. Chairman.

I am going to leave you today with four impressions, and I will keep it crisp and short so that there will be enough time for questions.

In talking about Chinese technology today, there should be no doubt—and this is what the Chinese themselves have been saying for a long time—that their technology is quite backwards in just about all aspects.

The second point which follows after this reality is the potential import needs are absolutely enormous.

Yet the third one, and the one which I want to stress, is that the current situation in Chinese energy; that is, long-term planning, policy, technology is quite mixed; quite uncertain, lots of flux, lots of changes, lots of uncertainties.

And then the forth point that comes after the third one is that I, as an outside observer, would feel that a caution is warranted, and a rather slow pace and lots of prudence in dealing with this situation.

Let me give you a brief rundown on what the Chinese capabilities today are in individual energy fields.

Coal is the principal thing; accounting for some two-thirds of Chinese energy consumption. What is happening there is that the

extraction of it is as it was in this country 40-plus years ago; that is, the mechanization is very old because nearly half of the output comes out of the so-called small mines, which are basically shell pits, or surface things, almost no mechanization at all. All deep mines are in very, very great need of modernization. As a result the productivity of the mine is extremely low; in large mines some 2 tons—I give you these compilations so you can get a grasp of these figures; in U.S. mines about 10 tons per man per shift; in surface mines about 30 per manpower shift.

The surface mining which in the U.S. counts for over half the coal production, in China—we don't have the precise figure, but it's in the order of 10 percent only.

Coal transportation, which is a single large commodity, is very backwards. There are no unit trains as you have in this country—that is the train which shuttles between powerplant and the coal plant. This creates tremendous backlogs—2 million tons of coal are sitting at a given time.

So the potential need and their weak point, of course, is preparation. Almost all of their coal from the small mines is not prepared at all. And from the large mines even only a small fraction is prepared, salted, washed, and something done to it.

So they are reporting statistics in raw coal.

As far as oil is concerned, this has been a success story, because their production increase has been tremendous. However, they had difficult decisions to go ahead, either to go offshore, or to go West. Geologists spell for them that most of their resources ultimately will have to be looked at in the Western part of the country. That is an inhospitable desert part of the country; similar as the Russians, they are moving Eastward with their oil discoveries. So the Chinese will have to move Westward. It seems to be more convenient for them to go offshore, because definitely there is an offshore potential, but there is a great deal of "what to do" and they can't do both.

And it seems they decided for the offshore, and they are going into this exploration and possible reproduction, and whatever, 5 to 7 years.

However, their domestic capabilities, again, are something of at least 15, 20, or 25 years behind what is the Western standard, for example, for drilling.

The other day I was reading in the oil journal that hundreds of wells were drilled in a basin in Oklahoma of 15,000 16,000 feet, in depth. That's about 5 kilometers of deep wells. While there is now two single Chinese experimental wells, of 7 kilometers, and most of the oil is coming from one, 2-kilometer depths is the Chinese average as opposed to 4 or 5 kilometers in the United States.

So their drilling is in great need of modernization. The transport for oil is still shipped by trains. Only half of it goes through the pipelines. Of course, this is extremely wasteful and inefficient. The pipeline is very thin, very regimentary, 7, 8 kilometers. So they need a great improvement.

Most of their resources are now in the North and they need to ship it South. Their tankers are tiny by world standards.

Their refining, again, is about 20 or 25 years behind the world standards.

So whatever you touch in the oil industry needs a great deal of modernization.

Finally, in power production, the shortages of power have been absolutely severe ever—well, ever since the late 1950's. The latest estimates, the Chinese official estimates, I should point out, are that 30 percent of the capacity lies idle because there is not enough power to run it.

The base of the power, they say to themselves, is staggering; transmission takes up as much as 20 percent. The standard is 5, 6, 7 percent.

They have mastered the production of only up to 200 megawatts. They have only two, 300 megawatts units, but they have not been working well. While the average size of a newly installed American unit is five, 600 megawatts and the largest of over 1,000 megawatts. So it's the whole generation, the transmission is extremely backwards. Because of the huge idle potential, they need long-distance transmission, high voltage.

Yet they have only one 330-kilovolt line, 500 kilometers. So, again, this is a whole generation gap in power technology.

But strangely enough, their imports since 1972 have not been very large. They have imported lots of petrochemical installations, but I wouldn't count this directly as energy, because it is as sort of a secondary.

But their purchases of oil-producing and coal-producing technology have not been that great. Of course, they have started to negotiate for all kinds of things, but it's sort of hanging in the air. I would say there is some \$6 billion in the air for coal mines, but very little of that has been signed off. And there are untold billions again in oil, but very little actually has come through.

But this brings me to a third point here, that they, themselves, and it's not strange, it's to be expected looking at the difficulties with the energy policy in this country and Soviet difficulties, have a tremendously hard time to say to themselves what we want to do, because the deficiencies are everywhere. And it's so difficult for them to set the policies. As just one example, let me talk about coal because it's their principal fuel.

For years they have been neglecting the investment in coal. They have been overtaxing their large mines, and they have been pushing these small mines and saying, this is how we will achieve it, these thousands and thousands of small mines.

So now, 45 percent of this is coming out of the small mines. Now, they say, we have to modernize. It's difficult to modernize the small thing. So we will put it into key installations in the big mines, but because most of the coal is in the North and lots and lots of the consumption is in the South, they said, we have to make the South as self-sufficient as possible. So they started pushing the coal mines in the South. And they realized themselves again, they said, wait, most of the good coal is in the North—that's where the load is thick and the coal mines are good, why not concentrate on the northern coal mines.

So this is very extensive now, but it is a difficult policy because if you consider one spot—and this is in the Chong Chee Province that means they would not be able to ship the coal out. Already they have tremendous problems and they realize they are insufficient,

and so they have to put in high-voltage lines, but they don't have high voltage technology.

Now, I want to point out to you that what they are trying to do is unprecedented in the history of economic development because of the speed. They cannot afford to import; they cannot afford not to wait, but they simply do not know what to do first because they need to do all these things at the same time, and they can't.

So I think it will be quite a while before they, themselves, could thrash it out, and they, themselves, will know which will come first and what fashion.

The energy policy is in a great state of flux in this country, it's in even a greater state of flux in China. And this is why I would feel that the United States should go, if possible, slow, because of, as the Chinese call it "readjustments." Many readjustments are bound to occur in the energy power thinking. And what seems today a glaring thing; to say just jump on it and let's do it, may not seem so easy, even to them.

So I would think that the proper response—the urge, of course, is to sell, but the proper response is to go slow.

Let me stress especially one point, I feel that strategically the first mistake, I'm sure, this country could make is to barter its technology for Chinese oil. I think the last thing this country needs is a drop of foreign oil on its shore. That's the last thing this country needs.

[The prepared statement of Dr. Smil follows:]

CHINA'S ENERGY TECHNOLOGY

DOMESTIC CAPABILITIES, IMPORTS, AND POLICY IMPLICATIONS

(By Vaclav Smil, Associate Professor, University of Manitoba, Winnipeg, Canada)

DOMESTIC CAPABILITIES

China's energy industries have made some impressive strides during the three decades of the Communist regime placing the country third in the global ranking of coal output, eighth in crude oil and fifth in natural gas extraction and seventh in electricity generation. Yet in per capita terms China remains an energy-poor country and its fuel and power technologies -- which have, of course, advanced substantially from the meagre foundation in the early 1950's -- remain much behind the advanced world standards, are almost uniformly inefficient and appear to be poorly managed.

Since 1978, after years of dubious propaganda, Chinese have started to reveal these serious technological lags and gaps that are found in virtually every energy exploration, extraction, transportation and conversion activity; they now readily admit to be at least 15-20 years behind the current Western performance and stress the critical weakness of the whole energy sector in the national economy.

The following review of China's energy technologies is designed to quickly appreciate both the existing technological lag and the immense scale of the future requirements necessary to support the desired modernization. A detailed review of individual Chinese fuel and power technologies in international perspective is presented in Appendix A.

Coal Industry

China's coal industry, which provides nearly 70 percent of the nation's primary energy consumption and whose annual extraction is surpassed only by the Soviet and U.S. totals, is relatively quite backward.

In 1978 45 percent of the raw coal output came from more than 20,000 small mines, most of which are truly primitive surface enterprises relying solely on human labor. The predominant extraction method in large mines is still the combination of blasting with dynamite, loosening of coal and rock with picks or pneumatic drills and then manual loading with shovels into small carts. Economically the most desirable way of coal extraction -- completely mechanized large-scale surface mining -- is done on a minuscule scale.

Only a few of the largest underground mining centers can boast of having a variety of imported or domestically-produced modern extraction, loading, conveying and lifting machinery. Domestic production of such equipment is largely based on the Soviet and East European designs of the 1950's and on even older Western prototypes. Chronic shortage of high-quality steels is especially felt in this industry where machinery is exposed to intensive wear. Low degree of mining mechanization shows in very poor productivity. Chinese have some of the world's best coal seams yet even in their most advanced underground mines extraction is just about two tonnes of raw coal per miner a day; nationwide average is well below one tonne.

Most of the raw coal is never sorted, washed and sized due to the lack of preparation capacities. Consequently the shipped fuel contains a high proportion of uncombustible waste, making its transportation more expensive and its burning less efficient. Long-distance movements of coal are necessary (it is the top commodity hauled in China, some two-fifths of total tonnage) but ordinary small capacity freight cars are used in relatively light trainloads pulled predominantly (90 percent) by inefficient steam locomotives.

Oil and Gas Industry

Introduced by the Soviets in the 1950's, the industry is still marked by the typical shortcomings of the Soviet hydrocarbon technology: lasting shortages of advanced exploration equipment, impossibility to locate deep structures, use of turbodrills and primitive drill bits, inadequate pipes, pumps and gas treating facilities. Although virtually all essential kinds of onshore exploration equipment are now produced in China, their sophistication and performance lag one to two decades behind Western levels.

Most of the drilling is confined to depths up to 4,000 meters and the first two experimental 7,000+ m wells were completed in 1978, twenty years after the comparable US effort; in contrast routine drilling goes on in Oklahoma's Anadarko Basin to depths of 5,000-6,000 meters (15,000-16,000 feet). Offshore drilling is even less advanced: a mere handful of domestic jack-up rigs and drillships can only work in waters 30-80 meters deep and there are no modern Chinese-made exploration and supply vessels, offshore mooring terminals and production platforms.

Crude oil transportation relies about equally on inefficient shipping by a fleet of over 30,000 small railroad tank cars and on a very sparse network of small and medium-diameter (20-61 centimeters) pipelines whose total length is about 7,000 kilometers. Chronic shortages of good steel preclude any large-scale production of high-pressure seamless pipes and pipe laying still requires much heavy manual labor (trough digging by pick axes and shovels is common). Chinese-made tankers are tiny by world standards and quality of ship production is generally poor. There is only a single harbor capable to handle

moderately large (up to 100,000 dead weight tons) ships.

Domestic crude oil refining technology is best compared to the Western capabilities of two decades ago. The main shortcomings are the still restricted variety of refined products and their poor and inconsistent quality. First large completely Chinese catalytic cracking unit was completed only in 1978 and pollution controls in most refineries are wholly inadequate. Only two refineries process more than 5 million tonnes of crude a year and shortages of refining capacity have led to relatively large combustion of unrefined crude oil. Distribution system for refined products is very rudimentary and quite inefficient giving rise to appalling shortages of fuel and lubricants in rural areas.

Power Industry

Grossly inadequate electricity generation is blocking China's economic advance even more than the difficulties with fuel industries. Equipment is obsolete, overloaded and in poor repair, generation efficiency is low, production management shoddy and long-distance transmission and system interconnections have only just begun.

Both thermal and hydro generating units are based on old Soviet or Greek prototypes. Maximum thermal unit is rated at 300 MW but only two turbogenerators of this size are in partial operation after years of adjustments and test; largest mass produced units have 200 and 150 MW, too small to take the advantage of known economics of scale. Hydro units seem to be in better shape, though there is only one 300 MW generator. Annual production of generating equipment is far below the basic requirements and some of the installed machinery has

remained totally idle. Two advanced power generating concepts -- pumped storage and gas turbines -- play a negligible role in China. There is no nuclear power plant.

Coal is the principal power plant fuel in China and relatively small size of thermal power plants equipped with inefficient machinery result in its considerable waste. Consumption of standard coal per generated kilowatthour is at least 35 percent greater than in the USA. Power plant controls and safety are also behind the acceptable Western standards; for example, China's first computer-controlled steam turbo-generator was installed only in 1975. Hydro construction is still small in relation to the immense potential and a group of large stations begun in the late 1900's was not completed until the mid-1970's.

Transmission technology is 15-25 years behind the Western performance. There is just a single 330 kilovolt line (534 kilometers long), individual regional or provincial generating systems are completely isolated or tied together by single 110 or 220 kilovolt lines and there are no direct current transmission lines. Network stability and reliability is poor and power interruptions are common.

IMPORTS

Even a brief review of China's domestic energy technology capabilities leaves no doubt about the huge potential for imports if the country is to modernize her inadequate and inefficient fuel and power industries. Yet, so far, the energy technologies have not been topping China's import list. By far the largest items have been various petrochemical plants and processes and modern iron and steel installations. However, imports of coal mining machinery, offshore oil rigs and vessels and power turbogenerators have not been negligible (especially when considering the erratic nature of import deals during most of the 1970's): between 1972 and 1978 Chinese firmly contracted for just over US \$1 billion of these technologies and their intents in these fields since 1973 translate into potential deals worth much over US \$10 billion for the next 6-10 years. What portion of this sum will be actually contracted for remains anybody's guess.

Coal Industry

First substantial agreements for imports of coal mining technology during the 1970's were signed in 1973 and 1974 when the Chinese purchased well over US \$100 million of assorted mining machinery. About a third of this total went to England whose long-wall mining technique is a favorite method in large modern Chinese mines (it was introduced there by the Soviets in the 1950's) and about one-sixth was for the purchase of Buyrus Eric electric shovels and drills for surface mines. The rest went for West German and Polish underground coal cutting, loading and conveying equipment.

Frenzied modernization plans in 1978 led to many exploratory talks

and eventual exchanges of letters of intent with several Western and Japanese companies but a few firm contracts have been signed so far. This is not surprising in view of the huge sums tossed about in 1978 and early 1979 -- and the subsequent Chinese "readjustment" of economic plans. By far the largest of these new contemplated deals (US \$4.2 billion) would involve West Germany's Krupp, Demag, Thyssen and Ruhrkohle joined together in setting up five new underground mines, modernizing another one and opening up two large surface mines. Britain's Dowty, Anderson Strathclyde, Gullick Dobson, Powell Duffryn and National Coal Board and Japanese Mitsui Mining are in competition to develop other mines and to deliver assorted machinery.

Oil and Gas Industry

Imports for oil and gas industry in the 1970's have been predominantly in three fields: assorted technology for offshore exploration, drilling and production; steel pipes from expanding pipeline network; and a wide variety of petrochemical plants and processes.

Among the main items imported to establish China's offshore oil and gas production capability have been:

- a geophysical exploration ship from CCG, France
- eight offshore rig supply vessels from WECO, Denmark
- a secondhand shallow-water jack-up rig from Japan
- three large modern jack-ups from Robin Loh yard in Singapore
- a large semisubmersible rig from Norway (Aker H-3)
- two semisubmersible rigs from Japanese Hitachi
- two rigs by National Supply
- a Bethlehem jack-up.

There have been also relatively minor purchases of drilling bits, blow-out preventers and other oilfield equipment from various U.S. corporations. The latest exploration agreements between China and a host of Western (mainly US) oil companies (more than a dozen seem to be involved) are a qualitatively new development which has, to put it mildly, a highly unusual character and is shrouded in peculiar secrecy.

Relatively fast expansion of petrochemical industries has been a major part of China's modernization during the 1970's and the reliance on imports of complete plants, individual processes and equipment was critical. Imported technologies are ranging across the whole petrochemical spectrum -- from basic refining process to nitrogenous fertilizers and synthetic leather. Japan, West Germany, France, Netherlands and the USA have been the main exporters. The total value of the firmly contracted imports in this category between 1972 and 1978 was rather large, approximately US \$2.2 billion, but because most of these technologies belong to the chemical industry category I will not itemize the principal deals.

Power Generation

Chronic power shortages, inadequate domestic production capacities and the need to install larger and reliable thermal turbogenerators necessitated fairly substantial imports of power generating equipment during the 1970's. Between 1972 and 1978 China contracted for close to 6,000 MW of capacity (for comparison, China's total domestic output of generating equipment was around 8,000 MW in 1978) at a cost of over U.S. \$700 million.

Major imports of power generating equipment from Western Europe

and Japan (between 1970 and 1978 Chinese also contracted for over 3,000 MW of thermal turbogenerators from the USSR and Czechoslovakia, mainly in 200 MW units) included (the year of contract signing in parentheses is followed by approximate dollar value in millions):

- one 125 MW thermal turbogenerator from GIE, Italy (1972; 9)
- two 60 MW hydro turbogenerators from Alsthom-Neyrpic (1972; 10)
- two 125 MW thermal (coal) units by Hitachi, Japan (1972; 30)
- two 250 MW thermal (coal) turbogenerators by Hitachi, Japan (1973; 72); all four Hitachi units are now in full operation at Douhe station near Tangshan (when under the construction the plant was much damaged by July 1976 earthquake), currently one of China's largest
- two 320 MW thermal (oil) turbogenerators from GIE, Italy (1973; 80); these two units are now in full operation in Beidagang power plant supplying Dagang oilfield and its off-shore drilling base in Bohai Gulf (they are currently the largest turbogenerators operating in China)
- one 300 MW thermal turbogenerator (brown coal) from CEM, France and Brown-Boveri, Switzerland (1974; 55).

Over 300 MW of gas turbine generators (mostly in units of 20 MW) have been also imported from England, Belgium, Japan and Canada. All of the imported generating technology have been standard, mostly small and medium-size items (although a 320 MW generating unit is a record size in China it has just about half the power of a typical new unit installed in the US in the 1970's; largest US units are now well over 1,000 MW).

POLICY IMPLICATIONS

In this final section I would like to look at China's many performance and policy problems stemming from the poor energy technology and to outline what I would consider a desirable US response.

Current Chinese Problems

Official admissions published in newspapers and professional monthlies and broadcast by the central and provincial radio stations during the past two years, and especially since the spring of 1979, combine to give a rather appalling appraisal of China's energy situation. In spite of the relatively fast output increases there are "acute shortages" of all fuels and electricity and China's current energy production cannot support the existing 350,000 industrial enterprises.

The nationwide combustion efficiency of fossil fuels is merely 28 percent, compared with values in excess of 50 percent in the industrialized countries; efficiency of many millions of coal-fuelled cooking and heating stoves is only 15-18 percent and steam locomotives, still the mainstay of railroad traction, have efficiencies below 10 percent.

Power shortages are so severe that 20-30 percent of the country's productive industrial capacity lies idle. Consumption of electricity by power plants is high and transmission losses are described as "tremendous" -- usually more than 20 percent in rural areas. Some installed generating equipment fails to produce anything. Specific consumption of electricity in steel making, coal extraction and chemical industries actually rose between 1965 and 1977.

News about large-scale conservation campaigns are continuously

coming out of China but this year Hua himself revealed that industries, transport and communications services waste as much as 30 billion kwh of power and tens of millions of tonnes of coal each year. Waste of petroleum fuels must be also considerable judging by the fact that the new government instructions require all regions and departments to save in 1979 2-3 percent of allotted coal and power but 5-10 percent of oil products.

Shortages of refined oil products are widespread and truly critical. They are worse where they are needed most: in agriculture. China's food production has just kept pace with population growth and the peasants are not eating any better in the late 1970's than they were in the late 1950's. Farming modernization is a must for China's economic advance and fuels and lubricants and power are the key. Yet one can read stories such as about Hunan (40 million people) where the number of tractors went up seven times between 1966 and 1977, the number of diesel engines 130 times (mainly for water pumping and crop processing) and the walking tractor total grew 436 times -- while the supply of diesel oil increased only 6.4 times and deliveries of lubricants just 2.75 times.

Results are predictable: tractors and motors remain idle, draft animals must be retained, necessitating the expenses for both the feed and machinery. Shortages of lubricants are forcing inexperienced peasants to use vegetal oils and lard as the only available substitutes, seriously damaging crankshafts and bearings. Not surprisingly then, another mass campaign is currently underway in China designed to substitute oil products by coal wherever possible. Surely it is appropriate to be reminded that this is the sorry state of affairs in a nation whom

the naive Western businessmen and assorted instant energy experts have been touting (some still are!) as a looming oil-exporting giant. After all, as late as 1976 some people were predicting China's crude oil exports surpassing 100 million tonnes in 1980!

Evidently, the array of technologies needed just to close the existing gaps and to eliminate the worst inefficiencies is stunning: the list is all-encompassing and nearly endless ranging from basic mine mechanization, good drilling bits and gas-treating equipment to new efficient boilers and large generators, high-voltage transmission lines and much expanded pipeline network to improved energy conversion in all basic industries (above all iron and steel, color metallurgy, chemicals and cement), better ways of household cooking and heating (new stove designs, LPG, natural gas, cogeneration) and reliable fuel and lubricants distribution network for the country's rural areas (just the last item is mind-boggling!)

And the proposed bold plan to modernize China's economy -- regardless of the actual deadlines (obvious nonsenses such as 65 million tonnes of steel by 1985 have been already discarded, as was the "basic farming mechanization" by 1980) and particularities of individual product goals -- would require an expansion of energy output unparalleled in human history. Here one encounters another kind of profound problem facing the Chinese leadership today. Whatever its actual speed, such an expansion would need a solid long-term strategy, a truly comprehensive energy policy. Yet what one can discern are extremely bold goals surrounded by tenuous pronouncements, abrupt policy changes, including complete reversals, and lack of intersectoral coordination.

Although the Chinese want to double their 1977 coal output within a decade the policies guiding the extraction have recently taken some abrupt changes and a clear-cut long-range plan is far from definitive. During most of the 1970's coal industry grew as much by construction of new large and medium-size shafts as by pushing the extraction much beyond the designed capacities in existing large collieries (for example, Kailuan, China's largest coal mining center was producing twice its original capacity before it was devastated by July 1976 earthquake) and by opening up of small scale rural pits. In spatial terms, the goal was to make the individual provinces as self-sufficient as possible and, above all, to lower drastically, and eventually to eliminate, the southern dependence on the imports of northern coal.

After years of relative neglect and serious under-investment, the industry was given a very prominent place in the nation's economic strategy and set on a firmer course by a long-range development plan announced by its minister, Xiao Han, early in 1978. The five essential points of the plan were: to minimize the investment in new shafts by securing much of the output increases by stepped-up exploitation of existing mines; to promote a rapid and widespread expansion of small coal mines; to eliminate the traditional southern dependence on the northern coal within a decade; to utilize widely all low quality solid fuels (peat, stone coal, oil shale) and mining wastes; and to achieve the mechanization of all key operations in China's major mines by the year 1987.

Since then, the greater emphasis on rapid modernization, favoring the economies of scale, has considerably weakened the stress of indiscriminate opening of small mines (producing inferior fuel at excessive

cost) and on the use of low quality coal and wastes. And it also seems that the Chinese planners came to realize the limits to the expansion of many existing mines and the latest pronouncements, including the Premier's report to the National People's Congress in June 1979, talk about speeding up the construction of new collieries, including large surface pits.

And the latest important shift, announced in Spring 1979, is away from the effort to increase the southern coal self-sufficiency and toward the concentration on rich north China, and especially Shanxi, deposits. Such a move makes eminent sense for many reasons. Shanxi's bituminous coal reserves account for one-third of China's total, are of excellent quality in thick, mostly level, or only slightly inclined, seams and are relatively close to the surface. In contrast, eight provinces south of the Yangzi have mere 1.8 percent of the country's coal reserves, largely in deep, thin, inclined and dislocated seams. Consequently, extraction is three to four times faster in Shanxi than in the south, cost of raw coal is 40-50 percent less and investment per tonne of new mine capacity is about 30 percent lower.

Concentration of new large mines in Shanxi thus seems the most logical way to achieve the ambitious goal of doubling the output in ten years; or, as Renmin Ribao editor's note put it, the new proposal tallies with objective reality. Part of that reality, however, are some serious obstacles to the expansion. Huge amounts of Shanxi coal will have to be shipped to other provinces and this would be impossible without building new major railway links and double-tracking and electrifying the old ones: due to inadequate transportation even today some two million

tonnes of coal are waiting in stockpiles to be shipped out of the province.

An obvious alternative to avoid massive coal transfers and railway construction is to build a group of large thermal power plants in Shanxi and to transmit electricity to other provinces — but this would require an unprecedented expansion of long-distance high-voltage lines and their upgrading much beyond the current Chinese capabilities (advanced foreign technology imports would be inevitable) and it would create a huge demand for cooling water in a region with low, uneven and erratic precipitation (annual average in most of the province is just 300-400 mm and much of this total comes down in irregular summer downpours) where even essential irrigation water is already scarce and where the only possible major means of securing more industrial water would be to divert it from the silty Huang He which forms Shanxi's western boundary. All of these are neither easy nor inexpensive choices to make, and it will certainly take many years before a question of how far the coal mining concentration in Shanxi is worth pushing will be resolved.

Since 1973, more has been written abroad on China's crude oil industry than on any other sector of the country's energetics and the principal outlines of petroleum development policy seem to be reasonably clear. On the consumption side, the policy is to assure that petroleum does not become China's major fuel in the future and that coal and hydro-electricity be used as much as possible to free the crude oil for export. On the production side, the high extraction increments of the recent past (average annual rate of about 20 percent from 1966 to 1978) will not be possible to maintain (in fact, annual increases were below 10 percent in 1977, 11.1 percent in 1978 and the planned 1979 growth is merely

1.9 percent), but the policy is to develop China's petroleum potential as fast as practicable.

This is best exemplified by the official goal of opening up ten oilfields as big as Daqing by the end of the century, an extremely ambitious task. In this respect, Hua's only sentence referring to the petroleum industry in his June 1979 Report on the Work of the Government was most revealing. He stated that "geological survey and prospecting must be stepped up, and more oil deposits found so as to maintain a rational balance between extraction and reserves." This clearly indicates either the onset or imminent prospect of a declining reserve/output ratio. Undoubtedly, the country still has very large quantities of total petroleum resources. But moving them into the category of reserves (verified, technically manageable and economically feasible), through geophysical and geological exploration and oilfield development, is becoming increasingly difficult. Even if Chinese offshore oil resources - conveniently located underneath the East and South China Seas in proximity to major markets of North China, Shanghai, Jiangsu and Guangdong - were in geologically uncomplicated and easily extractable formations (and they are quite obviously in neither), offshore exploration, wildcat drilling and platform production, especially in the deeper parts of the continental shelf and in the typhoon-plagued areas, will be a very expensive proposition for China's economy.

Opening up of the Renqiu oilfield on the North China Plain, about 150 km south of Peking, shows that the petroleum potential of the Sinian onshore strata has not yet been fully tapped, but the stratigraphy of the country points inexorably to its western parts - remote, sparsely populated and environmentally inhospitable - as the main depository of hydro-

carbon-bearing onshore sediments. Chinese planners are thus facing two almost equally burdensome choices for their long-range crude oil strategy: to go offshore or to go west.

It might seem that an irrevocable decision has been made in favour of the first strategy, with its unavoidably high foreign technology participation, and with its appealing outcome of extracting hydrocarbons both on the doorstep of the major Chinese coastal industrial and agricultural consuming areas, and close to the huge Japanese market which could be served without ports and pipelines by loading large tankers at offshore mooring facilities. But the extent and timetable of this effort (which is bound -- even in the case of substantial oilfields -- to take at least 5-7 years and more likely a decade to reach a substantive productions stage) are as yet far from clear, and reversals and "readjustments" are very likely.

Thus long-term oil expansion strategy has probably not been settled by excluding, for the time being, the huge western potential (after all, intensive development goes on at a newly-discovered oilfield about 200 km east of Kashi in Xinjiang on the western edge of the Tarim Basin). The only constants remain a potentially huge domestic need -- and widespread and serious shortages of refined oil products.

Current Chinese power generation plans emphasize the building of large mine-mouth stations and groups of power plants in coal mining regions to create gigantic electricity supply center (Shanxi concentration is envisaged to have as much 20,000 megawatts) -- as well as the expansion of hydrogeneration at the highest possible speed. Both of these strategies, while sound in principle, will face several considerable obstacles -- and would bring some intractable problems.

Both the mine-mouth plants and large hydro stations mean locations far from major load centers; in the case of giant hydro stations those distances are in many hundreds of kilometers. Yet, as already pointed out, China's transmission technology is extremely backward (low voltages, poor management, high losses) and cannot handle properly even the existing meagre ties -- while these new plans would inevitably require thousands of kilometers of very high voltage links tied in computerized systems. Good quality steel requirements for transmission towers and conductors are, obviously, another serious impediment.

However, I feel the main long-range problems to be environmental. So far, in their wish to industrialize, Chinese have mostly avoided proper pollution controls and have hardly begun to consider many environmental impacts of their bold modernization plans. Consequently, the country already suffers many serious environmental decays. Acid rain (and dry air pollution deposition) caused by sulfur and nitrogen oxides from large concentrations of coal-fired power plants might, in long-run, dangerously impair China's food production capability by lowering crop yields, destroying forests and wiping out aquaculture over large regions.

Huge dams, especially the planned Sanxia on the Yangzi, present different dangers. Sanxia's 27,000 megawatts, by far the world's largest hydro station, would concentrate in one spot about half of China's 1978 total power generating capacity. Leaving aside the question of how prudent it is from engineering standpoint to concentrate so much power in a single place, I would be very worried about the earthquake damage to such a giant structure (also, in fact, about the earthquakes induced by the huge volume of stored water), about silting rates

(especially in view of the recent reports of major increases in deforestation and erosion in some parts of the Yangzi Basin), about possible spread of aquatic weeds, changes of local climate and about the dam's effect on the water supply in the whole lower Yangzi valley.

I have dwelt in some detail on the current Chinese energy problems and policies to deal with them in order to show both the depth and complexity of existing and potential difficulties and the fluidity and tenuousness of recent bold plans. To me it seems quite clear that in today's Peking there is a good deal of wishful thinking, of tossing around unrealistic performance goals, setting overly ambitious time-frames, putting too much faith in foreign technology and underestimating environmental and social impacts of many giant energy schemes.

Implications for the U.S. Policy

To sum up succinctly my opinion of what the US response should be is easy: prudent and cautious. The very opposite of that not infrequent recent mentality of deals at any cost designed to open the door to the so wrongly perceived fabulous China market. One does not know what emotions should come topmost when hearing and reading about "super secret" meetings (where the participants must pay \$100 to attend) which result in U.S. companies bearing the entire cost of a huge exploration enterprise ("They go in totally with their chins out") and not being assured of getting any subsequent production rights. Hardly a normal business practice: what other poor developing nations can boast of being served in such a fashion?

Prudence seems to me to be dictated by the fact that the U.S. long-term benefits accruing from eager accommodation of Chinese needs are very

uncertain and some suggested pay-offs look rather undesirable. To begin with, the top Chinese trade officials and planners have often stated that large-scale imports of complete plants or sets of equipment (be it turn-key delivered refineries, thermal power stations, drilling rigs or hydro turbogenerators) are just a passing phenomenon that "must be changed". Their declared strategy, not unreasonably, is to make selective purchases of key equipment and to acquire the access to various top technologies (patents, operation know-how, expert training abroad, export consultations in China) so they could enhance their manufacturing and designing skills and undertake the projects themselves.

Confident predictions and optimistic forecasts of large long-term energy technology exports to China thus seem to be yet another instance of wishful thinking that governs so much of the Western doings with that country. Moreover, the Chinese seem to be determined not to pile up huge trade deficits: hence their offers of compensatory trade and co-operative production. These deals are supposed to change the whole set-up of Chinese trade. While it is clear that the U.S. capacity for absorbing Chinese textiles, handicrafts, fake antiques, pig bristles, goose and duck downs and feathers (these items have been the top U.S. imports from China) is rather limited, the barter of the top US exploration, extraction, conversion and transportation technology for China's plentiful crude oil is considered by many as very desirable.

I would, most emphatically, disagree. Economically and strategically the last thing the U.S. should wish for is to further increase the dependence on imported oil -- and to have it unloaded at the West Coast. Besides, the potential for huge and swiftly developable offshore crude discoveries in China is all but certain and high, quality of the

currently exported oil is unsuitable for US market, its price is, in fact, higher than the comparable Indonesian crude — and, even when the deals would go eventually through, most of the newly extracted oil would almost certainly end up on Asian, above all Japanese, market.

Perhaps it is appropriate to recall in this relation those rather immodest US-Soviet-Japanese energy-technology swap plans from the beginning of this decade: billions of dollars in equipment and machinery making the Tyumen oil to flow across Siberia to the Pacific Coast and the West Siberian natural gas to move (liquefied, of course) to the East Coast ports by billions of cubic meters a year. One does not hear, fortunately, anything more about that folly but it is surely instructive to keep it in mind while trying to look at the likely fate of Sino-US energy-technology swaps.

Prudence is also dictated by the described lack of firm development plans in China and by the high fluidity of Chinese thinking about the speed and extent of modernization. The "readjustment" of the late winter and spring of 1979, following so closely the unrealistic plan-making of the 1978 and hitting and stunning even the Japanese who thought to be safely "in", was not certainly the last turn on China's road to modernization. At this stage the long-term U.S. interests might be better served by going slow and, in fact, by trying to moderate some Chinese flights of fancy rather than attempting to kow-tow to them. Sanxia hydro project is a perfect case in point: why should the U.S. hurry to outdo the Soviets in creating an even bigger "Aswan"?

Finally, there are political reasons for prudence. Three decades of Communist China's record are the last thing to inspire beliefs in a stable leadership and reliable policy-making. The generational succession

has yet to run its full course and the freer flow of information from China shows to anybody who is willing to follow the situation closely the immense social and political tensions present in the society. It is also a curious sight to observe the U.S. denial of the MFN status to the USSR because of its human rights violations (as one who was fortunate to leave Czechoslovakia after the Soviet invasion of 1968 I hasten to add: rightly so) -- while closing both eyes to China's very unenviable record in that respect.

An observation by the sagewhom the Chinese Communists at first barely tolerated, later viciously reviled and now again grudgingly accept would seem to me to give a fine guidance to the U.S. policy in respect of technology transfer to China. Said Master Kung (Confucius): "Those whose measures are dictated by mere expediency will arouse continual discontent".

I do not wish to make any predictions about the course of China's grandiose modernization plans, stability of its leadership or its future "tilts". All I am suggesting is that the abundant signs of uncertainty, fluidity and tenuousness emanating from China should not be ignored. Chinese cannot afford not to buy and not to acquire a variety of advanced energy technologies -- the needs are clearly enormous.

But, inspite of that need, the scale of this effort will, most likely, prove to be much smaller than eager anticipations of many Western businessmen and politicians, Chinese will continue to deal with different sources (after all, US has very few items on the list of energy technologies that could not be supplied by Japan or Western Europe) and they have comparatively little to offer in return.

Is not there a time for "benign neglect" of China. Or, if that seems too strong, might it not be helpful to start, finally, treating China just as another country? I'd urge a try.

Mr. BROWN. Mr. Smil, you had a statement in your prepared text that intrigued me in reference to large-scale exploration agreement between China and the Western oil companies. You indicated that there are a dozen or more oil companies involved. You said it was of a highly unusual character and shrouded in peculiar secrecy.

I suspect we don't know much about it. But can you say anything more about that arrangement?

Mr. SMIL. Yes. All I can say is what I know from people who don't want to be identified by talking to me. The companies will probably go in, promising that they will do a very considerable exploration job in fairly difficult waters without any return for it, without even a firm promise that if and when they discover they will be let in on actually producing this. This is how I understand the agreement stands. I don't know if it has changed in the recent 6 weeks, but this is the original agreement; they simply go layout, put out their best technology, as I say, in difficult waters, and part of those waters are under dispute between Vietnam and China, and they are bringing American companies and American interests on the side of China against Vietnam, which is politically very sensitive, without any firm agreement that, yes, when we discover, you are the ones who will be invited to the oil pit.

Mr. BROWN. In view of what you have said about the need for petroleum in China for their own domestic uses, it seems that they should probably have a high priority—I'm not clear in my mind, does the agreement just cover offshore exploration, or are there agreements to explore the large onshore resources in China?

These agreements I'm thinking about are for offshore exploration, ranging from the north [inaudible] all the way to the South China Sea to Vietnam. So the North would be Japanese, South would be American; French, and Canadian, just about every big name in the international oil is involved in this.

But, of course, to pick up your point about the latent domestic needs. It is so huge, and here, again, I want to stress, I think this is illustrative of their tremendous problems that one of their provinces which is a very important populus, an agricultural province of 14 million people, gave these marvelous figures of saying how tractors, have increased, multiplying by 10, hundreds of times. At the same time the amount of oil and lubricants afforded to that province have just grown by 2, 3, 4, 5, 6 times. Consequently they have had such shortages that peasants are using lard and vegetable oils to lubricate their machinery, and ruining it in the process.

You see, they may have the oil but they don't have the energy to bring it where it is needed the most, because the distribution of encompassing the hundreds and thousands of little villages in the very difficult terrain; central and south China has very difficult terrain, so their domestic needs potentially are for 500 million tons, not 100 million tons they produce today. So the difference between what they are able to produce between now and what they have agreed to in the future—this is like the scissors which will be closing or will be closed very shortly I think.

Mr. BROWN. Let me ask you one other question.

Normalization of relations between the United States and China is fairly recent, and it sparked sort of a euphoria about the huge potential that exists.

In Canada you have had normalization for a considerably longer period of time. And I would like to ask you what is the current attitude in Canada about the potential that exists for mutually beneficial economic relations between Canada and the PRC?

Mr. SMIL. Well, what I gather from Ottawa is, Canadians now have a hard time to just keep their great advantage of selling wheat, because we have such a rotten shipping system. We've got the wheat, bulging, you know; my province Saskatchewan is bulging because we can't deliver to those ports and we can't ship it to them, and that's what I'm telling you. I think the feeling among businessmen in Canada is why the Chinese should go to us really when they can go to Japan or to the United States. So there were high hopes for selling technology items, including, as you mentioned, lots of hydroelectric, because we are the masters of it. But, so far, there is nothing on the paper. And, as I say, we have been struggling to maintain our own traditional large wheat exports. So the euphoria is gone.

Mr. LLOYD. Mr. Roth?

Mr. ROTH. Thank you, Mr. Chairman.

What percentage of the Chinese oil that they can produce now goes to Japan?

Mr. SMIL. It's about 10 percent roughly.

Mr. ROTH. Japan actually is going in—

Mr. SMIL. They change it a little bit every year, but the Japanese exports by early 1980's shouldn't be greater than about 50 million tons, on the order of 10, 8½ million. So they are producing 100 million tons last year, 110 million tons this year. The total exports are maybe 15 percent, and to Japan about 10 percent.

And in that regard, I should perhaps remind you that just about 4 years ago, people were writing that by 1980 China would be exporting 100 million tons of oil. This is the total Chinese production today.

Mr. LLOYD. Would you say that figure again?

Mr. SMIL. Just 4 years ago people were writing in scientific journals and business journals that by 1980 China would be exporting 100 million tons of oil.

Mr. LLOYD. You're saying tons, not barrels?

Mr. SMIL. No. Tons. And this is what their total production is now, and they are exporting, say, 50 million tons today. So the hopes, you know, are collapsing really.

Mr. ERTEL. If the gentleman would yield.

Just to put it in perspective. How many barrels are in a ton?

Mr. SMIL. Well, it depends on the density. But about 7.2 is the average. If you go by—7.25, that's the average.

Mr. ERTEL. So you're talking about 700 million barrels of export, that's what they were projecting?

Mr. SMIL. Yes. Simply 10 times more than it is today, because they were projecting that the output would be 400 million tons by 1980. This was so irrational, but it got such a heavy play—it was put forth by the Japanese, and it got worldwide play, and all kinds of people were believing it actually, I think, unfortunately.

Mr. ERTEL. Thank you. I'm sorry to interrupt. I wanted to get it to something I could understand a little better.

Mr. ROTH. Well, the question I have, you know, there has to be some quid pro quo in everything, and if China is going to be importing our technology, there has to be something we can get from China; whatever they have access of, if it isn't oil.

What should our countries be looking for from China?

Mr. SMIL. Well, I'm very discouraged by looking at the list of leading imports from China to the United States, because you go down the list and it's duck, chicken feathers, camel hair, fake antiques, printed textiles. Well, they can't have that many antiques obviously to satisfy the U.S. market.

So it's discouraging to look at the list of imports. The potential is there for many things, especially as far as metals are concerned; there, the potential is large. I don't know how fast it could be realized and specifically what metals could be imported on short notice. Otherwise, there is no potential for anything notable. Certainly not food. And certainly I think the last thing the country needs is more textiles from Asia.

Mr. ROTH. It doesn't paint a very nice picture.

Mr. SMIL. No. I would be very pessimistic because there is very little that China can meaningfully offer to the U.S. except oil which I would be terrified of accepting.

Mr. ROTH. Thank you, Mr. Chairman.

Mr. LLOYD. Mr. Ertel?

Mr. ERTEL. I guess the question one would ask is: Why would you be terrified accepting their oil?

Mr. SMIL. Because as I said, from an economic and strategic point of view, I think this is the last thing this country needs, any more foreign oil. I think anything the United States can do to decrease imports of oil is absolutely essential for the U.S. economy and survival. So why try to import; moreover, where would it end up, on the West Coast. Now, this is the last thing anybody would want, American Oil on the West Coast.

Mr. ERTEL. On the short term we're going to be importing oil regardless.

Mr. SMIL. That's true.

Mr. ERTEL. If the Chinese can produce oil which we can import, which, in fact, increases the world supply, then do we not, in fact, reduce or at least ameliorate somewhat the stranglehold the OPEC nations have on us; and, therefore, isn't it to our advantage if we export to China—just looking at it from a very short-term point of view—oil technology or drilling technology, helping them to explore, and, in fact, increasing the world's supply of oil?

Isn't that to our advantage and also to the Chinese's advantage, because eventually the Chinese would be able to turn that oil production inward to develop their economy? And as I read your paper it indicates they have a very severe energy problem within China. So how could we lose?

Mr. SMIL. Well, you are quite right in saying that in short this would enlarge the world oil market. And that sort of should help everybody. But I think it is postponing the inevitable because the enlargement wouldn't be so large. You are talking about really incremental things. You see, the decision of Saudi Arabia to pump 1 million barrels or less is much more important than whatever the Chinese would be able to offer in the next 5 or 7 years.

I would bet everything on that. So it is just postponing the inevitable. The Soviet situation is similar. The Soviets are exporting today more than the total Chinese oil production, more than 100-million tons. But those exports, again, are closing. So when the Soviets entered into oil exports and start exporting to Eastern Europe and Western Europe, they are postponing the inevitable for, say, 15 years because throughout the late 1950's they started to have very high oil exports, but that's it, they are out now, and they, themselves, have a hard time. They said it on the first pages of their newspapers as of last week. So they, themselves, are having a hard time satisfying Eastern customers.

So it is true what you are saying, but I don't know how many years, 5, 10, 12 years? That's all. It is just postponing the inevitable.

Still you will come to the day when you will have to again face that there will be very little or no oil that China will be able to offer—the Russians are already coming to that point.

You see, that's why I put into the paper the reminder about the huge contemplated Sino-American deals from the beginning of this decade. People were talking about these millions and billions of cubic meters of liquified natural gas coming from Siberia; then people were talking about the Japanese taking these millions and billions of cubic meters of gas coming from Siberia. And nothing has come out of that, because the Soviets have looked at it hard and nothing has come out of that.

So I would be very, very careful about staking much belief into that. You are right, but it is a time-limited affair. I don't know how long, if it's a decade, or 2 years, or 5 years.

Mr. ERTEL. One could argue, a decade better than nothing; and, second, it gives us a potential possibility of developing our own energy industry in this country during that interim period of time.

In addition to that, by increasing the world supply, if we increase China's economic welfare—and you have said here that they don't even have oil to lubricate their machinery, they're using vegetable oil and fouling it up, if you were a Chinese policymaker, would you not say that this would be someplace you would concentrate and, in fact, try and encourage the United States to export to them, or to us, oil technology?

Mr. SMIL. Oh, yes, of course, I would. If I were to be Chinese, this is precisely what I would be believing. But the problem here is that most of that oil probably would end up on Asian markets anyway. Most of it wouldn't go to the United States and wouldn't go to the west coast.

Most of that oil, even when discovered by American companies, and eventually perhaps drilled by American companies would be taken by Japan. I think I would be almost certain of that.

Mr. ERTEL. I guess my final question, and I don't want to belabor the point, but isn't it to our advantage—in fact, I think you said at the end of your presentation that you would be very—I don't remember exactly how you said it—that you would be very cautious or pessimistic about swapping American high technology for Chinese oil.

Mr. SMIL. Yes.

Mr. ERTEL. If we do bilateral agreements and if, in fact, we transferred our high technology to China and had a bilateral agreement for them to provide oil to us, over the long haul, wouldn't we, in fact, be increasing our position, and, in fact, wouldn't that help us, and wouldn't it, again, help China, wouldn't it be to both of our mutual advantages, especially if we had them tied up in a long-term agreement?

Mr. SMIL. We're coming to a very touchy point, and I wouldn't want to draw parallels here, but simply, it is good to look back over the history of the People's Republic of China. It does not inspire in me and many people, many beliefs about the political establishment in that country. So I would be very cautious to enter into any long-term agreements for vital commodities with that country. That's all I would say.

Mr. ERTEL. Has China had a history of not complying with its long-term agreements?

Mr. SMIL. Well, it's not a question of—to the best of my knowledge they didn't conclude any long-term agreements to export vital metals. Perhaps the Russians, but that was a different story.

It's just simply that things may break down as they did before. And then when the machine of the states breaks down as it did in the latter part of the 1960's, I think there is very little of what could be done with that.

Mr. ERTEL. I think we take that chance with any country. You're talking about the political stability of the internal government. We took that chance in Iran and look what happened there.

Mr. SMIL. Yes, but you would be taking a chance with a commodity that is so imperiled. Something may happen. So, you know, its adding another risk to the long list of risks which already exist. That would be my argument.

Mr. ERTEL. Thank you very much. I can't say that I agree with everything you say, but I certainly find it provocative.

Mr. SMIL. That's what I intended.

Mr. LLOYD. I would like to ask your opinion as a person who has obviously studied not only the energy picture, the development, and probably the history and background of its cultural and so on and so forth of China, but as a person who has, quote, "no great vested interest in the United States" other than I'm sure an abiding interest because of the international position that it holds.

I would be interested in your position and your attitude again as to our governmental involvement vis-a-vis France, Japan, and even Canada in aiding our business involvements whether it is in developing situations such as China for the United States, or, say, with our more traditional partners of trade, like the Europeans.

In the technological term, do you see we are going to have to make some major changes in the way we have been doing business?

Mr. SMIL. Well, this is a part of the story, and I know relatively little, but let me try to tackle it from a different angle.

Going back to the specifics of energy, I think, as I pointed out in the written testimony, that it seems to me that the Chinese do not appreciate enough at this point, as we didn't in this country 20 years, or 30 years ago, many environmental and social implications over what they were to do. And I would say this country, that is, the governmental organization of this country, could do a great

service—and clearly, this is what the Chinese need at this point, to make them aware of what are some of the drawbacks on what they want to do. Because it is easy to jump into many projects, and it looks like a business, and it brings some instant success I suppose. But, in the long term it may bring some very, very severe problems.

I think the experience that this country has, the environmental facet, the environmental problems, this country is the world leader—the Chinese want to double their coal production by 1987 and double it again by the end of the century. So we're talking about billions of tons by 1987; 2 billion tons by the end of the century. This is pretty much along the U.S. lines, this pretty much is what you people want to do, bring it over 1 billion tons.

And I consider the problems—I don't think they appreciate the problem of putting lots of fossil fuel powerplants, which for us as we're finding now is probably the key environmental problem to our lakes, our forests.

So if there would be something which you as a Government should do which would not bring any billions of dollars, but it would be rather to make the Chinese aware, or to offer them this kind of expertise which, in the long run, would save them untold problems and which would make them perhaps responsive to a slower approach in their thinking of their long-term energy policy plans.

Mr. LLOYD. That brings me to the next question. One of the things we are criticized for is the fact that we do, indeed, meddle in other country's affairs, and that we tend to set certain standards for them.

And yet you are advocating we, in the United States, set a moral standard as it applies to the environment in this case.

Do you think that is an image we should go forward with?

Dr. SMIL. No, I wouldn't think it is to set world standards, because if somebody has extremely high needs to keep environment as clean as possible, it is them, because they will never be able to supply their food by imports. What they are importing is completely marginal. So they must grow their own food. And, moreover, there is that traditionally large dependence on irrigation because of the rice culture.

It would be unsightly for us to have part of the Appalachia without forests, but we surely would survive much better than they would if they would start putting into play these 10,000 high sulfur coal, it would ruin their capacity to grow food.

So it's not moral, it's a matter of survival. And food comes first in China because, again, the official admissions are the food consumption in China has not increased at all from the late 1950's to the late 1970's, it's on the same level. It's basically on the level of bare survival. There's nothing else to it. And, of course, you know, the refining of coal, the environmental impact in densely populated parts of China which need that soil and need that water, you know, I think that is one of the key things that really should be made real strongly aware of it.

Mr. LLOYD. Thank you very much, Dr. Smil. I appreciate your presence here today. And as my colleague has said, indeed, you have been provocative, and we look forward to not only hearing

what you have to say but reading what you have today. We appreciate your presence today.

Dr. SMIL. Thank you.

Mr. LLOYD. Our next speaker is Mr. Eugene A. Theroux, partner with Baker and McKenzie right here in Washington, D.C.

Mr. Theroux, it's all yours.

[The biographical sketch of Mr. Theroux follows:]

EUGENE A. THEROUX

Eugene A. Theroux is a partner in the international law firm of Baker & McKenzie. Mr. Theroux made his first visit to China in June, 1972, as an adviser to House Leaders Hale Boggs and Gerald Ford, who constituted the first delegation from the House of Representatives to China. Since 1972, Mr. Theroux has made sixteen visits to China. He served as Vice President of the National Council for U.S.-China Trade during 1973-75 and, on behalf of the Council, opening the first office for American business in China at the Chinese Export Commodities Fair in 1973. Mr. Theroux has presented lectures on American law to a number of Chinese Foreign Trade Corporations, and he has spoken and written widely in the United States on the legal aspects of Sino-American trade. He is a graduate of Georgetown University Law School, and is a member of the Massachusetts and District of Columbia Bars.

Mr. THEROUX. Thank you, Mr. Chairman. I will be brief because I know your time is short.

Mr. LLOYD. Do we have your statement?

STATEMENT OF EUGENE A. THEROUX, PARTNER, BAKER & MCKENZIE, WASHINGTON, D.C.

Mr. THEROUX. Mr. Chairman, I have an unfinished statement which I have not yet submitted for the record because I was in China up until a matter of hours ago; I was hoping to be able to provide for you this morning some late news on the development of China's patent law in particular. Unfortunately, I can't do that because the Chinese have yet, up until this morning, have done nothing by way of introducing a patent law in China.

Mr. THEROUX. All inventions in China, including technical improvements, are under existing regulations and considered the property of the state.

The Chinese have established procedures governing the issuance of official certificates and cash awards to inventors, and these procedures are embodied in certain regulations. Those regulations will in all probability be superseded, and I have been assured, in fact, that they will be, by a patent law system.

Under the existing system, however, inventors are given incentives for creativity through the offering of cash rewards and other forms of recognition for technical improvements, inventions and so on.

Under the existing regulations the state, the Chinese Government, retains ownership of all such inventions and technology. And all enterprises throughout China are free to utilize those inventions.

As written, the regulations permit foreigners to apply for and qualify for cash awards in invention incentive programs. And the regulations also allow the sale of those inventions to third parties upon Chinese Government approval.

Importantly, I think, under the existing invention regulations of China, it appears that the Chinese are not legally precluded from

acquiring foreign patents or know-how without either the consent of or compensation to the owners; that, moreover, under these provisions the rights taken would become the property of the state; eligible not only for domestic exploitation but for export abroad.

The Chinese recognize that this state of affairs concerns foreign businessmen; therefore, they have been very quick to assure foreign businessmen that they can obtain protection in the regard, to the extent they feel it is needed, by the terms of the contracts they sign.

So far, the Chinese have been prepared to accept standard international contractual provisions which go to protecting patents and know-how.

As Ambassador Phillips mentioned in his testimony this morning, there are very few, although some, incidents where the Chinese have not been faithful to those agreements.

As far as trademarks are concerned, the Chinese do provide for trademark registration and protection. And they have allowed American firms to register their trademarks in China since January 1, 1978.

There is no copyright law in China. All three of these subjects, patents, trademarks and copyrights are covered in the United States/China Trade Agreement which is still pending final approval by the Congress. But once approved by the U.S. Government, there should be no serious impediment to Chinese willingness to accord proper protection to the patents, trademarks and copyrights owned by U.S. persons.

In my statement for the record, I indicate some examples of how the Chinese do offer protection to foreign patents, in particular. And also some examples, isolated ones, of Chinese copying foreign products and processes.

The most serious problem that I have identified, as a private practitioner in the area of technology transfer to China, has been less in the area of finding legal protection for the patents, know-how, and other properties transferred to China, and more in the area of negotiating compensation terms.

Companies faced with the vast opportunity of the China market does not want to lose that market. They are willing to take some risks. With the potentially fluctuating political situation that exists in China, and in the absence of a patent law, naturally these companies want to be paid and compensated for the technology, and other property rights that are transferred.

So, the most serious practical problem is not really the subject of this hearing, not a legal one. That is, the Chinese presently lack sufficient foreign exchange to be able to compensate companies in the amounts we often think are sufficient. We are seeing now, I think increasingly, Chinese proposals that foreign firms accept at least part of the payment in the form of goods. And, of course, this imposes a certain difficulty our sellers, or licensors, but it's a matter for commercial negotiation.

I might just say a word about the fact that the Chinese, naturally, as Mr. Li said, have a policy of self-reliance in foreign trade. They are going to try to do as much as possible themselves, for themselves.

In some circumstances, they may even copy foreign products and processes. For the most part, however, pirating is not going to be realistic, because the reverse engineering problems that the Chinese will face will be insurmountable. It's one thing to develop a prototype from a foreign product, and quite another to gear up for mass production.

I think the opportunities are substantial for American companies in transferring their patents and know-how and technology to China; there may be a short-term problem in protecting these satisfactorily. But, sooner or later the Chinese are going to have some form of patent law. And, in the meantime, the United States/China Trade Agreement offers adequate protection, I believe.

We have yet to solve completely the matter of satisfactory payment in hard currency, which at least my clients hope for and expect. Perhaps the answer is, as we have been discussing all morning, to help them build the capacity to export oil, for example, so that they will earn the hard currency necessary to pay for the technology they need to acquire.

Maybe I should stop there since I think we are past our time.
[The prepared statement of Mr. Theroux follows:]

TESTIMONY
OF
EUGENE A. THEROUX
BEFORE THE
SUBCOMMITTEE ON INVESTIGATIONS AND OVERSIGHT
AND THE
SUBCOMMITTEE ON SCIENCE, RESEARCH AND TECHNOLOGY
OF THE
COMMITTEE ON SCIENCE AND TECHNOLOGY

- - -

JOINT HEARINGS ON TECHNOLOGY TRANSFER TO CHINA
NOVEMBER 15, 1979

Mr. Chairman, it is an honor and privilege to appear before the two Subcommittees considering the important subject of technology transfer to China.

This morning I would like to summarize for you the status of Chinese law regarding industrial and intellectual property rights, and to provide some observations based on personal experience as regards some legal and practical aspects of technology transfer to China.

1. Status of Chinese law regarding industrial and intellectual property rights

a) Patent law

The PRC has no patent law and no procedure for the registration of foreign (or domestic) patents, although I was assured as recently as last week in Beijing that China is working intensively on a patent law. In fact, China now has six specialists in this country studying with our own Patent Office, and other such specialists have recently

studied the patent registration systems of Japan and West Germany, among others. At present, though, in China all inventions and technical improvements are considered to be the property of the State. There have been established, however, procedures governing the issue of official certificates of recognition and cash awards to individual inventors. These procedures are embodied in the "Regulations on Awards for Inventions" and "Regulations on Awards for Technical Improvements," promulgated October 23, 1963, by the PRC State Council, and issued again in revised form on December 28, 1978.

These 1963 Regulations replaced earlier rules of 1950 and 1954 that had provided for certain patent rights. The new Regulations have the explicit purpose of encouraging inventions and improving techniques and thus promoting modernization of science and technology. The Rules establish a system under which a party may apply to the State for official recognition of an invention or technical improvement. Inventions are defined as "major new scientific and technological achievements," which must also meet the following three conditions: (1) never achieved before, (2) advanced, (3) proved applicable through practice. Inventors are entitled to receive an invention certificate and cash rewards depending in sizes on the importance of the invention. Technical improvements, if adopted, also qualify for cash awards

and commendation based on their use. The State retains ownership of all such inventions and technology. All enterprises throughout the country may make use of inventions as needed. Foreigners may apply and qualify for the above certificates and awards for their inventions and technology. The regulations allow the sale of Chinese inventions to foreigners upon approval by the State Scientific Commission.

Under the Regulations, it does not appear that the Chinese are precluded from acquiring foreign patents or know-how without either the consent of or compensation to the owner. Moreover under the above cited provisions, such rights would become the property of the State, eligible not only for exploitation domestically, but also for sale abroad.

The absence so far of a Chinese patent law providing for the protection of at least foreign patents and of a patent registration system, together with the fact that China does also not belong to the Paris Convention for the Protection of Industrial Property, is of concern to any potential foreign licensor to China. The Chinese realize this and, in order to encourage the import of much needed foreign technology, they have been willing to provide protection for foreign patents or know-how by contract on a transaction-by-transaction basis. So far, it is exclusively within the four corners of a contract negotiated with the Chinese, that foreign businessmen obtain the necessary protection with respect to such matters

as the scope of application of their patents and know-how, the sale of products covered by a patent, the confidential treatment of the know-how transferred and sublicensing or assignability of the patents and know-how.

With the growth of their foreign trade with the United States the Chinese now seem to be willing to commit themselves to protection of foreign patents and know-how on a more substantial basis. Accordingly, the Chinese have agreed to a clause in the U.S.-China Trade Agreement stating that each party to the Agreement "shall seek, under its laws and with due regard to international practice, to insure to legal or natural persons of the other Party protection of patents and trademarks equivalent to the patent and trademark protection correspondingly accorded by the other Party." Moreover, as I noted earlier, the Chinese are in fact in the process of drafting a patent law and establishing an organization concerned with patent registration. In addition to Chinese legal teams working with patent experts in other countries, it is planned that experts from China will be sent to the World Industrial Property Organization (WIPO), to the International Patent Bureau, and to patent offices in other countries for training. Indications are that China will join the Paris Convention for the Protection of Industrial Property as soon as a comprehensive system of patent protection has been established in China.

b) Trademarks law

By contrast to the lack of a Chinese patent registration system, a procedure is available in China for the registration of foreign trademarks. The subject matter is governed by the "Regulations of the People's Republic of China Governing Trademarks" promulgated by the State Council on April 10, 1963 and the "Implementing Rules under the Regulations Governing Trademarks" promulgated by the Central Administrative Bureau for Industry and Commerce on April 25, 1963.

Under these Regulations, a foreign party may apply for trademark registration in the PRC if a reciprocal agreement on registration of trademarks exists between the applicant's country and the PRC. With respect to the U.S. registrants, this precondition will be covered by the U.S.-China Trade Regulations Agreement, pending now before Congress, which provides that "legal or natural persons of either Party may apply for registration of trademarks and acquire exclusive rights thereto in the territory of the other Party in accordance with its laws and regulations." As a matter of fact, the Chinese have allowed U.S. firms to register their trademarks in China since January 1, 1973.

Applications for trademark registration are to be addressed to the Trademark Registration Agency, China Council for the Promotion of International Trade, Beijing, which agency

acts as the foreign firm's agent with the Central Administrative Bureau for Industry and Commerce. According to the Regulations, this Bureau is responsible for administering the PRC trademark regulations. The Regulations set for the documentation which must accompany each application.

Registration will not be granted for trademarks containing words or markings similar to China's national flag or other official emblems or metals, similar to national flags or emblems of other countries, similar to marking of the Red Cross or Red Crescent and for those "which have an ill-effect politically." Apparently, registration will not be granted of foreign-language trademarks for goods intended for use in China.

Registration, based on 78 classes of goods, is granted to the first applicant. Trademarks registered by local enterprises have no fixed duration; they are valid until withdrawn by the registered. Trademarks registered by foreign parties are valid for periods of ten years and renewable for further 10 year periods. The owner of a registered trademark acquires the exclusive rights to its use in the PRC. Registered foreign-owned trademarks may be assigned to other foreigners.

Trademark registration may be cancelled where the quality of the product does not meet governmental requirements, where it is altered without governmental authority, when a

registration has not been used for one full year and no permission of such non-use has been granted and where the government approves a third party application for cancellation. Apparently, according to Chinese information, the "cancellation for non-use" provision is not, in practice, applied on foreign trademark registrations.

c) Copyrights law

There is no copyright law in China, and there has been little evidence that the Chinese are at work on such a law. Naturally, this is a matter of concern to American authors and publishers, although the US-China Trade Agreement does offer some basis for hope that the Chinese will not pirate copyrighted American works.

2. China's Participation in International Conventions relative to the Protection of Patents, Trademarks and Copyrights

The PRC so far has not become a party to any international convention relative to the protection of patents, trademarks, or copyrights. As mentioned above, there are indications, however, that the PRC will soon join at least the Paris Convention for the Protection of Industrial Property. In fact, Chinese representatives have for several years attended, in observer's status, meetings of the World Industrial Property Organization (WIPO) which administers the Paris Convention. Whether China is planning to join such other con-

ventions as the Madrid Convention concerning the International Registration of Trademarks, the Universal Copyright Convention of Geneva and the Berne Convention for the Protection of Literary and Artistic Works is at present not known.

3. Copying of foreign products and use of foreign technology without authorization and compensation

3.1 Background

Although China's record of strict contract compliance is on the whole excellent and while China does seem willing to pay for needed equipment and technology, there are some instances of unauthorized copying of foreign products and use of foreign technology by Chinese entities. It may not be surprising that China sometimes attempts to narrow the technology gulf with the outside world without incurring burdensome royalty expenses which draw on scarce foreign exchange reserves. Moreover, Marxist-Leninist ideology holds that inventions and technical improvements should not be saleable private property but must be at free disposal of the collective. Even in the course of foreign companies' preliminary efforts to sell to China, Chinese negotiators often are provided with extensive technical data on the respective products or technology. When purchasing machinery and equipment, the Chinese buyers nearly always request detailed technical information

Examples of duplicating have also been noticed by Swiss Trade delegations to the PRC. At the occasion of a visit to a Beijing factory, it was observed that the machine tools used in the manufacturing process included one authentic Swiss machine and a number of Chinese-built duplicates thereof.

Also according to the National Council, copying of foreign process technology also is not uncommon in China. An example is the unauthorized use of foreign soybean processing technology. Also, the Chinese have been trying, though until now apparently without success, to copy foreign-developed hydrocracking process technology for use in oil refining plants.

Finally, reprint and translation of foreign books without authorization of the foreign copyright holder is widespread, particularly in the science field. According to a recent Swedish study on Chinese publishing in electronics and metallurgy, some 20% of the books on semi-conductor technology and computer technology are translations of foreign books. In metallurgy, some 30%-40% of the books on ovens, converters, and non-ferrous metallurgy are translations.^{1/}

^{1/} (Dissemination of Technology Information in China. An investigation in Publishing in Electronics and Metallurgy, Research Policy Studies Lund University, Sweden, Discussion Paper No. 127, April, 1979).

be included in the deal at no extra charge. Also, during early negotiations the Chinese frequently demand extensive pre-disclosure of technical data which they can afterwards use as a matter of practice even if finally no contract is reached on the transfer of the technology.

3.2 Examples of copying

According to the National Council for U.S.-China Trade, the PRC now produces its own version of certain American food processing machines, a Massey-Ferguson 35 hp tractor, and certain International Harvester mining equipment. Another notable example of copying furnished by the National Council is Chinese duplicating of Samsonite travel luggage. In this instance, the imitation was so complete that a key belonging to an original Samsonite suitcase was found to fit in the lock of a Chinese manufactured duplicate. According to a report in the September, 1978 issue of Popular Photography, China was at that time testing prototypes of two cameras that are exact replicas of the German Leica and Swedish Hasselblad. The two models were supposed to be put into production within a year, apparently under the names of East Wind and Red Flag. It has been noted that the Chinese might very well decide not to risk patent infringement litigation by exporting the cameras, but might simply manufacture them for domestic use. Two American machine tool experts recently in China reported seeing Chinese-manufactured duplicates of machine tools produced in the U.S. a decade ago.

Similarly, a large number of Chinese publications intended for use in the petroleum industry are translations of foreign, particularly U.S. books.

3.3 Limited copying possibilities

A Canadian government publication for Canadian exporters candidly states that, "the Chinese study foreign models in order to improve them or adapt them to local conditions," but continues to say that "this, however, should not be considered a real problem for Canadian exporters of modern technological products."^{2/} Indeed, copying today's standardized and mass-produced products is neither very easy nor always effective. One American attorney has pointed out that reverse engineering has intrinsic limits in China.^{3/} The process of recreating designed plants from a prototype, he has noted, will not disclose to the would-be imitator all important tolerance and material specifications. Materials can be analyzed, but standardized reproduction of them in China is rather difficult. Potential exporters must also bear in mind that for the Chinese to reproduce a few copies of an item that work more or less effectively is quite a different thing from a facsimile of the mass-production system that, most likely, is efficiently churning out these items abroad. Chinese examination of prototypes will not disclose the sophisticated manufacturing technology of automation process and numerical controls that go into making them.

^{2/} Canadian Department of Industry, Trade and Commerce, Markets for Canadian Exporters, Ottawa, 1971, p. 16.

^{3/} See Licensing U.S. Technology to the People's Republic of China, Clark T. Randt, Jr., unpublished manuscript, 1974, on which this discussion is based.

Duplication attempts utilizing blueprints, technical articles and even patent registered materials are frequently no more efficacious. Most patents cannot be "worked" without complementary know-how. This related knowledge is also necessary to utilize effectively information from other modes of technical descriptions. Even where material specifications are known, China's present capacity to produce these materials in a consistent manner is extremely limited, and product design is not production plan design. Where moving parts place emphasis upon stress specifications for materials, China's chances of producing a competitive replica are still more remote.

Also, the China's ambitious four modernization programs ask for an expedient use of modern technology. Copying foreign advanced technology and duplicating industrial products on the necessary mass-production level, however, takes a long time. The time factor clearly makes copying an unsuitable alternative to the proper contractual import of foreign key technology and products.

4. Payment of royalties

4.1 Background

The Chinese have had an aversion to the payment of royalties. Royalties in the sense of license fees tied to the industrial output achieved by means of the licensed technology run counter to the underlying principle that technical

inventions are property of the collective. The idea that a private person or entity should be allowed to control and sell for personal profit an invention or technical improvement which might benefit the collective and increase general prosperity is unacceptable in Marxist-Leninist thinking. The payment of royalties for the use of an invention, by Chinese reckoning, amounts to an acceptance of exploitative, monopolistic and capitalistic practices.

4.2. Substitute methods of payment

With regard to domestic inventions and technical improvements, the Chinese, so far, have adhered to above-mentioned principles. Inventions cannot become private property and consequently cannot become object of an assignment for consideration by the individual inventor to the state enterprise who is going to use the invention or improvement for the benefit of the collectivity.

On the other hand, the Chinese quite obviously are not in a position to enforce these principles with respect to foreign-developed technology. If they want to make full use of such technology and not merely limit themselves to the troublesome and often unsuccessful duplicating or copying of foreign products or technology, they have to pay. The Chinese realize this, and in an attempt to reconcile Marxist-Leninist principles with the practical need for

foreign technology have resorted to the following payment alternatives:

(i) In case of plant or equipment sales to China, the Chinese sometimes have accepted inflated hardware prices if their need for the item was great enough. In two reported cases of equipment purchases, one from Italy and the other from Australia, the lump-sum paid for the hardware simply included the purchase of the patents.^{4/}

(ii) In a display of additional flexibility, the Chinese also have agreed to lump-sum license fees. These fees are not tied to the actual output realized by use of the licensed technology but calculated beforehand on the basis of the design capacity of the plant using the licensed technology or some other mutually agreed upon basis. Lump-sum license fees are not only provided for in pure licensing contracts but also, and in an increasing number, in license agreements tied to hardware sales in the context of agreements for the construction and start-up of turnkey plants.

^{4/} Business International: Doing Business with the People's Republic of China, N.Y. 1973, p. 68.

China has accepted both lump-sum license fees paid at one time or spread over a certain period. Most licenses of U.S. technology have been with lump-sum payment clauses providing for a fee financed over time. The terms of such clauses often follow those apparently first established with the Japanese licensors: financing over three to five years at 6%. The payment schedules are also fairly standard. In case of licenses in the context of a supply of turnkey plants, they call for sizeable down-payments tied to events between the time of contract execution and plant stock-up with the remainder to be paid in yearly installments. Down-payments may be tied to the execution of the contract, government approval of the contract, the delivering in China of the documentation, the arrival of the engineering data, the commencement of construction, and the delivery of the equipment. In pure licensing agreements down-payments may be tied to such events as the execution of the contract, the delivery of the patent list and the validated U.S. export license and the start-up of the plant where the licensed technology is to be used.

(iii) Where turnkey plants are sold to the Chinese, the processing technology for the plant

may come from another source other than the main contractor for the plant. Where this is the case, the Chinese originally have preferred that such processing license be provided by a sub-license through the prime contractor:

Examples are the licensing by Dutch State Mines (DSM) of its urea processing technology in the context of sales in 1964 and 1973 by Continental of Holland and Kellogg Continental of several urea plants to China. In both cases DSM got its lump-sum license fee from the prime contractors. In the first case payment was provided for in Dutch guilders and spaced out over three years. In the second case payment was likewise provided for in Dutch guilders but spread out over four years. 5/

From the standpoint of the Chinese, contracting with a single responsible prime contractor simplifies problems relating to responsibility for meeting deliveries, performance and mechanical guarantees and alike. From the standpoint of the original licensor of the technology, however, this scheme has the disadvantage of an indirect relationship with the licensee, leaving the licensor in the sometimes not very comfortable position of a third party beneficiary. Foreign licensors have tried to persuade the Chinese that a direct relationship between licensor and the Chinese licensee would provide much greater flexibility in any communications

during and after plant start-up with the concerned Chinese enterprise, while at the same time still permitting the Chinese to deal with any competent engineering contractor approved by the licensor. The Chinese have appreciated that and to an increasing degree have agreed to enter into direct licensor-licensee agreements paralleling the respective plant constructions contracts.

One interesting example is the license sold by Standard Oil of Ohio for a plant to produce 50,000 metric tons annually of acrylonitrile, a basic raw material for synthetic fibers. The plant sale was negotiated by Asahi Chemical, Niigata Engineering, and Chori Trading of Japan in 1973. The lump-sum license fee was about \$8 million to be paid in U.S. dollars over a period of almost five years in seven installments. The first payment was due 60 days after the Japanese government's approval of the plant sale, followed by further payments in August and September, 1973 and four annual installments in 1974 through 1977. Payments to be channeled through a Japanese bank included adjustments to take account of monetary erosion. Payments were not tied to output. Standard Oil originally had asked for the right to audit the plant's production but this was not granted.

A second example is Bayer's (Federal Republic of Germany) sale of technology contained in a \$30 million polyvinyl and ethylene vinyl acetate plant to be delivered as a turnkey installation by Japan's Kuraray Industries. The terms for Kuraray were 30% down, with the balance paid in ten installments over five years, after final shipment

in 1976. The balance carries 6% annual interest. Kuraray was to be paid in Rmb, and Bayer was to get a lump-sum license fee directly from the PRC. 6/

4.3 Excess capacity fee

Licensors of industrial technology, of course, have an invested interest in insuring that their process is utilized within the terms of the grant for a plant of a certain capacity. Most plant processes are endemically limited to producing a certain quantity of the desired material by the design capacity. Modifications in some cases, however, permit production of unauthorized and unpaid for excess. The standard licensing clause which in western licensing agreements has emerged in response to this particular problem provides for an option to pay running royalties or a new lump-sum fee on the overage. To be enforceable, this clause must be coupled with plant inspection provisions, allowing the licensor to verify the quantity of production and to check for capacity-expanding modifications.

Most American licensors, anticipating the reluctance of the Chinese to grant inspection rights, have not pursued this matter, and some discounted the risk merely charging a higher rate in the first place. At least one case has become known, however, where a U.S. firm inserted a provision requiring an additional lump-sum license fee for over-production

6/ Business International, Ibid p. 52.

and indeed was granted specific rights to audit the plant's production quantity. This provision reportedly details what capacity related facilities at the plant would be opened to foreign inspection.

Another American corporation is known to have solved the problem of unauthorized over-production by retaining the process catalyst technology. The company can measure Chinese production by monitoring its catalyst sales.

5. Recent Developments

There are indications that the Chinese's attitude toward royalty payment might change in the sense that they would no longer refuse to pay genuine running royalties tied to the output. One U.S. licensor, for instance, is said to have recently been sounded out on a combination payment basis of a partial paid-up license fee (lump-sum payment) with accounting on production for the balance. Also, there has been a report that China's recently established equipment and machinery corporations "would consider payment of royalties on sales of the products of proposed joint ventures."^{7/}

^{7/} "China Moves to Grant Protection for Patents of Foreign Companies," Business China, Business international Asia/Pacific Ltd., January 24, 1979, p. 10.

Mr. LLOYD. Thank you very much, Mr. Theroux.

Mr. Brown?

Mr. BROWN. Mr. Theroux, we heard yesterday, I think it was, from a representative of Bell helicopters with regard to an arrangement that they had entered into, or in the process of entering into for what was designated as coproduction of a model of Bell helicopters in China, which seemed to be a device under which the company could protect its patent rights and other proprietary knowledge, while at the same time developing a substantial market for helicopters in China, and I gather in the rest of Asia.

Are you familiar with other arrangements of this sort designated as coproduction arrangements?

Mr. THEROUX. Mr. Brown, I'm working with the McDonnell Douglas Corp., in connection with its negotiations with the Chinese. So to some extent I am familiar with some of the problems involved, yes.

Mr. BROWN. But this seemed to be a vehicle which is carefully crafted to provide for the transfer of a specific technology, the production of helicopters, in stages with apparently a reservation to the company of the final knowledge, which seems to involve a patented gear construction in the helicopter, or something of that sort.

It seems to me—and I ask you to comment—that that is an adequate pattern of protection for American firms if they want to engage in a transfer of technology while protecting their own basic patent rights.

Mr. THEROUX. Yes, Mr. Brown, I think you are exactly right.

I expect in these areas, where the technology transferred is very highly sophisticated and where, in fact, the American company, involved in the coproduction, or some similar arrangement, because of the realities of the situation, is going to retain the substantial technology involved.

Even in the process of working out a coproduction arrangement and manufacturing, the Chinese are not going to gain the technology that would enable them to duplicate or replicate a complete plant or product, for example, of the type found in the United States.

I would personally expect that companies at the lower end of the technology scale may have the most to worry about as far as copying is concerned.

Mr. BROWN. Well, by the same token, the amount of sophisticated technology that they have, which is protected by patents, would be relatively low in this kind of operation, it seems to me.

Frankly, I think any protection of this sort is transitory since, as you succeed in transferring the technology and the training, the local production personnel, there's going to be bright engineers and others who would develop the capability to analyze and design something that is at least a close substitute for whatever it is that is patented.

Mr. THEROUX. Yes, that's right.

Mr. BROWN. I have no further questions.

Mr. LLOYD. Thank you, Mr. Brown.

Mr. Ertel?

Mr. ERTEL. Thank you, Mr. Chairman.

Mr. Theroux, I'm very interested in your observations. Quite frankly, the Chinese have protected, or at least abided by their agreements on the protection of proprietary rights, commercial rights, or whatever you call them of American companies. But you say there have been some isolated incidents where it has not been.

Now, we have not had an extensive technological exchange with China over the past few years.

Given these isolated incidences now, do you expect as our trade develops and more transfer of knowledge that these isolated incidences will become more and more the norm?

For instance, the Japanese were very good at reverse engineering for a long period of time. Do you have any reason to believe the

Chinese would not be as good; and, second, follow a pattern of now going from the isolated incident to the more regular incident in reverse engineering?

Mr. THEROUX. In all honesty, I would have to say that possibility certainly does exist.

It's very difficult to verify what is happening in China. For example, if a company transferred technology for a chemical process, there may be contractual safeguards to prevent the Chinese from duplicating that plant somewhere else in China. And as I mentioned, and stressed, as far as we know they have not breached those agreements.

However, as a practical matter, it's impossible to tell for certain whether or not they have done this, or whether they might do this in the future. We have to rely on their good faith.

And I would have to underscore that, for the most part, and in the vast majority of cases, and, in fact, except for some isolated examples, they have shown themselves to be faithful to their agreements.

We just have to hope for their continuing good faith.

Mr. ERTEL. Let me ask you an additional question; that when we contract there, let's say we're developing an aircraft, do you contract with the state association, state organization which is within a province, and, therefore, are you only binding that particular state agency; and, in fact, that knowledge can flow through the Government to some other state corporation and they can develop—there's no violation of contract because it's in fact, not the same entity; and, therefore, the technology has been transferred and there has been no breach of contract, no protection of rights, but because of the centralized type of Government and the rediversification of that through state agencies, how do you avoid that situation—or do we?

Mr. THEROUX. You have identified a very interesting legal problem, Mr. Ertel, because the entity with which an American company ordinarily contracts in China is either a foreign trade corporation, which is a state-owned enterprise, or a municipal, or perhaps a scientific or technical organization which is also wholly funded by the State and could be considered an agency or instrumentality of the central Government.

In drafting the agreements between American companies and those agencies, a great deal of care has to be taken to restrict any subsequent transfer of technology to other enterprises in China.

One of the interesting things that I have noticed is that the Chinese have been willing to have the foreign trade corporation concerned—the China National Technical Import Corp., for example—undertake not to transfer certain technology to anyone else in China, or to any third party anywhere. But the fact of the matter is, that organization itself is not an operating entity. It is only a purchasing agent.

So by the terms of some of the contracts that have been concluded, the Chinese technically are legally barred from transferring acquired technology to the very end-user, or manufacturer, for whom they are acting. It is an odd legal situation.

I guess that is an illustration of just how tightly some of these agreements are drawn, because the companies do recognize the potential for abuse there.

I just stress again, the agreements are only as good as the parties are faithful to their mutual intent and what promises that given technology would be strictly limited to the purpose of a particular agreement.

Mr. ERTEL. I understand what you are saying. I understand that is one of the basic tenants of an agreement. But, you know, times change. As China becomes more technically oriented, more advanced, maybe some of those traditions go a little down the road, as they have in many other countries, they look for ways out.

If I remember correctly, China is becoming more diversified by having municipal corporations, by having State organizations and they are contracting directly with the U.S. companies. They are not going through a centralized purchasing any longer. And, therefore, you have got that potential.

And if in fact it comes to fruition that, in fact, there is a transfer, whether it's deliberate or not, and there is competition among the various entities in China, what kind of a legal machinery does an American corporation have, or we have, to prevent that, or to recover for that?

Mr. THEROUX. At the moment—it was mentioned this morning that arbitration exists. So that if an American company believes that its rights under an agreement are being transgressed, can ask for arbitration in some third country, or, perhaps, arbitration in China.

As a matter of fact, and a matter of practice, those legal remedies may be inadequate.

China does not yet have the legal mechanism for a company to come in and file a lawsuit, for example, in China in Chinese courts. Neither the courts for this purpose, nor the law or lawyers exist.

To some extent this is true around the world. Companies that transfer technology always take risks—and they count on the fact they are getting paid, getting compensated under those agreements, and that as time goes on, for the most part, perhaps the technology becomes obsolete. And so companies often consider the risks worth taking.

But you are right, there is no sure way you can prevent the kind of damage that you have identified.

Mr. ERTEL. And the last question is, doesn't that result in flying low on the technology transfer, and, therefore inhibits technology transfer because the price up front is so high that it makes it more difficult to transfer technology, and more difficult for exchange?

Mr. THEROUX. That's exactly right.

Mr. ERTEL. I have no further questions.

Mr. LLOYD. Mr. Nelson?

Mr. NELSON. I pass.

Mr. LLOYD. Mr. Brown?

Mr. BROWN. Mr. Chairman, if I may be permitted a gratuitous remark. I would like to point out that with the finest legal system and the greatest number of lawyers in the world, we, in the United States still have the occasion to have contracts that—

Mr. ERTEL. May I have rebuttal—I don't really want rebuttal. I would like to point out to Mr. Brown, who has always been one interested in the creation of jobs in the United States, but that system we have developed has created an awful lot of jobs for lawyers.

Mr. THEROUX. As a matter of fact, Mr. Chairman, it seems to me that he is calling for yet greater numbers of lawyers in the United States to prevent the kind of abuses that he is referring to.

Mr. LLOYD. I think on that note we would like to thank Mr. Theroux for joining us today. I thought your comments were very good, and we look forward to your statement. And I would like to ask you to include in your statement, if you could, an indication of what might be some of the solutions in our commercial relationships with China where we can enhance our competitiveness, our ability to compete in the world against entities such as the Japanese, French, et cetera.

I thank you very much for joining us today.

Mr. THEROUX. Thank you.

Mr. LLOYD. The committee will stand adjourned until the call of the Chair.

[Whereupon, at 12:25 p.m., the subcommittee adjourned.]

○



A11600 773080

