

The Cox Committee Report: An Assessment

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Contents

Introduction	5
About the Authors	7
Executive Summary	9
The Cox Report on Governance and Policy in China: Problems of Fact, Evidence, and Inference <i>Alastair Iain Johnston</i>	21
A Critique of the Cox Report Allegations of Theft of Sensitive U.S. Nuclear Weapons Information <i>W. K. H. Panofsky</i>	45
The Cox Report and the U.S.-China Arms Control Technical Exchange Program <i>Marco Di Capua</i>	65
A Critique of the Cox Report Allegations of PRC Acquisition of Sensitive U.S. Missile and Space Technology <i>Lewis R. Franklin</i>	81

Introduction

The publication in early 1999 of the unclassified version of the Final Report of the Select Committee on U.S. National Security and Military/Commercial Concerns with the People's Republic of China (known as the Cox report, and hereafter referred to as the report) provoked considerable reaction and concern. The report made a number of spectacular accusations against both China and several U.S. research and development organizations important to U.S. security, such as the nuclear weapons laboratories and various missile and satellite companies. The language of the report, particularly its Overview, was inflammatory and some allegations did not seem to be well supported.

Stanford University's Center for International Security and Cooperation (CISAC) has been involved in the study of the international role of nuclear weapons, nuclear arms control, the role of export controls on high technology items in national security, and the politics and external policy of China for a number of years. To several at the Center, the statements made in the report warranted further study and discussion. As a result, four contributors with long experience in one or another of the topics taken up in the report, Alastair Iain Johnston, W. K. H. Panofsky, Marco Di Capua, and Lewis R. Franklin, agreed to make an assessment of statements made in the report. I agreed to provide coordination, an introduction, executive summary, and some editing, and to provide reviewers. Brief biographies of all five of us are given after this introduction.

In the six months since this task was undertaken, a number of assessments of the Cox report have been published. Inevitably there is some duplication between these publications and the present paper. Nevertheless, we believe there is enough that is new or not well known in this paper to warrant publication.

The paper consists of four contributions. The first, by Alastair Iain Johnston, deals with Chinese politics, economics, and nuclear doctrine. The second, by W. K. H. Panofsky, deals with nuclear weapons. The third, by Marco Di Capua, deals with the so-called lab-to-lab programs, which consist of interactions between U.S. and Chinese nuclear weapons laboratories carried out under U.S. law and regulations to deal with such matters as safety and arms-control monitoring. The fourth, by Lewis R. Franklin, deals with missiles. A fifth chapter was originally planned, on the relation between scientific excellence at the nuclear weap-

ons laboratories and openness to the broader scientific world, but the recent National Academy of Sciences report on the subject* makes this chapter unnecessary. Two of the contributors to the present paper, Panofsky and I, also participated in preparing the National Academy report.

As the authors and readers of this paper are well aware, an appropriate relationship between the United States and China is essential to progress and peace in the coming century. Such a relationship must be based on a realistic, informed view on each side of the capabilities, history, motivation, and likely evolution of the other. It should also be based, insofar as possible, on a realistic view of how China and others view the United States. Unfortunately, in our opinion, in many instances the report does not contribute to such realistic, informed views. Some important and relevant facts are wrong and a number of conclusions are, in our view, unwarranted. These are summarized in the Executive Summary which follows.

We have checked our findings and referenced them wherever possible. In addition to factual findings, the authors have in places stated their conclusions regarding some policy implications of the findings and of the Cox report conclusions. Conclusions and opinions are of course the authors' individual responsibility. We realize that not all of the report was declassified and thus some of the factual justification for the report's conclusions may be classified. Whether we are right or wrong in our disagreements with the report, we hope that the following analyses contribute in a positive way to the ongoing debate on these important matters.

We are grateful to many people who heard expositions of our findings, read drafts of our paper, and gave us valuable criticisms. We thank the officials, former officials, and scholars who gave us their advice. All errors in facts and judgments of course remain the responsibility of the authors.

We thank our editor, Megan L. Hendershott, and CISAC's outreach and publications acting manager, Eileen Hughes, for their help.

This paper has been reviewed for classification and found not to contain any classified material.

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* The National Academies, "National Security and Scientific Openness," October 1999.

About the Authors

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W. K. H. Panofsky's field is experimental high-energy physics. After attending Princeton University (B.A., 1938) and the California Institute of Technology (Ph.D., 1942, in x-rays and natural constants) he worked on various military problems including as a consultant to the Los Alamos National Laboratory in New Mexico during the war years. He then went to the University of California at Berkeley as a researcher and then associate professor of physics. He joined the faculty of Stanford University in 1951, and in addition to being professor of physics he served as the director of the Stanford High Energy Physics Laboratory. In 1961 he became director of the Stanford Linear Accelerator Center. Dr. Panofsky has served in many advisory capacities to various government agencies and in 1959 he served as chairman of the U.S. delegation in Geneva of the Department of State for the Technical Working Group on High Altitude Detection of Nuclear Explosives. He has been president of the American Physical Society, a member of the President's Science Advisory Committee under Presidents Eisenhower and Kennedy, and a member of the General Advisory Committee to the President under President Carter. He is the past chairman of the Committee on International Security and Arms Control of the National Academy of Sciences.

Marco Di Capua is a physicist at Lawrence Livermore National Laboratory. He is responsible for Chinese affairs in the Proliferation Prevention and Arms Control Group of the National Security Directorate. He was a Commissioned Officer in the Foreign Service of the United States assigned to the Foreign Service Institute, Washington, D.C. (1992–1993), and at the U.S. Embassy, Beijing (1993–1997), as Counselor for Science and Technology Affairs. At Lawrence Livermore National Laboratory (1984–1992) and at Physics International in San Leandro, California (1974–1984), he carried out R&D in flash radiographic electron

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Lewis R. Franklin joined the Center for International Security and Cooperation in 1992 as a visiting scholar and continues as a research affiliate with the Center. His current research focuses on international space policies for the post-Cold War period. A career intelligence expert on Sino-Soviet missile and space research and development, he retired as a vice president in TRW Space and Defense. He was recognized by the CIA with its Gold Medal Agency Seal Medallion for contributions to U.S. intelligence technology and national security.

Michael M. May is the co-director of Stanford University's Center for International Security and Cooperation and professor (research) of engineering-economic systems and operations research at Stanford. Professor May is director emeritus of the Lawrence Livermore National Laboratory, where he worked from 1952 to 1988. He was technical adviser to the Threshold Test Ban Treaty negotiating team; a member of the U.S. delegation to the Strategic Arms Limitation Talks; and at various times has been a member of the Defense Science Board, the General Advisory Committee to the AEC, the Secretary of Energy Advisory Board, the RAND Corporation Board of Trustees, and the Committee on International Security and Arms Control of the National Academy of Sciences. He is a member of the Council on Foreign Relations and the Pacific Council on International Policy, and a Fellow of the American Physical Society and the American Association for the Advancement of Science.

Executive Summary

The Cox Commission of the U.S. Congress was established in June 1998 to investigate concerns over Chinese acquisition of sensitive U.S. missile and space technology in connection with the launching of U.S. civilian satellites using Chinese launchers on Chinese territory. The investigations were broadened in October 1998 to include alleged security problems and possible espionage at the U.S. nuclear weapons laboratories. Some conclusions were released in January 1999 by the White House together with the administration's response. The full declassified (redacted) version of the report of the Cox Commission was released on May 25, 1999.

The Cox Report on Chinese Politics, Governance, and Nuclear Doctrine

In chapter 1 the Cox report provides an introductory discussion of the nature of the Chinese political system, the decision-making process, and the relationship between economic development and military modernization in China. The purpose of this introductory section appears to be to establish an interpretative lens through which to view the details of PRC activities with respect to the acquisition of nuclear, missile, and high-speed computer technology. The point presumably is to cast these activities in the worst possible light—that they are all aimed at modernizing the People's Liberation Army (PLA) so as to challenge U.S. interests, and that this policy reflects the basic preferences of top Chinese Communist Party (CCP) leaders. Otherwise, it is unclear why the report would include a very general discussion of the policy-making structures and process in the PRC in a report about the details of nuclear and missile espionage.

To this end, the report outlines the organizational structure of the PRC and argues, in essence, that all state, military, and commercial activities in China are “controlled” by the CCP politburo. The general problem with this section of the report, however, is that it paints a picture of an extremely centralized political system where policies across government,

military, and commercial activities are uniformly directed by a handful of leaders in the Politburo Standing Committee. The impression left by the report is that the top leadership of the CCP holds distinct, uniform policy preferences, and that these preferences dominate, overriding the preferences of all other players in the state, military, and commercial sectors. The report assumes that just because the head of a state bureaucratic entity is a CCP member this ensures CCP “control” (presumably meaning the imposition of CCP preferences on the entity).

Such a picture is based on skewed research into the organizational structure of politics in China. Most problematic is that in reality, as most experts on the Chinese political system (including the experts cited by the Cox report) recognize, this top-down, uniform-preferences view of Chinese policy is a caricature of a much more complicated system. Scholarly research on policy processes in energy policy, environmental policy, arms control, and foreign and military policy, among other major areas of public policy, all indicate that the policy process is more often characterized by interagency rivalries, bargaining, and logrolling. The preferences of different actors, far from being uniform, often reflect the narrow parochial interests of their organization. The PLA, for instance, constantly complains that it has, in fact, not received the resources it needs. Many in the PLA oppose the policies and preferences of the Ministry of Foreign Affairs. In most cases, these bureaucratic disputes and negotiations are conducted by leaders of organizations who share membership in the CCP. In other words, contrary to the argument of the Cox report, membership in the CCP does not automatically lead to uniform preferences over public policy. In short, this discussion of the political process provides a rather bizarre characterization of the system. But it serves the purpose of characterizing the system as, essentially, totalitarian, highly and effectively coordinated, and aimed primarily at challenging U.S. interests.

The report then goes on to discuss the relationship between economic development and military modernization. It does so primarily in a discussion of the “Sixteen Character policy.” The point of this section of the report is to drive home the finding that the “main aim for the civilian economy is to support the building of modern military weapons and to support the aims of the PLA” (Vol. 1, Ch. 1, p. 5). In other words, the Sixteen Character policy, the report claims, establishes the subordination of the civilian economy to military modernization. The sixteen characters can be translated as: combine the military and civilian; combine peacetime and wartime; give priority to military products; and use the civilian to support/cultivate the military.

In fact, as the primary source used by the report itself makes clear, the Sixteen Character policy refers narrowly to the conversion of military-industrial enterprises under the direction of the State Council and provincial and municipal governments. The policy applies to the state-owned enterprises within the military-industrial complex; together these employ about 7 percent of the total labor force in state industries, and produce about 5 percent of industrial output in China. In other words, the Sixteen Character policy applies to a rather small portion of the overall economy, not the overall economy as the Cox report claims. Specifically, the policy refers to the development of commercial lines of production in debt-ridden military-industrial factories, the profits from which are to be used to sustain the unprofitable and low-output military production line in these factories. This meaning of the policy is clear from an examination of discussions of the meaning of the Sixteen Character policy in Chinese sources. In addition to this basic error in understanding the nature of the Sixteen Character policy, the Cox report includes a number of misquotes of sources when trying to justify

its argument that economic modernization has all along been subordinate to military modernization in China.

On Chinese nuclear doctrine issues, the report is exceedingly unclear about the actual state of development in Chinese nuclear weapons capabilities. There appears to be a tension between two presumed purposes of the Cox report. On the one hand, the report must explain the Chinese “demand” for U.S. nuclear and missile technology. Hence the need to underscore the technical backwardness of current Chinese capabilities, which it does in places. On the other, in line with what Cox Committee member Norm Dicks called its “worst-case” flavor, the report also needs to stress the imminent Chinese threat to U.S. security. Hence the stress on real-time technological sophistication and success in modernizing nuclear capabilities. In addition the report mischaracterizes Chinese nuclear doctrine, claiming that its announced doctrine is one of limited deterrence. In fact China has no announced doctrine, and the few comments that Chinese leaders have made over the years indicate an operational doctrine that to this point is more akin to a minimum deterrence doctrine than a limited deterrence doctrine. The report mixes up kilometers and miles when discussing the range of one of China’s missiles, and exaggerates the degree to which alleged missile technology transfers from the United States have sped up the deployment of another missile. It also misstates China’s position on no first use of nuclear weapons and Taiwan.

In short, the discussion of Chinese politics, economic modernization, and nuclear doctrine lacks scholarly rigor, and exhibits too many examples of sloppy research, factual errors, and weakly justified inferences.

Allegations of Theft of Sensitive U.S. Nuclear Weapons Information

This section of the summary is divided into three subsections. The first lists the main allegations and statements made in the Cox Commission report together with brief background comments. The second addresses the significance of allegedly stolen information about the W-70 and W-88 weapons and weapons codes. The third addresses the Cox report criticisms of security and counterintelligence at the nuclear weapons laboratories and discusses the laboratories’ international contacts. Throughout this review, the emphasis is on three questions:

1. What information beyond what is publicly known, if any, has allegedly been stolen?
2. Is the alleged stolen but not publicly available information of sufficient value to enable the PRC to field new designs without testing?
3. What impact would such weapons have on the security of the United States?

Main Allegations and Statements of the Cox Report

A problem with the Cox Commission report is that the authors provide little context for their allegations, leaving the reader with no way to judge their importance, aside from whether the allegations are true. Thus it is never made clear how much the Chinese learned on their own and from publicly available information. The report makes broad accusations against

the Chinese with little or no support or comparison with other states' practices. The impact of losses is either overstated or not stated.

1. The PRC has stolen design information on the most advanced U.S. nuclear weapons, including every currently deployed thermonuclear warhead in the U.S. ballistic missile arsenal and the neutron bomb, which the United States has not deployed.

No evidence or foundation is presented for these allegations other than recounting the existence of a "walk-in" agent with some data on one system. China tested a "neutron bomb" in 1988 but has not deployed it. The United States tested and deployed three such weapons, and has now withdrawn them. The relevance of two such alleged thefts is discussed below.

2. The Select Committee judges that the PRC will exploit the stolen information for its next generation of thermonuclear weapons and the stolen U.S. secrets give the PRC information on such weapons on a par with the United States.

No information is given that traces China's nuclear weapons to U.S. sources. There is no way to judge whether a "next generation of thermonuclear weapons" would be based on such theft or earlier Chinese knowledge. It is extremely unlikely that, absent nuclear testing, theft of information could lead to any such new generation.

3. The Select Committee judges that elements of the stolen information will assist the PRC in building the next generation of mobile ICBMs.

4. A PRC deployment of mobile thermonuclear weapons or neutron bombs based on stolen U.S. design information could have a significant effect on the regional balance of power.

A mobile ICBM, the DF-31, was initially tested this year. If deployed, it could increase the survivability of Chinese land-based missile forces. Deployment of survivable thermonuclear weapons could affect both the strategic and regional balance of power if the number of nuclear delivery vehicles became much larger. How U.S. interests are affected by survivability of Chinese nuclear forces is a complex question, however. Survivable weapons are less likely to be used first.

5. The Select Committee judges that if the PRC were successful in stealing nuclear test codes, computer models, and data from the United States, it could further accelerate its nuclear developments.

Such computer models and data could accelerate weapons development, although advanced computers and models were not needed to design either the W-70 or the W-88.

6. Despite repeated PRC thefts security at our national nuclear weapons laboratories does not meet even minimal standards. Counterintelligence programs fail to meet even minimal standards.

Minimal standards are not defined, nor is the record of security and counterintelligence at the laboratories compared with similar records elsewhere. No evidence is given of what lapses occurred, what standards and improvements are needed, or where else lapses may have occurred. In contrast, a committee for the Intelligence Community chaired by Admiral Jeremiah concluded in 1998 that it could not "determine the full extent of weapons informa-

tion obtained, for example we do not know whether any weapon design documentation or blueprints were acquired,” and that among “espionage, contact with U.S. and other countries’ scientists, conferences, and publications, unauthorized media disclosure, declassified weapon information, and Chinese indigenous development, the relative contribution of each cannot be determined.”

Significance of Allegedly Stolen Information about the W-70 and the W-88 and about U.S. Nuclear Weapons Computer Models

The W-70 (“neutron bomb”) was developed to defeat massed tank attacks without damaging surrounding towns and villages. Its effectiveness in that role has been contested. It has no advantage against cities and other “soft” targets over standard nuclear weapons. A version was also developed for an atmospheric nuclear ballistic missile interceptor, the Sprint. It is essentially irrelevant to the military posture of China against the United States.

The W-88 was designed about thirty years ago and is deployed on U.S. missiles carried in Trident submarines. It fits into the slender multiple independently targeted reentry vehicles required for high accuracy. China tested a possibly similar system several years ago. The only evidence provided that the design of that weapon was derived from information stolen from the United States is that a Chinese “walk-in” agent provided the CIA with a classified PRC document referencing information related to the W-88. The provenance and sponsorship of the agent have not been made clear. If the document contains information not available from public sources, it would provide evidence of Chinese access to classified information, though not of where the alleged leak took place.

China has about twenty ICBMs at present capable of reaching the United States. Designs similar to that of the W-88 could permit MIRVing these missiles or new ones, which in turn would have mixed effects on the Chinese strategic position, effects discussed at greater length in the text. Such designs or other compact warheads could permit more survivable basing for Chinese missiles, which in turn could provide greater stability in case of a crisis between China and another nuclear power.

Computer models (codes) would add to the basic knowledge related to nuclear weapons design, although it must be added that China has had what is regarded as a highly competent nuclear weapon program for thirty-five years or more. The codes, in the opinion of nuclear weapons designers in the United States, would not be sufficient by themselves to permit fielding a new design, especially not one that could be deployed without nuclear tests. Such codes are specialized to the particular user, contain many empirical entries valid for limited uses, and are by necessity incomplete.

Security, Counterintelligence, and International Contacts at U.S. Nuclear Weapons Laboratories

A report by a committee of the President’s Foreign Intelligence Advisory Board (PFIAB), chaired by PFIAB chairman former senator Warren Rudman, issued in 1999, provided an extensive summary of the vulnerabilities of the U.S. nuclear weapons laboratories to foreign penetration. The Rudman report cites a dismal record of resistance to implementation of security measures on the part of the Department of Energy (DOE) and proposes a major reorganization in which DOE national security activities would be taken over by either an autonomous or a semiautonomous agency. Many reasons for this proposal are outlined in

the report, some of which are discussed in the text. Legislation addresses some but not all the problems noted in the report.

Neither the Rudman nor the Cox report makes a distinction between security measures designed to deny opportunities for harmful information transfer and those designed to interdict or prevent such transfers. However high the barriers to transfer, transfer cannot be prevented if there is a will to transfer information illegally. This leads to a focus on the security clearance process for individuals, a process that has in the past proven difficult and important.

A complicating factor is the enormous volume of classified information in a variety of formats to be protected and administered, and the large number of people who have legal access to it. This complication is made worse when materials that are already in the public domain and are only marginally relevant to truly sensitive information are protected. Expert reviewing bodies have uniformly concluded that the DOE should build very high fences around truly sensitive information, not diffuse restraints around vast and generally publicly known information.

The current preoccupation with security has unfortunately, however, led to ill-considered measures which may damage national security. In particular, negative impacts have been felt on the lab-to-lab programs under which U.S. nuclear weapons scientists interact particularly with former Soviet scientists in similar areas with a view to keeping former Soviet scientists in difficult economic situations from selling their talents elsewhere. The lab-to-lab program also has involved Chinese scientists, to improve nuclear materials safety, safeguarding, and verification of arms-control agreements. The programs have been successful in achieving their goals without releasing classified information and are reviewed in another chapter of this report.

Of even greater importance is the quality of U.S. personnel at the national laboratories. These laboratories share the largest part of the responsibility for maintaining the safety and reliability of the nuclear weapons stockpile. One component is the continuous inspection of nuclear weapons in stockpile in order to uncover any damaging changes as the weapons age. Another is to better understand the behavior of the weapons in the stockpile. Both require attracting and retaining scientists and engineers of the highest quality. This cannot be done if the laboratories are isolated from the scientific and engineering communities at large, although it can and has been done while protecting classified information. While the Cox Commission has not made a case that any security lapses have been caused by such unclassified exchanges, its report has led to proposed impediments to such exchanges that would make employment at the laboratories less attractive at a time when attracting top talent is already difficult.

More generally, training of U.S.-born scientists and engineers has been insufficient to meet the demand in the high-growth technical sectors of the American economy. As a result, a significant fraction of staff members in American high-technology enterprises are foreign, principally Asian. These people make major contributions to U.S. productivity. The Cox report, while not specifically associating any alleged loss or theft with open scientific exchanges, does allege that essentially all Chinese visitors to the United States are potential spies. This has cast a cloud of suspicion over both foreign and Asian-born U.S. staff members of U.S. companies. At the same time, there is no evidence presented in any report that Chinese scientific visitors have abused their privilege in visiting the United States by behaving differently from U.S. scientists abroad.

The Cox Report and the U.S.-China Arms Control Technical Exchange Program

The Cox report alleges, without providing any evidence, that the “lab-to-lab” exchanges of the late 1980s and 1990s were a pipeline for transfer of U.S. secret information about nuclear weapons to China. In fact, the risk of such transfer was recognized from the start and decisive actions taken to mitigate and manage it. The Cox report does not discuss the reasons for the lab-to-lab programs, nor the advantages to the United States, but calls for a definitive assessment of the risks and benefits of the programs by the U.S. government. It also does not seem to distinguish between contacts in high-energy physics, which have nothing to do with weapons, and contacts regarding nuclear weapons. This report deals only with the latter.

The 1980s scientist-to-scientist contacts were authorized by the U.S. Department of Energy and took place when the strategic interests of the United States and China were more aligned against the Soviet Union. The focus of these contacts was to increase U.S. knowledge about a program that was poorly known and documented at that time. The contacts ended in the late 1980s.

The U.S.-China Arms Control Technical Exchange (ACE) Program began as a U.S. initiative in 1994 to improve contacts with China in the area of arms-control verification, nuclear materials protection, and nonproliferation. The rationale for such a program stems from China’s relative isolation from the forty years of arms-control exchanges and negotiations that involved the other nuclear weapons states and key non-nuclear-weapons states. In the mid-1990s, China’s adherence to the Comprehensive Test Ban Treaty (CTBT) and compliance with the Non-Proliferation Treaty were sought—the latter specifically with regards to possible past Chinese nuclear transfers to Pakistan. With this in mind, the United States proposed a collaboration on the technical issues involved in nonproliferation, arms control, and nuclear materials protection, control, and accounting (MPC&A) between U.S. nuclear weapons laboratories and the China Academy of Engineering Physics (CAEP) and other entities in China responsible for nuclear weapons research, development, and testing. A long-term goal of the program is to demonstrate that cooperative nuclear materials protection and arms-control measures can be carried out without compromising national security. Following a series of visits, the proposal was accepted by CAEP in 1995.

From the start and throughout their course, the exchanges were carefully guided and monitored by an Interagency Contact Group consisting of the State Department, Department of Energy, the U.S. Arms Control and Disarmament Agency, Department of Defense, and the White House through the National Security Council and the Office of Science and Technology Policy. The Interagency Contact Group approved each topic scheduled for discussion. Day-to-day leadership of the ACE program is carried out by the program steering committee composed of representatives of the laboratories.

From the start also, intelligence and political vulnerabilities were realized. An elaborate multilevel system of access controls, with continuous oversight by counterintelligence (CI), was established and is described in the text. CI is an active part of the program at the laboratories. The program is as well under the oversight of the U.S. embassy in Beijing, which is advised of and approves all activities. The ACE program is small, consisting of two people at each of the three U.S. laboratories and supervision from the government. The United States and China each pay their own expenses.

The technical achievements of the ACE program to date include a joint demonstration on the technical aspects of MPC&A and a bilingual primer on the subject, which was expected to be the first of a series of joint publications on the approved exchange topics. The ACE program also carried out workshops with CAEP on export controls, atmospheric modeling, and treaty monitoring and verification technologies.

These activities were carried out in 1997 and 1998. Late in 1998, the ACE program steering committee identified opportunities to carry out joint activities on seismic verification of the CTBT, to apply one MPC&A technique to a fuel fabrication plant in China, to hold preliminary discussions on a CTBT on-site inspection exercise, and to initiate discussions of techniques to verify a fissile material cutoff. None of the discussions came close to containing information that could benefit China's nuclear weapons program.

Following the conclusions of the Cox report released in January 1999, Chinese agencies involved told the ACE program steering committee in February 1999 that the start of technical activities related to CTBT verification would have to wait until a more propitious time. Visits to and from China were postponed. Chinese participation in an arms-control meeting scheduled to be held at one of the laboratories was canceled as likely to inflame passions and "not furthering the interests of the United States and China." Other activities have since then also been canceled by China.

The ACE program was carefully controlled from the start, contrary to the Cox report suggestion that uncontrolled interactions were taking place between U.S. and Chinese weapons scientists. No evidence has been given that it resulted in any assistance to China's nuclear weapons program. It was proposed by and furthered objectives of the United States, although China also benefited by gaining greater confidence in arms-control activities in which it participates.

Concerns over PRC Acquisition of U.S. Missile and Space Technology

This section comprises two subsections. The first addresses the alleged loss of sensitive missile and space technology to the PRC in the course of accident investigations. The second addresses the history and current conditions under which U.S. satellites are launched abroad.

This material is preceded in the Cox report by an inaccurate recounting of the 1955 deportation by the United States of a China-born, U.S.-educated missile expert, Qian Xuesen. Qian, a former U.S. Army officer who had evaluated German V-2 rockets after World War II, then taught at the Jet Propulsion Laboratory of the California Institute of Technology, had his clearance revoked because of claims that he had befriended several people at Caltech in the thirties who were communists. He was arrested (but never prosecuted) when he tried to visit China in 1950 with documents that appeared to violate one of the then-applicable export-control laws. After a period in jail and under house arrest, he was deported (he did not "emigrate," as the report states). He then became the scientific leader of China's missile program for some years, during a period when the PRC received help from the Soviet Union to develop its own missile technology. There is no evidence that Qian spied for China. While his training and intelligence were of material help to his native country after he returned, there is little likelihood that the PRC's currently deployed ICBMs are based in significant part on Qian's knowledge of German V-2 rockets, JATO rockets, and forties-era short-range

rockets, or that he ever participated in the early U.S. Titan ICBM development, contrary to the Cox report statement.

Theft and Technology Loss in Satellite Launches and Launch Failures

The Cox commission was originally chartered to investigate the potential transfer of sensitive missile technology to the PRC in the aftermath of three unsuccessful launches of U.S.-manufactured satellites on Chinese Long March rockets in China. Hughes Space and Communications International, Inc., and Space Systems/Loral manufactured the satellites. The central issue was whether these companies violated the conditions of their export licenses by providing information to the PRC during subsequent investigations of the launch failures, and the PRC thereby gained access to sensitive missile technology. Most of the Cox commission report is devoted to analyzing whether the launch failure investigations led to illegal U.S. technology transfer and to assessing the consequences.

The Hughes-manufactured (the satellites had been made for foreign civilian customers) satellite launch failures occurred in 1992 and 1995. The Cox report notes that Hughes personnel, after the failures, provided information on aerodynamic buffeting of the satellite fairing (provided by the PRC) during the rocket's exit from the atmosphere without seeking prior State Department approval to transmit technical information to the PRC or apply for an additional export license for the failure analysis. The PRC denied responsibility for the failure, but, after another similar failure, corrected its fairing design. The Cox report concludes that the PRC could use the information provided to improve the reliability of future ICBMs, though it notes that the sophisticated fairing design needed to protect satellites during the launch ascent is unlikely to be used on ballistic missiles.

The Loral-manufactured satellite launch failure occurred in 1996. Chinese personnel ascribed the cause to a fault in the rocket's inertial measurement unit (IMU), which it provided. Some telemetry data, however, were not consistent with that assessment. The insurer requested that an independent review committee be formed, in which Loral and other Western experts participated. A Loral employee chaired the committee at Chinese request. The committee's preliminary report was faxed to Chinese participants without Loral securing prior government approval or an additional export license, a mistake voluntarily admitted by Loral. The preliminary report suggested a different IMU failure mode from the one initially identified by PRC engineers, one that was consistent with the telemetry data. This was subsequently confirmed and corrected. The Cox report concludes that the correction to the IMU could be adapted for use in the PRC's road-mobile missile program, which is possible but not deemed likely owing to differences in the launch and operational environments between mobile missiles and space launch vehicles.

In both of these cases, it appears that the management of the U.S. companies did not attempt to obtain a separate export license to participate in these technical discussions and meetings. Because of ambiguity over government policies, regulations, and jurisdiction, it is unclear whether the companies were legally required to do so. In some cases, individual members of the project teams may have unilaterally communicated technical information to the PRC without getting prior management approval or having the government review the material. When these communications came to the attention of the government offices involved, they advised that an export license should be applied for to resolve whether a separate accident review license was needed. The U.S. companies then made voluntary disclosures of the information they had. The Justice Department has initiated criminal investiga-

tions to determine whether violations of the export license conditions occurred. There has been no official release of the results and no criminal indictments to date.

It is unclear when or whether Chinese engineers would have found the information on their own. It is also unclear what the applicability of the information to military systems is. In neither case does the Cox report provide evidence of spying or violation of the U.S.-PRC Technology Safeguarding Agreement on the part of the Chinese. On the other hand, it is clear that, not mainly the information transmitted, but the example of rigorous, objective fault analysis, management attention, and quality control given by Western engineers may be of use to the Chinese in designing future launch vehicles and missiles. In one case, the insurer's refusal to insure a launch compelled the PRC organizations to step up to a higher standard of openness, letting the chips fall where they may.

In summary, no credible evidence of theft or breach of agreement by the PRC is presented. It may be that such theft or breach did occur, and it may be that declassification needs prevented presentation of that evidence. No evidence is presented that what the Chinese learned in the accident investigations described led to the ICBM improvements claimed. A number of technical and numerical errors and inaccurate and selective quotations also occur.

History and Current Conditions of U.S. Satellite Launches Abroad

The reasons for U.S. companies using PRC and other foreign launch facilities lie in a combination of commercial success on the part of the U.S. companies in providing low-lifetime-cost, high reliability, modern communication satellites for the world market, a success which relies on large business volume, and an inadequate indigenous U.S. launch capacity. As the U.S. government stopped ordering rockets in anticipation of the shuttle replacing expendable launchers, U.S. launch production facilities were phased out and U.S. launch complexes neither modernized nor expanded. As a result, the new additional commercial launcher demand greatly exceeded the U.S. launch capacity, resulting in longer delays in launching satellites. Additionally, U.S. launch costs rose to two to four times Russian and Chinese launch costs. International customers for the satellites, usually consortia of private and government investors, looked to invest the \$250 million or so launch-plus-satellite cost and the \$50 million or so insurance cost optimally. In some cases, Asian investors specified that the satellites be launched from the PRC.

These circumstances led the United States in 1996 to transfer commercial satellite export-license control to the Department of Commerce and to promulgate rules specifying which technical parameters could be shared with launch providers and which could not. Unfortunately, during the ensuing interim period intergovernmental and government-industry coordination was poor, leading to ambiguities and mistakes. Unexpected developments such as insurer involvement and international accident investigations complicated the situation. There is a clear need for correction and improvement based on lessons learned.

The U.S. political environment, however, led to a rider being attached to the 1999 Defense Appropriations Act, without committee hearings or floor debate, that returned jurisdiction to the State Department and added a number of restrictions on foreign launches of U.S. satellites. New State Department rules issued just prior to the May 15, 1999, transfer of authority further restricted the process. The State Department currently is unable to process license applications in any predictable manner and some international customers have expressed unwillingness to buy U.S. satellites. No U.S. allies support the new U.S. satellite

technology export controls, and, contrary to the legislation, the State Department regulations restrict allies and other states equally.

Research satellites, mainly fielded by universities and other schools, are for the first time subject to these regulations. State Department advice to academic requests indicates that the space technology subelements as well as the intellectual component embodied in academic public-domain information (textbooks, papers, lectures, and theses) are included. Universities must register as munitions contractors to apply for an export license and the license and a DoD-approved security plan must be approved before any preliminary scientific discussions are held. These procedures are not likely to prove either acceptable to many academic institutions or feasible from the standpoint of costs.

Since commercial and academic activities have had a significant value for defense and will have even more in the future as non-defense components and ideas are increasingly used in defense systems, there is a clear need from a defense point of view for a system that permits U.S. companies and universities to continue making progress and exercising leadership in the international space arena. Whatever system of constraints evolves from the present situation must take into account both the benefits and the costs of international participation. There are benefits to defense as well as to commerce and academic knowledge. The United States historically has made better use of the growing pool of common knowledge and experience than have its strategic competitors.

The Cox Report on Governance and Policy in China: Problems of Fact, Evidence, and Inference¹

Alastair Iain Johnston

“We did not engage in opinion. We reported only facts. . . . ,” Cox said.²

“The first page of the ‘Overview,’ for example, makes one statement that is simply incorrect. It says that the United States has not deployed an enhanced radiation warhead or a neutron bomb. In fact, we have deployed three: the W-70 on the Lance tactical missile; the W-66 on the Sprint interceptor; and the W-79 on an 8-inch artillery round. This is not a serious mistake, but a report of this importance should not contain such mistakes.”³

Introduction

The Cox report has attracted a great deal of public attention since its release in May 1999. This attention has mainly been due to its dramatic claims about the “theft” of U.S. nuclear warhead and missile technology, and the implication that this theft will allow China to build a far more modern nuclear force that will threaten the continental United States. A number of scientific experts have critiqued the Cox report precisely for these claims, arguing that the evidence presented in the report is insufficient even to reach what one member of the Cox Committee himself called a “worst-case” analysis. I am not a nuclear or missile scientist, so I happily leave the assessment of the scientific accuracy of the Cox report to my scientist colleagues, Pief Panofsky and Lew Franklin.

However, overlooked in all the press attention to the alleged “theft” of nuclear-related technology have been those parts of the report that deal with China’s politics and foreign/security policy. These parts of the report, found mainly in the first chapter, are actually quite important to the overall message of the document. They establish a conceptual framework with which to analyze the long-term political and strategic relevance to the United States of all the other claims about stolen military technology. There has been no effort in the press or among pundits, however, to examine the accuracy of these parts of the report. So as part of our collaborative effort to assess the factual claims of the report, my role in this division of labor is to look at the description and analysis of Chinese politics and policy-making, particularly as it pertains to the Cox report’s claims about the relationship between economic development and military modernization in China. I also touch on the Cox report’s discussions of Chinese nuclear doctrine as this topic is one of the most difficult analytical issues for those who study PRC security issues. The bottom line is that the Cox report presents a highly distorted and poorly researched picture of the nature of politics and policy-making in China.

1 The Structure of the PRC Government

The purpose of this first section of the Cox report (Vol. 1, Ch. 1, pp. 4–10) appears to be to establish that all Chinese economic and military modernization policies, and the technology-acquisition activities that concern the Cox Commission, are directed by a small number of top Communist Party officials who view the United States as their primary adversary. Otherwise, it is unclear why the report would include a very general discussion of the policy-making structures and process in the PRC in a report about the details of nuclear and missile espionage. This section, then, establishes an interpretative lens through which to view the details of PRC activities with respect to the acquisition of nuclear, missile, and high-speed computer technology. This interpretative lens casts the allegations about these acquisition activities in the worst possible light, by suggesting that the basic preferences of the top Chinese Communist Party (CCP) leadership are to use domestic economic modernization and economic interaction with the outside world principally to increase Chinese military power so as to challenge U.S. interests. To establish this interpretive lens, the report outlines the organizational structure of the PRC and argues, in essence, that all state, military, and commercial activities in China are “controlled” by the CCP top leadership.

There are substantial inaccuracies in this characterization of politics in China and in the Cox report’s use of evidence.

1.1 The Cox report states, “. . . in ultimate control of all state, military, commercial, and political activities in the PRC, is the Chinese Communist Party.”⁴ The footnote to this statement (footnote no. 1) further states: “the distinctions between [state, military, and party] are largely artificial.”⁵ The report then refines this claim by stating that it is in fact the twenty-four-member politburo of the Communist Party which “ultimately controls the PRC’s political, military, governmental, and commercial activities. . . .”⁶

These are extremely vague statements. Indeed, in these first five pages of the report, the term “control” is used twelve times to describe the CCP leadership’s relationship to the state,

military, and/or commercial activities. Nowhere is the term “control” defined, nor are any specific examples given where the CCP has dictated policy outcomes that these other entities would have opposed had it not been for the CCP’s “control” over them. In fact, the Chinese Communist Party is not in “ultimate control” of all commercial activities. According to the China International Investment Corporation the private sector accounted for about 41.8 percent of GDP in 1997. State-owned enterprises (SOEs)—those owned by the central government in Beijing—accounted for 38.4 percent of GDP. The private-sector enterprises accounted for 31 percent of urban employment.⁷ These non-state businesses obviously operate within the constraints of central and local government fiscal and monetary policy, as well as other regulatory parameters. To say that the CCP ultimately controls the activities of these enterprises would be similar to saying that the U.S. government ultimately controls the commercial activities of U.S. private businesses through its fiscal, monetary, and regulatory policies.

By emphasizing the CCP supremacy, moreover, the report undermines its conclusions in two ways. (1) Precisely because the CCP is supreme, its policy lines generally determine the allocation of resources to the military. Since the late 1970s, as I will note in more detail later, the policy line has been to subordinate military modernization to the development of the overall civilian economy. Hence it is precisely CCP “supremacy” that has enabled the political leadership to resist the consistent demands of military leaders for more resources from the state. (2) Relatedly, the PLA has consistently demanded more resources from the state, but has been unable to extract these. I will come back to this issue shortly.

1.2 The Cox report states: “The CCP’s main aim for the civilian economy is to support the building of modern military weapons and to support the aims of the PLA.”⁸

This particular conclusion is clearly meant to be a major thrust of the report, an interpretative lens through which readers are to view the rest of the evidence in the report. The quote is placed over a full-page photograph of the top Chinese leadership on page 5 so as to underscore the importance of this finding. It is repeated again on page 14 of the report. This statement implies, in curious tension with the statements about CCP supremacy, that the CCP leadership’s primary goal in its economic modernization plans is to accommodate the interests of the PLA.

This is misleading in at least two ways. First, most specialists in Chinese politics would argue that the main aim of building up the civilian economy is to improve the living standards of ordinary Chinese people so as to boost the legitimacy and longevity of CCP rule, and to create the material basis for achieving a status commensurate with China’s image as a major power. The goal is not to support the narrower preferences of the PLA per se. There is obviously room for debate, but in order to present a radically alternative interpretation of the relationship between the civilian economy and military modernization, one needs far more evidence than provided in this report (see, below, the discussion of the Sixteen Character directive). Second, the Cox report misses the fact that in the process of modernizing the civilian economy the PLA has in fact consistently complained that it is underfunded. These complaints go back to the early years of Deng Xiaoping’s rule and persist today.⁹ It has only been in the mid to late 1990s that we have seen substantial real increases in military expenditures under conditions of low inflation. Even so, the central government has resisted de-

mands from the PLA, for example, that military expenditures be fixed at a certain portion of GDP.

The statement in the Cox report implies that the CCP's goal in modernizing the economy is in fact to serve the interests of the PLA. This implication is inconsistent with the evidence from the past twenty years of CCP policy toward economic development, where the modernization of the military has consistently been ranked behind the modernization of the civilian economy as a public-policy priority. To be sure, one aim of modernizing the civilian economy is to increase China's comprehensive national power (*zong he guo li*), one component of which is military power, such that China can take its place as a great power on the world stage. This will require allocating more resources to the PLA, and these resources will be created through the wealth generated from economic modernization. But this is a long-term aim, and it is misleading to argue simplistically that this is or has been the main goal of CCP economic policy over the last twenty years.

1.3 The Cox report states, in reference to research on military affairs from PLA think tanks, "This military research is channeled through a State Council unit known as the International Studies Research Center. The Center acts as a conduit and central transmission point to channel intelligence, research reports, and policy documents to the top Communist Party leadership."¹⁰

The point of this statement is unclear, but presumably it is meant to show how military preferences are articulated at the politburo level. But this particular statement is moot. The Center is not the primary channel for military research into the State Council. For one thing the Center no longer exists, having been for all intents and purposes subsumed in 1998 by the Institute of International Studies, a think tank attached to the Foreign Ministry. For another, the military has many other channels through which to forward research to the politburo, the Central Military Commission, and the State Council. Any military research sent to the State Council, for example, will likely flow through the State Council's Foreign Affairs Leading Small Group office. Some PLA units can send research and recommendations directly to politburo members. A great deal of military research and policy position papers will flow through the Central Military Commission General Office. The Center simply did not play that role. There was a time in the 1980s when the leader of the Center, Huan Xiang, hoped to turn the Center into an institution similar to the U.S. National Security Council. But in the 1990s, particularly since Huan's death in 1989, the influence, role, and importance of the Center have declined dramatically. It is certainly not the important institution that the Cox report erroneously implies it is.¹¹

1.4 The Cox report states: "The PRC Constitution asserts the supremacy of the Communist Party over all other government, military, and civilian entities."¹² This is referenced with footnote 3, which states "See the Constitution of the People's Republic of China, Articles 2, 3."

If one looks at Articles 2 and 3 of the PRC Constitution, there is in fact no statement about the supremacy of the CCP over all government, military, and civilian entities (whatever a civilian entity is). The CCP is in fact not mentioned at all. Rather, one finds articles with

reference to central state authorities, not central party authorities. It is not the PRC Constitution that establishes the leadership role of the CCP in Chinese politics. It is the CCP Party Constitution that does so.

1.5 The Cox report states that “Nowhere is the supremacy of the Communist Party more clearly enunciated than with the PLA. This supremacy is explicitly set forth in the PRC Constitution.”¹³ The report then provides a footnote (footnote 5) to “The PRC Constitution, Article 29.”

If one looks at Article 29, however, nowhere in this article is there a statement “explicitly” or implicitly setting forth the supremacy of the CCP over the PLA. The CCP is not mentioned at all. CCP leadership over the PLA is, in fact, stated in the CCP Constitution and in the 1997 National Defense Law, among other sources.¹⁴ Obviously the PRC constitution is not a good guide to how politics actually works in China. The point here is only that the writers of the report have provided an inaccurate footnote that in no way provides the evidence that they claim it does.

The general problem with this section of the report is that it paints a picture of an extremely centralized political system where policies across government, military, and commercial activities are uniformly directed by a handful of leaders. The impression left by the report is that the top leadership of the CCP holds distinct policy preferences, and that these preferences dominate, overriding the preferences of all other players in the state, military, and commercial sectors.¹⁵ The report assumes that just because the head of a state bureaucratic entity is a CCP member this ensures CCP “control” (presumably meaning the imposition of CCP preferences on the entity).

Such a picture is based on very skewed research into the organizational structure of politics in China. The authors of the Cox report seem to have missed the rich and burgeoning literature on how policy is actually made in different issue areas. The actual process of policy-making often operates in contradiction to this structure. In reality, as most experts on the Chinese political system recognize (including the expert whose study is cited by the Cox report as a source of its information about the political system, Kenneth Lieberthal), this top-down, uniform-preferences view of Chinese policy is a caricature of a much more complicated system.¹⁶

Scholarly research on policy processes in energy policy, environmental policy, arms control, and foreign and military policy among other major areas of public policy indicates that the policy process is more often characterized by interagency rivalries, bargaining, and log-rolling within the boundaries—sometimes narrow, sometimes wide—of general policy lines set by the politburo.¹⁷ The preferences of different actors, far from being uniform, often reflect the narrow parochial interests of their organization. The PLA, for instance, constantly complains that it has, in fact, not received the resources it needs. The military has complained that state financial planners have been unwilling to allocate enough resources to military modernization, most recently demanding, but not receiving, a relatively high fixed percentage of GDP to be devoted to the military.¹⁸ Many in the PLA oppose the policies and preferences of the Ministry of Foreign Affairs (MOFA), calling it the “selling out the country” ministry (*maiguo bu*—which sounds a bit like the Chinese-language term for the Foreign Ministry, *waijiao bu*).¹⁹ The Foreign Ministry, for its part, has complained that the military and security interests have often undermined its efforts to portray China as a more responsible member of international arms-control regimes. The ministry’s arms-control spe-

cialists complained, for instance, that the nuclear weapons community pursued its own narrow interests in the interagency process during negotiations leading up to the Comprehensive Test Ban Treaty. They also complained that the PLA was unhelpful in supplying information relevant to negotiations over the Protocol II of the Convention on Certain Conventional Weapons.²⁰ Environmental scientists in the State Meteorology Bureau and the National Environmental Protection Agency have been at odds in the past with the Foreign Ministry over the degree of China's commitments to the control of global warming gases.

In most cases, these bureaucratic disputes and negotiations are conducted by leaders of organizations who share membership in the CCP. In other words, contrary to the argument of the Cox report, membership in the CCP does not automatically lead to uniform preferences over public policy. Indeed, when CCP members in the PLA call CCP members in the MOFA "traitors" for allegedly taking a soft line on U.S. policy or when CCP members of the MOFA arms-control community complain that CCP members of the nuclear weapons community are harming China's international image by pressing for a particular obstructionist policy in CTBT negotiations, it is clear that CCP membership does not lead automatically to a similar set of policy preferences.

Interestingly, while the Cox report relies heavily on Kenneth Lieberthal's study of Chinese politics to describe the organizational structure of politics, it ignores Lieberthal's analysis of how policy-making actually works. Lieberthal's book provides an extensive discussion of how different bureaucratic actors, with their own defined interests, engage in bargaining and logrolling in public policy, where many decisions are relegated to relatively low-level officials and organs.²¹ Apparently the Cox report authors missed those sections of the book. Lieberthal also teamed up with Michel Oksenberg to write perhaps the most detailed and authoritative study of domestic policy processes in China. They conclude that over time "units at all levels of the national hierarchy have acquired control over resources that enable them to bargain with their superiors rather than to simply accept the chain-of-command of formal organizational ties."²² They refer to the Chinese system as, essentially, a "mature Soviet-type system" where the top leaders "are constrained by the bureaucratic evolution of the system they have created. The mature Soviet-type system, to repeat, is a bureaucratically dominant but fragmented system with a protracted, disjointed policy process characterized by bargaining and consensus building."²³

In short, making concrete policies in the Chinese political system involves many of the same bureaucratic and political games that characterize political systems around the world. The one major difference is that in China, unlike in liberal democracies, nongovernmental interest groups and publics have no role, for the most part, in these policy processes. The Cox report description of how actual policy is made in China is surprisingly inaccurate.

2 The Sixteen Character Policy

The point of this section of the Cox report (pp. 13–18) is to drive home the finding that the "main aim for the civilian economy is to support the building of modern military weapons and to support the aims of the PLA."²⁴ This relationship, says the report, is embodied in the so-called Sixteen Character policy. According to the report, it is this policy, first enunciated by Deng Xiaoping in the late 1970s, that establishes the subordination of the civilian economy to military modernization. The sixteen characters can be translated as: combine the military

and civilian; combine peacetime and wartime; give priority to military products; and use the civilian to support/cultivate the military.

2.1 The Cox report states that the Sixteen Character policy “holds that military development is the object of general economic modernization, and that the CCP’s main aim for the civilian economy is to support the building of modern military weapons and to support the aims of the PLA.”²⁵ The report states that this policy was “formally codified” in 1997. The report cites primarily the work of John Frankenstein and Bates Gill in its discussion of this policy.

It is not entirely clear what the Cox report means by “formally codified.” According to two academic experts on the Chinese military-industrial complex, the Sixteen Character directive was issued by the CCP Central Committee in 1979.²⁶ It is possible that the Cox report authors are referring to Article 30 of the National Defense Law of 1997, which states that the Sixteen Characters applies to the development of science and technology for China’s national defense industries.²⁷ But this is a statement of a long-standing policy, not a qualitatively new thrust in Chinese military development.

A more serious problem with the Cox report claim, however, is the fact that, as the article by Frankenstein and Gill used by the report makes clear, the Sixteen Character policy refers narrowly to the conversion of military-industrial enterprises under the direction of the State Council and provincial and municipal governments.²⁸ That is, it applies to the state-owned enterprises within the military-industrial complex; together these employ about 300,000-plus technical specialists and about 3 million workers working in around 1,000 factories and 200 research institutes.²⁹ This is about 7 percent of the total labor force in state industries.³⁰ One estimate suggests that defense industries probably do not contribute much more than 5 percent of industrial output in China.³¹ In other words, the Sixteen Character policy applies to a rather small portion of the overall economy. In particular the policy refers to the development of commercial lines of production in debt-ridden military-industrial factories, the profits from which are to be used to sustain the unprofitable and low-output military production line in these factories. While the Cox report concedes that this original, limited, and circumscribed meaning could be a valid one, it also claims that the more expansive interpretation, which the report clearly prefers, is equally valid.³² In fact it is not.

This is clear from an examination of discussions of the meaning of the Sixteen Character policy in Chinese sources. The 1997 National Defense Law states in the chapter on the production of military products by military industries, for example: “The principle of combining military with civilian production, manufacturing products for both peacetime and wartime use, giving priority to manufacturing military products, and supporting military production with civilian production shall be applied in developing science, technology, and industry for national defense.”³³

One of the most detailed discussions of the meaning and scope of the Sixteen Characters is found in a chapter specifically on the policy in a book entitled *China’s Defense Conversion (Zhongguo jun zhuan min)*. The chapter states quite clearly that the Sixteen Character phrase “is the summary of several decades in the development experience of China’s military industries.”³⁴ The chapter breaks down and explains each of the four character phrases.

“Combine peacetime and wartime” means that the development of military industries must take into account the supply of products during wartime and the development of pro-

duction and reserve capacity during peacetime. This means military industries must choose models of development that are suitable for both peacetime and wartime.³⁵ The chapter also glosses this phrase to mean that military industries are unique in that they must follow both the “law of war” (the military) and the “laws of economic development” (the civil).³⁶

“Combine military and civilian” means developing civilian product lines such that civilian demands can be met, firm profits can be increased, and these can be used to support less profitable military product lines during peacetime.³⁷ In other words, precisely because the central government cannot fully finance debt-ridden military industries, this phrase encourages military factories to develop commercial products to increase their profitability. Military industries should be encouraged to develop technology that might be appropriate for civilian products. The term also means that military-industrial production must also be factored into the perspective of macroeconomic management.

“Give priority to military products” means that the primary job of military industries is still to produce goods for the military. So any commercialization of product lines must not impinge too far on the industry’s ability to meet the military needs of the PLA or military exports.³⁸ The phrase is a warning to military-industry managers not to move so far into commercial product lines such that, in times of war, switching back to military products is hampered. This phrase cannot plausibly be interpreted to mean that military modernization writ large takes precedence over general economic development, nor that the latter serves the former.

“Use the civilian to cultivate/support the military” has two meanings. The narrow meaning refers to plowing profits from civilian commercial products back into fixed capital upgrades for military production. The broader meaning is simply that central government revenues (e.g., taxes) from the development of the civilian economy are returned to the military industries through national defense expenditures. In other words, the phrase is a statement of fact common to all states: “Basically speaking, military expenditures come from the transformation of income from civilian products [via national government taxes]. This is the essential meaning of ‘using the civilian to cultivate/support the military.’ From this perspective, [the concept of] ‘using the civilian to cultivate/support the military’ is an objective presence [or feature] in every country’s national defense expenditures.”³⁹

This interpretation of the Sixteen Characters as a policy limited to military-industrial conversion is typical in the Chinese literature. For example, an article in the journal *Military Economic Research* notes that “combine the civilian and the military” and “combine wartime and peacetime” is a policy suited for an era in China’s development in which military industries must be subordinated to the overall task of developing the national civilian economy.⁴⁰ The most common term used in Chinese sources to underscore this broader subordination of the military to the civilian is *fu cong da ju*, or “subordinate oneself to the overall situation.” The “overall situation” typically refers to development of the national economy. Indeed, another article in the same journal quotes a speech by Jiang Zemin delivered at the closing ceremonies of the 5th meeting of the Central Committee of the 14th Party Congress: “National defense construction and the construction of the military must rely on economic construction, and be subordinate to the overall situation in the construction of the national economy [*fu cong guojia jingji jianshe de da ju*]. Only when the national economy has developed can we provide the necessary material and technical basis for national defense modernization.”⁴¹ Then, in his speech at the 15th Party Congress in September 1997, Jiang stated: “The army should subordinate itself to and serve the overall interests of national

economic development, strengthening itself through thrift and hard work and actively supporting and participating in the economic development of the country.”⁴²

A similar sentiment was expressed by Chinese defense minister General Chi Haotian in 1996, when he called for converting enterprises to keep military mobilization and production needs in view: “On condition that production of military supplies is not affected, facilities and equipment of [defense] scientific research should enthusiastically service the country’s economic construction.”⁴³ The same argument was made by the general manager of the China Aviation Industry Corporation in a 1997 article about the Sixteen Character policy: “Basically, although a nation’s national defense situation is subject to many factors, it is mainly determined by the level of economic development of the nation. Therefore, the approach that detaches itself from national development levels and simply emphasizes and develops national defense buildup cannot be maintained for long. China is rather backward, both economically and technologically. National defense buildup can only be developed to the extent permitted by national conditions and national strength; it absolutely cannot be rushed.”⁴⁴

These are not just statements for public or foreign consumption. Similar arguments are made in materials that are supposed to be off-limits to foreigners. In a book that summarized a decade or more of academic research in the PLA, published for circulation within the military only (*junnei faxing*), the authors commented on research relating to the Sixteen Character policy by noting that this research “clearly indicates that national defense science, technology, and industry must serve national defense modernization, and must also serve the modernization of the national economy.”⁴⁵

This is not to deny that “conversion” means, in the long term, the use of profits and technology acquired from the civilian economy for military modernization. Indeed, as Frankenstein notes, “[one] *intention* of conversion appeared to be not only to utilize redundant facilities, but also to apply the benefits of conversion—funds and improved technology—to the maintenance of the defense industrial base and to further military modernization. The aim, according to an article in *Military Economic Research*, is to put the defense industries ‘on the development road of the socialist market economy, and to guarantee the unbroken improvement of military production capabilities.’”⁴⁶ But the efforts to “use the civilian to support/cultivate the military” have hardly been successful, according to the Chinese sources. According to Frankenstein, a NORINCO official confided that 90 percent of defense industries were having difficulties meeting payroll. According to a Chinese newspaper, among military industries in Sichuan, where these enterprises are heavily concentrated, “most factories are on the verge of bankruptcy.”⁴⁷

In general, then, the Cox report misinterprets the economic activity of the Chinese military enterprises and the PLA. Commercialization under the guidance of the Sixteen Character policy, rather than representing the militarization of the Chinese economy, represents the fact that resources for the PLA are constrained, a constraint imposed by the economic development priorities of the political leadership. As one of the top experts on Chinese military industries, cited a number of times in the Cox report, puts it in reference to PLA enterprises (as opposed to those in the military-industrial sector): “The impetus for the expansion of the PLA into commerce came from the military budget shortfalls of the 1980s, when military modernization was the last of the ‘Four Modernizations.’ For instance, one of the goals given the PLA’s SanJiu, or 999, pharmaceutical conglomerate is to ‘play a positive role in developing the army’s production and in making up for the inadequacies in military spend-

ing.’ Other military analysts have written of ‘contradictions’ between Army requirements and budget allocations.”⁴⁸

The commercialization of the military industries under the Commission on Science, Technology, and Industry for National Defense (COSTIND), similarly, is due to resource constraints. Precisely because these industries do not have quick and easy access to state funds, and because they are poorly managed, they are, for the most part, in debt, producing smaller amounts of inferior military products. According to John Frankenstein and Bates Gill, the leading academic authorities on the Chinese military-industrial complex, the production of aircraft, bombers, ships, and tanks has all dropped in the 1990s compared with the 1980s.⁴⁹ This is one reason why the PLA would prefer to import its technology, precisely because of the sorry state of the military industries. Indeed, Zhu Rongji is reported to have stated that most of the indebted SOEs are defense SOEs.⁵⁰ Defense conversion (commercialization, more accurately) is designed primarily to sustain these enterprises through production of civilian products. Military production will benefit, the hope is, through profits that are plowed into the unprofitable production of military hardware and through taxes to the state, a portion of which will be reallocated as military expenditures.

The point of all this is that the Cox report has gotten the meaning and scope of the Sixteen Character policy wrong, despite the fact that the report’s primary source for this policy—Frankenstein and Gill’s article—clearly shows that the policy is limited to firms and factories in the Chinese military-industrial complex, not in the economy as a whole. The Cox report uses its expansive and implausible interpretation of the Sixteen Character policy to drive home its thesis that China’s economic development, including its high-tech development, is aimed primarily at meeting the needs of the Chinese military. The evidence concerning the meaning and scope of the Sixteen Character policy does not support this thesis.

2.2 The Cox report’s only evidentiary challenge to the claim (made by the Chinese and most specialists on Chinese politics) that military modernization is subordinate to economic development comes from a citation to testimony by Michael Pillsbury to the Senate Select Committee on Intelligence.⁵¹ The report states: “But as Dr. Michael Pillsbury of the National Defense University has testified publicly, the doctrinal and strategic writings of many PLA leaders and scholars are inconsistent with a subordination of military modernization efforts. In fact, according to Pillsbury, these views are ‘surprising, and perhaps even alarming.’”

The footnote (number 17) is to Pillsbury’s congressional testimony. If one looks at this testimony, however, the Cox report clearly takes Pillsbury out of context. The full quote is as follows: “In the case of China, it is at present impossible to know with confidence what the ultimate significance of Chinese writings about future warfare may be, in part because much more needs to be known about how Chinese military publications may (or may not) be related to Chinese strategy and to research, development and acquisition programs. One thing is for sure: current PLA writings about the subject of future warfare do not fit the recent direction of China’s observed modest program of military modernization. *They are surprising and perhaps even alarming.*”⁵²

The context of this quote is obvious—Pillsbury is not referring to the relative priority attached to economic and military modernization. He is referring instead to the disjunction between the writings on the nature of future warfare on the one hand and the currently

observed military modernization program on the other. His testimony then speculates as to how to identify and respond to Chinese military modernization *in the future* should these writings determine *future* policies of technology development and acquisition. Contrary to the Cox report, this is not a comment about the alleged subordination of economic modernization to military modernization in the 1980s and 1990s.

2.3 The Cox report states: “Despite the PRC’s public claims, it is estimated that their actual military spending is four to seven times greater than official figures.”⁵³

The footnote to this claim about the size of China’s military budget is to Frankenstein and Gill. However, Frankenstein and Gill do not make this estimate.⁵⁴ “Four to seven times” would put China’s expenditures in the 400–700 billion renminbi (RMB) range. While Chinese military expenditure estimates are very soft, the Cox report uses an extreme and high range that very few other serious analysts of Chinese spending use. The CIA, for instance, believes the figure is about two to three times the officially announced budget, or about 200–300 billion RMB.⁵⁵ A 1995 study by the Government Accounting Office agrees with the CIA estimate of two to three times the official figure.⁵⁶ The International Institute for Strategic Studies in London puts China’s military spending for 1997 at \$36.5 billion, or about 300 billion RMB at current exchange rates.⁵⁷ Even the U.S. Arms Control and Disarmament Agency (since reorganized as the Bureau of Arms Control and the Bureau of Non-Proliferation), which provides the highest U.S. government estimate, puts the figure at \$50–60 billion; at current exchange rates this would be about 450–550 RMB. No serious analyst of the PLA believes 700 billion RMB is a plausible figure. At the very least the Cox report should have acknowledged the more broadly held range of estimates.

2.4 The Cox report states: “Communist Party Secretary Jiang Zemin, in March 1997, publicly called for an ‘extensive, thoroughgoing, and sustained upsurge’ in the PLA’s acquisition of high technology.” This quote is footnoted (no. 27) to the BBC *Summary of World Broadcasts*, April 7, 1997.

This quote is used to emphasize the PLA’s success in getting the top leadership to pay more attention to the high-technology needs of the PLA. The quote is a misquote, however. In fact, the article that the Cox report cites states: “To implement CMC Chairman Jiang Zemin’s instructions on expeditiously whipping up an extensive, thoroughgoing, and sustained upsurge of *studying* high-tech knowledge in the whole army, the General Staff Department drew up a ‘three year plan for cadres of the whole army to study high tech knowledge’ . . .”⁵⁸ Clearly, the citation refers to instructions from Jiang Zemin to start an “extensive, thoroughgoing, and sustained upsurge” in the study of high-tech weapons in the PLA. Contrary to the Cox report, this particular citation does not state that Jiang publicly called for an upsurge in the acquisition of high technology. “Studying” may well be an integral part of the process of acquiring new technology, and Jiang Zemin may have called at some point in time for an “upsurge” in the acquisition of high technology for the PLA. But in this instance, as in others in the Cox report, the footnote reference does not support the claim in the text.

2.5 The Cox report states: “The PRC’s approach to resolving this conflict [between military modernization and economic development] has been to seek ‘comprehensive national power,’ in which high-technology industries, economic growth, and military modernization are all interrelated.”⁵⁹

In fact the concept of comprehensive national power (CNP) (*zonghe guoli*) has very little to do with the Sixteen Character policy or with the reconciliation of tensions between economic development and military modernization. It is a term used to describe the cumulative weighted effect on the power of states of a range of variables. It refers broadly to new ways of measuring the power and influence of states in an era where traditional military power is no longer as important as economic power, high-technology capabilities, and less tangible assets such as human capital and national cohesion. In both of the two most influential studies of CNP in China, one by a PLA colonel, Huang Shuofeng, and the other by a research team at the Institute of World Economics and Politics (IWEP) of the Chinese Academy of Social Sciences, military power is only one variable of several that determine a state’s overall CNP. The IWEP study, for example, uses sixty-four variables, only five of which are military variables. Together these five measures are weighted such that military power makes up only 10 percent of the final index of CNP.⁶⁰ Thus to increase CNP entails increasing a range of variables other than military power alone. Despite its introduction by the authors of the Cox report, in proper context the concept of CNP does not support the report’s overall contention that economic development is subordinate to military modernization.

2.6 The Cox report, citing the Chinese National Defense White Paper (1998) as evidence that the Chinese leadership has decided upon a rapid modernization of the PLA’s levels of high technology (footnote 28), states “The PRC’s 1998 Defense White Paper pointedly stated that ‘no effort will be spared to improve the modernizational level of weaponry.’”⁶¹

The White Paper also states, however, “Since the introduction of the policies of reform and opening to the outside world, the Chinese government has strictly controlled its defense expenditure at a comparatively low level so that it can concentrate on economic construction,”⁶² a statement that is inconsistent with the Cox report’s spin on the relationship between military modernization and economic development. In its appropriate context, the quote used in the Cox report refers to efforts within the constraints imposed by the overall policy of subordination of military modernization to economic development.

In short, the Cox report substantially mischaracterizes the nature of the Sixteen Character policy. Rather than establishing that economic modernization is subordinate to military modernization, it is clear from the sources that the Cox report itself used, as well as from Chinese-language sources, that the Sixteen Character policy refers much more narrowly to the conversion of military industries run by COSTIND.

3 Nuclear Posture and Doctrine

Discussion of China's nuclear posture and doctrine is found both in chapter 2 and in chapter 4 of the Cox report. Besides the factual errors in this discussion (as shown below), the report is exceedingly unclear about the actual state of development in Chinese nuclear weapons capabilities. There appears to be a tension between two presumed purposes of the Cox report. On the one hand, the report must explain the Chinese "demand" for U.S. nuclear and missile technology. Hence the need to underscore the technical backwardness of current Chinese capabilities. On the other, in line with what Cox Committee member Norm Dicks called its "worst-case" flavor, the report also needs to stress the imminent Chinese threat to U.S. security. Hence the stress on real-time technological sophistication and success in modernizing nuclear capabilities.

3.1 The Cox report states in footnote 1 of chapter 2: "The Select Committee believes that nuclear tests related to the development of the PRC's *next generation* of thermonuclear warheads may be continuing."⁶³ The report then goes on to state: "The PRC has acquired U.S. nuclear weapons design information that *could be utilized* in developing the PRC's *next generation* of modern thermonuclear warheads."⁶⁴ The report then states: "*Completing the development of its next-generation warhead poses challenges* for the PRC."⁶⁵ Then the report states: "Since signing the Comprehensive Test Ban Treaty (CTBT) in 1996, the PRC has faced new challenges in maintaining its modern thermonuclear warheads without physical testing. Indeed, even after signing the CTBT the PRC may be testing subcritical or low-yield nuclear explosive devices underground at its Lop Nur test site."⁶⁶ But the report also states: "The loss of design information from the Department of Energy's national weapons laboratories *helped* the PRC in its efforts to fabricate and *successfully test* its next generation of nuclear weapons designs."⁶⁷

The report apparently cannot decide whether China's nuclear test series from 1992 to 1996 has or has not enabled China to develop a new-generation miniaturized warhead for installation on its next generation of ICBMs, the DF-31, DF-41, and JL-2. The first four quotes from the report all imply that China has not yet completed the development of its next-generation warhead, will need continued underground testing, and that the CTBT, if enforced, will hinder China on this score. The last citation implies that this is all past tense, that this next-generation warhead is for all intents and purposes available.

As for the claim that China may be continuing to test nuclear explosive devices, the report does not provide any evidence. Contrary to the implication of the report, however, from 1996 up through the period when the report was finished, there is no evidence that China conducted any nuclear test explosion that would violate the CTBT.⁶⁸ It may well have conducted subcritical tests since signing the CTBT, but so have the United States and Russia, and the United States officially does not consider this to be a violation of the spirit or letter of the treaty.⁶⁹

3.2 The Cox report argues that due to China's alleged acquisition of missile-related technology and nuclear warhead design information from the United States China may deploy a new ICBM, the DF-31, as early as 2002.⁷⁰

The report implies that this deployment date is earlier than expected, and that, presumably, the deployment date would have been later had it not been for the American missile-related technology and warhead design information allegedly acquired by China. This is misleading. In fact, many sources have long predicted that the DF-31 may be deployed in the late 1990s or in the first couple of years of the 2000s. These predictions were made before any news of U.S. technology transfers to China surfaced. For instance, two of the most respected analysts of China's nuclear and missile programs, Stanford's John Lewis and Hua Di, stated in a 1992 article that the DF-31 is "expected to be operational in the mid 1990s."⁷¹ In the absence of any direct evidence of China's own expected deployment date, and since most Western analysts were not predicting a date later than 2002, then there is no evidentiary basis to suggest that the 2002 date represents a significant speeding up of Chinese deployment based on the acquisition of U.S. technology.

3.3 The Cox report states: "The PRC's announced strategic doctrine is based on the concept of 'limited deterrence,' which is defined as the ability to inflict unacceptable damage on an enemy in a retaliatory strike."⁷² The report then references this statement with an article written in 1995 about recent trends in deterrence thinking among Chinese strategists.

There are two major errors in this statement. First, the PRC has no "announced strategic doctrine," and the source used for this quote does not state that China has an announced doctrine. One major area of consensus among analysts of Chinese nuclear doctrine is precisely the point that the PRC has not yet enunciated a nuclear doctrine beyond the statement issued when China exploded its first nuclear weapon in 1964, namely that China would develop only a small arsenal and that it would be based on NFU (no first use of nuclear weapons). While there are debates among Western specialists as to what the operational doctrine might be, the Chinese government simply has not announced one.

Second, the term "limited deterrence" does not refer to the ability to inflict unacceptable damage in a second strike, commonly identified as deterrence based on mutual assured destruction (MAD) in U.S. deterrence language. Such an ability is more compatible with a "minimum deterrence" doctrine. Rather, limited deterrence (*you xian he weishe* in Chinese), as used by Chinese strategists and as indicated in the article cited by the Cox report, refers to a limited warfighting doctrine, whereby a state has the capacity to attack some range of enemy military targets, possibly preemptively, to deter war or to control intrawar escalation should deterrence fail. This is more similar to American nuclear doctrine.

While a number of PLA strategists have favorably discussed this strategy, whether it is the basis of operational nuclear doctrine is simply not clear. Limited deterrence may become the PRC's operational doctrine, in which case the doctrine will not be based on the ability to inflict unacceptable damage in a retaliatory strike. The authors of the Cox report clearly misread the article they cited for this characterization of current Chinese nuclear doctrine.⁷³

3.4 The Cox report states: "Following the detonation of its first nuclear weapon in 1964, the PRC publicly declared that it would never use nuclear weapons first against the homeland of a nuclear power or a non-nuclear nation. The PRC pointedly does not include Taiwan in this formulation."⁷⁴ The report then goes on to clarify this some more: "The PRC might allow

the first use of nuclear weapons on its own territory, which the PRC views as including Taiwan.”⁷⁵

The PRC has in fact officially (“pointedly”) included Taiwan in the scope of its no-first-use declaration. While no mention was made of Taiwan in the 1964 statement, in 1996, after a senior Chinese Foreign Ministry official was reported to state in an interview with a Western journalist that no-first-use didn’t apply to Taiwan because it wasn’t a sovereign state, a Ministry of Foreign Affairs spokesperson quickly corrected this comment by stating that no-first-use did in fact include Taiwan.⁷⁶ The original comment by the diplomat was probably a technical, legal statement to the effect that the PRC does not consider Taiwan a sovereign state. Whether this correction is credible in military operational terms is one thing. But the fact is it was made well before the Cox report began its research. Taiwan is officially included within the scope of the NFU commitment.

The Cox report seems to rely here on some research from the 1980s that China’s NFU pledge might not apply to the use of nuclear weapons on China’s territory. This speculation, however, rests on one comment by a relatively low-level Chinese strategic analyst interviewed by two American analysts in 1982.⁷⁷ In context, this individual was referring to the possible use of small-yield nuclear weapons against a blitzkrieg by Soviet armored forces in north or west China. Taiwan was not the subject of his remarks. Since then, this interview has become the secondhand source for a lot of speculation about whether China’s NFU does or does not apply to Chinese territory. There are strategists in China who would prefer to abandon the no-first-use pledge because it accentuates the vulnerability of Chinese missiles. But we have no information about their influence on actual operational plans. In other words, the evidentiary basis for this entire question of first-use on Chinese territory or against Taiwan is extremely slim. At the very least, the Cox report should have acknowledged this. We simply don’t know what Chinese operational plans might entail.

3.5 The Cox report states: “The JL-2’s 7,500 mile range will allow it to be launched from the PRC’s territorial waters and to strike targets *throughout* the United States.”⁷⁸

The footnote to this statement (footnote 26) is to a report by the National Air Intelligence Center entitled *Ballistic and Cruise Missile Threat* (NAIC-1031-0985-98).

In fact, the NAIC report does *not* claim the JL-2 will have a range of 7,500 miles. Rather, the NAIC report states that the range will be about 4,500 miles. This range will enable China to “target *portions* of the United States.”⁷⁹ Other sources also indicate that the projected range of the JL-2 is far less than 7,500 miles. The Federation of American Scientists gives a range of 8,000 *kilometers*, or about 4,800 *miles*, for the JL-2, as does the Carnegie Foundation, the Natural Resources Defense Council, and the Centre for Defence and International Security Studies.⁸⁰

Adding to the confusion in the Cox report, the authors give an entirely different range for the JL-2 in the chart on page 180. Here the Cox report states that the range is 4,871 miles. 4,871 *miles* is equal to about 7,800 *kilometers*, so it seems that authors of the report have confused kilometers and miles.

Since the Cox report states that the road-mobile DF-31 with its 5,000-mile range will only be able to hit Alaska, Hawaii, and parts of Washington state,⁸¹ then the JL-2 with a comparable range, and launched from China’s territorial waters, will also only be able to strike at

these portions of the United States. It will not, contrary to the Cox report's claim, be able to hit targets "throughout the United States" if launched from China's territorial waters.

3.6 The Cox report states that Chinese scientist Qian Xuesen was commissioned as a colonel in the U.S. army air force and "eventually began working on the Titan intercontinental ballistic missile."⁸² The report then goes on to state that Qian lost his security clearance over suspicions of spying for China. The report implies that his spying on the Titan program gave a boost to the development of Chinese ballistic missiles after Qian returned to China in 1955.

This section of the report relies on two sources for its story about Qian—an unspecified DoD briefing to the Cox Committee in December 1998 and a book on the Chinese missile program by Iris Chang, *Thread of the Silkworm*. The claim that Qian worked on the Titan program is referenced to the DoD briefing, but the entire story is given the aura of credibility through the reference to Chang's work as well. Either the DoD briefers were mistaken or the Cox report authors were mistaken. In fact Qian was denied a security clearance in 1950 and could not have worked on the Titan program, which started in 1955.⁸³

Chang herself has criticized the Cox report for misusing her research: "'As the person who wrote the definitive biography of Tsien [Qian], all I know is that the U.S. never officially charged Tsien with espionage. . . [and] in the end they found no convincing evidence that he was either a Communist or a spy,' Chang said."⁸⁴

3.7 The Cox report states in chapter 2, "Once the PRC's small, mobile strategic ballistic missiles are deployed, however, they will be far more difficult to locate than the PRC's current silo-based missiles. This will make the PRC's strategic nuclear force more survivable."⁸⁵ Then in chapter 4, referring to the development of the mobile DF-31 ICBM and JL-2 SLBM, it states: "The fact that these new nuclear weapons will be far more survivable than the PRC's current silo-based forces could signal a major shift in the PRC's current nuclear strategy and doctrine."⁸⁶

Since the Cox report has basically affirmed that the United States does and should have the ability to destroy Chinese missiles in a first strike,⁸⁷ it is not surprising that the PRC would want to improve the survivability of its missiles if it is to preserve a credible deterrent. It is unclear why survivability alone would signal a major shift in doctrine. After all, Mao Zedong called for hiding Chinese missiles in caves and valleys to reduce their vulnerability to attack, and Mao is identified with a "minimum deterrent"-like nuclear doctrine. The concern for survivability would be equally consistent with either a MAD-based second-strike doctrine or a first strike/intrawar deterrence and warfighting doctrine. A far better indicator of a shift toward a limited warfighting notion of deterrence would be MIRVing of a relatively large ICBM force. Yet the Cox report itself admits that it has no evidence that China has or will MIRV.⁸⁸

The Cox report statements also raise the whole question of what ensures strategic and crisis stability in the nuclear era. There were debates over this throughout the Cold War, but the basic concept of strategic stability, embodied in the ABM Treaty, is that mutually survivable nuclear forces where both sides can credibly threaten unacceptable damage to the other

are more stabilizing than a situation where one side has a credible first-strike option. The latter situation provides the vulnerable side an incentive to “use them or lose them,” and provides the side with the first-strike option an incentive to strike preemptively, early in a crisis, precisely to prevent the vulnerable side from “using them or losing them.” If both sides have survivable second-strike forces, then there is less premium placed on shooting first in a crisis, with a concomitant expansion of the time frame available for diplomacy.

3.8 The Cox report states: “These enhancements to the PRC’s nuclear forces, together with its expanding economic capabilities, present the PRC with additional options for changes in its strategic doctrine. *The PRC’s growing economy, for instance, could allow it to produce and deploy more missiles than earlier planned.*”⁸⁹

The logic in this statement is odd. Since no one, including the Cox Commission, knows how many missiles the Chinese “earlier planned” to deploy, nor when these plans were drawn up, it is impossible to know whether economic growth in the future will allow it to deploy more or less than planned. Moreover, since economic growth rates have, in fact, slowed somewhat in the late 1990s, and will likely continue to slow over the next few years, then logic suggests China will be able to deploy fewer missiles than “earlier planned” presumably because at the time these earlier plans were drawn up economic growth was higher.

3.9 The Cox report claims (p. 183) that of the approximately twenty CSS-4s (DF-5s) all but two were deployed in the 1990s.

This claim is made presumably to show that China has dramatically sped up the deployment of ICBMs that could hit targets in the United States. The figure of twenty deployed CCS-4s/DF-5s is a very soft figure, however. A 1998 National Intelligence Estimate on the ballistic missile threat to the United States states that China has “about 20” DF-5s.⁹⁰ The most recent International Institute for Strategic Studies annual *Military Balance*, however, puts the figure at seven.⁹¹ In 1997 the Federation of American Scientists estimate was thirteen.⁹² Robert Manning in a presentation to the Rumsfeld Commission in April 1998 put the total ICBM figure at thirteen to eighteen.⁹³ As for how many were deployed and when, at least one knowledgeable source estimates that the Chinese had deployed two to five DF-5s in the 1980s.⁹⁴ Another source puts the figure in the late 1980s at two to four.⁹⁵ The Natural Resources Defense Council estimates that two to four had been deployed by the late 1980s.⁹⁶ In other words, the evidentiary basis for the Cox report claim is problematic. The degree of uncertainty should have been acknowledged.

Conclusion

These flaws in the Cox report are not nitpicks. Nor have we provided the sum total of errors in the report.⁹⁷ The combination of factual errors, misused evidence, incorrect, misleading, or nonexistent citations, and implausible interpretative spins of existing research—interpretations that the authors of the research themselves would likely have objected to—together

create a misleading impression of Chinese politics and economics. This impression or interpretive lens appears to have had its effect, however. As one prominent example, a *New Republic* editorial concluded:

The PRC follows a Sixteen-Character Policy that, as the Cox report notes, has been codified by the central committee. This policy deliberately blurs the lines between state and commercial entities and military and commercial interests. . . . These are not isolated episodes but are part of a coherent strategy aimed at finding a way to use the American industrial base to build up the Chinese military. The truth is that in a Communist state such as China, where the party remains firmly in control, there can be no real distinction between the private and public sectors.⁹⁸

This quote represents the wholesale acceptance of the Cox report's message. However, aside from the fact that in the United States and other Western democracies the private and public sectors also work together in the military technology area, this characterization of Chinese politics, as I have indicated here, is simply inaccurate. The security relationship between the United States and China is likely to be complex and difficult at best, and is beset with important uncertainties. There are certainly many aspects of Chinese military modernization and patterns in the Chinese use of force that are not conducive to maximizing peace and development in the Asia Pacific region. There is some reason to question, as well, whether there is much basis at the moment for building a "strategic partnership" with the leadership of the People's Republic of China. But this is no excuse for imprecise writing, sloppy research, and ill-informed speculation.

Notes

¹ Note: all electronic sources from the World Wide Web were accessed during the period July 15 to August 16, 1999. My thanks to the following people for their comments on and criticisms of this assessment: Dennis Blasko, Thomas J. Christensen, John Frankenstein, Bates Gill, Paul Godwin, Michael May, James Mulvenon, Michael Nacht, Robert S. Norris, Pief Panofsky, Jonathan Pollack, Edward Steinfeld, and Michael Swaine.

² John Diamond, "China Spy Furor May Be Overreaction," Associated Press (AP), May 26, 1999.

³ John M. Spratt, Jr., "Keep the Facts of the Cox Report in Perspective," *Arms Control Today* (April/May 1999).

⁴ Cox report, 4.

⁵ *Ibid.*, 234, footnote 1.

⁶ *Ibid.*, 4.

⁷ My thanks to MIT professor Edward Steinfeld for these data.

⁸ Cox report, 5.

⁹ See, for example, Ellis Joffe, *The Chinese Army after Mao* (Cambridge: Harvard University Press, 1987), 48-62.

¹⁰ Cox report, 10.

¹¹ See, for instance, Michael D. Swaine, *The Role of the Chinese Military in National Security Policymaking* (Santa Monica, Calif.: The RAND Corporation, 1998), 61.

¹² Cox report, 9.

¹³ Ibid.

¹⁴ See for instance Article 19 of the National Defense Law in FBIS-CHI-97-055 (March 18, 1997).

¹⁵ See in particular Cox report, 9.

¹⁶ Interestingly, one of the China experts interviewed by Cox Commission about Chinese politics and the PLA sent a copy of Lieberthal's book to the staff precisely to clear up what he viewed as inaccurate assumptions about Chinese politics. This came after he was asked by one Cox Commission staffer, "I mean, the Communist Party controls everything in China, right?" His purpose in alerting the staff to Lieberthal's book was to show that politics in China was often a messy process of interagency bargaining and lower-level resistance to upper-level directives, and that the top-down characterization, embodied in the staffer's question, was inaccurate. Evidently reading Lieberthal's book had no effect on the initial views of the Cox Commission staff. My thanks to James Mulvenon for relaying this information to me.

¹⁷ For a small sampling see Kenneth G. Lieberthal and Michel Oksenberg, *Policymaking in China: Leaders, Structures and Processes* (Princeton: Princeton University Press, 1988), Elizabeth Economy, *Negotiating the Terrain of Global Climate Change Policy in the Soviet Union and China: Linking International and Domestic Decisionmaking Pathways* (Ph.D. diss., University of Michigan, 1994), Alastair Iain Johnston, "Prospects for China's Nuclear Force Modernization: Limited Deterrence versus Arms Control," *China Quarterly*, no. 146 (June 1996): 548–576; John Lewis, Hua Di, and Xue Litai, "Beijing's Defense Establishment: Solving the Arms Export Enigma," *International Security* 15, no. 4 (Spring 1991): 87–109; Kenneth G. Lieberthal and David M. Lampton, eds., *Bureaucracy, Politics, and Decision Making in Post-Mao China* (Berkeley and Los Angeles: University of California Press, 1992); Lu Ning, *The Dynamics of Foreign Policy Decisionmaking in China* (Boulder, Colo.: Westview Press, 1997); and Swaine, *Role of the Chinese Military*.

¹⁸ That the CCP must continuously emphasize that the "Party Controls the Gun" is precisely because the top leadership worries that on certain policy issues PLA preferences (or preferences of bureaucracies within the PLA) may be different from those of the top leadership. The Cox report can't seem to decide whether it should emphasize that the CCP controls PLA preferences on military modernization or that the CCP is serving PLA preferences.

¹⁹ See Li Nan, "Organizational Changes in the PLA, 1985–1997," *China Quarterly*, no. 158 (June 1999): 14.

²⁰ These complaints were outlined to me during interviews I conducted with arms-control specialists in the Ministry of Foreign Affairs, the Chinese nuclear weapons institutes, the Chinese academic community, and the Canadian embassy in Beijing from 1994 to 1999.

²¹ See Kenneth G. Lieberthal, *Governing China: From Reform through Revolution* (New York: W.W. Norton, 1995), 174.

²² Lieberthal and Oksenberg, *Policymaking in China*, 406.

²³ Ibid., 410.

²⁴ Cox report, 14.

²⁵ Ibid., 14.

²⁶ See John W. Lewis and Hua Di, “China’s Ballistic Missile Programs,” *International Security* 17, no. 2 (Fall 1992): 33.

²⁷ See “Law of the People’s Republic of China on National Defense,” FBIS-CHI-97-055 (March 18, 1997).

²⁸ John Frankenstein and Bates Gill, “Current and Future Challenges Facing Chinese Defense Industries,” *China Quarterly*, no. 146 (June 1996).

²⁹ John Frankenstein, “China’s Defense Industries: A New Course?” *Peace Economics, Peace Science and Public Policy* 5, no. 1 (Winter 1998–1999): 10.

³⁰ Estimated from table 2 and data on the total number of industrial employees in the “Communiqué of the State Statistical Bureau of the People’s Republic of China and the Third National Industrial Census Office on the Third National Industrial Census,” at <http://www.stats.gov.cn/english/gb/97gb02.html>.

³¹ My thanks to John Frankenstein for this estimate.

³² Cox report, 15. In fact the more expansive interpretation describes one of the general goals of economic modernization, but the Sixteen Character policy does not describe or “codify” this goal. Incidentally, the footnote that references this equivocal statement refers to Frankenstein and Gill, a 1998 DoD report entitled *Future Military Capabilities and Strategy of the People’s Republic of China*, and a letter from RADM Mike Ratliff, a senior officer in naval intelligence, forwarded to the Cox Committee. The Frankenstein and Gill citation does not justify the Cox report’s claims here, and neither does the DoD report since it doesn’t mention the Sixteen Character policy at all. There is no indication of what is contained in the Ratliff letter. As with other footnotes, the evidence cited in the footnote does not buttress the argument in the text.

³³ Article 30 of the National Defense Law in FBIS-CHI-97-055 (March 18, 1997).

³⁴ *Zhongguo Jun Zhuan Min* [China’s defense conversion] (Beijing: China Economics Publishing House, 1994), 33. Emphasis mine. FBIS has translated the book. See *China’s Defense Conversion*, FBIS-CHI-95-144-S (July 27, 1995). The quotations are my own translation of the original Chinese text.

³⁵ Ibid., 38.

³⁶ Ibid., 37. “Civil” here is shorthand for the “laws of economic development,” another term for market forces.

³⁷ Ibid., 38–39.

³⁸ Ibid., 39–40.

³⁹ Ibid., 41–42.

⁴⁰ See Wan Xiaoyuan, “Lun shehuizhuyi shichang jingji tiaojian xia de junshi jingji fazhan qushi” [On the development trends of the military economy under the conditions of a socialist market economy], *Junshi jingji yanjiu* [Military Economic Research] 12 (1996): 11. Emphasis mine.

⁴¹ Cited in Zhang Hanjie, “Guo ji rizi shi jundui yi xiang kua shiji de changqi fangzhen” [Practicing austerity is the military’s long-term task into the next century], *Junshi jingji yanjiu* [Military Economic Research] 7 (1997): 18.

- ⁴² Jiang Zemin, Report to the 15th Party Congress, Xinhua, September 21, 1997, in FBIS-CHI-97-266 (September 23, 1997).
- ⁴³ Chi Haotian, "Taking the Road of National Defense Modernization Which Conforms to China's National Conditions and Reflects the Characteristics of the Times—My Understanding Acquired from the Study of Comrade Jiang Zemin's Expositions on the Relationship between the Building of National Defense and Economic Development," *Qiushi* [Seeking Truth] (April 1996), in FBIS-CHI-96-120. Cited in Frankenstein, "China's Defense Industries," 31.
- ⁴⁴ See Zhu Yuli, "Learning from the Thought of Deng Xiaoping on Military-Civilian Integration of Industry," *Qiushi* [Seeking Truth], no. 17 (1 Sept. 1997): 17–19, in FBIS-CHI-97-311 (November 7, 1997).
- ⁴⁵ *Junshi xueshu yanjiu: huigu yu zhanwang* [Military academic research: Review and prospects] (Beijing: Military Sciences Publishing House, 1995) (*junnei faxing*) [Internal military circulation], 389. Emphasis mine.
- ⁴⁶ "On the development of conversion in large and medium size defense enterprises," *Junshi Jingji Yanjiu* [Military Economic Research] (February 1997): 14. Cited in Frankenstein, "China's Defense Industries," 33.
- ⁴⁷ Pei Jiansheng, "Market solution eludes remote military-industrial complex," *China Daily Business Weekly*, 6–12 November 1994, 7. Cited in *ibid.*, 28.
- ⁴⁸ Quotes from Chinese sources are "Military Organizes Transnational Enterprise Group," in FBIS-CHI, 9 December 1992, 33. Cited in *ibid.*, 12; Gu Jianyi, "*Junshi Jingji Ruogan Xianshi Wenti Fenxi*" [On current problems in military economy], *Junshi Jingji Xue* [Military Economic Studies] (June 1995): 32–35. Cited in *ibid.*, 12.
- ⁴⁹ See Frankenstein and Gill, "Current and Future Challenges."
- ⁵⁰ Frankenstein, "China's Defense Industries," 18.
- ⁵¹ Cox report, 15.
- ⁵² Testimony of Dr. Michael Pillsbury before the United States Senate Select Committee on Intelligence, November 1997. Posted on the webpage of the U.S.-Asia Strategy Council: http://www.asiastrategy.com/testimony_pillsbury.html.
- ⁵³ Cox report, 17–18.
- ⁵⁴ Elsewhere Frankenstein is only willing to go as far as to state that "most analysts believe that the 'real' Chinese defense budget is considerably more than the official figure—at least double." See Frankenstein, "China's Military Industries," 14.
- ⁵⁵ See the CIA *World Factbook 1998* at <http://www.cia.gov/cia/publications/factbook/ch.html#mil>.
- ⁵⁶ Government Accounting Office, *National Security—Impact of China's Military Modernization in the Pacific Region*. GAO/NSIAD-95-84 (June 1995) at <http://www.fas.org/irp/gao/ansi95084.htm>.
- ⁵⁷ IISS, *World Military Balance 1998/99* (1999), 297, table 46.
- ⁵⁸ Xinhua, March 31, 1997, in *BBC Summary of World Broadcasts* (April 7, 1997).
- ⁵⁹ Cox report, 17.
- ⁶⁰ See *Shijie zhuyao guojia zonghe guoli bijiao yanjiu* [Comparative research of the comprehensive national power of the major countries of the world] (Changsha: Hunan Publishing House, 1996), 69, 169.

⁶¹ Cox report, 18.

⁶² *National Defense White Paper* (State Council Information Office), July 1998, at http://www.uic.edu/~rodrigo/white_paper_98.htm.

⁶³ Cox report, 241, emphasis mine.

⁶⁴ *Ibid.*, 69, emphasis mine.

⁶⁵ *Ibid.*, 72, emphasis mine.

⁶⁶ *Ibid.*, 84.

⁶⁷ *Ibid.*, 73, emphasis mine.

⁶⁸ According to the Prototype International Data Center set up to help monitor the CTBT, and sponsored by the U.S. DoD Defense Threat Reduction Agency, there was no seismic activity within the latitude and longitude parameters of the Lop Nor testing range (roughly 41.1–41.8N and 88.2–88.9 E) from China's last test in 1996 through December 1998. See the *Reviewed Event Bulletin* (a list of global seismic events) at <http://www.pidc.org/dataproduct/prod.html>. The *Washington Times* claims that an unnamed U.S. official said that the Chinese might have conducted a "large underground nuclear explosion that was carried out in an 'evasive way' by the PRC to avoid international detection" at their test site at Lop Nor in Xinjiang province sometime in the first half of June 1999. See Bill Gertz and Rowan Scarborough, "Small Nuke Test?" *Washington Times*, June 18, 1999, 9. However, according to the *Reviewed Event Bulletin* no detectable seismic activity occurred in the first two weeks of June within the latitude and longitude parameters of the Lop Nor testing range. See also the Nuclear Explosions Database maintained by the Australian government at http://www.agso.gov.au/information/structure/isd/database/nukexp_query.html.

⁶⁹ The United States and Russia have conducted several subcritical tests since signing the CTBT in 1996. For example, on the U.S. subcritical test in July 1997 at the Los Alamos test site in Nevada see <http://www.acronym.org.uk/17sub.htm>. On the role of subcriticals in the maintenance of U.S. nuclear weapons see the testimony before the Senate Subcommittee on International Security, Proliferation and Federal Services, October 27, 1997, at http://www.fas.org/spp/starwars/congress/1997_h/sh105-267.htm.

⁷⁰ Cox report, 61.

⁷¹ Lewis and Hua, "China's Ballistic Missile Programs," 11.

⁷² Cox report, 192.

⁷³ The article cited was mine. See Alastair Iain Johnston, "China's New 'Old Thinking': The Concept of Limited Deterrence," *International Security* 20, no. 3 (Winter 1995/96).

⁷⁴ Cox report, 192.

⁷⁵ *Ibid.*, 193.

⁷⁶ Agence France-Presse, August 6, 1996. Most recently, perhaps partly in response to the Cox report, the Chinese government again officially stated again that China would not use nuclear weapons against Taiwan. A Foreign Ministry spokesperson stated: "We will not be the first to use nuclear weapons and will not use nuclear weapons against non-nuclear-weapons countries and regions, let alone against our Taiwan compatriots." Charles Hutzler, "China Won't Use Nukes vs. Taiwan," Associated Press, Beijing, September 2, 1999.

⁷⁷ Banning Garrett and Bonnie Glaser, *War and Peace: The Views from Moscow and Beijing* (Berkeley, Calif.: Institute of International Studies, 1984), 126. One of the most thorough

surveys of open and closed Chinese writings in the 1970s and 1980s on theater and tactical nuclear weapons and the problem of a Soviet blitzkrieg doesn't indicate any discussion about first-use on Chinese territory. See Chong-pin Lin, *China's Nuclear Weapons Strategy* (Lexington, Mass.: Lexington Books, 1988), especially 87–88.

⁷⁸ Cox report, 187. Emphasis mine.

⁷⁹ See the NAIC report at <http://www.fas.org/irp/threat/missile/naic/part06.htm> (my emphasis).

⁸⁰ For FAS estimate see <http://www.fas.org/nuke/guide/china/slbm/index.html>. For the Carnegie Foundation see <http://www.ceip.org/programs/npp/numbers/china.htm>. For the NRDC see <http://www.nrdc.org/nrdcpro/fpprog.html>. For the CDISS see <http://www.cdiss.org/btablea.htm#INDEX>.

⁸¹ Cox report, 182.

⁸² *Ibid.*, 178.

⁸³ See the comments on Qian and the Titan program made by space expert Mark Wade at <http://www.fas.org/news/china/1999/990528-prc2.htm>; and “Errors Mar Cox Report” James Oberg, Special to ABCNEWS.com, at http://abcnews.go.com/sections/science/oberg_archives/oberg_archives.html.

⁸⁴ “Author Denounces Cox Report: Iris Chang tells conventioners that her research was misused,” Perla Ni, *Asiaweek* (June 3, 1999). http://www.asianweek.com/060399/news_irishchang.html.

⁸⁵ Cox report, 62.

⁸⁶ *Ibid.*, 193.

⁸⁷ “Because they will be much more difficult to locate and destroy than the PRC's current silo-based ICBM force, these new mobile ICBMs will present a more credible threat against the U.S. in the event a crisis develops over a regional conflict in East Asia.” Cox report, 192.

⁸⁸ Cox report, 196.

⁸⁹ *Ibid.*, 194.

⁹⁰ See the comments by Robert Walpole, national intelligence officer for Strategic and Nuclear Programs at the Carnegie Endowment for International Peace, at <http://www.ceip.org/programs/npp/brief13.htm>.

⁹¹ *World Military Balance* 1998/99, 178.

⁹² See <http://www.fas.org/nuke/guide/china/icbm/index.html>.

⁹³ See http://www.fas.org/irp/threat/missile/rumsfeld/pt2_manning.htm.

⁹⁴ Harlan Jencks, “PRC Nuclear and Space Programs,” in Richard Yang, ed., *Yearbook on PLA Affairs, 1987* (Kaohsiung: Sun Yat-sen Center for Policy Studies, 1988), 106.

⁹⁵ See Ngok Lee, *China's Defence Modernization and Military Leadership* (Sydney: Australian National University Press, 1989), 64, table 2.2.

⁹⁶ My thanks to Stan Norris of the NRDC for this estimate.

⁹⁷ See for example the long list of factual errors in the Cox report description of the Chinese satellite launch program at <http://www.fas.org/news/china/1999/990528-prc1.htm>.

⁹⁸ Editorial “Broken Engagement,” *The New Republic*, June 14, 1999.

A Critique of the Cox Report Allegations of Theft of Sensitive U.S. Nuclear Weapons Information

W. K. H. Panofsky

1 Factual Assessment: Nuclear Weapons

1.1 Context

The Cox Commission was established in June 1998 by House Speaker Newt Gingrich primarily to investigate the alleged security and corruption problems associated with the launching of American satellites on Chinese rockets. The investigations were broadened in October 1998 to include alleged security problems at the U.S. nuclear weapons laboratories resulting in the alleged theft of nuclear-weapons-related information by the People's Republic of China. The commission released its report in highly classified form in January 1999; public release followed after an extensive debate as to what parts of the report should remain classified in order to protect "sources and methods" of U.S. intelligence collection. Thus the commission with its staff of about fifty individuals dedicated about four months to examining nuclear-weapons-related issues.

In addition to the report of the Cox Commission, there have been numerous other recent investigations of the alleged leakage of American nuclear-weapons-related information and of the security management at American nuclear weapons laboratories. A committee for the Intelligence Community (IC), headed by Admiral David Jeremiah, completed its investigation in late 1998 and an impact statement reflecting the alleged nuclear weapons information losses was issued by the Intelligence Community, also late in 1998. In addition, President Clinton chartered a subgroup of four individuals drawn from the President's Foreign Intelligence Advisory Board (PFIAB) to investigate the problems associated with security in

the U.S. nuclear weapons establishment. That committee, headed by the PFIAB chairman former senator Warren Rudman, issued its unclassified report in June 1999. That report had a much narrower focus: its target was the organization of the Department of Energy in security-related matters rather than a critical evaluation of the impact of alleged information transfer in the nuclear weapons area to China.

In contrast to the largely undocumented statements of the Cox report, the reports by the IC are much more cautious and factual than the report and its preceding leaks in the media. The Rudman report associates its position on Chinese spying on U.S. nuclear information with that of the IC, not with the Cox report. In fact Rudman et al. state: "Possible damage has been minted as probable disaster; workaday delay and bureaucratic confusion have been cast as diabolical conspiracies. Enough is enough."

The Information Office of China's State Council released a document on July 15, 1999, titled "Further Refutation of the Cox Report, Critically Responding to Most of the Cox Commission's Allegations."¹

The United States is one of five nuclear weapons states; China detonated its first nuclear device thirty-five years ago in 1964. China's nuclear weapons program benefited initially from collaboration with the Soviet Union. This was terminated in the early 1960s and was followed by an intense indigenous effort, which was largely shielded from the negative impact of the Chinese Cultural Revolution. Leadership of the Chinese program was exercised by highly capable Chinese scientists and engineers, some but not all of whom were trained in the United States and Europe.²

Essentially all nations in the world operate intelligence agencies whose goal is, among others, to collect information from other nations which those nations wish to protect from disclosure. The United States supports by far the largest intelligence-collection effort among the countries of the world. A budget of approximately \$30 billion is dedicated to its Intelligence Community, consisting of the Central Intelligence Agency (CIA), the Defense Intelligence Agency (DIA), the National Security Agency (NSA), the intelligence agencies of the armed services, and other agencies. Customarily intelligence agencies do not publicly herald their achievements in penetrating other countries' security protective systems, nor do they advertise when their own protective barriers have been breached. Release of the episodes of alleged Chinese spying, designated as "thefts" in the Cox Commission report, is a singular event in the public history of intelligence collection.

The report of the Cox Commission was unanimous and thus bipartisan. However, after release of the report, Congressman John M. Spratt Jr. of South Carolina released a long factual statement which de facto dissents from many of the major conclusions of the Cox Commission report. Inquiry into the basis of this unanimity revealed that the Democratic leadership in the Congress decided that the output of the Cox Commission should not become a matter of political contest since the issues could not be productively debated in the upcoming presidential and congressional campaigns.

1.2 General Comments on the Reports of the Cox Commission and the Rudman Committee, and the Impact Statement of the Intelligence Community

A fundamental problem with the reports cited is the fact that they do not reference the above context but state their conclusions in absolute terms. Therefore the reader has no way to judge the importance of the allegations, quite apart from judging whether the allegations are factually correct. Moreover almost all conclusions are not supported either by argument or

sources. In contrast, the impact report of the Intelligence Community is much more cautious in admitting ignorance about details of alleged losses and about the impact of such losses on the present and future performance of Chinese nuclear weapons systems. In this paper I will critically confront the assertions in the Cox report concerning Chinese nuclear spying. I will then examine the relevance of the alleged nuclear weapons information losses to U.S. national security. This approach raises both serious questions as to the factual basis for the extent of Chinese penetration as well as the significance of the losses alleged in the Cox report.

The Cox Commission maintains that Chinese intelligence-collection efforts extend greatly beyond those managed by the two established Chinese intelligence organizations. The named agencies are the Ministry of State Security (MSS) and the General Staff's Military Intelligence Department (MID). The report correctly states that Chinese military attachés are intelligence officers but fails to state that U.S. military attachés at foreign (including Chinese) U.S. consulates are employees of the DIA.

The Cox Commission claims that "the PRC is increasingly looking to PRC scholars who remain in the United States as assets who have developed a network of personal contacts that can be helpful to the PRC's search for science and technology information" (Vol. 1, Ch. 1, p. 41). Even Chinese dissidents who left for the United States are designated as "sleeper" agents.

The Cox Commission report makes largely unsupported allegations about theft of nuclear weapons information, but the impact of losses is either greatly overstated or not stated at all. From the point of view of U.S. national security, answers to the following three questions are crucial, but are not addressed in the Cox report:

1. What, if any, specific factual information has been compromised *beyond what is publicly known*, and how important is it?
2. Is the alleged "stolen, but not publicly available" information of sufficient value to the PRC to lead to new designs that can be fielded *without nuclear tests*, which China has proclaimed it will not conduct, considering its signature of the Comprehensive Test Ban Treaty?
3. What *impact* would such weapons have on the national security of the United States?

The remainder of this section lists and comments on crucial statements in the Cox Commission report.

A. The People's Republic of China (PRC) has stolen design information on the United States' most advanced thermonuclear weapons. (Overview, p. ii)

For reasons noted above, it is extremely difficult to judge the significance of a broad statement of this kind. It is alleged that classified information on some thermonuclear weapons has been transmitted to the PRC through channels not specified in the unclassified report other than the "walk-in" agent. No evidence is presented as to the extent to which that information goes beyond that publicly available, nor does the report give any indication as to the extent to which the transferred information has added to that developed by the Chinese indigenously.³ Additionally, no comparison is given as to the relative success of the diversion to the PRC relative to that to other foreign countries.

B. The stolen information includes classified information on seven U.S. thermonuclear warheads, including every currently deployed thermonuclear warhead in the U.S. ballistic-missile arsenal. (Overview, p. iii)

The report elaborates only on the W-88 and the W-70. These are discussed further below. The report states without either foundation or elaboration that “thefts” have occurred in relation to other warheads deployed by the United States.

C. The stolen information also includes classified design information for an enhanced radiation weapon (commonly known as the “neutron bomb”), which neither the United States, nor any other nation, has yet deployed. (Overview, p. iii)

China tested an enhanced radiation weapon in 1988 but has not deployed such a device. This information was well known in the U.S. technical community. The United States tested several versions of enhanced radiation weapons and, in contradiction to this statement, has deployed the W-70 on the Lance short-range ballistic missile and has mounted an enhanced radiation weapon on the Sprint ABM atmospheric interceptor. Deployment was restricted to the continental United States. For reasons discussed separately, this so-called neutron bomb lacks significant military utility. Therefore the relative extent to which the neutron bomb developed, but not deployed, by China used indigenous talent or externally acquired sources is essentially irrelevant.

D. The PRC has obtained classified information on the following U.S. thermonuclear warheads, as well as a number of associated reentry vehicles (the hardened shell that protects the thermonuclear warhead during reentry).

E. The Select Committee judges that the PRC will exploit elements of the stolen design information on the PRC’s next generation of thermonuclear weapons. (Overview, p. v)

No information is given which traces China’s existing nuclear weapons, deployed or undeployed, directly to identified U.S. classified nuclear weapons sources. It is presumed that the PRC may be engaged in a process aimed at modernizing its nuclear forces. However, the PRC has signed the Comprehensive Nuclear Test Ban Treaty (CTBT) and, notwithstanding the lack of ratification by the United States and the People’s Republic of China, has stated it will not test in the future as required by the Vienna Convention on the Law of Treaties. It is therefore difficult to believe that it will deploy a “next generation of thermonuclear weapons.” New designs of the “physics package” without nuclear testing are extremely difficult, if not impossible. There is consensus within the U.S. nuclear weapons community that no foreign country, including China, would develop and deploy new thermonuclear weapons of designs entirely based on clandestinely obtained information. Thus there is no way to judge the extent, should China field a new generation of thermonuclear weapons, of the benefit derived from publicly available knowledge, indigenous design efforts, and clandestinely obtained information.

F. The stolen U.S. nuclear secrets give the PRC design information on thermonuclear weapons on a par with our own. (Overview, p. vi)

It is extremely unlikely that this statement is true. Current Chinese nuclear weapons designs are considerably less advanced than those of the United States measured by almost all available parameters. It is extremely unlikely that this situation will change drastically, in particular in the absence of nuclear tests. It should be noted that the report maintains that PRC penetration of U.S. labs commenced in the late 1970s. The “modern” W-88 was then already developed; the alleged W-88 “theft” was therefore of already old U.S. technology. The conclusion that PRC design information is “on a par with our own” is not credible considering the characteristics of current Chinese weapons.

G. The Select Committee judges that elements of the stolen information on U.S. thermonuclear warhead designs will assist the PRC in building its next generation of mobile ICBMs, which may be tested this year. (Overview, p. vii)

A Chinese road-mobile ICBM, the DF-31, has been initially tested this year. But it is extremely unlikely that the DF-31 will at the same time carry a new untested warhead. Development of a road-mobile missile would increase the survivability of Chinese land-based nuclear forces, which in their present fixed-silo form could be targeted by the United States.

Subsidiary statements are made by the committee regarding introduction of small thermonuclear warheads without any evidence that weapons derived from the “stolen” W-88 design will be carried by the delivery systems, in particular without nuclear tests.

H. The Select Committee judges that, if the PRC were successful in stealing nuclear test codes, computer models, and data from the United States, it could further accelerate its nuclear development. (Overview, p. ix)

This statement is hypothetical. Indeed high-performance computers *could* accelerate nuclear weapons development in China. While this may indeed be true, it should be noted that the W-88, which is at this time the most modern warhead on the U.S. submarine fleet, was developed using computers of much lower capacity than high-performance computers now on the open market. The whole question as to the extent to which the export of high-performance computers can be controlled in the present international markets is discussed in another CISAC report.⁴

I. In the near term, a PRC deployment of mobile thermonuclear weapons, or neutron bombs, based on stolen U.S. design information could have a significant effect on the regional balance of power. (Overview, p. x)

While this statement implies that the relative nuclear *strategic* balance between China and the United States is not affected by the alleged diversions, it states that the “stolen” information could have significant impact on the regional balance. Extensively deployed mobile-based and survivable thermonuclear weapons could indeed affect both strategic and regional relations. The question of how the survivability of Chinese nuclear forces affects U.S. inter-

ests and nuclear stability is complex and needs discussion. Again, the question is ignored of how new thermonuclear warheads could be developed in the absence of nuclear testing. Moreover, as discussed in another section of this paper, the opinion is widely held that a neutron bomb is not a weapon of significant value in tactical combat.

J. Despite repeated PRC thefts of the most sophisticated U.S. nuclear weapons technology, security at our national nuclear weapons laboratories does not meet even minimal standards. (Overview, p. x)

K. Counterintelligence programs at the national weapons laboratories today fail to meet even minimal standards. (Overview, p. xi)

This allegation is meaningless without context. In particular, the term “minimal standards” needs to be defined. Security at our national nuclear weapons labs is in fact high in many aspects. There are effective guard forces, security clearance checks, automated gates, and so forth. There is considerable security awareness. Counterintelligence programs exist but their scope seems inadequate to meet the needs. There clearly have been security lapses and improvements are needed, but the question of what these are to be is not addressed in the Cox report. Moreover, the question of how a system of security administration meeting the “highest standards” can cover the vast number of people and volume of classified information and materials without undue interference with the efficient performance of work is not addressed. Note that classified design information on nuclear weapons is held not only at the national weapons laboratories but is also widely disseminated throughout the nuclear weapons complex of the Department of Energy and throughout many parts of the Defense Department and its contractors, in particular in respect to deployed weapons systems. The Cox Commission does not address security outside the nuclear weapons labs.

Let me compare some of the statements made in the Cox Commission report with the conclusions of the Intelligence Community on the impact of the alleged losses.

The Cox Commission states that “the People’s Republic of China has stolen classified information on all of the United States’ most advanced thermonuclear weapons” (Overview, p. ii) and “the PRC next generation of thermonuclear weapons currently under development will exploit elements of stolen design information” (Vol. 1, Ch. 2, p. 61). In contrast, the Intelligence Community states: “We cannot determine the full extent of weapons information obtained, for example we do not know whether any weapon design documentation or blueprints were acquired.”

The Cox Commission report alleges that information acquired through spying has “saved the People’s Republic of China years of effort” (Vol. 1, Ch. 2, p. 62, 73), but this conclusion is not supported by evidence and not confirmed by the Intelligence Community. More specifically, the Intelligence Community concludes that among “espionage, contact with U.S. and other countries’ scientists, conferences and publications, unauthorized media disclosure, declassified weapon information, and Chinese indigenous development, *the relative contribution of each cannot be determined.*” In contrast, the Cox Commission discusses only the alleged thefts and does not discuss the other sources of Chinese advances in nuclear weapons technology.

1.3 Findings Concerning the Alleged Theft of Information on the W-70 and the W-88 and Classified Weapons Codes

The W-70 nuclear device exists in two versions, one of which is an “enhanced radiation” weapon. In turn, enhanced radiation weapons amplify the lethal flux of prompt radiation while diminishing somewhat the effects of blast, thermal output, and delayed radiation through fallout. The term “enhanced radiation” can refer either to enhancement of the thermal x-rays of the device or to enhancement of the neutron flux (above 10 MeV) produced. Enhanced radiation weapons amplifying the thermal x-ray flux were used by the United States for the Spartan warhead, designed to intercept incoming missiles outside the atmosphere. Enhanced radiation weapons using increased neutron fluxes are incorporated in a variant of the W-70 which was deployed in the short-range U.S. Lance missile, and another in an enhanced radiation warhead (W-66) was deployed in the atmospheric Sprint ABM interceptor. The latter applications are popularly designated by the term “neutron bomb.” As noted above, the Cox report states, incorrectly, that “[t]he U.S. has never deployed a neutron weapon” (Vol. 1, Ch. 2, p. 61).

The United States did not deploy enhanced neutron radiation weapons overseas and discontinued the U.S. deployment of the W-70 and any other version of enhanced radiation weapons after it was broadly recognized that such systems lacked military utility. The advantage on the battlefield claimed for the “neutron bomb” was that its lethal radius would be very sharply defined and that therefore collateral damage effects associated with the use of nuclear weapons could be minimized. The popular notion that neutron bombs would kill people while leaving buildings standing is untrue. The neutron bomb confers no advantage against cities and other “soft” targets. High-energy neutrons can penetrate heavy radiation shields. At best, it was thought it could confer an advantage against tanks, destroying them while not damaging neighboring villages. More detailed analyses taking into account variability of terrain and intervening absorbers indicated that broader claims were largely unfounded. Moreover, radiation as a weapon in combat is of dubious value since there is a wide range between a radiation dose which will eventually prove lethal and the dose required for incapacitation.

China first tested a neutron bomb in 1988 but never deployed such a weapon. Thus the alleged “theft” of classified information related to the W-70 is essentially *irrelevant to the present or future military posture of China, either strategically or tactically*.

The situation concerning the W-88 is more complex. The W-88 is the weapon deployed on the U.S. missiles carried by the Trident submarines. It was designed about thirty years ago but is regarded as a “modern” two-stage thermonuclear weapon. The warheads of the Trident missile carry a number of slender reentry vehicles (MIRVs) which are designed for high accuracy because of their relatively high weight-to-drag ratio. The W-88 in turn was designed to fit into such slender ammunitions and to produce a relatively high yield-to-weight ratio.

China tested a system exhibiting principles possibly similar to those incorporated in the W-88 several years ago, but no evidence is given in any of the reports that the design of that weapon was derived from information “stolen” from the United States. Its system is believed to be larger than the W-88 and is not even remotely a copy or a “knock-off,” to use Congressman Cox’s term, of the W-88.⁵

The evidence for the allegation that design-related information for the W-88 has been stolen derives largely, if not entirely, according to the Cox report, from a Chinese “walk-in”

agent who provided the CIA in 1995 with a classified PRC document which in turn references classified U.S. design information relating to the W-88. The report does not provide any evidence about what motivated the Chinese “walk-in” to reveal the results of Chinese espionage, which could in fact be considered incriminating to the “walk-in” agent. The provenance and sponsorship of the agent have not been made clear. However, whatever the explanation for this somewhat bizarre episode may be, if indeed the PRC document was genuine and it included classified information about the W-88, and not just publicly available sensitive information, it would provide evidence that China did access U.S. classified information on this warhead. No source of the alleged leakage is given; in view of the widespread dissemination of information and widespread deployment of the W-88, the source of the alleged leak has not been localized. In view of the above, some discussion on the potential impact of this episode is in order.

The present Chinese inventory of nuclear weapons is estimated to be:

Chinese Strategic Nuclear Forces, 2005–2010			
Type	Range/Payload (Km/Kg)	<u>Total Forces</u>	
		1998	2005–2010
Land-Based Ballistic Missiles			
DF-3/3A (CSS-2)	DF-3: 2,650/2,150 DF-3A: 2,800/2,150 Warhead: 3.3 MT	38	38+
DF-4 (CSS-3)	4,750/2,200 Warhead: 3.3 MT	10+	~10
DF-5 (CSS-4)	DF-5: 12,000/3,200 DF-5A: 1,300/3,200 Warhead: 4–5 MT	~20	~28
DF-21/21A (CSS-5)	DF-21: 1,700/600 DF-21A: 1,800/600 Warhead: 200–300 KT	30	30+
DF-31	8,000/700 Warhead: 100–200 KT	Under development	N/A
DF-41	12,000/800	Under development	22+
Strategic Submarines and Submarine-Launched Ballistic Missiles			
Julang-1 (CSS-N-3)	17,000/600 Warhead: 200–300 KT	12	~12
Julang-2	8,000/700 Warhead: 100–200 KT	Under development	<96
SSBN	N/A	1	<6
Note: Nuclear warhead yields are expressed in kilotons (KT) and megatons (MT), indicating an explosive force equivalent to that amount of TNT.			
~100 Strategic ~450 Total		U.S. Enduring Stockpile ~10,000	

Source: Ming Zhang, *China's Changing Nuclear Posture* (Washington, D.C.: Carnegie Endowment for International Peace, March 1999).

It is extremely improbable that a foreign country would or even could copy a specific design for which partial information was obtained through espionage but where no actual drawings or prints were acquired. Rather, it is plausible that, if motivated, China could improve its existing design by employing similar basic design ideas and principles with this information. The result could be a more compact small medium-yield thermonuclear warhead. This in turn could be used in producing warheads for a multi-warhead missile either not individually targetable (MRV) or multiple independently targetable reentry vehicles (MIRV).

China has neither developed nor deployed multiple warhead missiles. It is of course not known what China will do in the future, but one can conclude that a MIRV-capable missile could not offer any significant strategic advantage to China in relationship to the United States in the foreseeable future. Let me explain the basis for this statement.

At this time China has only about twenty long-range deliverable missiles, and that number is unlikely to more than double within the next decade. China is the only nation among the declared nuclear weapons states that has officially adopted a “no first use” policy, that is a policy under which nuclear weapons would be used only after attack against China with nuclear weapons by others. In its relationship to the United States this is the only policy China could, as a practical matter, adopt, since the United States has many thousands of nuclear warheads which could be directed against China. Thus, vis-à-vis the United States China can maintain only a second-strike posture as a deterrent since for decades to come it could not consider a preemptive nuclear strike under any circumstances.

Let us discuss in further detail how the strategic nuclear relationship between the United States and China might be affected if China should decide to MIRV its long-range missiles capable of reaching the United States. Let us assume that for reasons noted above China will continue to proclaim, and adhere to, its “no first use” posture.

Since, predictably, the number of China’s missiles capable of reaching the United States will remain small, MIRVing these missiles could enable China to threaten a larger number of retaliatory targets in the United States. Whether or not that is an advantage is arguable.

As a simple calculation⁶ taking into account the damage versus yield relationship against soft targets and the loss in total yield resulting from fractionating the payload, total *damage expectancy is reduced* by MIRVing the available payload. On the other hand, MIRVing generates a threat against a larger number of retaliatory targets and this might be a bargaining or prestige advantage in a situation of rising tension.

MIRVing its long-range missiles would result in an increased demand on China’s weapons-usable fissile materials where China may face some limits. MIRV’d land-based missiles would make these a higher-value target to preemptive attack unless they are survivably based—i.e., made land-mobile. Note that at this time China has deployed only one SLBM submarine carrying medium-range missiles and appears to have encountered significant difficulties with this system. Thus a significant Chinese sea-based retaliatory force carrying MIRV’d strategic missiles is not expected in the foreseeable future.

Another motivation for a potential Chinese MIRV’d strategic force is its ability to penetrate the proposed U.S. national missile defense (NMD). However, this can also be achieved by other cheaper penetration aids such as balloons.

While the above arguments each have limited merit, they partially offset one another and at any rate have only minor leverage on the U.S.-China strategic relationship. Thus the only real advantage of more compact warheads to China would be that, given successful development of the associated missile system, they could lead to a more survivable land-mobile

deployment. This is not a threat to the United States but provides for an increase in strategic stability. In summary, even a worst-case projection of the consequence of the alleged compromise of the W-88 design would not be a matter of significant military concern to the United States.

The Rudman report complains that the principal governmental investigations of the alleged leakage of nuclear weapons information have concentrated almost entirely on the W-70 and W-88. The allegations, and by implication the information transmitted by the “walk-in” Chinese agent,⁷ cover some unspecified classified information which does not extend to drawings and complete documents. We do not know the extent to which this information goes beyond what is available publicly from unclassified sources, such as the weapons design data books published by the Natural Resources Defense Council (NRDC). Therefore the extent, let alone the significance, of these additional alleged information transmissions is impossible to assess from the unclassified reports, but the above discussion indicates that *the impact on U.S. security is strictly limited.*

Similarly, the importance of the much-publicized episode of the Los Alamos scientist Wen Ho Lee is difficult to assess. Lee was removed from his job on grounds that he transcribed classified-weapons-related computer codes to an unclassified system. No explanation is given for why he did this and no evidence seems to indicate that the information once transcribed was in fact made available to a foreign country. Lee has not been charged with any crime. The codes in question are the so-called legacy codes which contain information about the physical processes relevant to the behavior of nuclear weapons such as high-pressure hydrodynamics, radiation transport, etc. They also contain historical information. Clearly such codes, should they be made available to a foreign country, could add to the basic knowledge within that country relating to weapons physics design, but the usefulness of that knowledge clearly depends on the level of erudition already existing there. It is dubious that these codes would have materially aided the Chinese nuclear weapons program. China has had a highly competent nuclear weapons program, and we should note again that it has nuclear weapons experience of thirty-five years. Such codes would be quite difficult to interpret but possibly could assist the Chinese in general background information. They would not be sufficient to lead to a new design, especially not one that could be deployed without tests.

The Cox report also alleges (Vol. 1, Ch. 2, p. 85) that certain U.S. named codes (the MCNPT, the DOT 3.5, and the NJOYC codes) have been acquired. However, these codes are open reactor engineering codes available worldwide.

The utility of such codes, either of the alleged stolen classified variety or the identified openly available material, is of very limited value to a foreign nuclear weapons country. Classified codes are very specialized, containing many empirical entries and normalizations which limit their utility to particular designs.

The Cox report alleges that the “stolen” information would make it possible for China to develop new nuclear weapons which could enter its stockpile without testing, alleging that it could not do so otherwise. This claim is strongly contradicted by nuclear weapons designers in the United States. In particular, Harold Agnew, a former director of Los Alamos, has stated categorically that China could not develop new nuclear weapons with or without testing a nuclear device based on leaked nuclear weapons information. He points out that no responsible designer would stockpile a weapon designed from foreign codes; such codes are by necessity incomplete and Agnew notes that they may even contain deliberate “viruses” which would make the resulting product defective if designed from such codes.⁸

Whatever the quantity and quality of nuclear weapons design information which the Chinese may have derived by espionage, such designs would have to be developed, weaponized, and produced, and, depending on their level of sophistication, would have to be tested. Therefore the optimum protection against China effectively utilizing such information would be the coming into force of the CTBT. While there is not universal agreement on this point, American weapons designers generally concur that nuclear weapons based on existing *physics packages* can be maintained safely and reliably under an adequate Stockpile Stewardship Program (see section 1.5). But all agree, however, that any designs incorporating new physics packages should not be stockpiled without nuclear weapons tests.

1.4 Comments on the Criticisms of the Security and Counterintelligence Process of DOE As Applied to the National Labs

The principal but not the only focus of protecting nuclear-weapons-related information today should rightly be to prevent its release to non-nuclear-weapons states in order to keep the lid on nuclear weapons proliferation; that is, to limit the number of undeclared or declared nuclear weapons states. Thus it remains essential to U.S. national security to maintain highly secure barriers around nuclear weapons design information and to erect the strongest possible safeguards to protect nuclear-weapons-usable materials.

These conclusions are based on the overwhelming military power of the United States in both conventional and nuclear weapons. The United States has a great deal to lose should nuclear weapons proliferate further, but its security is very unlikely to be significantly affected by changes in the nuclear posture of the minor nuclear weapons states (China, the United Kingdom, and France). The damage assessment of the Intelligence Community rather than the Cox report provides a guide in judging the military significance of the losses that may have occurred. The limits on the impact of the alleged losses, even under worst-case assumptions, are discussed in the previous section.

How are we to judge the *criticisms of the security and counterintelligence process of DOE as applied to the national labs*, in light of the significance of the actual “losses,” in comparison with the opportunities that the American system of open scientific inquiry, including involvement with foreign scientists, offers to the United States?

The Rudman report provides an extensive summary of the vulnerabilities of the U.S. labs to foreign penetration which have existed for several decades and which exist today. It cites a dismal record of repeated criticisms of DOE’s security and counterintelligence administration from a variety of sources: reviews internal to DOE, congressional reviews, reviews by the General Accounting Office, and reviews by ad hoc bodies. The common judgment of the Rudman panel is that the impact of these reviews on the implementation of actual security measures has largely been short-range and that many of them have been ignored. The Rudman panel traces this resistance to change to a number of major structural defects within DOE and to the general arrogance of the scientific and technical community concerned in rejecting external oversight. Thus the Rudman panel in “purple prose” proposes a major reorganization in which the administration of all national security activities currently under the aegis of DOE would be incorporated into either an autonomous agency reporting to the president or a semiautonomous agency under a new undersecretary reporting directly to the secretary of energy. The current political discussions involving DOE, the Congress, and the president’s office focus on the latter alternative, but the outcome of these discussions remains uncertain at the time of this writing.

To this writer there is considerable attraction to incorporating the security functions of DOE (defense programs, nonproliferation and national security, and fissile materials management, as well as counterintelligence and security oversight) into a division of DOE under direct-line responsibility of an undersecretary. The Rudman panel outlines many reasons in support of such a reorganization. One very important by-product of compartmentalizing the security functions within DOE is that this decreases the impact of tighter security restrictions within those parts of DOE where security restrictions are needed in relation to those parts of DOE where they are not. One of the serious problems that continues to beset current DOE practices is in the formulation of DOE-wide regulations, orders, and other controls. The rules as formulated tend to be overbroad: while correcting alleged deficiencies in one sector of the department, burdensome rules are generated which impede efficiency in another.

In the past DOE has gone through a series of "alarms" leading to preoccupation with diverse administrative deficiencies, such as those in operational reliability, quality assurance, environment, safety and health, and now security. Once deficiencies in each one of these cases were recognized, the general response was to create new organizational units, reporting to the "highest level" and specifically dedicated to managing the aforementioned topics. Yet each one of these items should be an integral part of the culture which is dedicated to carrying out the technical and scientific work of the department, rather than being delegated to a separate organizational unit. Indeed specified organizations dealing with each one of the items cited can be very useful if they provide *services* such as specialized expertise and resources to each operating-line unit and if they have "stop work" or other policing responsibilities to respond to crucial emergencies. But they should *not dilute the line responsibilities* of the functional operating units.

Imposing "czars" to assume control over such items, be they quality assurance, safety and health, or security, tends to dilute the responsibility of each operating-line department. In addition, as a practical matter such central control is impossible to exercise efficiently since the technical substances of the activities to be controlled are extremely diverse. A security "czar" as recently established in DOE reports directly to the secretary, while officers responsible for both military and nonmilitary *programs* report "through channels." Thus the checks and balances between the program needs and security objectives become inoperative. Therefore "security by achievement," which has served U.S. military power well in the past, takes second seat to "security by restriction," which ultimately is a perishable commodity. The Rudman recommendations are reasonable and could be implemented without disturbing significantly the high quality of the work of the parts of DOE that would be affected (and whose scientific and technical quality the Rudman panel praises in the strongest terms).

The question remains whether it makes sense to reform one sector of DOE activities while many identified defects apply to the department across the board. That pattern is indeed confusing and the reporting relationships which the Rudman panel decries as they apply to the defense sector of DOE also apply to a varying extent to most if not all DOE activities. For instance, the question raised by the Rudman panel whether the Field Operations offices, which were created early by the Atomic Energy Commission, retain value today is a DOE-wide issue. Discussing that question is not part of our task today.

There is great inconsistency in the management of many of DOE's activities, many of which have a historical basis that is no longer valid. The administration of activities directly related to energy is disjointed, with nuclear energy, fossil energy, and renewables administered through completely different channels. This problem is justly attributed in the Rudman report to the fact that most of the activity of the DOE originated from the fusion of a large

variety of tasks whose responsibility was spread widely across the federal government. Successive administrations and energy secretaries have not succeeded in organizing these diverse activities into a logical pattern with clearly defined lines of authority and responsibility. Thus a principal question which will arise sooner or later is whether it makes sense to create what the Rudman panel designates as an undersecretary for stewardship and whether there should not also be other undersecretaries for science and energy and nuclear regulation instead of a single “chief” undersecretary as exists today. In fact, a matter not addressed by the Rudman panel is the relationship of the new undersecretary for nuclear stewardship to the principal undersecretary.

Pending legislation⁹ provides for a new undersecretary to discharge responsibility over the military activities of DOE but does not address most of the other problems addressed by the Rudman panel.

Let me add a very abbreviated outline of the elements of American security systems designed to protect information whose release would damage the national security. Such information is *classified* in the United States, with the level of classification related to the level of damage which would accrue to the national security if the information were compromised.

Protection of information suffers from a basic tension. In a democracy the public has a right to be kept informed on activities of government. This right is enshrined in the Freedom of Information Act, which obligates the federal government to release information bearing on its actions on request, with the exception of information listed in designated categories of which classification is one. Thus classification must balance the damage to national security which would result from release of information with the public’s right to know and with the productivity gains derived from free communication.

The management of classified information implies that several tens of thousands of government employees and contractors are “cleared” to receive such information, provided they have a “need to know” such information in connection with their jobs. Once individuals have received clearance, *they have to be trusted* to handle such information in accordance with regulations which govern the handling and storage of classified information and materials. Technical barriers are erected that impede unauthorized transfers; such barriers make unauthorized transfers more difficult and can prevent losses by inadvertence. Such barriers cannot in themselves, however, be sufficient to totally prevent unauthorized transfers. After all, much classified information is contained within the brains of cleared individuals and thus control of information must always to some extent rely on *trust*, aside from management of materials, documents, and computer programs.

The Cox report, and to a lesser extent the Rudman report, fails to make an adequate distinction between the purpose of security measures designed to *deny opportunities* for harmful information transfers and those designed to *interdict* or *prevent* such information transfers. The Rudman report specifically decries that up to this time DOE has not succeeded in erecting impenetrable barriers between classified computer networks and unclassified systems. While indeed such “firewall” barriers are highly desirable, they can only deny opportunity for transfer. If there is a *will* to divert the relevant information, however, be it carried on a computer disk, on the written page, or within the head of a cleared individual, transfer cannot be prevented.

The clearance process is designed to screen out individuals who are likely to give classified information away. The process cannot be made infallible. During the Cold War, investigation focused on the candidate’s ideology, principally communist sympathies and association, foreign allegiances of the candidate or his family, and on dependents in the Soviet Union. In

addition such factors as drug and alcohol use, heavy indebtedness, and others that might make the candidate subject to blackmail were considered. Today ideology has lost much of its former relevance while the other factors remain important. However, the future *susceptibility* of the candidate individuals to the lure of money is difficult to predict, as the serious security breach in the CIA Ames case and other recent cases involving cleared native-born Americans document.

There is, however, another problem: protection of truly sensitive nuclear-weapons-related information is made much more difficult by classifying too large a volume of information of lesser need of protection, and by constantly introducing new areas of restriction, such as unclassified nuclear information, unclassified naval propulsion information, “sensitive” information, and so forth. This may mean that the sheer volume of information which must be protected is becoming so large that even the kind of reorganization proposed by the Rudman panel may not in fact prove more successful than previous attempts at reform.

Administration of classified information is the job of a large bureaucracy, considering the number of people holding clearances and considering the fact that the Department of Energy has custody of more than 200 million pages of classified documents, with the inventory held by the Defense Department being much larger. Moreover, classified information in the computer systems of DOE is very great, and in the interest of efficiency much of this information is being managed to permit easy retrieval. Such centralization of the computer systems has at the same time increased the vulnerability of such systems since access at a single point can yield a large amount of data.

Accusations of transfers of computer data from classified to unclassified systems have been made against a number of individuals in a variety of contexts. The motivation for such transfers can simply be a matter of convenience associated with the difficulties in operating the classified systems. Whether espionage plays a role in such transfers is a matter which only a detailed case-by-case investigation can determine.

Indeed, deficiencies in the security management by DOE of classified materials have been identified over many years and covering several administrations, but *perfection in achieving true security can only be a goal*. The basic physical principles of nuclear and thermonuclear explosives are well known. Much information has been declassified and has been collected in summary works, notably in the publications of the NRDC. Thus, whatever improvements in guarding classified materials can and should be made, one must recognize that classified information ultimately will become publicly available either through leakage or independent rediscovery. Thus the security of the nation must be achieved by a balance between “security by restriction” and “security by achievement.”

To summarize, many reviews of the information-control systems of the government, in particular those by panels of the National Academy of Sciences, have concluded that simply bolstering the security walls around classified information can only be a temporary remedy. The uniform position of such reviewing bodies, including DOE’s Fundamental Classification Review Group of 1995–1996 chaired by Albert Narath, has been that DOE should build *very high fences around truly sensitive information* while resisting the understandable bureaucratic forces which urge building diffuse restraints around vast volumes of information.

1.5 International Contacts of the United States Laboratories

In summary, the foregoing analysis clearly indicates that there have been deficiencies in the security barriers at institutions under control of DOE designed to impede transfer of sensitive information to other countries and probably as well in the security measures by the many other agencies of government having custody over such information. While the management of security can certainly be improved, however, the impact on national security of past transgressions appears marginal and should not be a cause for the type of politically exploited "spy hysteria" which we are seeing today. But, unfortunately, the situation is worse. The preoccupation with security induced by the Cox Commission report has led to a stampede toward ill-considered measures which may in themselves damage national security to a greater extent than the alleged spying could do.

Let me enumerate such negative impacts on: (1) The lab-to-lab programs conducted by the national nuclear weapons labs and (2) the Stockpile Stewardship Program.

(1) One of the principal security threats facing this country is the possible leakage of nuclear-weapons-usable materials from the countries of the former Soviet Union and the emigration of talent possessing nuclear-weapons-related information to countries potentially hostile to the United States. It can be reasonably concluded that "preventive defense" stemming such an outflow of material and talent is much more cost effective in aiding U.S. national security than defending against the possible consequences of such transfers to hostile countries. Thus a substantial number of programs have been developed which share the common goal of assisting the countries of the former Soviet Union in strengthening their materials protection, control, and accounting (MPC&A) over their weapons-usable materials and in preventing the "brain drain" of scientific and engineering talent from the states of the former Soviet Union into potentially hostile employment. These programs, which include the substantial effort under the aegis of the Department of Defense called Cooperative Threat Reduction (CTR), the various centers designed to give financial support to scientists of the former Soviet Union by employing them in constructive civilian enterprises, cooperative efforts transferring highly enriched uranium to the United States, and working with countries of the former Soviet Union in reducing their plutonium stockpiles, are all essential but cannot be discussed here in detail.

One of the most immediately successful efforts of these programs has been the "lab-to-lab" program under which scientists at American nuclear weapons laboratories collaborate with their counterparts in the countries of the former Soviet Union, and to a lesser extent with Chinese labs, in strengthening the safeguards against diversion of weapons-usable materials and in improving the accounting for such materials to make control possible.

Historically during the Cold War, nuclear weapons and nuclear weapons materials control in the Soviet Union were exercised through elite troops acting as guards and couriers for such materials. At the same time the Soviet Union did not use technical surveillance instrumentation to a significant extent and its standards of accounting were low. With the end of the Cold War the morale of the former elite guards has deteriorated; some of them are unpaid and some lack the most elementary comforts. In view of this fact, the previously neglected efforts to develop and deploy instrumentation for materials protection and improvements in accounting have moved to the forefront; U.S. assistance toward this end is clearly valuable to U.S. security. Such work has been carried out under the aegis of the lab-to-lab program sponsored by DOE, which has had substantial positive results. This is not the

place for a detailed review of this program. Suffice it to say that roughly half of the institutions in the former Soviet Union where weapons-usable materials are stored have been upgraded in their MPC&A activities under this program, although the number of actual buildings which have been improved is a smaller fraction. Accounting is much improved, and thus far no documented examples of actual loss of weapons-usable materials sufficient to make nuclear weapons have been recorded.

A large amount of work along these lines remains to be done. First, the task is far from completed. Second, the problem of maintaining the new instrumentation by the host country's personnel remains a considerable challenge. Finally, the manufacture of the instrumentation should be transferred to indigenous sources. All of these goals require continued or even expanded lab-to-lab contact. This in turn requires frequent visits by Russian, Chinese, and other nationals to U.S. weapons labs. Impeding such visits or even reducing their frequency would have a highly detrimental effect.

(2) Of even greater importance is the quality of U.S. personnel at the national weapons labs. These labs continue to share the largest part of the responsibility for maintaining the safety and reliability of the U.S. nuclear weapons stockpile. This responsibility is managed under the Stockpile Stewardship Program, which has two major components. The first component, which may be called "core stewardship," involves continuous inspection and some disassembly and reassembly of nuclear weapons designed to uncover and remedy defects. Part of this program is testing of the non-nuclear components, including such methods as high-speed radiography of the high-explosive assembly, testing of the firing and fuzing and other control machinery, and so called subcritical tests. These are designed to pinpoint missing information about the behavior of nuclear materials at high pressures without release of nuclear energy. Some of the importance of these activities has been increased by the cessation of nuclear weapons tests, but most such activities are made necessary simply by the aging of the nuclear weapons stockpile. For instance, metallurgical changes take place in plutonium over time due simply to the effects caused by the accumulation of helium engendered by the alpha decay of plutonium. Thus the program also includes remanufacture.

The second part of the Stockpile Stewardship Program is dedicated to miscellaneous activities which have relevance to the physics of nuclear weapons and to nuclear weapons design but which are carried out largely to maintain an interesting and creative environment for nuclear weapons scientists at the national labs.

To satisfy this dual objective of the Stockpile Stewardship Program it is necessary to recruit, retain, and replace first-class scientists and engineers. This in turn is possible only if those scientists and engineers can be persuaded that they are part of a national and international community of scientists, that their work can be informed by the current state of the art worldwide and that, where classification permits, their work will receive worldwide recognition. The type of "splendid isolation" that was practiced in the Soviet closed cities and in the early days of Los Alamos cannot endure in peacetime in the democratic, open-economy United States. While the Cox Commission has not made a case that any security lapses have been directly caused by scientific exchanges, its report has led to proposed impediments to such exchanges which would clearly make employment at the national weapons labs considerably less attractive and would thus hurt productivity of these labs.

Quite apart from the specific instances listed, where foreign contacts between U.S. labs and foreign scientists directly serve national security we are facing the problem that the United States is increasingly drawing on foreign scientific and engineering manpower in

order to increase productivity. Training of scientists and engineers in the United States has been insufficient to keep up with the demand of the high-technology industry, and therefore Congress has lowered immigration barriers to foreigners. Accordingly, a significant fraction of staff members of high-technology enterprises in the United States are foreign, principally Asian and Indian; these people make major contributions to the productivity of high-tech industries. Thus an unfortunate effect of the exaggerated perceptions generated by the Cox report about Chinese spying is a cloud of suspicion over both foreign and U.S. national scientific and engineering staff members of U.S. companies and labs of Asiatic background.

The Cox report did not specifically associate any of the specific alleged losses with the open scientific exchanges between China and the United States. Yet the report alleges that essentially all Chinese visitors to the United States are tasked to collect restricted information, and thus are potential spies. I see no evidence to support this allegation. From my personal experience as a scientific visitor to Chinese scientific institutes, both those working in basic science and those active in applied work (including the China Academy of Engineering Physics, the equivalent of the U.S. nuclear weapons laboratories), I can certify that my Chinese hosts are at least as forthcoming in answering my curiosity-driven inquiries as American scientists are when hosting Chinese visitors.

Clearly one can expect that Chinese scientific visitors are “debriefed” by government officers after returning home as is also generally the case for U.S. visitors to China. *But there is no evidence presented in any of the reports that Chinese scientific visitors have abused their status beyond commonly accepted international norms.* On the contrary, those reciprocal visits and scientific operations have yielded great benefits to both countries.

Notes

¹ This report contains itemized rebuttals of the Cox Commission allegations. In so doing it acknowledges the indigenous development of the neutron bomb. Contrary to newspaper and congressional allegations, this inclusion is simply part of the rebuttal, not a “nuclear threat” aimed at Taiwan.

² The evolution of the Chinese program is described in John W. Lewis and Xue Litai, *China Builds the Bomb* (Stanford: Stanford University Press, 1988).

³ The Cox report in its appendix gives the following footnote under the heading of “PRC Theft of U.S. Thermonuclear Warhead Design Information”: “Premier Zhu Rongji recently praised the efforts and progress of PRC and U.S. scientists who attended the 19th Meeting of the Sino-U.S. Joint Committee on High Energy Physics. Reportedly, Zhu expressed pleasure that the ‘two nations have conducted wide-ranging in-depth exchanges during the meeting and put forward many helpful proposals, which will not only be conducive to the development of high energy physics in PRC and the U.S., but also help expand scientific and technological cooperation between the two countries.’ An area of concern is the PRC intelligence practice of mining even ostensibly cooperative scientific exchanges for useful information.” “Premier Meets U.S. Science Group,” *China Daily*, November 18, 1998.

I was present at the meeting of the Sino-U.S. Joint Committee on High Energy Physics described in this footnote, and the meeting with Premier Zhu. This episode dealt entirely

with the question of financial support by China of the Chinese program in basic high-energy physics. *It had nothing whatever to do with thermonuclear warhead design information.*

⁴ Seymour E. Goodman, Peter Wolcott, and Patrick T. Homer, *High-Performance Computing, National Security Applications, and Export Control Policy at the Close of the 20th Century* (Stanford: Center for International Security and Cooperation, 1998).

⁵ Statement by Representative Cox as quoted in the *San Jose Mercury News*, July 1, 1999.

⁶ See e.g. Richard L. Garwin, "Why China Won't Build U.S. Warheads," *Arms Control Today* 29, no. 3 (April/May 1999): 28 ff.

⁷ Some even suggest that the "walk-in" specifically was intended by Chinese authorities to induce the self-induced "spy scare" in the United States to damage the U.S. nuclear program. See e.g. Lars-Erik Nelson, "Washington: The Yellow Peril," *The New York Review of Books*, July 15, 1999.

⁸ Harold Agnew, letter to the editor, *Wall Street Journal*, May 17, 1999.

⁹ Year 2000 Defense Authorization Act.

The Cox Report and the U.S.-China Arms Control Technical Exchange Program¹

Marco Di Capua

The Cox report devotes attention in volume 1 to interactions² between the three U.S. Department of Energy national laboratories³ and the China Academy of Engineering Physics (CAEP).⁴ These three U.S. national laboratories, CAEP, and the Northwest Institute of Nuclear Technology (NINT) in China are responsible for research, development, and testing of nuclear weapons.

The Cox report alleges that⁵

The China Academy of Engineering Physics has pursued a very close relationship with U.S. national weapons laboratories, sending scientists as well as senior management to Los Alamos and Lawrence Livermore. Members of the Academy of Engineering Physics senior management have made at least two trips during the mid-to-late nineties to U.S. national weapons laboratories to acquire information and collect intelligence. The presence of such PRC nationals at the U.S. national weapons laboratories facilitates the PRC targeting of U.S. weapons scientists for the purpose of obtaining nuclear weapons information.

U.S. and PRC lab-to-lab exchanges were ended in the late 1980s but were resumed in 1993. Scientific exchanges continue in many areas including high-energy physics. Discussions at the U.S. national laboratories are supposed to be strictly limited to technical arms control and materials accounting issues. Nonetheless these visits and scientific conferences provide opportunities for the PRC to interact with U.S. scientists outside of official meetings, and facilitate the targeting of U.S. weapons scientists.

The U.S. national laboratories argue that there are reciprocal gains from the exchanges. The Department of Energy describes some of the insights gained from these exchanges as unique. On the other hand, the PRC scientists have misled the U.S. about their objectives

and technological developments. Despite considerable debate in Congress and the Executive branch, including several critical Government Accounting Office reports, the U.S. Government has never made a definitive assessment of the risks versus the benefits of scientific exchanges and foreign visitor programs involving the U.S. national weapons laboratories.

Thus, the Cox report alleges that the “lab-to-lab” exchanges of the early 1990s were a pipeline for transfer of U.S. secret information about nuclear weapons to China.

This transfer is a risk that all the U.S. government policymakers and national laboratory scientists who conceived and established the exchange programs, the management of the national laboratories that hosted them, and the technical personnel who implemented them recognized at the very beginning of the lab-to-lab exchange program. From the beginning all took decisive actions to mitigate and manage this risk. This paper describes the risk management and risk mitigating process at LLNL in some detail. The Cox Committee report does not discuss this process at all.

These laboratory-to-laboratory exchange programs were conceived and existed within the context of national and global security. Thus, this paper also describes the U.S. national security, global security, and foreign-policy context of these lab-to-lab exchanges. The Cox report does not discuss this context either.

The aim of the laboratory-to-laboratory exchange program with China is to further the national security interests of the United States by promoting technical approaches to the implementation and verification of arms-control treaties that the international community embraces.

The program launched technical exchanges on:

- nuclear materials protection, control, and accounting
- export controls
- atmospheric modeling
- seismic verification of the Comprehensive Test Ban Treaty
- technical issues related to the fissile material cutoff treaty.

Some of the Chinese participants, just like some of their U.S. counterparts in many instances, had previously provided technical support to their respective government delegations in international forums. Nevertheless, both the United States and China saw value in technical specialists finding common technical ground away from the contentious atmosphere that sometimes accompanies such forums.

In addition to these senior specialists, China selected a group of junior scientists to participate in the lab-to-lab program. The U.S. participants and CAEP management recognized the long-term benefits that would accrue by encouraging a new generation to work alongside well-established specialists from both countries in nonproliferation and arms-control activities.

Thus, the suspension of the lab-to-lab program, resulting from fears engendered both in the United States and China by the allegations of the Cox report, closes the door, at least for the present, on an opportunity for the United States to promote its national and global security agenda within the Chinese nuclear weapons community.

1 The Foreign-Policy Context for Interactions between U.S. and Chinese Nuclear Weapons Laboratories

With the cessation of nuclear testing and the signing (by the United States and China among others), of the Comprehensive Test Ban Treaty (CTBT) in 1996, the U.S. national laboratories are placing additional emphasis on technical matters and issues related to nonproliferation, arms control, and treaty verification. These activities accelerated in the early '90s with the end of the nuclear arms race, the end of the Cold War, and reductions in nuclear arsenals. For example, the U.S. national laboratories began collaborating in the early '90s with Russian nuclear weapons laboratories and institutions on securing stockpiles of weapons-grade plutonium through the Material Protection, Control and Accounting Program; and the Initiative for Proliferation Prevention (IPP) Program and the International Science and Technology Center (ISTC), which provide incentives for displaced nuclear-weapons scientists to remain in Russia and the Commonwealth of Independent States.⁶

Nonproliferation and arms-control activities are even taking place with a country the United States is still in a state of hostilities with:⁷ the Democratic People's Republic of Korea (North Korea), where U.S. national laboratory scientists are securing irradiated nuclear fuel in the nuclear facility in Yongbyong. This work falls under the U.S.-DPRK Agreed Framework that freezes the DPRK program for production of fissile materials for nuclear weapons in exchange for nuclear-power reactors supplied by the Korean Peninsula Energy Development Organization (KEDO).

National laboratory scientists also train International Atomic Energy Agency (IAEA) inspectors and technical personnel who monitor compliance of third countries with the Nuclear Non-Proliferation (NPT) Treaty. These inspectors come from IAEA member countries, including the People's Republic of China.

The United States and China (which is also a recognized nuclear-weapons state) established the U.S.-China Arms Control Technical Exchange Program (ACE) in 1994 within the context of international activities, promoted mainly by the U.S. government, that center on nuclear nonproliferation, arms control, and negotiation and verification of nuclear-arms-related treaties. The Cox report applies the generic labels "laboratory-to-laboratory interactions" or "lab-to-lab exchanges" to the ACE program.

It also applies the same labels to interactions⁸ that took place between the U.S. and Chinese nuclear-weapons organizations in the 1980s following the reform and opening policies implemented under Deng Xiaoping's leadership.⁹ At that time China revealed some of its nuclear accomplishments with the publication of a comprehensive review¹⁰ of China's nuclear activities since the foundation of the PRC in 1949. More detailed records of the program began to appear in U.S. publications in the late '80s as well.¹¹ These contacts had no specific focus other than to increase the U.S. knowledge about a program that was not as well known or publicly documented as the U.S. program.¹²

Through these scientists' contacts and publications, which took place at the height of the Cold War when the strategic interests of the United States and China were aligned against Russia,¹³ the United States developed a technical understanding of the status and key players of China's nuclear weapons program. These contacts also occurred as key Chinese weapons scientists who trained in the United States, United Kingdom, France, and Germany between 1930 and 1950 were turning over the leadership of the program to a second generation of

scientists that were trained in China and Russia. This second generation was unknown in the United States at that time.

An additional context of these contacts was that for sound policy reasons the United States desired that China join the International Atomic Energy Agency (which took place in October 1983) and that China access the Nuclear Non-Proliferation Treaty (which took place in March 1992). Thus accurate, up-to-date information on China's nuclear programs was essential for the development of U.S. policies toward China in this context.

The Cox report correctly states that these contacts ended in the late eighties.¹⁴

Within the context of U.S.-China technological exchanges in the early eighties, in 1985 the Senate Banking Committee and the House Energy and Commerce Committee asked that the U.S. Congress Office of Technology Assessment (OTA), under the leadership of John Gibbons, undertake a study to address many of the very same issues that the Cox report would address a decade and a half later.

These issues were, as they are today, the national security implications of the transfer of technology with potential military applications to China and the need for the United States to shape policies that balance U.S. commercial and national security interests.

OTA issued two reports, one in 1985 and one in 1987. These reports were initially prompted by a government-to-government agreement on nuclear cooperation initialed by President Reagan in China in 1984, signed in Washington in 1985, and forwarded for approval to Congress in July 1985.

The first interim report¹⁵ mainly addresses proliferation concerns and the extent to which cooperation in nuclear power could strengthen China's ability to produce improved nuclear weapons and warships. The report is prescient since it suggests that one of the questions Congress ought to be asking is "What access does China now have to our national laboratories, companies involved in military work, and production facilities, and how much would it change if we approve the nuclear cooperation agreement?" (p. 43)

The report points out the challenges that the United States faces in using technology as an instrument of foreign policy, the disagreements between branches of the U.S. government that preclude the implementation of systematic technology-transfer policies, and the difficulty of using technology as an instrument of foreign policy because in many instances the owner of the technology is the private sector rather than the U.S. government. It also underscores the danger arising from the lack of an overall policy of technology transfer, inasmuch as transfers conducted on a case-by-case basis cause the United States to lose sight of overall U.S. goals. (p. 13)

The second report¹⁶ deals with a broader array of technologies and examines for the first time, just as the Cox report would twelve years later, the implications of U.S.-China cooperation on satellite launches. It suggests in this context that the biggest threat of U.S.-China launch cooperation is that China could become a commercial competitor to U.S. and European launch services.

The second report assesses the "economic, political, and strategic implications of technology transfer to China in the context of China's capabilities and evolution" (p. 4). It seems that many of the conclusions of the 1987 report still hold true today. Ironically the only one that is dead wrong is the assertion of the progress that the Soviet Union was allegedly still making in the decade of the eighties.

The conclusions of the 1987 report (pp. 10-13) are perhaps not much different from the conclusions of some of the authors of this present assessment:

Technology transfer will assist China's military. The important questions are how much will it help and how much that matters to the U.S. or its allies.

Acquiring modern weapons would be the fastest way to a modernized military, but China does not feel the need to be pressing enough to sacrifice its economic priorities.

The transfer of dual-use technologies has increased rapidly. While it is reasonable to assume that China's military has access to such technology if it demands it, that does not mean that the military will be able to use it effectively.

China's difficulties in assimilating advanced technologies suggest that more could be transferred without incurring much risk that China will use them to produce sophisticated weapons systems, but this risk will grow over the years as China's technological capability improves.

If China is to become a major power, it will be through developing its capabilities throughout the economy. Thus in the long term, technology transfer will have a great military effect if it spurs innovation, modernized thinking, research and development, and economic growth generally. However, China will not have the economic depth to become a superpower for several decades, especially considering the progress the United States and the Soviet Union will also be making.

At worst, the current policy of technology transfer to China entails only moderate direct risk to the United States. In particular, as a regional power, China would be capable of putting great pressure on the U.S. allies in East Asia.

The large-scale Soviet military build-up and political initiatives are the greatest concerns to the United States. China shares this perception, which has become the basis of de-facto military cooperation, though China is very unlikely to jeopardize its status as self-appointed Third-World spokesman by an overt alignment.

The Cox report does not reference either of these earlier works commissioned by Congress.

2 National Security—An Anchor and Foundation of the U.S.-China Arms Control Technical Exchange Program

The anchor and foundation of the ACE program, from its very beginning as a U.S. government initiative in 1994, are U.S. national security interests. According to the State Department, the ACE program was established under the premise that U.S. foreign policy and nonproliferation interests could be positively served by increased lab-to lab contacts with the People's Republic of China in certain defined areas such as arms-control verification and nonproliferation.

The view of the State Department was that the United States should pursue contacts on an ad-hoc, exploratory basis¹⁷ in a manner that would neither violate U.S. sanctions on China

nor undercut foreign policy or national security constraints on cooperation with China that were in place at that time. In the view of the State Department, such contacts should not create public misapprehensions that the United States is providing support to the Chinese nuclear weapons effort.

On this basis, the State Department granted permission to the U.S. national laboratories for technical activities with CAEP, under the guidance of an Interagency Contact Group, in arms-control treaty verification, nuclear safeguards, and other proliferation topics. The State Department chaired the Interagency Contact Group but left it to DOE to supervise and fund the effort with funds for nonproliferation activities appropriated by Congress.

From the very start the United States and China agreed that each would pay for its own activities and thus no moneys would be exchanged. In this regard the ACE program was fundamentally different from the lab-to-lab programs that were taking place in Russia at the same time.

The “ad hoc” basis meant that both sides would carry out technical activities using a “bottoms-up” approach.¹⁸ The Interagency Contact Group consisted of the State Department, Department of Energy, the U.S. Arms Control and Disarmament Agency (now a part of the U.S. Department of State), the U.S. Department of Defense, and the White House through the National Security Council (NSC) and the White House Office of Science and Technology Policy (OSTP). The DOE provided policy guidance and approved in advance the technical activities proposed by scientists at the national laboratories. It remained up to the scientists themselves, who organized the effort through a U.S. Steering Committee, to identify activities that could be acceptable to government agencies and officials on both sides.

The Steering Committee has one member from each laboratory. It meets regularly to keep the program on track, keep the Interagency Contact Group informed, and coordinate technical activities at the three laboratories.

The laboratories provided visible and proactive counterintelligence (CI) supervision from separate budgets. This supervision has been a firm anchor throughout the program. The next section elaborates some of the details of this supervision at LLNL.

Notwithstanding the broad technical scope of the ACE program, the size of the program remains small. At its peak, ACE funding supported the equivalent of two full-time scientists per year at each laboratory. Supervision at DOE headquarters probably involved one-tenth to one-fifth of the time of a full-time DOE official per year depending on the amount of coordination required by the Interagency Contact Group.

3 Risk Management in the ACE Program

From the start of the ACE program, the Interagency Contact Group, the Department of Energy, the Steering Committee, the national laboratories, and the scientists themselves all realized that the ACE program and the participants were vulnerable. One vulnerability was scientists’ access to nuclear and national security information that the United States and the PRC must protect. Political vulnerability is another, inasmuch as technical interactions in the ACE program take place in subjects that involve issues of national security, are close to the policy-making process, and are very sensitive to domestic U.S. politics. Thus the United States devoted as much attention to management of the risks to national security that accompanied ACE as it did to the execution of the technical activities of the program.

The perceived risks of the program are:

1. That the ACE program could provide a setting for espionage,
2. That transfer of technologies and know-how could take place in contravention of U.S. export-control laws and regulations,
3. That technical interactions could take place in subjects, or at a time, in which competing interests within the U.S. government had not yet been reconciled and the policy-making process had not reached a consensus,
4. That unapproved technical interactions could muddle or confuse ongoing U.S.-China bilateral or multilateral negotiations,
5. That mishaps, real or perceived, in any of these areas could be fatal to the program or the careers of the scientists involved,
6. That actual or perceived security missteps could result in accusations of espionage for the participants,
7. That ACE activities could provide opportunities to CAEP to pinpoint technologies and experts for targeting.

To manage these risks ab initio in the United States, the organizers built four shells around the ACE program, common to all three laboratories, in addition to the multilevel security approach which relies on control of access and need-to-know at national laboratory facilities.

In the multilevel security approach, the laboratories have fenced, controlled access “kernels” called limited or exclusion areas where classified activities take place. These limited or exclusion areas have enhanced physical security, and security clearances and need-to-know are required for access. Chinese visitors were not allowed into these areas with the exception of the director’s office for protocol reasons.

These kernels are surrounded by areas where unclassified activities take place or that may house valuable equipment. These “business” areas, which are not accessible to the general public, do not require a clearance, but are still subject to visitor control. Access is not much different from areas where corporations conduct their business. In these areas visitors need to carry badges that authorize their presence and may require escorts in addition. Finally, there are some areas open to the general public such as cafeterias, auditoriums, and visitors centers. Chinese visitors were allowed escorted access to selected facilities in the business areas and in open areas as well.

The additional shells are:

1. The Interagency Contact Group
2. The U.S. Steering Committee
3. Integral counterintelligence oversight at the laboratories
4. Embassy and consular oversight in China

The Interagency Contact Group provides guidance on what may be appropriate subjects for interactions proposed by the U.S. and Chinese scientists. The Interagency group in 1995 approved nuclear materials protection, control, and accounting; atmospheric science related to nonproliferation; monitoring technologies for nuclear materials and processes and their application; and technical issues related to monitoring of a CTBT. It later added control of nuclear technologies (export controls).

These collaboration subjects remained unchanged from the inception of the ACE program until its suspension in the wake of the Cox Committee report allegations.

The U.S. Steering Committee rotates the chairmanship among the three laboratories. The Steering Committee guarantees that the three laboratories speak with one voice (the chairman's) in their interactions with China and the CAEP. The committee briefs and takes guidance from the Interagency group. It develops the work plans for the ACE program and distributes ACE tasks among the three laboratories to meet program and budget milestones.

The Steering Committee also undertakes a security control role by supervising the ACE program, the participants, and the technical activities.

Counterintelligence has been an integral part of the ACE program from its conception. CI oversight is an additional layer of protection over and above the multilevel security approach at the national laboratories outlined above.

At LLNL, for example, CI provides protection to the ACE program through background checks on ACE visitors from China, CI advice on how to safeguard sensitive information from elicitation, cautionary briefings based on the experience of previous visitors or travelers, in-person briefings before travel, and debriefings upon return. In addition ACE delegations traveling to China bring their own interpreters, travel as a group, make their own hotel arrangements, and use the English language (even those who speak Chinese or other languages). Through visit and travel postmortems, CI on occasion has identified areas that required additional or different security attention. SNL and LANL have similar programs.

The oversight of the U.S. embassy in Beijing is an integral part of ACE visits to China. A Request for Country Clearance advises the embassy in advance about activities the ACE program will undertake in visits to China. The embassy grants approval for the visits at the discretion of the ambassador. In embassy premises, embassy officials provide the ACE travelers insights on Chinese politics that may have an impact on the ACE program. Conversely, through these embassy interactions, the ACE delegations share their insights and observations with the foreign-policy establishment. State Department cables reporting the accomplishments of the visits were routinely drafted at the embassy in Beijing for a wide Washington distribution.

4 Contributions of the U.S.-China Arms Control Technical Exchange Program to U.S. National Security

An intellectually honest approach to nuclear matters in China must begin with the premises that:

China has the intellectual resources to develop nuclear weapons to meet its deterrence needs,¹⁹

China has the industrial infrastructure to produce nuclear weapons,

China's nuclear weapons program shares the same intellectual ancestors as the U.S. program, namely the giants of physics in European universities of the 1930s and the U.S. universities of the '40s,²⁰

China's program also shares ancestry with the Russian program of the '50s,²¹

China has nuclear weapons in its arsenal, and

China has been a nuclear-weapons state for thirty-five years.

What distinguishes China from the other weapons states (Russia, Britain, France, and the United States) is that after the Sino-Soviet rift of 1960, China entered a period of isolation at a time when vigorous scientific and arms-control interactions regarding nuclear weapons were taking place, even among Cold War foes. In a forty-year-long arms-control process U.S. and USSR weapons scientists participated in the successful negotiation of the Limited Test Ban Treaty (1963), the (Nuclear) Non-Proliferation Treaty (1968), the Anti-Ballistic Missile Treaty (1972), the Anti-Ballistic Missile Protocol (1974), and the Threshold Test Ban Treaty (1974).²²

China's experience with arms control and nonproliferation international activities, in comparison, is much shorter. China joined the IAEA in 1983 and signed the NPT in 1992. The CTBT (signed in 1996) is the first nuclear arms-control treaty that China actively negotiated. When the ACE program started, China was the wild card in the CTBT negotiations. A CTBT had become a priority for the United States. Russia, having lost access to its test site in Semipalatinsk, Kazakhstan, had limited options. Britain favored it, and it was clear that a mix of international pressure and incentives could get France to come on board.²³

Simultaneously, the United States had concerns that Chinese nuclear entities might be supplying nuclear technology and materials to the Pakistani unsafeguarded program, despite China's professed adherence to the Non-Proliferation Treaty starting in 1992.

To address the technical component of these treaty verification, nonproliferation, and arms-control issues that had a direct bearing on U.S. national security, the United States exploited a window of opportunity to construct the ACE program with China.²⁴

A "back-channel opening to China's nuclear weapons labs" forged by Los Alamos scientists²⁵ was used to arrange a visit of Chinese scientists to the United States, which would become the first step in establishing the ACE program.

In February of 1994, six high-ranking officials of the PRC nuclear complex visited LANL, LLNL, and SNL. At LLNL, their visit focused on environmental restoration, links of LLNL with industry, and activities on nonproliferation, arms control, and international security.

This visit prompted an exchange of letters between the State Department (July 1994) and the DOE (October 1994) that set in motion the policy process that would develop the framework for interactions between U.S. and Chinese nuclear weapons laboratories. These interactions would eventually become the U.S.-China Arms Control Technical Exchange Program. A follow-up visit to China in October 1994 by the Los Alamos director helped the process along.

Within this policy framework, the U.S. government sanctioned an initiative under which the directors of the national laboratories, in January 1995, proposed to CAEP a collaboration on technical issues in the areas of nonproliferation, arms control, and nuclear materials

protection, control, and accounting. CAEP accepted this proposal and thus the ACE program was born. Workshops on export controls were added soon after the program began.

The ACE program has three important demonstration goals:

To show to the China Academy of Engineering Physics that

1. developing and deploying technical expertise in nuclear materials management, nuclear arms treaty implementation, and treaty verification is an important function of nuclear weapons laboratories;
2. the United States devotes significant national laboratory resources to arms-control and nonproliferation activities in the national laboratories; and
3. nuclear weapons scientists, supporting policymakers, have a role in nonproliferation and arms control.

A longer-term goal, linked to arms-control-treaty verification, is to demonstrate that to foster trust and participation in international arms-control and nonproliferation regimes, information had to be and could be shared with the international community without compromising national security. The United States expected that the program would demonstrate how the United States and Russia, for example, can share information about unclassified and nonsensitive aspects of their nuclear weapons programs without compromising national security.

It appears that as the program was starting, interest in nuclear nonproliferation and arms control had already developed within the leadership of CAEP due to the ongoing CTBT negotiations in Geneva. This interest is witnessed in the publication of a book in 1996 on the scientific and technical foundations of arms control by Du Xiangwan, a deputy director of the CAEP.²⁶

5 Technical Accomplishments of the ACE Program

A significant accomplishment of the ACE program was the U.S.-China Integrated Demonstration of Nuclear Materials Protection, Control and Accounting (MPC&A). It was dedicated on July 21, 1998, shortly following President Clinton's Beijing summit of June 1998.

The MPC&A demonstration was the first major bilateral nuclear initiative following the Beijing summit. It exhibited the most important aspects of advanced nuclear materials safeguards systems and showcased working equipment and techniques to officials, nuclear material managers, and technologists. The demonstration took place at the easily accessible Laboratory for Nuclear Safeguards of the China Institute of Atomic Energy (CIAE), located in the Fengshan district about forty-five kilometers southwest of Beijing.

A unique feature of this integrated demonstration was the publication of a bilingual (English and Chinese) primer on the technical aspects of nuclear materials protection, control, and accounting. This Los Alamos report²⁷ was coauthored by ACE scientists from the CAEP, LANL, LLNL, and SNL. The U.S. and Chinese laboratories expected that this would be only the first of a series of joint, bilingual publications on nonproliferation and arms-control topics.

The program had other accomplishments as well. It has carried out workshops with CAEP scientists on export controls, atmospheric modeling, and treaty monitoring and verification technologies. A paper by Nancy Prindle elaborates on these achievements in more detail.²⁸

At the time of the demonstration, both sides were pleased by the momentum that the program had gathered and the confidence that the U.S. and Chinese governments were expressing on the importance of the ACE program to the national security of both countries and the propriety with which technical tasks were carried out. In addition, the enthusiasm with which a younger generation of Chinese scientists were embracing up-to-date techniques for nuclear materials control and treaty verification boded well for the future of the ACE program.

Many of these activities took place in 1997 and 1998. At this time, coincidentally, China's leadership was carrying out an extensive restructuring of the military and civilian bureaucracies. These reforms accelerated after the election of Zhu Rongji as premier in March 1998. These reforms also affected Chinese civilian and nuclear military organizations and are still having an impact on China's approach to nonproliferation and arms control. A paper by W. L. Hsu elaborates on these changes.²⁹

Encouraged by these successes, the Joint U.S.-China ACE Steering Committee met in late 1998 to select activities the program could accomplish in the twenty-first century. The steering committee identified opportunities to:

1. Carry out joint technical activities with the Northwest Institute of Nuclear Technologies (NINT) in Xi'an on seismic verification of the CTBT.³⁰
2. Apply one of the techniques that were implemented at the MPC&A demonstration at a fuel fabrication plant in China. A preliminary schedule for this activity was established at that meeting.
3. Hold preliminary discussions with CAEP on a CTBT on-site inspection table-top exercise.
4. Initiate discussions of techniques that may be applicable to verify a fissile material cutoff treaty regime.

At no time did any of these exchanges ever come close to discussing scientific information that could benefit China's nuclear weapons program.

In February of 1999, following the allegations of the Cox report, NINT told the U.S. Steering Committee that the start of technical activities related to CTBT verification would have to wait for more propitious times. Similarly, CIAE gave notice that a visit that DOE nuclear material management officials were planning for the spring would be postponed as well. The most severe blow came when Ambassador Sha Zhukang, the director of the Office of Non-Proliferation and Arms Control at the China Ministry of Foreign Affairs, canceled participation in a traditional arms-control meeting at Sandia National Laboratories in Albuquerque. Sha told his Sandia hosts that the presence of a Chinese official at a national laboratory would inflame passions further and would not further the interests of the United States and China. Since then, other related nuclear activities have been canceled by China as well.

Conclusions

The ACE program furthered the national security interests of the United States by promoting technical approaches to the implementation and verification of arms-control treaties that the international community embraces.

The Cox Committee report suggests that uncontrolled interactions were taking place between U.S. and Chinese nuclear weapons scientists in the course of the ACE program. On the contrary, elaborate controls were in place at the very beginning and remained in place to control the interactions and protect U.S. national security information.

The ACE program payoff to national security was just beginning and its suspension, resulting from the allegations of the Cox report, is a setback to U.S.-China progress on arms control.

Notes

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² The Cox report discusses these interactions in volume 1, chapter 2, pp. 80–83.

³ The three U.S. DOE laboratories are Lawrence Livermore National Laboratory, Livermore, California (LLNL), managed by the University of California; Los Alamos National Laboratory, Los Alamos, New Mexico (LANL), also managed by the University of California; and Sandia National Laboratory, Albuquerque, New Mexico (SNL), and Livermore, California, both managed by the Lockheed Martin Corporation.

⁴ The China Academy of Engineering Physics (CAEP, previously known as the 9th Academy) under the Commission on Science, Technology, and Industry for National Defense (COSTIND) is the People's Republic of China (PRC) organization responsible for China's nuclear weapons. An additional organization in China, the Northwest Institute of Nuclear Technology (NINT) in Xi'an, also under COSTIND, was responsible for China's nuclear testing program. The history of these organizations is outlined in *China Builds the Bomb*, John W. Lewis and Xue Litai (Stanford: Stanford University Press, 1988).

⁵ The Cox report, p. 81ff.

⁶ "Russian-American Collaborations to Reduce the Nuclear Danger," *Los Alamos Science* [Special Issue], no. 24 (1996) recounts in great detail the circumstances, processes, and per-

sonal interactions leading to the lab-to-lab collaborations between U.S. and Russian nuclear weapons laboratories.

⁷ The UN and the DPRK signed an armistice in July 1953 but the DPRK demands that a U.S.-DPRK peace agreement replace the armistice.

⁸ See for example W. Broad, "Spies vs. Sweat: The Debate Over China's Nuclear Advance," *New York Times*, 7 September 1999.

⁹ M. Di Capua, "Technology Innovation in China," *The Bridge* 28, no. 2 (1998): 4-13 explains how Deng Xiaoping's policies unleashed the industrial revolution that has been sweeping China since 1978.

¹⁰ Li Jue et al., *Dangdai Zhongguo de he gongye* [China's contemporary nuclear industry] (Beijing, 1987).

¹¹ Lewis and Xue, *China Builds the Bomb*.

¹² Harold Agnew, letter to the editor, *Wall Street Journal*, May 17, 1999.

¹³ In his book *About Face: A History of America's Curious Relationship with China, from Nixon to Clinton* (New York: Alfred A. Knopf, 1999), James Mann chronicles the U.S. political climate of the early eighties that led to closer defense ties between the United States and China and the loosening of controls on exports of high technology to China.

¹⁴ They actually ended in the wake of the Tiananmen Square events of June 1989.

¹⁵ U.S. Congress, Office of Technology Assessment, "Energy Technology Transfer to China—A Technical Memorandum," OTA-TM-ISC-30 (Washington, D.C., USGPO, September 1985).

¹⁶ U.S. Congress, Office of Technology Assessment, "Technology Transfer to China," OTA-ISC-340 (Washington, D.C., USGPO, July 1987).

¹⁷ The absence of a "government-to-government" agreement between the United States and the PRC determines the "ad hoc" nature of the program.

¹⁸ In this approach, research themes and activities rise up through successive layers of management and administration that vet them.

¹⁹ Yang Zhenwu, Chen Yan, and Luo Wuwen, Xinhua dispatch, 18 September 1999. As a prelude to the commemoration of the fiftieth anniversary of the People's Republic of China on October 1, on September 18, 1999, the Chinese Communist Party Central Committee, the State Council, and the Central Military Commission held a joint session at the Great Hall of the People to honor twenty-three scientists and technologists who made outstanding contributions to China's nuclear weapons and missile (satellite) programs. At this meeting President Jiang Zemin underscored these programs as a key to China's international status and influence. President Jiang also upheld these programs as examples of what China can accomplish by the central party's leadership; independence and innovation; wise management of limited resources; respect for knowledge and its practitioners; and management that upholds quality and results.

²⁰ Among the scientists honored at the September 18 meeting were graduates of the universities of Edinburgh, Paris, and Berlin; MIT, Michigan, Yale, Harvard, Purdue, Caltech, and Berkeley.

W. Ryan and S. Summerlin, in *The China Cloud—America's Tragic Blunder and China's Rise to Nuclear Power* (Boston: Little, Brown & Co., 1967), describe the saga of the return of foreign-trained Chinese scientists to China, among them Qian Xuesen, who figures prominently in their book and incorrectly in the Cox report. In their prologue the authors say:

No one can say precisely how many Chinese scientists were trained in the United States in techniques related to nuclear energy and then carried their knowledge to China. The figure most widely accepted is eighty or more, who studied in campuses from Pasadena to Cambridge, from Princeton to Berkeley. Many of the eighty were considered brilliant. But they represented only a tiny proportion of the Chinese who studied in the United States. Many remained in America after Communism took over their native land.

Of those who returned—and they were key men [and women], some may have been pawns of intrigue, lured home by propaganda and threats from Peking which played upon deep feelings of family loyalty. Some became discouraged or even frightened by the atmosphere in America at the beginning of the decade of the fifties. Some may have been convinced Communists all along. *In any case the point to remember is that they went home from America, and had they not gone, the Chinese would have had a severe shortage of the senior scientists necessary to produce nuclear weapons.* [italics mine]

Journalist Chet Huntley, in a note for the dust jacket of the book, comments:

Every American would do well to familiarize himself with this shocking story: how our frenetic efforts on behalf of total security, our buildup of distrust and suspicion, produced a nightmare—the China bomb.

It would seem, then, that in the wake of the Cox report, history may be repeating itself half a century later.

²¹ For a candid first-person account of Soviet and Chinese cooperation in nuclear weapons development, see Ye. A. Negin and Yu. N. Smirnov, “Did the Soviet Union Share Its Atomic Secrets with China?” in *Proceedings of the International Symposium on Science and Society—The History of the Soviet Atomic Project* (Moscow: Atomic Science and Technology Publishing House [IZDAT], 1997).

²² See Arms Control and Disarmament Agreements, United States Arms Control and Disarmament Agency, Washington, D.C. (1996), also U.S.GPO ISBN 0-16-048689-0.

²³ S. Coll and D. B. Ottaway, “Rethinking the Bomb—Will the United States, Russia and China be Nuclear Partners or Rivals in the 21st Century? Secret Visits Helped Define 3 Powers’ Ties,” *Washington Post*, 11 April 1995, p. 10F5. See also “Russian-American Collaborations to Reduce the Nuclear Danger.”

²⁴ The context of the CTBT negotiations is described in some detail in Coll and Ottaway, “Rethinking the Bomb.”

²⁵ *Ibid.* This is a detailed and readable account of the genesis of the Russia lab-to-lab and the China ACE programs in the aftermath of the Cold War. This article explores the policy question of risks and benefits of interactions between U.S. and Chinese nuclear weapons organizations.

²⁶ Du Xiangwan, *Kezhunbei kongzhe de kexue jishu jichu* [The scientific and technical foundations of nuclear arms control] (Beijing: China Defense Industry Press, 1996). While this book reviews arms control abroad, it provides no insights on China’s technologies or attitudes on arms control. It may very well have been written as a reference compendium to bring the Chinese delegation to the Conference on Disarmament CTBT negotiations up to speed on nuclear arms control. This book has been used as a textbook in an arms-control course offered at the Institute of Applied Physics and Computational Mathematics (IAPCM) of the CAEP in Beijing (I. Johnston, private communication, 1999).

²⁷ X. Chen, M. Di Capua, W. Hsu, S. Hsue, N. Prindle, J. Rodriguez, B. Sinkule, and T. Wang, *Integrated Demonstration of Materials Protection, Control and Accountability*, LALP-98-65, June 1998.

²⁸ N. H. Prindle, "The U.S.-China Lab-to-Lab Technical Exchange Program," *Nonproliferation Review* 5, no. 3 (Spring-Summer 1998): 111-118.

²⁹ W. L. Hsu, "The Impact of Government Restructuring on Chinese Nuclear Policy Making," *Nonproliferation Review* 6, no. 4 (Fall 1999).

³⁰ NINT is the unit of COSTIND that carried out the Chinese nuclear test program. NINT was a very welcome addition to the ACE program.

A Critique of the Cox Report Allegations of PRC Acquisition of Sensitive U.S. Missile and Space Technology

Lewis R. Franklin

Introduction

Since publication of the Cox report,¹ most of the public discussion has focused on the allegations of the theft by China of U.S. nuclear weapons designs and data. Much less discussed have been the allegations of theft and loss of missile and space technology associated with the launch of U.S. satellites on Chinese Long March rockets, the subject of this section. Yet the reporting of both dramatic allegations has drowned out the voices of those who seriously challenge the basis of much of the report's substance and conclusions, pointing to extensive problems with the factual content and the unreasonableness or improbability of the dangers and risks assumed posed to U.S. national security.

The charter of the Cox Committee in House Resolution 463² was based on the House leadership's concern about the potential transfer of sensitive missile technology to the PRC through the interactions of two U.S. satellite companies (Hughes Space and Communications International, Inc., and Space Systems/Loral) with the PRC in the aftermath of three unsuccessful launches of their U.S.-manufactured satellites on Long March rockets. The central issues were whether these companies violated the conditions of their export licenses by providing information to the PRC during subsequent PRC-instigated investigations of the launch failures, and whether the PRC gained access to sensitive missile technology in the process. The companies' activities were referred by the Departments of Defense and State to the Justice Department for investigation into possible export-license violations, which then initiated criminal investigations that are ongoing. As yet no indictments have been submitted for prosecution, nor has there been a public indication that prosecution is likely.

Most of the report is devoted to these issues of alleged missile and space technology loss to the PRC, and in pronouncing judgments on evidence of alleged PRC theft and the sometimes-related alleged violations of export licenses. This central issue of alleged PRC acquisition of U.S. sensitive missile technology dominated the first four months of the committee's six-month tenure, and the unclassified report devotes more than 600 of 900 total pages (and 1,500 of the 1,886 references) to missile and space technology-related concerns, including high-performance computing, with only 35 pages (and 13 references) devoted to nuclear weapons matters. The suspicions of nuclear weapons information loss to the PRC only came to the Cox Committee's attention in the last two months before the mandated 31 December 1998 completion of the committee's report, so the research and information gathered are much less in the nuclear area.

While numerous reports have been published criticizing the conclusions of the nuclear section (e.g., the President's Foreign Intelligence Advisory Board's "Rudman report"),³ much less has been published challenging the missile and space accusations, although both Loral and Hughes have vigorously denied the charges of export regulation and license violations. The PRC has recently issued a remarkably lengthy and detailed critique of the report,⁴ claiming its strict adherence to the U.S.-PRC Technology Safeguarding Agreements,⁵ denying espionage in the instances reported, and asserting that all the military weapons programs allegedly modernized by stolen technology were the methodical results of PRC in-country capabilities and developments.⁶

The Cox Committee has put forth to the nation serious charges of wrongdoing by U.S. government officials, private-sector executives and employees, and citizens and agents of the PRC. As is the prerogative of Congress, no standard of proof, such as that expected by a grand jury or required in a court, is presented. In fact, in many of the instances cited, I believe there are other possible explanations that have at least equal likelihood, including replacing "the PRC stole" with "the PRC obtained" (from inadvertent loss or public domain sources) and even "the PRC has probably not illegally obtained" (but slowly developed mainly through growth of internal engineering and research capabilities).

The following sections present an analysis and review of a number of the main committee conclusions as presented in the report's Overview (pp. i-xxxvii) and chapter 4, PRC Missile and Space Forces (pp. 171-232). My purpose in this section is to examine the report's main conclusions, the basis and likelihood of the supporting information, and the reasonableness of the logical process used by the committee. Based on my analysis of the process leading to the committee's conclusions, I would advise that considerable caution be observed before using the report's information as a basis for export-control policy and legislation; for understanding of the PRC's present and future missile force capabilities and their threats to U.S. interests; and for assessing the PRC espionage threat to U.S. commercial satellite technology.

1 Alleged Theft of Missile Technology by the PRC

1.1 Theft and Espionage

The Cox report uses the words "theft" and "stolen" to characterize China's numerous alleged efforts to obtain classified military information or sensitive military technology re-

stricted from export to the PRC. Such activities are more commonly referred to as acts of espionage, as they are perpetrated by individuals acting on behalf of a foreign state and for the benefit of that state, rather than for the benefit of the individual, and the espionage activities are usually referred to as “spying.” The word “espionage” is occasionally used by the report’s authors, importantly in part 4 of the Overview (p. xxxiii): *To acquire U.S. technology the PRC uses a variety of techniques, including espionage, controlled commercial entities, and a network of individuals and organizations that engage in a vast array of contacts with scientists, business people, and academics.* Here the report begins to blur the line between prohibited gathering of U.S. national security information and PRC activities that violate no law, including gathering information from commercial and public research sources, as if these quite separate activities are equally dangerous and harmful to U.S. national security. It is implied that such information gathering is unique to the PRC,⁷ and that it is conducted “to place the PRC at the forefront of nations and to enable the PRC to fulfill its international agenda,” which is then defined to include “territorial claims against other Southeast Asian nations and Japan.” The previous report style of reporting specific alleged thefts changes in this final part of the Overview to a broad assertion that nearly every contact between U.S. and Chinese individuals and organizations is organized for the purpose of acquiring U.S. technology. These statements are also important for what they do not say—that there are many legitimate reasons for the PRC to collect technical, business, and scientific information. These include building business relationships with the best U.S. partner, assessing competitive understanding of the marketplace for Chinese products, and learning about the availability of new materials and products that would help China modernize its civil society and improve its standard of living.

Certainly the PRC conducts espionage, and the report mentions a few instances where prosecutions were obtained, or where exports occurred under circumstances of misleading documentation, some of them fortunately thwarted. Yet it is surprising that, if the great number of thefts over so many years suggested by the report did occur, so few prosecutions have occurred. This is at variance with the report’s theme that most (or even all) Chinese advancements in military weapons resulted from espionage. Should this be attributed to the shortage of FBI resources and a remarkable ability by the PRC to operate undetected until “discovered” by the Select Committee, as suggested in the report, or is it possible that the committee has exaggerated the scope and success of China’s espionage efforts? The tendency of the committee to make a worst-case assumption, without so saying, based on vague and circumstantial evidence detracts from the credibility of this important document.

In today’s world, espionage is a pervasive international activity by nearly every government (including close U.S. allies such as France, Israel, and Japan) and many nongovernmental and commercial organizations as well. The United States spends about \$30 billion annually on intelligence activities,⁸ a sum similar to the total annual budget of the People’s Liberation Army.⁹ Following the report’s release, China’s ambassador to the United States stated that the PRC neither conducts any espionage activities nor has any government organizations dedicated to such activities.¹⁰ While I think his denial was false and purposely misleading, it is common practice for governments to deny their involvement in specific espionage activities. For example, the involvement of government-owned and private PRC companies in illegally copying software to resell on world black markets at a fraction of the retail price is well known, and led to the passage of the Economic Espionage Act of 1996 (P.L. 104-294, 11 October 1996), which makes the theft of such intellectual property a crime and applies extraterritorially to non-U.S. citizens and organizations. And while the PRC has given indi-

cations that it will cooperate to curb these practices, they continue to persist, not only in the PRC but in numerous Asian and Eastern European countries as well.

1.2 Allegations of Theft by Qian Xuesen

The Cox report first implies (Overview, p. xiv) then asserts (Vol. 1, Ch. 4, p. 179) that the first Chinese missile technology thefts occurred when Dr. Qian Xuesen “emigrated” in 1955 after a twenty-year residence in the United States to Hong Kong (at the time a British leasehold from the PRC) and then traveled to the PRC to later become the head of its embryonic missile, and even later, space program. The actual theft referred to presumably consisted of textbooks and papers shipped, and in his personal knowledge as a missile expert based on the primitive U.S. missile experience at the time, much of which was obtained by close examination of captured German V-2 rockets. The report states: *During the 1950s, allegations arose that Qian was spying for the PRC. He lost his security clearances and was removed from consulting on U.S. ballistic missile projects. . . and In the 1950s, a U.S. military officer. . . for a U.S. ICBM program (the “Titan” missile program) emigrated to the PRC and illegally gave U.S. missile and missile-related technology to the PRC. . . . The allegations that he was spying for the PRC are presumed to be true.*

The history of Qian Xuesen (or Tsien Hsue-shen) is a tragic example of a foreign U.S. resident being caught up in the post-World War II fears of communism.¹¹ Qian was a brilliant China-born missile and, later in the PRC, space technology expert who was educated at MIT and Caltech, then commissioned as a U.S. Army officer assigned to the evaluation of captured German V-2 rockets. In 1948 he returned to teach and consult at the Jet Propulsion Laboratory. In fact, his security clearances were revoked because “the FBI claimed that several people Qian had befriended at Caltech in the 1930s were Communists,”¹² not because of suspicions of spying. When he decided to return to the PRC in 1950, ostensibly for a long visit, in reality as a release from the suspicious and humiliating environment he found himself in, the U.S. Customs Office inspected his baggage and found technical documents and papers that appeared to violate one of the then-applicable export-control laws. The documents were seized and Qian arrested. He soon found himself caught between the Immigration and Naturalization Service, which wanted to deport him as an undesirable alien, and the State Department, which wanted to prevent the departure of foreign nationals with sensitive military information to enemy (defined as communist at that time) nations. After being jailed briefly and undergoing house arrest while continuing to teach at Caltech, he fought the deportation order, apparently preferring to stay in the United States.

In August 1955 he was deported (he did not “emigrate”) to China, following a bureaucratically confused and inconclusive investigation by the FBI and the INS (reminiscent of the current Wen Ho Lee investigation). The U.S. Department of Defense, while reluctant to see him deported, admitted that it was “quite possible that any classified information, which he possessed at that time, is by now outdated by later research and is common knowledge in the Soviet Bloc.”¹³ To say then that this U.S.-educated and -trained scientist who was denied citizenship and deported and who then used his technical expertise in the service of his birth country, which welcomed his return (and which had during this period gone from Japanese occupation through World War II and a civil war to the recently [1948] formed People’s Republic of China), “illegally gave technology” is to overlook the fact that during most of the period when he was presumed to be spying China was internally wrought by civil war and the fact of his involuntary deportation from the United States.

Even though it is very unlikely that he was a spy, Qian certainly had significant technical information in his mind as a result of his numerous missile-related assignments. How is the report's extensive section on Qian—a saga more than forty years in the past, during the infancy of the U.S. missile program and in the infamous and hysterical period of the House Un-American Activities Committee—relevant to today's situation? It seems to be primarily an attempt to show that the PRC has taken missile secrets from the United States over a forty-year period, and to characterize its progress in missile development as mainly derived from espionage against the United States. This is an unwarranted portrayal, especially when one realizes that this event is separated from today by the disruptive Cultural Revolution in China. Far more important is the assistance to the PRC by the Soviet Union, which in the late 1950s provided the major education of China's future missile engineers at the Moscow Aviation Institute (the USSR's equivalent of Caltech), the technical assistance of Russian experts to help the PRC begin its missile activities, and a number of older Soviet missiles for training and experimentation. Further, as is detailed in a number of sources,¹⁴ the technical infrastructure of mainland China in the 1950s and 1960s was exceedingly primitive, lacking quality materials, chemicals, electronics, etc. suitable for missile and space development. This was such a serious impediment that China was unable to draw on publicly known technical solutions reported in professional journals, and was forced to craft technical approaches consistent with its limited (but also slowly growing) resources.

With the cancellation of all Soviet missile assistance in 1960, the PRC's missile programs proceeded at a slow but methodical pace, with many more mistakes than successes as they slowly conquered the numerous engineering problems. Mao's Cultural Revolution further handicapped their activities by not only disrupting the technical teams for "retraining," but also further isolating China from most business and technology contacts with the West.¹⁵ Even though in Qian China had a remarkable technological leader guiding its early missile and later space activities, the limited resources at his command mandated that their developments and missile designs have modest performance and production goals. For example, this meant that China could not even consider participating in the nuclear arms race with Russia and the United States, if only because of the production and economic demands. It had to accept the more risky but affordable strategy of deployment of a small survivable (fewer than thirty ICBMs) counterforce to deter any missile attack from Russia, India, or the United States.

In conclusion, I think that it was Qian's personal intellect and technological leadership capabilities that were delivered to the PRC by his deportation, and in this well-documented saga there is no single confirmed instance of his passing restricted information to the PRC prior to his deportation. The report's conclusion in the Overview 2D that "Currently deployed PRC ICBMs are based in significant part on U.S. technologies illegally obtained by the PRC in the 1950s" (apparently referring to Qian's deportation) seriously mischaracterizes the circumstances of this historical event, and its subsequent conclusion that "This illustrates the potential long-term effects of technology loss" is just wrong. The only U.S. (and German) missiles that Qian had any substantive involvement with prior to the revocation of his security clearances were the V-2, JATO rockets for launching aircraft, and a group of short-range tactical missiles. There is no single aspect of missile technical design, components, materials, fuels, or guidance technology from the late 1940s that did not have to be reinvented over the intervening thirty years for the PRC's ICBMs developed during the 1980s. Most engineers and experts on China's missile program (certainly excluding some of those who contributed to the report) would agree that this period would be sufficient for a native missile develop-

ment program to slowly grow and succeed, especially considering the considerable help the Chinese received from the Soviets.

2 Theft and Technology Loss during Satellite Launching and Launch Failure Events

Three major sections of the Cox report deal with the allegation of illegal technology transfer to the PRC during the launching operations of commercial communications satellites built by Loral and Hughes, and during subsequent activities in the aftermath of the launch vehicle failures of three of these launches. These issues were the basis for the establishment of the Cox Committee. The Overview Conclusion 2C states:

In the aftermath of three failed satellite launches since 1992, U.S. satellite manufacturers (Loral and Hughes) transferred missile design information and know-how to the PRC without obtaining the legally required licenses.

This information has improved the reliability of PRC rockets useful for civilian and military purposes.

The illegally transmitted information is useful for the design and improved reliability of future PRC missiles, as well.

It is worth examining the above sentences in closer detail to better understand how the committee chose to present its conclusions. After a review of the report's documentation in chapters 5 and 6, the following statement is suggested as a more correct alternative to the first two sentences:

After the PRC charged that a 1993 Hughes-manufactured satellite caused the launch failure, Hughes participated in accident investigations to determine the true cause of the failure in order to ensure that future U.S. satellite launches being planned would not similarly fail. No additional export licenses or government reviews were obtained prior to providing technical information to the PRC. In 1996 Loral was requested to chair an international review committee after a launch failure, which disagreed with the PRC's proposed determination of the cause of the accident. The Justice Department is currently conducting an investigation to determine whether these communications constituted a violation of any export laws or regulations. The Defense Department assesses that the information provided could improve the launch reliability of China's rockets and future missiles.

While these two statements say essentially the same thing, the committee's sentences emphasize presumption of guilt ("illegally") and certainty that the PRC benefited militarily, while the latter draws on the detailed reported documentation contained within the report. These characteristics, presumption of guilt and certainty of Chinese military benefit, typify the overall style of the report.

2.1 Alleged Theft and Technology Loss at the Launch Site

In 1988 (and updated in 1993) the United States and the PRC executed a Memorandum of Agreement on Satellite Technology Safeguards in which the PRC agreed to give the United States access to and complete control over the satellite and, importantly, *the PRC also agreed not to seek to obtain unauthorized information* (Vol. II, Ch. 7, p. 220). It is the committee's implied conclusion by presenting a long listing of potential opportunities and actual security lapses that the PRC consciously violated that agreement because there was the opportunity for them to do so. The caption accompanying a satellite figure on page 225 reads *Access to U.S. communications satellites has undoubtedly permitted the PRC to gain invaluable information about their configuration and design. In as little as two hours, PRC technical personnel can penetrate the interior of a satellite without leaving any traces* (no source given). The report speculates on what might be learned, giving examples like "technique for passive thermal control, encryption (in a sealed electronics box), and information (visually observable) about the satellite materials, the engine and propellant data and the electrical design." An experienced satellite technician could hardly imagine a PRC agent attempting such a risky (to the satellite) and dangerous (to the individual) exercise, using tools and removing covers with the attendant risk of dropping, breaking, denting, or marking, without leaving any traces. Later, in a surprisingly candid statement, the report states: *While the Select Committee's limited review found no witness to confirm that a transfer of controlled U.S. technology has occurred. . . it cannot be inferred that no such transfer took place* (p. 228). Again, the committee presumes the worst case.¹⁶

Numerous security lapses and procedure violations apparently did occur (pp. 229–232) when documents and equipment were occasionally left unsupervised. In addition, the physical facility was vulnerable to penetration or surveillance by a determined intelligence agent. And in fact it is likely, considering the intimate technical and logistical interaction of U.S. and Chinese teams during the complex process of mating the satellite to the booster, that some technical information was gained by the Chinese individuals involved, and possibly transferred on to other PRC experts. Particularly surprising is the nonoccurrence of any detected attempts by PRC workers to obtain access to sensitive equipment or copies of technical documents. Overall it seems that the PRC is abiding by the Satellite Technology Safeguards agreement at the launch site, but the committee does not even consider this possibility.

2.2 Investigations of Satellite Launch Failures

As both the situations and the technology differ between the Hughes (two satellite failures) and Loral (one satellite failure) cases, these are summarized separately. The key events in one or both of these are alleged in the Cox report to be:

1. Initially the Chinese asserted that the launch failure was the result of some malfunction or other problem caused by the satellite, which the U.S. companies, after preliminary analysis, denied.

2. A PRC-commissioned team convened to review the launch failure information received technical presentations from both the PRC and U.S. teams analyzing the telemetry data, performing simulations of failure possibilities, and evaluating technical designs (on fairings and guidance units) to simulate failure conditions.

3. From testimony and depositions referred to in the report, it appears that the management of the U.S. companies did not attempt to obtain a separate export license to participate in these technical discussions and meetings, and because of ambiguity over government-office policies, regulations, and jurisdiction it is unclear whether they were legally required to do so. In some cases, individual members of the project teams may have unilaterally communicated technical information to the PRC without getting prior management approval or having the government review the material.

4. When the technical communications came to the attention of one of a number of government offices involved, and they advised that an export license should be applied for to resolve whether a separate accident-review license was needed, the U.S. companies made voluntary disclosures of the technical information.

5. When these matters were brought to the attention of the Justice Department (at separate times), criminal investigations were initiated to investigate the possibility that specific violations of the export-license conditions may have occurred. These investigations are still under way, and although the Cox Committee received briefings on these from the Justice Department, there has been no official public release of any results of the investigation and no criminal indictments to date.

2.2.1 Hughes Optus B2 and Apstar 2 Launch Failures

In the report's chapter (Vol. II, Ch. 5) on Hughes's participation in several failed-launch satellite investigations, there are no reports of stolen information; rather, the report claims that Hughes provided unauthorized or unlicensed technical information to the Chinese members of the accident investigation teams following the 1992 Australian Optus B2 and the 1995 Asian Apstar 2 satellite launch failures of the Long March 2E rockets. This section of the report suggests that information on aerodynamic buffeting of the satellite fairing (as a probable cause of both failures) was communicated to the PRC during the accident review processes without the technical information having been reviewed and/or approved first by the State Department. The presumed committee logic is that:

- a) PRC missile and rocket engineers were not fully aware of the effects of aerodynamic buffeting during a rocket's exit from the atmosphere,
- b) they had a poor analytical capability to calculate the actual forces which the fairing had to withstand, and
- c) they learned this analytical technology from Hughes disclosures.

The committee concluded that the PRC could apply this specific knowledge not only to redesign of the fairing cover for the satellite, but also to improve the launch reliability and design of PRC missile reentry vehicles and possible future fairings for multiple reentry vehicle ICBMs.

It is not known whether the PRC military missile program had this knowledge or analytical capability prior to 1992. The PRC's initial denial of fault with its launch vehicle components was common to both of the Hughes accident investigations. I believe that the Chinese Academy of Launch Vehicle Technology (CALT, the PRC organization responsible for the accident investigations) could not, for internal political reasons, to avoid perceived international embarrassment and for fear of negative effects on future satellite launch sales, publicly admit that their launch vehicle or their fairing design was in any way the cause of the acci-

dent. This attitude resulted in accident review meetings with neither side admitting fault, further motivating Hughes to independently review the failure data and to conclude with even more certainty that the fairing design caused the failure. Following the Optus B2 failure, CALT did indeed modify the fairing, *but in a somewhat different fashion than that suggested by Hughes*. During preparations for the successful 24 August 1994 Optus B3 launch, Hughes technicians observed that additional strengthening rivets had been added to the fairing, rather than the structural strengthening measures suggested by Hughes earlier. Unfortunately the next launching of a Hughes satellite, the Apstar 2, failed in exactly the same manner, resulting in another accident investigation, this time more specifically concluding that the fairing was marginally designed, and when launched in the winter (December 1992 and January 1995) the prevailing upper-altitude winds added additional stress and buffeting, leading to the failures.

But is the information about accident-investigation procedures and structural analysis (referred to as coupled loads and finite elements analysis) techniques, if learned by PRC engineers, likely to materially improve the PRC's military satellite launching reliability or ICBM reliability? One answer to this is suggested in the Cox report's section on nose fairings (Vol. II, Ch. 5, 90–93), which includes a "hammerhead" fairing drawing similar to that used for the Hughes satellites and which required the sophisticated Hughes analysis technology. The report admits that it is unlikely that such a fairing would be used on ballistic missiles, saying that (simple) fairings might be used to protect MRVs or MIRVs if developed and deployed, to environmentally protect a road-mobile missile warhead if developed and deployed, or to reduce the reentry vehicle radar cross-section (stealth). It seems more likely that in any modernization of their small deterrent ICBM force the Chinese would continue to choose a straightforward design that would not require the analytical sophistication of the geosatellite fairings and that would draw on their past missile reentry vehicle experience.

2.2.2 Loral Intelsat 708 Launch Failure

The next Long March commercial launch failure occurred on 15 February 1996 and involved the Loral Intelsat 708 satellite. Just over a month later, the PRC engineers reported that the launch failure probably resulted from a fault in the inner part of the inertial measurement unit (IMU) of the Long March 3B rocket guidance system (Vol. II, Ch. 6, pp. 107–112). This time there was no denial of PRC responsibility for the failure, and this represents an important example of China's learning from its past nationalistic and secretive business practices and stepping up to international norms of responsible participation in the international launching business. When this preliminary failure assessment was presented to Loral along with telemetry and other laboratory tests of the suspect IMU component, there was concern that the telemetry data was not in total agreement with the proposed cause of the failure, and other possible causes could not be ruled out. At the insistence of the brokerage firm insuring the upcoming launch of the Apstar 1A, the PRC established an Independent Review Committee in April 1996, again showing its new responsiveness to the international business environment. Both Loral and Hughes were invited to participate, to which both agreed (along with a member from Daimler-Benz and retired experts previously with British Aerospace, General Dynamics, and Intelsat).

The PRC then requested that a Loral employee chair this committee and coordinate a preliminary report by May 10. This implicitly made Loral, at whose facilities a number of the meetings were held, responsible for compliance with U.S. export laws if the report contained any technical information. While the export issue was reportedly discussed in an

Independent Review Committee meeting, including the question of whether a separate export license was required, no specific steps were taken by Loral management to ensure that the preliminary report would be reviewed by the State Department prior to submission to the PRC, and on 10 May the preliminary report was faxed directly to the PRC. When this submission came to the attention of the government through a voluntary Loral disclosure and subsequent press report, and it determined that the document had not been reviewed nor an export license issued, the State Department advised Loral to not make any additional submissions requiring government approval to the PRC, and to disclose any additional past submissions that were possibly subject to the International Traffic in Arms Regulations (ITARs). This management oversight was shortly admitted to by Loral in a voluntary disclosure of the report and related information to the State Department, along with an implementing of corporate steps taken to correct deficiencies in controlling the export of technical information.

In its preliminary report to the PRC, the Independent Review Committee did not fully accept the PRC's 23 April conclusion of an electrical or mechanical failure of the IMU inner frame (the IMU is part of the onboard rocket guidance system) as the accident cause, specifically citing the PRC-supplied detail telemetry data from the IMU as being inconsistent with this cause. The report suggested several other possible causes, specifically identifying the IMU follow-up frame as suspect, and suggesting that CALT should not be satisfied with any conclusion that when simulated did not fully satisfy the complete telemetry record up to the rocket destruction. While it was not known at the time the draft report was transmitted what steps the PRC had already taken to investigate these suggestions, documents later received by Loral from the PRC indicated that it began to investigate the IMU follow-up frame about ten days after receiving the preliminary report, a failure mode which it had earlier discarded. In October 1996, the PRC confirmed the failure of the follow-up frame, specifically a failure of the follow-up electrical servo unit (Vol. II, Ch. 6, p. 157).

The Cox Committee concludes that the PRC came to this conclusion solely because of the suggestions of the Independent Review Committee, and further presumes that had this report not been sent to the PRC they would never have learned the true cause. The truth is probably more complex, since the PRC had early suspected the follow-up frame, and there would have certainly been some lower-level PRC engineers who were unsatisfied with the telemetry disagreement (and didn't attend the Independent Review Committee meetings). The information in the IRC report (and discussions in a meeting held in Beijing) was just one of many inputs received by the PRC failure analysis team, and I tend to concur with the July 1998 conclusion of the U.S. Interagency Review Team's examination, which stated that "the true failure may have been discovered more quickly as a result of the Independent Review Committee's report."

The Select Committee's judgment that this IMU could be "adapted for use in the PRC's planned road-mobile intercontinental ballistic missiles" is overly speculative, particularly because compared with the low-acceleration flyout and benign launch complex environment of space launchers, a road-mobile solid-propellant limited-range ICBM like the DF-31 places higher forces on missile components while accelerating, and there is shock and vibration associated with road transit and missile handling.

Finally, did the PRC learn the important aspects of the U.S. procedures of launch failure investigations? When one looks at the committee's selection of PRC corrective actions reported by CALT before launching (successfully) the Loral Mabuhay satellite in April 1997, the actions are mainly increased management attention to design reviews, environmental

testing, and quality control, an expected response to their string of failures (Vol. II, Ch. 6, pp. 169–170). Since there was no U.S. involvement in the design of any aspect of the rocket and no failures associated within any of the satellites during launch, from my reading of the Independent Review Committee’s activities the process was straightforward engineering analysis, which is probably what the lower-level Chinese engineers were doing also. One important lesson demonstrated to the Chinese in both the Hughes and Loral involvements is the unwillingness of U.S. management to accept a finding for which there is the slightest discrepancy from telemetry observations. And the insurance company’s refusal to insure a launch was the enforcement mechanism that compelled the PRC to step up to this higher standard of openness—letting the chips fall where they may.

Although the Cox report wanted to portray it otherwise, it is not a bad outcome for the PRC to have more reliable commercial space launching rockets, as they mostly launch U.S.-built satellites, and it is not in either of our interests for these failures to occur. That it has this business at all is the result of U.S. policy blunders, as the United States failed to look into the future requirements of our space-launch capability. By taking advantage of the PRC launch capabilities, over the 1990–1998 period one French and eight U.S. satellites were successfully launched to service the world’s geocommunications market, resulting in U.S. commercial dominance of the Asian communications satellite market. The United States today dominates the worldwide commercial satellite market, but as the restrictions described in section 2.2.4 are increasingly strictly implemented, we will shortly be finding numerous European and Asian aerospace competitors eroding the U.S. market share, since the new export restrictions imposed as a result of the committee hearings are unilateral and without the support of even our closest allies.

2.2.3 The New International Satellite Marketplace

Common to both chapters on launch failures is the report’s presumption that the launching of commercial communications satellites exposes highly sensitive technology possessed only by the United States, and that all of the technical details must be protected for national security reasons. As commercial comsats differentiated from their military heritage in the 1980s, U.S. companies found themselves in a very competitive market, between other U.S. companies and with European companies. Neither Russia nor China had competitive designs that could handle modern digital television and Internet-capable communications, provide extremely wide bandwidths, and provide the global communication companies the low-lifetime cost needed to compete commercially. It is to the remarkable credit of these U.S. aerospace companies that they succeeded in converting their businesses from their previous military satellite activities to the manufacture of low-cost high-performance satellites in high demand by the international market. As in so many modern manufacturing-intensive businesses, they succeeded by generating a business volume that made U.S. satellite prices lower than those of foreign competitors, with manufacturing technology, inaccessible to foreign competitors, the market discriminator.

With increased demand resulting in a larger number of commercial satellites to be launched, the U.S. launch capacity was suddenly inadequate, which the report importantly recognizes.¹⁷ This situation came about as a result of government-wide plans in the 1980s to launch nearly all satellites (government and commercial) using the space shuttle. And, as various government offices stopped ordering their usual numbers of Atlas and Titan rockets, the launch industry began to phase out production capability to manufacture them.

Correspondingly, government-owned launch complexes (in the United States all launch complexes are government-owned) were neither modernized nor expanded. After the *Challenger* failure, most government satellite programs chose to terminate their previous commitment to launch using the space shuttle exclusively and to return to their prior practice of contracting for a custom rocket configuration for each NASA or each small group of DoD satellites to be launched. Industry now had a reduced capability to provide these boosters, which were being ordered by many separate government agencies, resulting in smaller production runs. This demand was suddenly much larger than forecast, and with the many different versions of rockets being ordered the price was high, with some government programs paying over \$500 million for each launch. In addition, the scarcity of launch complexes became an unexpected bottleneck, in part because it was the custom of the U.S. government to integrate the satellite to the rocket as it sat on the launch pad. When satellites had problems and had to be removed and returned for rework, the launch complex often sat occupied by the waiting rocket for as long as nine months. Additionally, since most of the launch rockets used commercially were provided by the government, when there was a rocket launching failure the government conducted the failure analysis in private, until recently not making the detailed results available to the private sector, a practice that concerned both the commercial purchasers of satellite-launch packages and the launch insurance brokers. The space-launch insurance industry was increasingly suspicious that the government was not fully disclosing the causes of accidents.

The predictable result of inadequate U.S. launch capability, and of a number of other important factors more unique to commercial business than to the government, was that U.S. launch costs were two to four times the cost of Russian or Chinese launches, launches could not be scheduled when business reasons demanded, and the market for purchasing the satellite-rocket-insurance package rapidly internationalized. The international customers (usually consortia of private and government investors from as many as fifty countries) who actually purchase the resulting in-orbit capability want to make an optimum investment in each of these \$250 million+/- launch events, considering not only launch reliability but also the closely related insurance cost, often \$50 million more. In a number of the satellites launched by Loral and Hughes from China, the consortium purchasing the satellite capability had Asian ownership, including some investors from Hong Kong and the PRC; these companies in some cases specified that the satellite should be launched from the PRC if possible.

Thus developed a commercial space business environment quite different from the earlier military satellite business. This was first recognized in 1996 when export-license controls over commercial communications satellites were transferred to the Department of Commerce, and commercial satellites reclassified as “dual-use”¹⁸ items to permit more flexible but still government-monitored business practices. These changes became effective with the transfer of specific items from the State Department Munitions List to the Commerce Control List in October 1996. The subsequent Federal Register notice clarified that the technical data that could be provided to launch providers (export of technical information) included form, fit, function, mass, electrical, mechanical, dynamical/environmental, telemetry, safety, facility, launch pad access, and launch parameters. Importantly, other technical characteristics such as encryption, guidance, and upper-stage propulsion were retained on the Munitions List. While they could be exported as part of the completed satellite if a separate export license from the State Department were issued, no discussions or technical data could be

provided to the launch provider on these items except as permitted by the terms of the license.

The rules established by the Commerce Department were on the whole sufficient and proper, particularly when it was reaffirmed that the Defense Technical Security Administration (DTSA, now renamed the Technology Security Directorate and usually referred to as DTRA, for Defense Threat Reduction Agency) monitoring organization was to fully participate in commercial launches in the PRC. But implementation of these commercial rules by both government and industry, and poor intergovernmental coordination, led to a number of mistakes and poor management decisions. And the transfer of responsibility left a period of ambiguity for export licenses granted by the State Department prior to 1996. At least one company obtained what it thought was proper approval for export of technical information related to a State Department-issued license from those currently responsible in Commerce.

Unfortunately, in the accusatory environment created by the report's conclusions, the passage of hasty legislation instigated by committee members even before their study had progressed more than a few months returned responsibility to the State Department, as described in the next section. A more commonsense approach to correction of the satellite export rules based on lessons learned and new, unexpected activities occurring (like insurance broker involvement and international accident investigations) became impossible. Today's situation is near chaos as the State Department admits that it is unable (because of the mandated increased license volume and a staffing shortage) to process license applications in any predictable manner for the foreseeable future, and international customers are expressing unwillingness to buy satellites from U.S. suppliers in what they consider to be an unworkable, unpredictable, and U.S.-government-intrusive business environment.

2.2.4 Export-Control Regime Changes in the Strom Thurmond National Defense Authorization Act for FY1999

The first legislative accomplishment to come out of the Cox Committee investigation, and that which to date has had the most damaging impact on U.S. space research and commercial space leadership, was the change in the legislation regulating satellite exports that returned jurisdiction to the State Department. As will be discussed, these changes were further amplified by the strict and extensive changes made to the ITARs by the State Department in implementation of their new legal guidance.

Even before the committee had completed obtaining information and evidence on the technology export matters, arrangements were made in September 1998 to attach a rider to the 1999 Defense Appropriation Act, then undergoing finalization in the House (see H.R.3616—254-260, Subtitle B—Satellite Export Controls, SEC.1511-1516 and Subtitle C—Other Export Control Matters SEC.1521). No committee hearings were ever held on this rider, and both houses of Congress voted on the act as a whole without any specific debate on the addition. It was reported that Commerce strongly opposed the change, and the State Department has denied that it supported the transfer. With the presidential impeachment process dominating all political activities, President Clinton chose not to oppose this and signed the act.¹⁹

The act addition specified that:

1. licensing of satellites and related items should be returned to the Munitions List under State Department jurisdiction on 15 March 1999;
2. such export licenses must have a DoD-approved Technology Transfer Control Plan;

3. mandatory DoD monitoring of international business interactions, launch and launch failure analysis technical interaction with non-U.S. persons be added;
4. the licensee reimburse the DoD for all monitoring expenses;
5. a mandatory license be required before participation in a launch failure investigation;
6. the definition of related items now requiring a license (SEC.1516. Related Items Defined) be expanded to include ground support equipment and test equipment.

Most of the sections make specific reference to the PRC as would be expected from the committee's charter, and in SEC.1514 (b) the act states: "This section [SEC.1514] shall not apply to the export of a satellite or related items for launch in, or by nationals of, a country that is a member of the North Atlantic Treaty Organization or that is a major non-NATO ally of the United States."

In implementing the revised ITARs in 1999,²⁰ the State Department apparently interpreted this exception to apply only to the mandated monitoring activities, and is currently applying the new restrictive license procedures to all satellite and satellite-related exports, even to close allies such as France and Canada. Further, the expanded definitions of "satellite-related" (space-qualified integrated circuits and programmable commercial test equipment, for example) and the additions of defense technical services and space-insurance business meetings as new areas needing export licenses have spawned the growth of bureaucratic microregulation of the world-leading U.S. commercial satellite industry in response to accusations relating only to the PRC. What recently involved only a few dozen licenses annually will shortly grow to perhaps thousands per year, and license applications until recently taking a few months for issuance have seen only a few approvals since 15 March. Interestingly, initial anger in Europe over being restricted in quickly obtaining space components without first obtaining a license is quietly being replaced by the recognition of being given a unique competitive opportunity to rapidly challenge the U.S. market dominance.

Few are genuinely concerned that the Russian launch industry, whose space launchers (and deployed ICBMs) match or exceed those in the United States, will benefit technologically from launching U.S. satellites (other than earning revenue) compared with the PRC. And the same can be said for France, whose Ariane launcher series has been the principal competitor to U.S. space launchers for geostationary (GEO) orbits. Yet the new regulations will apply to U.S. satellites being launched here also.

A final concern is that the combination of the increased expenses of multiple licenses and slow license approvals, loss of sales from international purchasers unwilling to wait for or be subject to the new regulations, and the expenses of reimbursing the dramatically increased DoD monitoring effort will effectively raise the price of U.S. satellites, eroding some of the cost reductions obtained by U.S. satellite manufacturers through efficient manufacturing technology. The U.S. controls are unilateral, and the United States has found little interest from our allies in supporting this new export regime over and beyond the Missile Technology Control Regime²¹—they don't see the extreme danger in satellite export activities that the committee reports, and tend to view this as another U.S. political overreaction, which, unfortunately, will accrue to their commercial advantage.

2.2.5 Inclusion of University Space Research and Scientific Satellites and Space-Related Technical Activities under the Munitions Act

An even more serious long-term consequence of the new regulations is the specific inclusion of research and scientific satellites, including all their ground and space subelements, in the Munitions Act, subject to all of the monitoring procedures and expenses of the new regime. It is not known why this class of satellite activities, mainly involving colleges, universities, and even a few high schools, as well as larger private research centers, was included in the act, as there is no evidence or even discussion in the Cox report indicating that this is a problem area. The kinds of activities now covered as munitions activity are as diverse as academic research itself, and are inherently an international activity, with colleges populated by foreign students, foreign permanent residents, foreign faculty, and a rich international interchange of visitors and research information.

The product of these activities is, of course, the advanced research leading to both future commercial products that will strengthen the U.S. economy in the years to come and dual-use products that our military will purchase at commercial prices to retain our military strength. In the past, the ITARs have held that in general, the intellectual component of research and development activities is exempt from export controls (as opposed to hardware, which may or may not require a license), particularly if it is the result of activities in the public domain, such as university laboratory results, theses, textbooks, public lectures, faculty consulting, etc. The new act and ITARs seem to override this past interpretation regarding satellites, even though the exemption clause remains in the ITARs, by inferring that such items are a “defense service” which requires a license.

To get a license a university must first apply to the State Department and register as a “munitions contractor,” a title I think few educational institutions will welcome. The new procedures are extensive and unnatural to the management culture of the academic environment, and further I suspect they are unmanageable compared with the State Department’s expectations of a commercial aerospace company. A license must be approved before any technical discussions are held, such as a preliminary discussion to collaborate with a European research institute to provide a scientific instrument on a future scientific satellite. And presumably there must also be a security plan to specify DoD monitoring of all meetings with foreign persons and security for any resulting foreign contract activities. Another shock will come when the estimated cost for the DoD monitoring must be paid (in advance as the current draft procedure recommends). Typically research budgets for space instruments and even student satellites are only tens of thousands of dollars—the monitoring costs (reimbursement of government salaries, benefits, management pro rata, and travel and communication expenses) are estimated to exceed this even on small projects. There will also be additional legal expenses for assistance in preparing licenses. Two local universities, Stanford and UC Berkeley, have recently had to consider registering as munitions contractors. Stanford has chosen to make the difficult decision to withdraw from the international research opportunity, and UC Berkeley has decided to take the initial step of registering. Currently the University Scientific Research Association is conducting a survey of its more than seventy members to learn how other research institutions are dealing with this new situation, or whether they are even aware of the new regulations.

Unfortunately, with the State Department license application overload, there seems little likelihood of a university obtaining a license in a timely manner, unless it is able to receive a waiver. Recently, however, State Department legal staff have informally advised academic

representatives that in the current politicized export environment it is unlikely that waivers will be granted.

There is no more dire recipe for future U.S. economic disaster than to handicap research and development on satellite technology, a pillar of and partner to Internet technology as we move into the information age. This currently bleak situation fortunately has a remarkably simple solution: simply and clearly reinstate, either by new legislation or ITAR policy, that academic satellite research is exempt from State Department registration and export licensing, and that any resultant hardware or software can be exported by classification as a dual-use technology under Commerce jurisdiction.

3 Alleged PRC Theft of Missile Guidance Technology

Another example of alleged PRC theft appears in the Cox report's Overview, which asserts:

2A. The PRC has stolen U.S. missile technology and exploited it for the PRC's own ballistic missile applications.

The PRC has proliferated such military technology to a number of other countries, including regimes hostile to the United States.

and

The Select Committee has found that the PRC has stolen a specific U.S. guidance technology. . .

The Select Committee has uncovered instances of the PRC's use of this specific stolen U.S. technology that: [see list on page xiii of the Overview]

The Clinton administration has determined that particular uses by the PRC of this stolen technology cannot be disclosed publicly. . .

These conclusions are in part derived from a short paragraph titled "Stolen U.S. Technology Used on PRC Ballistic Missiles" (Vol. I, Ch. 4, p. 191), which states that the stolen guidance technology is used on a variety of U.S. missiles (Army TACMS and Navy SLAM-ER) and military aircraft (F-14, 15, 16, 117). The report (at least the unclassified version) provides no clues as to exactly when or where the alleged theft(s) occurred, but the caveat that "particular uses of this stolen technology cannot be disclosed publicly" (p. xiii) suggests that there is some government suspicion or evidence for this, and that a separate investigation may be under way. But the committee seemingly takes credit ("...has found... and... has uncovered...") for bringing this to light, and the reader is left with considerable uncertainty as to how confident the government is of this espionage situation.

In the statements where the report is just repeating information the committee was provided by the government, one cannot disagree. But when the list of U.S. weapons is given (p. xii, 191), all but one (TACMS) are aerodynamic vehicles employing what is usually referred to as inertial navigation systems (INS). These are designed to be used by onboard (or remote) pilots for aerodynamic vehicles (airplanes and cruise missiles) in an atmospheric flight environment. They differ significantly from inertial guidance systems (IGS), which are automatic and autonomous systems to control the rocket-engine thrust vector and used on ballistic missiles. By asserting that "this technology has direct applicability to the PLA's ballistic

missiles and rockets,” the committee fails to explain exactly how whatever was stolen, which is most suitable for aerodynamic flight guidance, could help “the PRC’s intercontinental, medium- and short-range missiles, and its spacelift rockets,” which have diverse requirements. So even if some espionage occurred against the U.S. military programs, it is difficult to accept the validity of such broad generalizations as are commonly found in the report, if only from a missile engineering basis. In fact there are a few advanced technologies, such as high-performance accelerometers and GPS technology, that the report did not mention that can contribute to both INS and IGS, but even these must be optimized for the particular class and environment of the missile.

Conclusions and Summary

In summary, there is no credible evidence presented or instances described of actual theft of U.S. missile technology, only allegations based on forty-year-old events and instances where the PRC would have had opportunity to obtain information offered during the accident-investigation process (in possible violation of the export license) and by opportunistic but prohibited access to the exported equipment and information during transport to and at the launch site in violation of the U.S.-PRC Technology Safeguarding Agreement. I of course cannot say whether any theft ever occurred, only that the committee’s published documentation fails to validate this conclusion. I also note that neither the committee nor the U.S. government has charged the PRC as having violated the agreement; this would be a valid basis for ceasing launches using the PRC rockets. The report’s speculations regarding technology theft at the launch complex are unwarranted, and certainly do not provide a basis to raise the issue to a diplomatic level. Many of the changes in the export-control law were specifically based on these unvalidated theft circumstances—changes that appear to have fixed a problem that never existed.

The surprising number of technical and numerical errors, and the occurrence of selective one-sided quotations from publicly available books and references noted by many reviewers,²² are such that the quotes from sources not publicly available should be considered suspect as well. Certainly some of these result from the declassification and publication processes, and the fact that testimony was still being taken as the report was being finalized before the mandated 31 December 1998 deadline.

Researchers and readers should observe considerable caution when utilizing data contained in the report and check facts with alternative sources whenever possible. Unfortunately, congressional policymakers have already drawn on many of the report’s speculative conclusions to introduce and pass legislation, legislation that most certainly in the near future will have to be withdrawn or redrawn.

Probably the most damaging consequence for this nation’s technology and business leadership in space is the Cox Committee’s ill-timed and poorly thought-out overturn of the existing satellite export-control regime. The draft legislation by Dana Rohrabacher (R-CA)²³ is an important first step toward correcting the State Department’s overreaction to Congress’s intention to apply restrictions to the PRC. A second step would be to immediately exempt academic and research institutions involved in international research by designating such activities as dual-use under Commerce jurisdiction. Another important step could be the initiation of a process that over time would result in commercial satellites again being classi-

fied as a dual-use technology. There is every indication that U.S. satellite manufacturers (and U.S. launcher companies with foreign partners, such as Lockheed-Martin ILS and Boeing Sea Launch) have recently implemented strong management commitments to control satellite technology information exports, and these procedures and practices, had they been adhered to during the period of Commerce management of these exports, would have addressed many of the concerns expressed in the Cox report. The benefits to our strongly promoting the dominance of the U.S. communications satellite industry will accrue not only to the economy, but even more to U.S. military dominance as the sustaining superpower in the information age.

Many in Congress who were aware of the Defense Act and the committee's prior work and who supported the act were no doubt of the belief that this change would strengthen the nonproliferation of dangerous missile technology. But were those who actually placed the legislation into the act also unaware that these satellite technologies are commercially available from many other countries and that the only effective mechanism to ensure effective proliferation control requires a major prior diplomatic component? The rush to implement legislation without close coordination with the State Department was a major mistake. Similarly, ignoring the Commerce Department's knowledge of the commercial satellite marketplace and its plans to improve the dual-use control procedures was a mistake.

In section 2.2.5 of this chapter the possibly inadvertent inclusion by Congress of academic and scientific satellite-related research activities under Munitions Act control was described, along with a proposed mechanism to simply and quickly remove this barrier to international space research cooperation and challenge to the long-standing principle of academic freedom, a hallmark of America's democratic tradition of public openness in basic research. These restrictions should be reversed, either by new legislation or ITAR policy, to state that satellite research is exempt from State Department registration and export licensing, and that any resultant hardware or software can be exported by classification as a dual-use technology and controlled under Commerce jurisdiction.

Notes

¹ <http://www.house.gov/chriscox/>.

² U.S. Congress Congressional Record, 18 June 1998.

³ *Science at Its Best, Security at Its Worst, A Report on Security Problems at the U.S. Department of Energy*. Report of the PFIAB subcommittee chaired by Warren Rudman, June 1999.

⁴ "A Technical Reassessment of the Conclusions and Implications of the Cox Committee Report," available on <http://www.fas.org/sgp/news/1999/07/chinacox/index.html>.

⁵ Memorandum of Agreement on Satellite Safeguards between the Governments of the United States and the People's Republic of China, February 11, 1993, and December 17, 1988.

⁶ "A Technical Reassessment of the Conclusions and Implications of the Cox Committee Report."

⁷ No other countries are mentioned as conducting similar activities against or in the United States, as if this is unique to the PRC.

- ⁸ CIA Press Release 03/20/98 No. 03-98, "Statement by the Director of Central Intelligence regarding the disclosure of the Aggregate Intelligence Budget for Fiscal Year 1998."
- ⁹ "Last of the Big-Time Spenders: Proposed Fiscal 1998 U.S. Military Budget Dwarfs All Others," <http://www.cdi.org/issues/wme/spend.html>.
- ¹⁰ Interview of PRC ambassador to the United States Li Zhaoxing on *NewsHour with Jim Lehrer*, May 10, 1999.
- ¹¹ Biography of Qian Xuesen in *Who's Who in China, Current Leaders*, first ed. (Beijing: Foreign Languages Press, 1989).
- ¹² Iris Chang, *Thread of the Silkworm* (New York: Basic Books, 1996).
- ¹³ Chang, *Thread of the Silkworm*, ref. 5, p. 188.
- ¹⁴ See for example John W. Lewis and Xue Litai, *China's Strategic Seapower* (Stanford: Stanford University Press, 1994).
- ¹⁵ Ibid. and John W. Lewis and Hua Di, "China's Ballistic Missile Programs: Technologies, Strategies, Goals," *International Security* 17, no. 2 (Fall 1992).
- ¹⁶ In an interview Cox disagreed that the report presented a worst-case scenario, saying that in his view the assumptions were watered down to gain bipartisan support and that he thought a more dangerous problem existed. Interview with Representative Cox on *NewsHour with Jim Lehrer*, 25 May 1999. Also see comment by Representative Dicks reported in the Bremerton, Washington, *Sun*, 26 May 1999, "Rep. Dicks: Put China report in perspective," available on <http://www.thesunlink.com>.
- ¹⁷ Cox report, Vol. III, Ch. 11, p. 172, Recommendation No. 24.
- ¹⁸ The term dual-use refers to a commercial product that can be used by both a civilian and a military user without modification.
- ¹⁹ Public Law 105-261.
- ²⁰ See International Traffic in Arms Regulations (ITARs), paragraph 124.15(c).
- ²¹ Missile Technology Control Regime (MTCR). See *Arms Control Reporter*, Vol. 1999, beginning page 706.a.1 (Cambridge, Mass.: Institute for Defense and Disarmament Studies).
- ²² See for example Chen Lan, "Errors in the Cox Report," <http://www.fas.org/news/china/1999/990528-prc1.htm>.
- ²³ See Jim Puzanghera, "Scholars caught in middle, Export rules frustrate colleges' space research," *San Jose Mercury News*, September 7, 1999.

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