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Technology Transfer to China: An Overview of the Cox Committee Investigation Regarding Satellites, Computers, and DOE Laboratory Management

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ABSTRACT

This report provides an overview of the findings and recommendations of the House Select Committee on U.S. National Security and Military/Commercial Concerns with the People's Republic of China as they relate to satellite launches, high performance computers, and management of Department of Energy (DOE) laboratories. The Select Committee, often called the "Cox Committee" after its chairman, Representative Christopher Cox, released an approximately 900-page, three-volume unclassified version of its report on May 25, 1999. This CRS report also provides background information on the satellite, computer, and DOE laboratory management issues to set the Cox committee findings and recommendations in context. This report will not be updated. CRS Issue Brief IB93062, *Space Launch Vehicles: Government Requirements and Commercial Competition*, and CRS Issue Brief IB10036, *Restructuring DOE and Its Laboratories: Issues in the 106th Congress* contain updated information on legislative activities resulting from the Cox committee recommendations on satellites and DOE laboratory management, respectively. CRS Report RL30220, *China's Technology Acquisitions: Cox Committee's Report—Findings, Issues, and Recommendations*, provides an overview of the entire Cox committee report.

Technology Transfer to China: An Overview of the Cox Committee Investigation Regarding Satellites, Computers, and DOE Laboratory Management

Summary

In 1998, the House of Representatives created the Select Committee on U.S. National Security and Military/Commercial Concerns with the People's Republic of China (PRC). Chaired by Representative Christopher Cox, the "Cox committee" was created partially in response to allegations that two satellite manufacturing companies—Loral and Hughes—might have transferred technology to China in the course of launching satellites on Chinese launch vehicles. The committee's mandate was broader, however, and it investigated other instances in which technology transfer might have occurred, particularly in high performance computers and nuclear weapons information from laboratories managed by the Department of Energy (DOE). The five Republicans and four Democrats on the committee unanimously adopted a multi-hundred page, classified report on December 30, 1998 and transmitted it to the President on January 3, 1999. Public release of the report was delayed until May 25, 1999 pending preparation of a declassified version (the committee's final report itself remains classified).

On the satellite issue, the Cox committee found that Loral and Hughes deliberately provided information to China that helped improve the reliability, though not the range or accuracy, of Chinese missiles. The companies are under a Justice Department investigation regarding alleged export violations. Loral concedes that it provided a report to Chinese officials without U.S. government approval, but both companies deny violating export regulations.

Regarding high performance computers (HPCs), the committee determined that U.S. HPC export policy has been circumvented by PRC end users, not properly monitored or enforced by U.S. officials, and that U.S. industry generally has been unaware of PRC applications of HPCs.

As for DOE management of its laboratories, the Cox committee found that security at DOE's nuclear weapons laboratories does not meet even minimal standards and the PRC has stolen design information on the United States' most advanced thermonuclear weapons.

The Cox committee issued 38 recommendations. In its response to the committee's report, the White House stated that it already was implementing most of those recommendations and that while it does not agree with all of the committee's analysis, it shares the objective of "strengthening export controls and counterintelligence, while encouraging legitimate commerce for peaceful purposes."

Congress passed legislation in the 105th Congress in response to the satellite export issues investigated by the Cox committee and is expected to pass further legislation in the 106th Congress to implement some of the Cox committee recommendations.

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Introduction

The House of Representatives created the Select Committee on U.S. National Security and Military/Commercial Concerns with the People's Republic of China (PRC) on June 18, 1998. Chaired by Representative Christopher Cox, creation of the "Cox committee" was spurred partially by allegations that two U.S. satellite manufacturing companies, Loral and Hughes, had improperly transferred technical information to China in the course of launching satellites on Chinese launch vehicles. The committee's charter also included investigation of other instances of possible improper transfer of technology, information, advice, goods, or services to the PRC.[1]

The committee was composed of nine Members: Republicans Cox, Porter Goss, Doug Bereuter, James Hansen, and Curt Weldon, and Democrats Norman Dicks, John Spratt, Lucille Roybal-Allard, and Robert Scott. The Members unanimously adopted a multi-hundred page report on December 30, 1998, which was presented to the President on January 3, 1999. Originally, the committee's existence would have expired at the end of the 105th Congress, but the House extended the committee's term into the 106th Congress to allow time for a declassified version of the report to be prepared (the committee's final report itself remains classified). The three volume public version,[2] approximately 900 pages long, was released on May 25, 1999 and is available at the House of Representatives Web site [www.house.gov].

Although transfer of satellite and launch vehicle technology had been the major public focus at the time the committee's work began, attention later shifted to findings concerning the leakage of information regarding nuclear bomb design allegedly from Los Alamos National Laboratory, one of the three U.S. nuclear weapons laboratories managed by the Department of Energy (DOE). The committee also investigated the transfer of high performance computer technology and other technologies. The

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[1] The committee was created pursuant to H. Res. 463, which specifies its charter (see pages H4748-52 of the June 18, 1998, Congressional Record).

[2] U.S. Congress. House. Select Committee on U.S. National Security and Military/Commercial Concerns with the People's Republic of China. *U.S. National Security and Military Commercial Concerns with the People's Republic of China.* 106th Congress, 1st session. Washington, U.S. Govt. Print. Off., 1999. 3 v., various pagings.

committee made 38 recommendations covering a spectrum of issues involving U.S.-PRC relations. This report provides an overview of the Cox committee findings and recommendations concerning satellite exports, high performance computers, and management of DOE laboratories. References to the appropriate volume and page number of the Cox committee report are shown in parentheses (such as "v. I, p. 16" for volume I, page 16).

Launches of U.S.-Built Satellites by the PRC

Background [3]

In 1988, the Reagan Administration granted permission to export three U.S.-made satellites to China for launch once China met three requirements: signing three international treaties regarding use of space; signing a bilateral trade agreement so China would not undercut Western prices for launching satellites; and signing a Technology Safeguard Agreement to ensure that no technology would be transferred during the time that American-made satellites were in China awaiting launch. China met those conditions and export of the three satellites, all manufactured by the U.S. company Hughes, was approved by the State Department and by the now-defunct COCOM (Coordinating Committee for Multilateral Export Controls).

China's decision to offer launches on a commercial basis came shortly after the U.S. space shuttle *Challenger* tragedy in 1986. At that time, commercial launches were offered only by Europe's Arianespace and the National Aeronautics and Space Administration (NASA) in the United States. The Reagan Administration and Congress had taken actions to facilitate the emergence of U.S. private sector competitors to NASA for launching satellites beginning in 1983, but private companies argued that they could not compete with government-subsidized prices for launching on the shuttle. The loss of *Challenger* and a subsequent policy decision that commercial satellites would not be launched on the shuttle except in unique circumstances opened opportunities for companies in the United States and elsewhere, including China, to compete in the launch services business.

The Reagan Administration decision to allow exports of satellites to China met mixed reactions because it could harm U.S. launch services companies just entering the market, but help U.S. satellite manufacturers by increasing competition in launching satellites into orbit. Concern about potential technology transfer during the time the satellite was in China awaiting launch was also a significant issue at that time, hence the requirement for a Technology Safeguard Agreement. Such an agreement was signed by the two countries in 1989 (revised version was signed in 1993).

The first commercial Chinese launch of a U.S.-built satellite occurred in 1990. By May 31, 1999, 20 commercial Chinese launches of U.S.-built satellites had been accomplished, of which 16 were successes, three were complete failures, and one was

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[3] For further background information, see: Congressional Research Service, *Space Launch Vehicles: Government Requirements and Commercial Competition*, by Marcia S. Smith, CRS Issue Brief IB93062, updated regularly.

a partial failure, placing the satellite into the wrong orbit.[4] A total of 26 U.S.-built satellites were launched (some launch vehicles carried two satellites into orbit at one time).

The Cox committee focused its examination on whether technology transfer occurred from Hughes or Loral to China during the investigations of the three launch failures, but also looked more generally at whether U.S. satellites are adequately secured while in China and whether information provided to insurance companies that insure the launches is subjected to adequate export control scrutiny.

The first two failures, on December 21, 1992 and January 25, 1995, involved satellites built by Hughes Space and Communications (hereafter "Hughes"), part of Hughes Electronics, a subsidiary of General Motors. The satellites were Optus 2 (owned by Australia) and APStar-2 (owned by Asia Pacific Telecommunications Satellite Co., Ltd., which is 75% owned by Chinese government-backed companies), respectively. The third failure, on February 14, 1996, was of the Intelsat 708 satellite built for the International Telecommunications Satellite Organization (Intelsat) by Space Systems/Loral (hereafter "Loral"), part of Loral Space & Communications.

Attention to the activities of satellite manufacturers following satellite launch failures in the PRC was sparked by Loral's actions following the 1996 failure. To ameliorate concerns of satellite insurance companies, the PRC asked Loral to convene a committee to review the PRC's analysis of the Intelsat 708 failure. Loral complied, establishing a committee that included representatives of Hughes, since Hughes had been involved in two failure investigations already. Loral concedes that in violation of its own internal policies, a copy of the committee's report was transmitted to Chinese officials without obtaining U.S. government approval. The Justice Department began investigating Loral in 1997 to determine if it had violated export regulations in the course of its review of the PRC's Intelsat 708 failure analysis. In February 1998, the Clinton Administration approved the export of another Loral satellite to China even though the Justice Department investigation was ongoing, raising additional congressional concerns. Further allegations subsequently surfaced that Hughes may have violated export guidelines during investigations of the 1992 and 1995 failures, as well as in conjunction with the 1996 failure. The Justice Department reportedly also is now investigating Hughes. Both companies deny violating export regulations.

Cox Committee Findings

According to the Cox committee, Hughes and Loral transferred information to the PRC in violation of export guidelines during the course of the failure investigations in 1992, 1995, and 1996. The committee found that following the failures, "U.S. satellite manufacturers 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

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[4] For further information on China's space program, see: Congressional Research Service, *China's Space Program: A Brief Overview Including Commercial Launches of U.S.-Built Satellites*, by Marcia S. Smith, CRS Report 98-575 STM, September 3, 1998.

purposes. The illegally transmitted information is useful for the design and improved reliability of future PRC ballistic missiles, as well" (v. I, p. xiv). In the 1992 and 1995 failures, which involved only Hughes, the committee concluded that Hughes "showed the PRC how to improve the design and reliability of PRC rockets. Hughes' advice may also be useful for design and improved reliability of future PRC ballistic missiles. Hughes deliberately acted without seeking to obtain the legally required licenses" (v. I, p. xvii). The report adds that there are differing views within the government as to how much the information might assist PRC missile development, but "There is agreement that any such improvement would pertain to reliability and not to range or accuracy" (v. II, p. 4). In the case of the 1996 failure review, which involved both companies, the committee concluded that "Loral and Hughes showed the PRC how to improve the design and reliability of the guidance system used in the PRC's newest Long March rocket. Loral's and Hughes' advice may also be useful for design and improved reliability of elements of future PRC ballistic missiles. Loral and Hughes acted without the legally required license, although both corporations knew that a license was required" (v. I, p. xix).

While in the PRC awaiting launch, U.S. satellite manufacturers are supposed to provide 24-hour physical security for the satellite to prevent the PRC from obtaining technical information. The Cox committee found "numerous" instances in which the satellite manufacturers or the security personnel they hired performed inadequately. "In light of the PRC's aggressive espionage campaign against U.S. technology it would be surprising if the PRC has not exploited security lapses that have occurred in connection with launch of U.S. satellites in the PRC" (v. I, p. xxi). DOD provides personnel to monitor compliance with export regulations during the course of launches of U.S. satellites on PRC launch vehicles, and the committee also found problems with the manner in which DOD executes that role.

The committee furthermore examined whether export guidelines are adequately followed in connection with providing technical information to insurance brokers and underwriters that insure satellites and satellite launches. The committee concluded that "... U.S. export control authorities may not be adequately enforcing these [export control] laws in the space insurance industry context, nor paying sufficient attention to these practices" (v. I, p. xxiii).

After reviewing the satellite launch business, the committee also concluded that by launching Western satellites, the PRC obtained launch experience that improved its position as a long-term competitor to U.S. companies and thus "It is in the national security interest of the United States to increase U.S. domestic launch capacity" (v. I, p. xxiv).

Cox Committee Recommendations

The committee made the following 10 recommendations regarding satellite exports (v. III, p. 170-172):

- Satellite export control provisions in the FY1999 Strom Thurmond National Defense Authorization Act should be implemented aggressively.

- The State Department should have sole satellite licensing authority.

- The executive branch and Congress should ensure that the State Department has adequate personnel and resources devoted to processing export license applications so export licenses can be acted upon in a timely fashion.

- The appropriate congressional committees should report necessary legislation to ensure that satellite manufacturers are not disadvantaged in collateral areas such as tax credits because of the transfer to the State Department of the responsibility to license satellite exports.

- High priority should be given by the Department of Defense (DOD) to recruiting , training, and maintaining a staff dedicated to monitoring launches in foreign countries of U.S. satellites and establishing and monitoring technology control plans to prevent any transfer of information that could be used by the PRC to improve its missile capabilities

- DOD, rather than satellite manufacturers, should contract for security personnel required at the launch site; the number of security personnel should be sufficient to maintain 24-hour security; and the satellite export licensee should be required to reimburse DOD for all associated costs of such security.

- DOD should ensure sufficient training for its personnel who monitor space launches from initial discussions through launch, and, if necessary, failure analysis (called the "launch campaign") and assign adequate numbers of monitors; ensure continuity of service by monitors for the entire space launch campaign period from marketing to launch and, if necessary, launch failure analysis; and adopt measures to make service as a monitor an attractive career opportunity.

- DOD monitors should maintain logs of all information authorized or transmitted to the PRC and that information shall be transmitted on a current basis to the Departments of Defense, State, and Commerce, and to the CIA; documents should be retained for the period of the statute of limitations for violations of the International Traffic in Arms Regulations (ITAR); and DOD should adopt clear written guidelines providing monitors the responsibility and the ability to report serious security violations, problems, and issues at the overseas launch site directly to the headquarters office of the responsible DOD agency.

- Relevant executive branch departments and agencies should ensure that the laws and regulations establishing and implementing export controls are applied in full to communications among satellite manufacturers, purchasers, and the insurance industry, including communications after launch failures.

- Appropriate congressional committees should report legislation to encourage and stimulate further the expansion of U.S. launch capacity.

White House and Congressional Responses

In its May 25, 1999 press release responding to the Cox committee report,[5] the White House stated that the Administration "agrees with and is carrying out all of the Committee's recommendations concerning satellite launches." The press release stated:

- The Administration has implemented the provisions of the FY1999 Strom Thurmond National Defense Authorization Act.
- The State Department has taken steps to ensure that U.S. companies understand and comply with the requirements of law and regulation for data that may be provided to space insurance companies.
- DOD is implementing several measures to strengthen monitoring of foreign launches, including establishment of a new Space Launch Monitoring Division within the Technology Security Directorate of the Defense Threat Reduction Agency and hiring 39 additional staff for this function who will receive enhanced training and provide end-to-end monitoring of controlled space launch and satellite technologies.
- DOD is examining the recommendation that it be responsible for hiring security personnel to provide physical security for satellites at foreign launch sites.
- The Administration is encouraging development of the U.S. domestic launch industry through DOD's Evolved Expendable Launch Vehicle program, NASA's Reusable Launch Vehicle program, and Administration efforts to assure range modernization at U.S. launch sites.[6]

Prior to the conclusion of the Cox committee investigation, Congress took action to transfer responsibility for export decisions for commercial communications satellites back to the State Department from the Commerce Department. The State Department had responsibility for exports of commercial communications satellites until 1993. The Clinton Administration transferred that authority to the Commerce Department in two steps (1993 and 1996). The FY1999 Strom Thurmond National Defense Authorization Act (P.L. 105-261) returned export control responsibility to the State Department effective March 15, 1999. It also expanded the requirements set forth in the FY1990-91 Foreign Relations Authorization Act (P.L. 101-246, Section 902) that prohibit the export of U.S.-built satellites to China unless the President grants a waiver and reports to Congress that (1) China has achieved certain political and human rights reforms, or (2) it is in the national interest of the United

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[5] The White House, *Response to the Report of the Select Committee on U.S. National Security and Military Commercial Concerns With the People's Republic of China*, May 25, 1999.

[6] For further information on these programs, see CRS Issue Brief IB93062.

States.[7] Under the new language in the FY1999 National Defense Authorization Act, the President also must provide a detailed justification for granting such a waiver, including information such as a description of all militarily sensitive characteristics integrated within or associated with the satellite and the impact on U.S. jobs of permitting the export. A number of other provisions were included in P.L. 105-261, such as specifying that investigations of launch failures are covered by export guidelines and require a license.

Following release of the Cox committee report, Congress has taken further action[8] both in response to the report and to concerns expressed by the U.S. aerospace industry. For example, aerospace companies have complained that State Department implementation of the new satellite export regulations is affecting exports for launches on non-PRC launch vehicles, such as Europe's Ariane, and that the State Department has insufficient personnel to carry out its responsibilities under that Act.

During deliberations on the FY2000 National Defense Authorization bill (S. 1059) on May 26 and 27, 1999, the Senate adopted an amendment by Senator Lott that requires the President to notify Congress promptly whenever an investigation is undertaken of an alleged violation of export laws in connection with a commercial U.S.-built satellite and whenever an export is approved for a U.S. person or firm that is the subject of such an investigation. This provision responds to concerns that the Clinton Administration approved the export of a Loral-built satellite even though Loral was already under investigation by the Justice Department. The Lott amendment includes language regarding the Defense Threat Reduction Agency (DTRA, part of DOD) monitors who are assigned to assure compliance with export regulations by U.S. companies during each launch campaign. The amendment directs the Secretary of Defense to establish regulations that allocate funds to assure the necessary number of DTRA launch campaign monitors, establish appropriate professional and technical qualifications and training for them, grant them authority to suspend launches for purposes of U.S. national security, increase their reporting requirements and the systematic archiving and preservation of those reports, and require exporters to reimburse DOD for expenses incurred in monitoring launch campaigns. The Lott amendment furthermore requires DOD to establish a counterintelligence program within DTRA as part of its satellite launch monitoring program, requires the State Department to provide timely notice to exporters of the status of their license requests, requires the State and Defense Departments to consult with the Director of Central Intelligence on commercial communications satellite export decisions, and requires those agencies to submit annual reports to Congress on implementation of satellite technology safeguards.

On June 9, 1999, the House adopted amendments to its version of the FY2000 DOD authorization bill (H.R. 1401) as well. A Cox amendment, *inter alia*, requires reports on implementation of the satellite export control authority and satellite export

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[7] For a list of waivers granted under P.L. 101-246, see Congressional Research Service, *China: Possible Missile Technology Transfer from U.S. Satellite Export Policy—Background and Chronology*, by Shirley Kan, CRS Report 98-485, May 10, 1999.

[8] For updated information on congressional action, see CRS Issue Brief IB93062.

licensing authority, requires a technology transfer control plan for satellite export licenses, specifies that DOD space launch monitors provide 24-hour, 7-day per week coverage, and establishes a DOD Office of Technology Security. Amendments by Representative Curt Weldon establish a Technology Security Division within DTRA as a separate DOD agency and require DOD to provide an annual report to Congress assessing the cumulative impact of individual export licenses by the United States to countries of concern. An amendment by Representative Gilman requires the Secretary of State to ensure that adequate resources are allowed for the Office of Defense Trade Controls for reviewing and processing export licenses in a thorough and timely manner and to obligate $2 million for additional staff for that office which had been identified by Congress last fall in the report accompanying the FY1999 Omnibus Appropriations Act (P.L. 105-277).

The Gilman amendment is similar to a provision in the FY2000 Foreign Relations Authorization bill (HR. 1211) as reported (H.Rept. 106-122) from the House International Relations Committee which Representative Gilman chairs. H.R. 1211 also directs the Secretary of State to establish an export regime that includes preferential treatment and expedited approval for exports to NATO allies, major non-NATO allies and other friendly countries.

High Performance Computers (Supercomputers)

Background

High performance computers (HPCs) are computers that can perform multiple, complex digital operations within seconds. Sometimes also called supercomputers, HPCs are actually a wide range of technologies that also include bundled workstations, mainframe computers, advanced microprocessors, and software.[9] The benchmark used for gauging HPC computing performance is to count the millions of theoretical operations per second, or Mtops, that the computer can perform. The actual Mtops performed by an HPC over a period of time can vary, based on which operations are performed (some can take longer than others or can be performed while other operations are taking place) and the real cycle speed of the computer.[10]

HPC technology has removed many of the technical constraints in advanced computing by reducing long computing times and complex computing functions that hindered solving mathematical, scientific, and engineering problems. Recent HPC applications range from accurate real-time weather forecasting and climate change modeling to simulations of nuclear weapons tests. Global market leaders are IBM and Sun Microsystems/Cray, followed by Japan's NEC (v. I, p. 144). The PRC has a limited ability to produce HPCs, and U.S. firms dominate the PRC HPC market (v.

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[9] A supercomputer is usually defined as a single, complex, mainframe computer that can undertake a series of specific computer functions. Michael S. Malone, ed.. "Big Iron: Supercomputers Are Back and Changing Business, Science, and Even You," Forbes ASAP. February 22, 1999. 96 pages.

[10] See: [http://www.whatis.com/mtops.htm].

I, p. 144-145). Generally, most U.S. high technology industry leaders have sought to increase, not limit, HPC exports.[11]

U.S. policy has recognized the importance of this technology by adjusting export control policy to reflect advances in HPC technologies. In 1992, the U.S. Commerce Department defined an HPC as 195 Mtops; any export above this level required an export license (v. I, p. 118). This definition was revised in 1994 (1,500 Mtops), reflecting new HPC technologies and expanding applications (v. I, p. 119). In 1996, the Department of Commerce once more revised its HPC definition, setting its benchmark for export licenses at 2,000 Mtops. The agency also forecast that 7,000 Mtop computers would likely become available in global markets by the end of 1997 (v. I, p. 121).

Also in 1996, the Department of Commerce created four Computer Country Groups for export controls of computers. These four categories — or "tiers"— of countries have different HPC export criteria. The PRC is a Tier 3 country, characterized as a security risk because of proliferation, diversion, or other security issues (v. I, p. 127-128). To sell to a PRC customer, an exporter must obtain a license from the Department of Commerce when exporting computers above 2,000 Mtops to the Chinese military or to a nuclear proliferation end user (or use); and an export license for any computer above 7,000 Mtops for all other Chinese end users (or use). Any export of a computer below 2,000 Mtops to a Tier 3 country does not require a license; any export of a computer below 7,000 Mtops to a non-military and non- proliferation end user does not require a license. U.S. exporters must maintain records of exports of computers from 2,000 Mtops to 7,000 Mtops to the PRC (v. I, p. 127-128).

Cox Committee Findings

The Cox Committee has determined that U.S. HPC export policy has been circumvented by PRC end users, not properly monitored or enforced by U.S. officials, and that U.S. industry generally has been unaware of PRC applications of HPCs. The major Cox Committee report findings on HPCs are summarized below.

- First, the Cox Committee estimates that since 1996, the PRC may have received a total of 603 HPCs from the United States. According to the Committee, this number has grown rapidly since 1996, when HPC export controls were greatly relaxed. It also encompasses a wide range of computing capacity, from lower-end 1,500-2,000, to 10,000 Mtops and above (v. I, p. 144-145). This wide range of computing has provided PRC end-users with different combinations of computing power and speed, and is linked to the second finding.

- Second, the Cox Committee has determined that PRC end users are clustering lower-end HPCs together to increase computing power and speed. Such actions could allow an end user to obtain several 500 Mtop HPCs — without needing an export license — and combine these into a single HPC with 2,000

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[11] Richard E. Cohen. *Hot Trade Winds.* The National Journal. 29 May 1999. P. 1471-1472.

Mtops processing capability. Similarly, several 2,000 Mtop machines could be linked together and provide high-end HPC functions to any PRC user. In both instances, U.S. export control policy would be circumvented, as PRC end users obtain needed HPCs without the proper export licenses (v. I, p. 134; 157-158).

- Third, the Cox Committee expressed concern regarding the blurred distinction between PRC private companies and state-owned enterprises (SOEs). This has resulted in high-end U.S. HPCs destined for civilian use finding their way to military and proliferation end users (or use), without a license. Since the mid-1990s, China has embarked on a long-term plan to privatize many SOEs.[12] However, domestic technology transfer between civilian and military end users has occurred in the past and is documented (v. I, p. 137; 138). The Cox Committee also contends that PRC students visiting federal laboratories and universities with HPC technologies may act on behalf of the Chinese intelligence organizations (v. I, p. 141-142), further blurring civilian, military, and academic lines among PRC users.

- Fourth, until June 1998, the U.S. government's ability to verify the location and use of HPCs in the PRC was blocked by that country's resistance to post-shipment, on-site verification visits. According to the Cox Committee report, the U.S. government has conducted only one post-shipment HPC verification in the PRC. A 1998 agreement affords the United States the right to request access to some HPCs, but includes substantial limitations on such requests and visits. Moreover, the post-shipment visits that are allowed can verify the location of an HPC, but not how it is used (v. I, p. 134-137).

According to the Cox Committee report, these findings raise significant security implications for the United States. A major implication addressed by the Cox Committee is the use of HPCs by the Chinese military to advance its nuclear weapons testing capability. If China complies with the Comprehensive Test Ban Treaty, "its need for HPCs to design, weaponize, deploy, and maintain nuclear weapons will be greater than that of any other nation possessing nuclear weapons, according to the Department of Energy" (v. I, p. xxix-xxx). HPC modeling and simulations could also be used by the PRC in its biological and chemical weapons programs, to advance methods of cryptology (the design and breaking of coded communications), and for other forms of information warfare (v. I, p. 112-117).

Cox Committee Recommendations

The Cox Committee report provided four policy recommendations.

- Legislation to require testing of HPCs and technology which may be potentially used for clustering and other combinations of computers. This would be undertaken by the Department of Energy, in consultation with the

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[12] See: Congressional Research Service. *Technology, Trade, and Security Issues Between the United States and the People's Republic of China: A Trip Report, August 1997.* By Glenn J. McLoughlin, CRS Report 98-617, 30 June 1998, p. 17-18.

Department of Defense, to provide a comprehensive review of actual and potential HPC technology before it leaves the United States (v. III, p. 172).

- An annual threat assessment of HPC exports to the PRC. The U.S. intelligence community would be required by legislation to conduct an annual comprehensive threat assessment of the national security implications of the export to the PRC of HPCs (v. III, p. 173).

- Legislation to require end use verification of PRC use of HPCs. This would include, as a condition of continued HPC export licensing, an open and transparent system of HPC verification by the PRC by September 30, 1999. Failure to establish such a system by the PRC would result in actions by the United States to lower the benchmark levels of HPCs sold to the PRC, denial of export licenses for computers to the PRC, and other appropriate measures. As part of this legislation, an independent evaluation of the feasibility for improving end use verification in the PRC and prevention of the use of HPCs for military purposes would be required (v. III, p. 173).

- Legislation to require that the executive branch encourage other computer-manufacturing countries, especially those countries that manufacture HPCs, to adopt similar export policies towards the PRC (v. III, p. 173).

White House and Congressional Responses

In response, the Clinton Administration agrees with the Cox Committee report that sales of computers to the PRC should be for commercial, not military, purposes.[13] The Administration also states that it is reviewing the potential national security uses of various configurations of computers, the extent to which these computers can be controlled, and the impact of controls on the U.S. industrial base. The Administration agrees that the United States needs the capability to visit U.S. HPCs licensed for export to China and observe how they are being used (although the Administration contends that it is not possible to obtain no-notice verification visits to any country, including the PRC). On this last point, the Administration did come to an agreement with the PRC for increased site visitations in 1998, but also contends that requiring the U.S. to visit every site where an HPC is installed, regardless of what business the end-user is in or how many times it has been visited before, would be ineffective and wasteful.[14]

HPC technology transfer and export control policies, including those related to the PRC, will likely be considered during congressional inquiry into the Cox committee's findings. In the 106th Congress, legislation was introduced by Rep. Hunter on May 26, 1999 that would prohibit the export of HPCs to certain countries

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[13] The White House, *Response to the Report of the Select Committee on U.S. National Security and Military Commercial Concerns With the People's Republic of China*, May 25, 1999.

[14] Statement by Under Secretary for Export Administration, "Commerce Report: Growing Demand for U.S. High Performance Computers." Washington: U.S. Department of Commerce. 8 January 1999.

until application of existing defense authorization export control policy is implemented. This bill, the Supercomputer Post-shipment Verification Act of 1999 (H.R. 1962), would also require the Secretary of Commerce to conduct post-shipment verification of each digital 2,000 Mtop computer exported from the United States since November 18, 1997 to all Tier 3 countries. The legislation has been jointly referred to the Committee on International Relations and the Committee on Armed Services of the House of Representatives, and awaits further action. On June 9, 1999 the House of Representatives unanimously approved an amendment to the DOD Authorization Act for FY2000 and FY2001 (H.R. 1401) that incorporates several of the recommendations from the Cox Committee report. Among several recommendations, the amendment requires that DOD provide reports to Congress on the national security implications of HPC exports to the PRC.

Management of Department of Energy Laboratories

Background

The Department of Energy (DOE) has nine large, multipurpose, national laboratories and a number of smaller, program-directed or specific-purpose laboratories. Of the former, three are nuclear weapons laboratories: Los Alamos National Laboratory in Los Alamos, NM; Lawrence Livermore National Laboratory in Livermore, CA; and Sandia National Laboratories in Albuquerque, NM and Livermore, CA. These three laboratories account for about 14% of DOE's FY2000 budget request for its laboratories and about 13% of its laboratory personnel (in full-time equivalents). The Cox report judged that the PRC's nuclear weapons intelligence efforts were focused mainly on DOE's three weapons laboratories plus Oak Ridge National Laboratory in Oak Ridge, TN. Oak Ridge also contributes to DOE's national security program, although most of its research and development (R&D) is devoted to DOE's science and energy resources missions (v. I, p. 62). DOE's Pacific Northwest National Laboratory in Richland, WA, also was mentioned in the Cox report as a primary focus, along with the four laboratories mentioned above, of DOE's new counterintelligence plan (v. I, p. 94).

DOE's laboratories comprise the federal government's largest laboratory system. They, especially the nine multi program laboratories, are widely considered to be an important national resource which conducts world-class science and engineering. The nine multipurpose laboratories, and thus the three weapons laboratories and the other two laboratories dealt with in the Cox report, are Federally Funded Research and Development Centers (FFRDCs), which are owned by the federal government but operated by private sector organizations under contract. The contractor of Los Alamos and Lawrence Livermore is the University of California; of Sandia is Lockheed Martin Corp.; and of Pacific Northwest is Battelle Memorial Institute.

Cox Committee Findings

The Cox report's findings that involve the DOE laboratories deal mainly with three areas of concern: *espionage* at the three nuclear weapons laboratories; the *culture of free scientific exchange* at DOE laboratories (common to most scientific laboratories, including the weapons laboratories and the two other DOE laboratories mentioned above) that it believes contributed to the loss of highly classified R&D information from these laboratories; and *management problems* at DOE headquarters and the contractor-operated laboratories that might have contributed to the losses of classified information through espionage or exchanges of scientific information between DOE and foreign scientists.

- The Cox report found that the "People's Republic of China (PRC) has stolen design information on the United States' most advanced thermonuclear weapons; . . . the PRC's next generation of thermonuclear weapons, currently under development, will exploit elements of stolen U.S. design information; and PRC penetration of our national weapons laboratories spans at least the past several decades and almost certainly continues today." These thefts of information "enabled the PRC to design, develop, and successfully test modern strategic nuclear weapons sooner than would otherwise have been possible" (v. I, p. ii). The stolen materials reportedly include classified information on every one of the seven currently deployed U.S. nuclear warheads and their reentry vehicles (including the nation's most sophisticated warhead, the W-88, for the Trident submarine-launched intercontinental ballistic missile), the nondeployed neutron bomb, and other information that could not be identified in the unclassified Cox report because the Clinton Administration has determined that it should not be made public.

- The Cox report states that, in spite of "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" (v. I, p. x). This finding refers mainly to the counterintelligence activities of DOE and its laboratories, that is, their active combating of espionage activities. After becoming aware of the security problems at DOE's weapons laboratories, the President issued, in February 1998, Presidential Decision Directive 61 (PDD-61), which requires DOE to implement improved counterintelligence procedures. DOE began to implement its improved procedures in November 1998. The Cox report judged that these procedures "will not be even minimally effective until at least the year 2000" (v. I, p. 64). An indication of the counterintelligence problems at the weapons laboratories is that it apparently cannot be determined whether or not the "legacy codes," which are very important in the design of nuclear weapons, have been stolen. This is because "no procedures are in place that would either prevent or detect the movement of classified information, including classified nuclear-weapons design information or computer codes, to unclassified sections of the computer systems at U.S. national weapons laboratories," thus making them accessible, for example, to visitors to unclassified areas of the laboratories (v. I, p. 85).

- A second problem area addressed in the Cox report is the contribution that the scientific "culture" of free information exchange — although restricted by law

in laboratories engaged in classified R&D related to national security — might have played in the transfer of classified R&D information to the PRC.

Scientific information exchanges are important to scientists, including those in the U.S. nuclear weapons laboratories, because such exchanges are considered to be scientifically beneficial to all parties involved. Thus, there is a tradeoff between preventing the transfer of information for national security reasons and promoting the transfer of information for scientific reasons. Following the dissolution of the Soviet Union in December 1991, which marked the end of the Cold War, there was a relaxation of restrictions on scientific exchanges (visits to laboratories, attendance at scientific meetings, and exchanges of scientific information and papers by scientists) with the former Soviet Union and other nations. U.S. and PRC laboratory-to-laboratory exchanges, however, ended in the late 1980s, although they resumed in 1993 (v. I, p. 82). This relaxation of restrictions might have contributed to more relaxed attitudes among scientists and DOE and laboratory management in their interchanges with foreign scientists.

- The report stated that DOE has no "mechanism for identifying or reviewing the thousands of foreign visitors and workers at the U.S. national weapons laboratories" (v. I, p. 94). Another problem identified in the Cox report, which contributes to the natural tendency among scientists to exchange scientific information, is the increasingly widespread use of email and the difficulties associated with controlling information stored on computers and accessible for email transmission (v. I, p. 94).

- The Cox report found that the PRC used scientific exchanges for espionage. "In several cases, the PRC identified lab employees, invited them to the PRC, and approached them for help, sometimes playing upon ethnic ties to recruit individuals" (v. I, p. 80). At an organizational level, the Cox report found that the "China Academy of Engineering Physics [CAEP] has pursued a very close relationship with the U.S. national weapons laboratories, sending scientists as well as senior management to Los Alamos and Lawrence Livermore" (v. I, p. 81). CAEP reports to the Commission of Science, Technology, and Industry for National Defense (COSTIND), the organization in charge of China's nuclear weapons program.

- A third area of focus of the Cox report is whether management problems at DOE and its contractor-operated laboratories contributed to the theft of classified R&D information by Chinese espionage or the loss of such information through scientific exchanges. For example, although the Central Intelligence Agency (CIA) had evidence in 1995 that secret information on the W-88 warhead had been obtained by the PRC, a DOE "investigation of the loss of technical information about the other five U.S. thermonuclear warheads had not begun as of January 3, 1999, after the Select [Cox] Committee had completed its investigation" (v. I, p. 84). DOE's new Counterintelligence Director reported in November 1998 that DOE, in effect, has not had a counterintelligence program "for many, many years" (v. I, p. 93).

PDD-61, discussed above, is an attempt to remedy some of these management problems. It requires that a senior Federal Bureau of Investigation (FBI) agent be placed in charge of DOE's counterintelligence program and that the national security

community submit a report to DOE, with recommendations, on its counterintelligence program. DOE approved that report's substantive recommendations in November 1998. The Secretary of Energy's new counterintelligence plan, based on those recommendations, directs, among other things, that DOE's Office of Counterintelligence "fund counterintelligence positions at individual laboratories so that they work directly for the Department of Energy, not the contractors that administer the laboratories" (v. I, p. 92). DOE's new Counterintelligence Director also has direct access to the Secretary of Energy, unlike his predecessors (v. I, p. 93).

Cox Committee Recommendations

The first eight recommendations of the Cox report refer to DOE's laboratories (v. III, p. 166-168):

- The President should report to Congress, at least every six months, on the steps being taken by DOE and other agencies to respond to PRC espionage, such as the theft of nuclear weapons design information from the laboratories.

- As a matter of urgent priority, DOE should implement, as quickly as possible, an effective counterintelligence program.

- Appropriate congressional committees should review the steps the executive branch is taking to implement PDD-61 and determine if the Administration and Congress are providing enough resources to establish an adequate counterintelligence program at DOE as soon as possible.

- Appropriate executive branch departments and agencies should conduct a comprehensive damage assessment of the security breaches at DOE's laboratories since at least the late 1970s and report to Congress.

- Appropriate congressional committees should report legislation, if necessary, to achieve effective counterintelligence in DOE.

- DOE and four other agencies should direct their inspectors general and counterintelligence officials to examine risks to U.S. national security due to the international scientific exchange programs of the DOE laboratories, and report their findings to Congress by July 1, 1999.

- Congress should examine whether DOE can protect nuclear weapons and related research and technology from theft and exploitation and whether it should retain responsibility for the nation's nuclear weapons development, testing, and maintenance.

- Because the executive branch failed to report adequately to Congress about thefts of secrets from the laboratories, as required by law, Congress should require strict compliance.

White House and Congressional Responses

The White House responded to the release of the declassified version of the Cox report on May 25, 1999 with a press release[15] on the same day. Noting President Clinton's written response to the recommendations on February 1, 1999, the press release stated that, although the Administration does not agree with all of the analysis of the report, it does agree with all of the recommendations concerning laboratory security, "many of which we have been implementing for months, and in some cases, years." The press release noted that the President, recognizing the need to respond to the national security threat to the DOE laboratories in 1997, issued PDD-61, calling it "the most comprehensive and vigorous attempt ever taken to strengthen security and counterintelligence procedures at the labs."

The press release identified how the Administration has responded or is responding to the recommendations of the Cox report:

- On March 29, 1999, DOE submitted to Congress its annual *Report on Safeguards and Security at the Department of Energy Nuclear Weapons Facilities* and the CIA, in coordination with other agencies, is preparing a semiannual report to Congress on the measures being taken to protect against PRC's efforts to obtain nuclear weapons and other classified information.

- DOE is implementing PDD-61 on an "expedited basis" according to the plan submitted to Congress on January 5, 1999 and has instituted additional counterintelligence actions at the laboratories, including in the "critical area of cyber security" involving its classified computers.

- The CIA, at the direction of the President, conducted an assessment of damage caused by PRC espionage, which was reviewed by an independent panel headed by Admiral David Jeremiah. Congress received a briefing on the review on April 21, 1999.

- The President directed DOE to complete an interagency assessment of laboratory-to-laboratory programs with China, Russia, and other sensitive countries by June 1, 1999.

In addition to these responses to the Cox report's recommendations, the President directed former Senator Warren Rudman, Chairman of the Foreign Intelligence Advisory Board, to evaluate security at DOE's laboratories, and directed the National Counterintelligence Policy Board to make recommendations to strengthen controls on nuclear information at facilities other than the laboratories that deal with nuclear weapons issues.

The Administration's response did not deal explicitly with the Cox report's seventh recommendation that Congress examine "whether [the] Department of

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[15] The White House, *Response to the Report of the Select Committee on U.S. National Security and Military Commercial Concerns With the People's Republic of China*, May 25, 1999.

Energy should maintain U.S. nuclear weapons responsibility" (v. III, p. 167). This is an issue that has arisen in the 104th, 105th, and 106th Congresses in the context of legislation introduced to restructure, and possibly abolish, DOE and transfer its laboratories to other federal agencies or privatize or close them. Under many of these bills, the DOE weapons laboratories would be transferred to the Department of Defense. The national security issues addressed in the Cox report might contribute to congressional debate on these types of bills, none of which was enacted in the 104th and 105th Congresses. Thus far in the 106th Congress, two bills to abolish DOE (S. 896 and H.R. 1649) have been introduced. These bills, among other things, would transfer the nuclear weapons laboratories to DOD.[16]

Other legislation in the 106th Congress also would affect DOE's laboratories. The Senate, for example, in its consideration of the National Defense Authorization Act for FY 2000 (S. 1059) following the release of the Cox report, debated an amendment (no. 446) to create a "National Security Administration" within DOE which would have responsibility for nuclear weapons production facilities and the national laboratories. Although this amendment was withdrawn, it was announced that the proposal would be offered as an amendment to the Intelligence Authorization Act for FY 2000 (S. 1009). S. 1062 (the DOE National Security Act for FY 2000, passed by the Senate as Division C of S. 1059) also includes a provision for a moratorium on DOE's laboratory-to-laboratory and foreign visitors and assignments programs. H.R. 1401, the House version of the National Defense Authorization Act includes a provision to establish a "Commission on Nuclear Weapons Management" which, among other things, would examine DOE's nuclear weapons laboratories and propose and evaluate alternative organizational and management structures, including possibly transferring authority for the laboratories to DOD. The Cox amendment to H.R. 1401 includes, among other things, a moratorium on foreign visitors at national laboratories pending background reviews. The Costello amendment to H.R. 1401 would make the contractors that operate and manage DOE laboratories subject to civil penalties of up to $100,000 per violation of any DOE rule, regulation, or order relating to the security of classified or sensitive information. Another recent bill, S. 887, also would establish a moratorium on the foreign visitors program at DOE's nuclear laboratories

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[16] For a discussion of these issues and current legislation, see Congressional Research Service, *Restructuring DOE and Its Laboratories: Issues in the 106th Congress*, by William C. Boesman, CRS Issue Brief 10036, updated regularly, 10 p.