Center for Strategic & International Studies
Washington, DC

Export Controls/Dual Use Technology and Technology Transfer Issues

Testimony of James Lewis

Senior Fellow and Director, Technology Policy
Center for Strategic & International Studies

United States-China Security Review Commission

January 17, 2002

Chairmen, Commissioners, I would like to thank you for this opportunity to testify on technology transfer, export controls and China. This is an important topic and I applaud the Commission for looking at it. It is an important topic, but one that has been much clouded by rhetoric and imprecision, and the Commission has an opportunity to dispel some of this.

That transfers of U.S. technology to China can damage national security has become a staple of the larger debate over China policy. Critics charge that China improves its military capabilities with U.S. commercial technology. While these charges are widely accepted, they are wrong. Despite the noisy China cases that attracted public attention in the past few years, a close examination suggests that U.S. technology is irrelevant to China's military modernization and that efforts to restrict high tech trade are more likely to damage than to improve U.S national security.

Contrary to claims that China acquires U.S. commercial technology and turns it to military purposes, the Chinese follow the more sensible course of acquiring modern military technology from non-U.S. sources. U.S. commercial technology is important to China's continued economic growth, but these commercial technologies are all available from other Western industrial nations that do not share U.S. concerns with China and which do not support an embargo on advanced technology exports. Other countries with advanced military and industrial technologies are willing to sell to China (although the ability of the PLA and China's defense industry to absorb these technologies remain mixed, despite China's general economic progress). There is not the slightest interest among America's major trade partners or allies in Europe or Japan support a cold-war style embargo (or indeed any embargo on technology) for China. Finally, the U.S. technology sold to China has been overwhelmingly civil and not military, and of little use in weapons production.

Given the limitations of its domestic arms industry, China can only improve its military through purchases of foreign military equipment. China cannot manufacture major weapons systems equal in quality to the best Russian, U.S. or European equipment. While foreign purchases are

crucial to any effort to modernize China's military, the U.S. does not sell military or proliferation-related items to China. None of the items that have starred in the U.S. debates over China - computers, satellites, telecommunications, elderly machine tools, semiconductor-manufacturing equipment - are regarded by the three major nonproliferation regimes (the Missile Technology Control Regime, the Nuclear Suppliers Group and the Australia Group for Chemical and Biological Weapons) as contributing to proliferation. This point is usually lost in the larger dispute about China, where charges that U.S exports help China develop weapons of mass destruction are frequent.

An ironic aspect of the China tech transfer debate is that it focuses on general purpose industrial goods, not weapons or military technology. The debate has blurred differences between military and civil technologies in a way that is unhelpful for analysis. Additionally, efforts to restrict access to these industrial goods make little sense in light of growing global economic integration. Multilateral cooperation in controlling these technologies is at a low ebb. While there was a consensus in the 1980s to control technology transfers among the U.S. and its allies vis-à-vis the Soviet Union, this consensus did not extend much beyond the Warsaw pact. The U.S. itself relaxed technology transfer controls for China in the late 1980s, when China became a useful card to play against the Soviets.

Differences between the U.S. and other Western industrial nations over how to treat China became apparent when the U.S. proposed in 1992 and 1993 to recast Cold War technology controls into broad restrictions to unstable regions like the Middle East or North Asia. The U.S., with global responsibilities, saw an international environment filled with new risks. Many allies, however, saw commercial opportunity. European allies in particular no longer faced a military threat to their survival. The result was a swift decline in defense budgets and a new view of China. With then return of Hong Kong and Macao to China, there is no European military presence in Asia for the first time in 500 years, eliminating any potential for friction. The PLA is far away and unlikely to ever threaten Europe (or, in the view of many Europeans, the U.S), making it very hard to win support among our allies for trade restrictions for industrial goods.

The clearest sign of different views on either side of the Atlantic was the demise of COCOM (the Coordinating Committee for Multilateral Export Controls). COCOM occupies a hallowed place in the hagiography of export controls. Under COCOM's rules, the U.S. and the major western industrial nations restricted their technology transfers to China, the Soviet Union and its allies. America and its major trade partners had a coordinated, multilateral approach to high tech trade with China. By 1992, the regime was moribund and other nations had stopped submitting their high tech exports to China for COCOM review, effectively ending multilateral cooperation and U.S oversight of exports to China. The COCOM bureaucracy, like all bureaucracies, continued to work and seek new tasks for itself, but COCOM depended on the financial contributions of the member states, and with the end of the Soviet Union, budget cutters in many nations were eager to pull the plug.

Many U.S. allies have dismantled restrictions on a range of industrial technologies once denied to the Soviet Bloc. Commercial concerns are paramount, and a few countries even see China as a lucrative military market. The result is that many U.S. restrictions are now unilateral and thus ineffective as restraints on China's ability to acquire advanced technology. While the U.S. developed a successor regime to COCOM (called the Wassenaar Arrangement), it is ineffective. Creating an organization is not a substitute for a shared strategic vision. Wassenaar members have rejected China as a target for restriction.

This divergence between the U.S. and its allies on technology transfer means that the European Union is increasingly important in setting tech transfer policies for its members and for nations who would like to be members. In 1994, as part of the larger reorientation of export controls, the European Court decided that dual-use industrial exports were an issue of trade rather than security, and so fell under the purview of Brussels (member states retain control of their arms

transfer policies). The EU developed its own technology transfer regulations for industrial goods to which all members must adhere and which any new entrant to the EU must adopt. EU nations have also adopted a common "Code of Conduct" for arms transfers. While the Code of Conduct was in some measure the result of U.S. prompting, it and a related conventional weapons "catch-all" created by the EU were carefully designed to avoid applying to China.

These EU regulations and policies differ extensively from U.S. practice and have become a de facto international standard. The growing stature of the European Union in setting international technology transfer standards, the emergence of common European identity and security policies, combined with differing views between the U.S. and Europe on the risks of high tech trade, is one of the most significant changes in the last decade for technology transfer to China.

The U.S. China debate has played a role in differentiating U.S. and EU policy and in enhancing the EU's role. The U.S. has not been able to explain to its allies how China is a threat to Europe and it has not advanced coherent strategic rationale for continued controls on many dual-use items. A large portion of U.S. and multilateral controls were designed to constrain Soviet weapons programs in the 1980s and make little sense in a different strategic context. U.S. allies now ask how transfers of telecommunications equipment or mass-market microprocessors contribute to weapons proliferation, and many nations suspect that our obsession with export controls is a cunning feint to gain commercial advantage. The partisan nature of the China export debate in the 1990s also did not persuade allies that China was a new threat justifying a COCOM style regime.

How do concerns over U.S. exports to China stack up in light of these trends? China allegedly imports U.S. computers, machine tools, aircraft engines, semiconductors, telecommunications and space technology to improve its military, but U.S. commercial exports are unimportant for China's military modernization. There is considerable evidence to support this conclusion:

-- Critics charge that exports from the U.S. of a thirty-year-old jet engine designed for small business jets would contribute to Chinese cruise missile production. The Chinese instead bought cruise missile engine technology from the French and advanced cruise missiles from the Russians.

-- U.S. and Chinese companies, in clear contravention of their export licenses, diverted used machine tools to a Chinese aircraft plant. The dramatic charge is that these machine tools were used to build the B-1 Bomber. In fact, the tools were twenty years old, worn, inaccurate and mostly sold as scrap. The Chinese uncrated one of the diverted machine tools, a stretch press, before the U.S. discovered the violation and required China to return the machine tools to a US-owned plant in Shanghai. At the plant, the new American owners inspected the tools and found them inaccurate, unrepairable and unusable. Ironically, the U.S. action led to an improvement in China's industrial capabilities, as the Chinese replaced the worn-out stretch press they were obliged to return with a more modern and sophisticated stretch press bought in Europe. China routinely acquires the most advanced five axis machine tools from European sources even when the end-user is a military installation.

-- The Department of State denied the export of a U.S.-built communications satellite to China, fearful that it would be used to collect signals intelligence. This was implausible. While both sigint and communications satellites pick up communications from the ground, communications satellites lack the capability for covert interception and processing. A commercial telecommunications satellite cannot intercept communications unless it has been substantially modified. Since this satellite was being built in the U.S., no such modification by China was possible.

-- In 1998, concerns over alleged leaks of space technology to China led to legislation that transferred export licensing for communications satellites from the Department of Commerce to the Department of State. When Congress weighed new satellite restrictions in 1998, it underestimated their cost. It did so because the 1998 debate overstated the "uniqueness" (and thus the risk to national security) of U.S. satellite and launch technology. The immediate result was a significant decline in the U.S. share of the communications satellite market and new pressures on America's satellite manufacturing base.

Space launch vehicles and ICBM's share technologies, but launching satellites on liquid- fueled Space Launch Vehicles involve different technologies than does launching warheads on solid-fueled ICBMs. One important difference is that warheads are designed to re-enter the atmosphere and satellites are not. Reentry entails very high temperatures, high g-forces and speeds exceeding Mach 6. Only a very strong vehicle can withstand this, and the robust warhead does not need the same sort of launch as does a more delicate communications satellite: the warhead can withstand vibration and environmental effects that would destroy a satellite.

A second difference is that long-range missiles are, ideally, capable of rapid launch on very short notice. Solid-fuel rocket engines are better for this than are liquid fueled rockets used for satellite launches. Satellite launches can take several days to weeks to prepare, allowing for the use of liquid-fuel engines (which are very vulnerable from the military perspective, as they must sit immobile on the pad for hours while being fueled, making them easy targets). Other important factors, such as thrust termination, also differ from liquid-fueled to solid-fueled rocket engines. China has had liquid-fueled ICBMs for several decades. It wants to move to solid-fueled, road-mobile ICBMs (the DF-31). The technology used for commercial space launches by liquid-fueled, immobile rockets will not help them make this move.

-- Charges that China gains military advantage from U.S. computer exports ignore the increases in computing power brought about by microprocessor performance software developments, and clustered computers. Today's retail-level computers provide all the computing power needed for military and proliferation-related applications.

Military applications do not require much computing power. Increases in computing power in the past 10 years has transformed computers from highly specialized research tools into commodities and break any connection between high performance computing and weapons proliferation. The United States itself used elderly 650 MTOPS VAX computers until recently in the J-STARS battlefield surveillance aircraft (MTOPS are a measure of computer speed). EP-3E aircraft, the type involved in the recent incident in China, used 240 MTOPS workstations. To put this in perspective, desktop or laptop computers on the market today using a single Pentium III chip operate between 700 and 1000 MTOPS. For these battlefield applications and for design and manufacture, computing power is less critical than the ability to integrate computers, sensors, and platforms into an effective system.

Critics believe that high performance computers are a particularly sensitive "enabling" technology for nuclear weapons, missiles, submarines, and other military applications. These charges grossly overestimate the amount of computing power needed for military use and weapons design. Access to computing power does not automatically translate into modern weaponry. The United States designed and built its nuclear arsenal with computers of 500 to 1000 MTOPS. At the time, these were large, sophisticated supercomputers. Consumer systems can now provide the computing power once supplied only by these "supercomputers." The U. S. designed its most advanced fighter, the F-22, with a 958 MTOPS Cray supercomputer, now roughly one-quarter of the power found in mass-produced Pentium chips.

Computational power is of little benefit for weapons design unless the computer is running sophisticated codes based on extensive experience and test data. Desktop computers and workstations can meet military requirements if-and this is the crucial element-they are running the

necessary software and databases. For nuclear weapons design, a central concern in the computer export debate, access to data derived from nuclear weapons explosions is more important than computing power. A country without extensive experience in weapons design is at a significant disadvantage, and the lack of reliable data and proven codes will substantially constrain the usefulness of computer technology for military or proliferation purposes.

-- Opponents of high-tech trade with China decry sales of semiconductor manufacturing equipment. This equipment is among the most advanced industrial technology in use today. Japan, Germany, the Netherlands and the U.S. are the major producers. U.S. firms complain of significant hurdles in exporting this equipment to China, even when the intended recipient is a plant owned by a U.S. company. Restrictions on semiconductor manufacturing have survived almost intact from Cold War export controls aimed at the Soviet bloc, despite radical changes in the international security and economic environment.

This restriction runs headlong into China's desire to build an advanced national electronics industry and the desire of other supplier nations to take advantage of China's cheap labor and domestic market. Many companies build plants in China to ensure access to China's expanding consumer market and to lower their labor costs. While U.S. export policy tries hold transfers of semiconductor manufacturing equipment by U.S. firms to two or three generations behind state-of-the-art, Taiwanese firms have been transferring advanced equipment to China. Taiwan is the leading foreign developer of China's microelectronics industry. All other major suppliers - the Netherlands, Germany and Japan, have told the U.S. that they will not block equipment sales to China. They have repeatedly questioned the contribution of semiconductor manufacturing equipment to military capabilities and proliferation and ask whether there is still any strategic rationale for controlling these items.

-- Project 909 is the name given by China to its plan to develop a microelectronics industry. Project 909 involves joint ventures between Chinese and foreign firms. The foreign firms supply financing and technology and the Chinese supply labor and market access. In 1996, the U.S. had just begun to consider whether to permit exports of semiconductor manufacturing technology to Project 909 when Japan announced that it had approved the participation of its firms and the transfer, under a "global license," of advanced semiconductor manufacturing technology. The transfer was covered by a short agreement between the two governments where China promised not to use the semiconductor manufacturing equipment for military or proliferation purposes. The U.S. sought to discourage the transfer, but the Japanese responded that they did not see the strategic concern over manufacturing semiconductors for cell phones and pagers.

-- A German company planned to sell advanced semiconductor manufacturing equipment to a Chinese firm. A U.S. company was competing for the sale, but the U.S. denied refused permission for its export out of concern that the recipient was somehow involved in missile proliferation (the Chinese company made electronic components for use in a range of goods, including missiles). The U.S. demarched the German government several times, asking that it deny its company permission to export. The Germans declined, noting weaknesses in the U.S. proliferation charge and pointing out that the equipment in question was not controlled by the Missile Technology Control Regime. After almost a year of discussion, when it was clear that the Germans would not back down, the U.S. finally relented and approved the sale.

-- While unable to persuade Taiwan, the Netherlands, Germany or Japan that there is a military rationale for denying semiconductor manufacturing technology to China, the U.S. had more success in applying restraints to itself. The endless debate over Motorola's requests to build a chip fab in China for more than two years shows this. The equipment would go to a Motorola-owned and operated plant to make components for pagers and other civil products. The Chinese government would not have access to the fab and could not design or build chips for military purposes in it. This situation offered the U.S. the maximum degree of control over semiconductor

manufacturing equipment, yet it took almost a year to approve and then with conditions that limited the equipment Motorola could use to two generations behind state-of-the-art.

-- Critics say that sales of advanced telecommunications equipment by U.S. firms increase China's capability for command and control and even contribute to proliferation. None of the nonproliferation regimes control telecommunications equipment and they do not regard it as a proliferation-related technology. Until 1994, the U.S. and its allies controlled telecommunications equipment exports in order to preserve the ability to monitor Soviet forces. In 1992, COCOM nations led by Germany and France, rebelled and threw off Cold War controls on telecommunications equipment. U.S. allies questioned whether there was still a strategic rational for controlling civil telecommunications. Over the last few years, they have forced the U.S. to decontrol most of this equipment. Even before the decontrol, major western producers had begun to transfer equipment to Russia and China despite U.S. objections.

The most famous case involving telecommunications equipment involves a Chinese company named Hua Mei. Some of Hua Mei's owners were in the PLA. Hua Mei bought an advanced videoconferencing system from the U.S. 9similar systems were also available form European suppliers) to use in hotels. Critics argued that the equipment would provide the PLA improved command and control. However, even the GAO noted that the equipment was for video-conferencing among hotels, suggesting that this military use scenario is implausible. The issue with China and telecoms is market access, not national security or nonproliferation.

This brief review paints a very different picture of transfers of U.S. commercial technology to China. These transfers were benign. Conditions in China are also important in understanding the limited risk posed by such transfers and the limited utility of technology restrictions. China's defense industries, although extensive, remain a product of central economic planning and cannot produce modern weapons. Much of the defense industrial base is comprised of the least productive elements of China's economy - the State Owned Enterprises (SOE) that are an immense drain on China's finances. Given the role the SOE's play in providing a social infrastructure the Chinese will find it politically difficult to undertake the necessary contraction in its defense industrial base (shutting inefficient or older plants to reduce over-capacity) that will be necessary to modernize arms production.

This weakness reflects choices China made in the 1950s. Experience counts in making advance weapons, where extensive databases and long practice at testing and integration skills are the most important factors for successful weapons production. If China had built the modern conventional forces advocated by Peng Teh-huai and others, it would have forty years of experience in developing an advanced military industrial base. Mao's emphasis on low-tech warfare denied this to China and in general, their arms industry lags far behind other nation. We should not underestimate China's desire to develop a modern defense industry, but we should also not underestimate the difficulties they face in doing this.

Given this, the Chinese are exploring military strategies that emphasize strength in areas where the U.S. is weak rather than in trying to match American military forces. The lesson of the Soviet Union being driven into bankruptcy while pursuing a mirror-image military posture has not been lost on Beijing (which could not afford such a strategy even if it wanted to). One of the flaws with the technology transfer critique s that it often fails to take into account how the acquisition plans of a nation pursuing a strategy of asymmetric warfare differ from those of a mirror-image opponent.

More importantly, while China pursues its long-term goal of becoming a modern industrial state with a strong defense industry, it imports modern weaponry. The names of the weapons that China has imported and which help set the military balance in Asia - Sukhoi fighter-bombers, Sovremenny destroyers, Crotale and Aspide missile technology, Lavi aircraft components, Spey jet engines - have a decidedly un-American ring. These are the transfers that affect the military

balance. China's principal sources of modern military technology are Russia and Israel. European countries are at best only secondary suppliers - The EU's Tiananmen sanctions apply only to 'lethal' equipment (i.e. arms, not sensors, avionics, engines). Of the $5 billion in arms China has imported in the last decade, only one percent has come from the U.S. China has also purchased modern military-industrial technology from foreign sources, but continues to have difficulties in using this technology to build modern weapons, even when supplied with turn-key facilities.

This will change as China becomes more technologically advanced and better able to absorb foreign technologies and build its own advanced equipment. This is an unavoidable corollary to China's broader modernization, albeit something that lies years in the future. While some advocate that the U.S. wage 'economic warfare' against China to prevent its economic modernization, there is no international support for this and 'economic warfare' is unlikely to be in the U.S. national interest. Keeping China poor would be more likely to increase instability in Asia and the Bush Administration has wisely rejected this option.

One troubling aspect of the China technology transfer debate is its emphasis on the risks of technology transfer has obscured the costs of restriction to the U.S. Technology denial can still be effective in those areas (such as in advanced sensors or satellite remote sensing) where the U.S. has unique capabilities or multilateral support, but the U.S. must exercise greater care in determining those areas where technology denial will damage its ability to maintain a robust industrial base, to cooperate with allies and to ensure continued technological innovation. The debate also fails to consider whether the process of absorbing western technologies and of making the necessary changes to reap their full economic benefit will do more to reshape and erode the control of the China's Communist Party than anything since 1926.

U.S. policy debates for much of the last century have been shaped as much by the symbolism of China as by the reality of bilateral relations. Themes and fables like the Open Door, the Arrow Shirt myth, the Good Earth, the Red Menace and Who-Lost-China appear to recycle at least once a generation. However, a reliance on symbols is not beneficial as the bilateral relationship enters a new and difficult phase. Powerful forces in China fear and distrust the U.S. China is modernizing its military forces in response to this, and also to secure the central role it believes it should play in Asia. America will need clear thinking and effective tools to manage this challenge, not irrelevant measures that can weaken U.S. technological strength and harm relations with allies without denying countries like China access to advanced technology.

James A. Lewis was a State Department negotiator in the first Bush Administration's effort in 1991-92 to create an arms transfer regime with the UN Security Council's permanent members. From 1993-96, he was a negotiator in the U.S. effort to replace COCOM that led to the Wassenaar Arrangement, with particular responsibility for conventional arms and technology. From 1997-2000, he was the chief negotiator in multilateral efforts to support the President's Special Envoy on Cryptography.