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Summary Report on Technology  
Transfer to Communist Countries  
and the Intelligence Community's  
Role and Effectiveness 

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*TTIC 81-001  
October 1981*

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**Director of  
Central  
Intelligence**

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# **Summary Report on Technology Transfer to Communist Countries and the Intelligence Community's Role and Effectiveness**



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**Submitted by the Director of Central Intelligence  
to the Senate Select Committee on Intelligence**

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*TTIC 81-001  
October 1981*

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The Honorable Barry Goldwater  
Chairman  
Senate Select Committee on Intelligence  
United States Senate  
Washington, D.C. 20515

Dear Mr. Chairman:

During several appearances before your committee by Admiral Inman and myself earlier this year, we discussed the problem of US and Western technology losses to Communist countries, and the need to do something about these losses. Your concern centered on three key questions:

- What is the role of the Intelligence Community in controlling technology transfer and how effective has the Community been in helping to prevent the loss of sensitive technology related to US national security?
- What are the nature and extent of US and Western losses and the benefits to the Communist countries acquiring our technology?
- What improvements would enhance the Community's capabilities to assist the appropriate agencies in protecting US and Western technology?

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I share your concern and am pleased to present to you this summary report in response to your three questions. Detailed backup material upon which this report is based is available for your review. This report focuses principally on losses of US (and Free World) technology to the USSR and Eastern Europe. A special section (appendix) was prepared on China but should be viewed in the context of the changing US policy regarding China.

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It is my conclusion, based on this report, that the concerns of the Senate Select Committee on Intelligence are well founded. The Soviets and East Europeans have for some time been trying to obtain the most sophisticated US and Western technology, to satisfy both military and economic needs, through all means at their disposal and with many notable successes. A variety of transfer mechanisms have been used, including lawful purchases and trade arrangements; short- and long-term visits to the United States by scientists, students, and trade representatives; unlawful diversions of materials from approved destinations abroad; and clandestine intelligence operations. The result has been the strengthening of the Soviet and East European industrial and military sectors, accompanied by a difficult-to-measure, but identifiable, reduction in the security posture of the United States and its Western allies.

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Although the Intelligence Community (IC) has only had a marginal role in US programs that regulate technology transfer, it has provided intelligence support to those departments and agencies that have sought it; however, those departments and agencies for various reasons have not been able to make the best use of the available IC support. The only specific statutory responsibility of the intelligence agencies is limited to assisting Commerce in determining the foreign availability of controlled US technology. The enforcement responsibilities for export control statutes are assigned to the Departments of Commerce, State, and Treasury. Only the FBI, among the Intelligence Community organizations, becomes involved in the prevention of US technology losses in an enforcement sense and that mainly as the result of the Bureau's foreign counterintelligence and other criminal investigations. The Intelligence Community performs many support and ad hoc functions in this area, but its primary role consists of the collection, analysis, production, and dissemination of foreign intelligence concerning Soviet and East European needs for, methods of, successes in, and benefits from acquisitions of US and Western technology. Given this very limited role, the Intelligence Community can do little by itself to improve the protection given to US and Western technology. Direct improvement is limited to increasing the efficiency and timeliness of the intelligence and counterintelligence efforts in this area.

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Since assuming the Directorship of Central Intelligence, I have initiated several actions that address the most serious IC-related problems identified in this report, including:

- Charging the Deputy Director of Central Intelligence for Foreign Assessment (DD/NFA) with enhancing the Intelligence Community's overall capability to support both national policymakers and the US Export Control Community's decisionmakers.
- Establishing a Technology Transfer Assessment Center within CIA.
- Developing an offensive counterintelligence program to counter hostile intelligence service efforts to acquire US technology abroad.
- Assigning the technology transfer issue to my Critical Collection Problems Committee for increased focus by collectors.
- Establishing a DCI Committee that incorporates my Committee on Exchanges (COMEX) to deal with all forms of US and Western technology transfer; this Technology Transfer Intelligence Committee is to ensure that optimum use is made of IC resources on this problem and that the IC's support of the Export Control Community is responsive and properly coordinated

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I would also like to call to your attention several important efforts that have been undertaken recently by elements of the Intelligence Community to improve intelligence support to export control policy and decision-making:

- The Defense Intelligence Agency now ensures that the military implications of technology transfers are factored into all appropriate DOD foreign weapon systems studies and that foreign technology availability assessments are being conducted in support of the Military Critical Technology List program levied on DOD by the Export Administration Act.
- The intelligence components of Commerce and Treasury, with the assistance of NSA and CIA, have taken the initiative to define their intelligence needs more precisely, and as a result the flow of relevant foreign intelligence for use in their export control efforts has increased.

[redacted]

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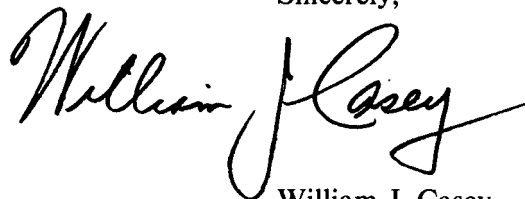
Several important problems remain to be addressed by the IC, but I intend to pursue them vigorously with all the resources I have available. Furthermore, I have asked Admiral Inman to conduct a review of the IC's current resource capability to address the remaining problems, and we will take appropriate steps to ameliorate those that are not adequately covered [redacted]

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The review conducted in preparing this report also identified a number of other important problems that affect US technology losses to the Communist countries but that are beyond the Intelligence Community's area of responsibility. These problems are identified in section III of the report. I am prepared to work with you and the appropriate departments and agencies to stop these illegal, unauthorized, or unintentional transfers of US technology. [redacted]

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Sincerely,



William J. Casey

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**Summary Report  
on  
Technology Transfer to Communist Countries  
and  
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Role and Effectiveness**


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
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
**Preface**

This report addresses three questions expressed by members of the Senate Select Committee on Intelligence concerning technology transfer to Communist countries: 1) What is the Intelligence Community's role; 2) What is the nature and extent of Western technology loss; and 3) What steps might be taken by the IC to improve the Community's role in helping to stop such losses? 

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The transfer of Western technology to Communist countries continues to be one of the most complex issues facing our government. The prevention of US technology loss is particularly complicated because it not only involves activities that are spread throughout the US Government, but also requires the active cooperation of foreign governments. In addition, the prevention and protective measures that can be taken by the US Government include such complex and diverse elements as US foreign trade policy and domestic and international export controls; domestic and foreign law enforcement and counterintelligence activities; and export control licensing requirements and the control of both unclassified and classified national defense information. The role of the Intelligence Community in this area has been poorly defined and other than the traditional responsibilities of collection, analysis, and the production of finished intelligence on East-West technology transfers, the Community has provided only support that has been directly requested. In the past, the IC considered this responsibility to be a secondary priority, at best 

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This report addresses the technology transfer loss problem and its national security implications. The term technology transfer connotes a wide range of trade, scientific, industrial, and communications activities; there is no single definition. When viewed in the context of technology loss the means of transfer becomes a greatly enlarged set, ranging from open source publications to war losses and traditional espionage. Transfer mechanisms that would not be considered cost-effective in commercial transfers, such as reverse engineering an illegally acquired missile component, become useful means to military adversaries who otherwise would be denied such technology. "Technology transfer" as used in this report means the conveyance of technical knowledge by legal or illegal means, including technical journals and memorandums, blueprints, technical proposals, official and personal conversations and plant tours, manufacturing equipment, whole plants, and end products. 


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This report was prepared by the Central Intelligence Agency, the Defense Intelligence Agency, the Federal Bureau of Investigation, the National Security Agency, the Department of Energy, the DCI's Committee on Exchanges (COMEX), and the DCI's Community Counterintelligence Staff. It was reviewed and coordinated by the intelligence components of the Departments of Commerce, State, and Treasury. The report was reviewed and concurred in by the National Foreign Intelligence Council on October 13, 1981 

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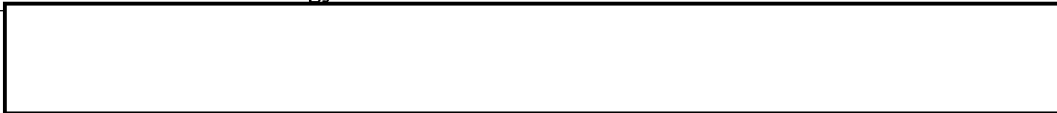
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## Technology Transfer and the Role of the Intelligence Community

### The Problem


The Intelligence Community (IC) shares the committee's concern regarding the transfer of Western technology that benefits the defense efforts of Communist countries. Our intelligence indicates that the Soviets and their Warsaw Pact allies have acquired large amounts of such US and Western technology and equipment through legal and illegal means, including their intelligence services. The Soviets have tried and succeeded in acquiring the most advanced Western technology. They have used their scientific and technological agreements with the West to facilitate access to the new technologies that are emerging from our applied scientific research efforts. They have used their scarce hard currency to legally purchase uncontrolled advanced Western technologies having defense-industrial applications. And, they have used their intelligence services to acquire those US technologies that are classified and export controlled 


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The Soviets and their Warsaw Pact allies have acquired militarily significant US technology through all possible technology transfer channels. Their effort to acquire US and Western technology is well planned and managed, its primary objective being to support Soviet and Warsaw Pact defense programs and to selectively fill gaps in their industrial base. Our intelligence indicates that this effort has been quite successful. Tables of selected US and Western technology and equipment acquired by the Soviets can be found in the tabular appendix to this report. 

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Over the last decade the KGB,<sup>1</sup> the GRU,<sup>2</sup> and the East European Intelligence Services have acquired key military technologies, such as US ballistic missile guidance components and designs; sonar and related antisubmarine warfare (ASW) technology; tank and antiarmor technologies; and wide varieties of missile and aerodynamic weapons technologies from the United States and its NATO allies. They have also been able to acquire large quantities of controlled technology such as semiconductor design and manufacturing equipment from the United States and other Western nations; we estimate that they may have acquired enough

<sup>1</sup> The Soviet Committee for State Security. 

<sup>2</sup> The Chief Intelligence Directorate of the Soviet General Staff. 

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equipment to set up [redacted] integrated-circuit production lines. 25X1  
 Similarly, Soviet and East European [redacted] acquisitions of US 25X1  
 computer technology have been responsible for many of their advances in 25X1  
 general purpose and minicomputers. [redacted]

The Intelligence Community has concentrated its efforts over the last several years in determining the nature and extent of Western technology losses. [redacted]

[redacted] We have only recently begun to focus our analytical 25X1  
 efforts on assessing the military value of these technology losses to the 25X1  
 Soviets and their Warsaw Pact allies. Although our intelligence concerning  
 actual Soviet use of acquired Western equipment and technology is limited,  
 we do know that the Soviets value Western technology quite highly. [redacted] 25X1

[redacted] have stated that the acquisition of Western technology and 25X1  
 equipment has saved the Soviets' defense production ministries millions of  
 dollars in R&D funds, not to mention the developmental time it has saved.  
 The Soviets' need to reduce Warsaw Pact military production costs is cited  
 as one of the primary reasons for acquiring advanced Western production-  
 related technology. [redacted] sources also have cited the innovative 25X1  
 effect of Western technology on Soviet industry as another reason for its  
 acquisition and use. For example, we believe the extensive effort to acquire  
 US-controlled semiconductor production equipment is an effort to modern-  
 ize the whole Soviet electronic component industry, a key sector in the  
 Soviet defense industry. [redacted] 25X1

Direct military applications of Western technology are hard to confirm, but we believe that most Western technology acquired by Soviet and East European intelligence services is used in some fashion by defense industry designers and manufacturers. We believe that such technology, which is usually acquired in response to specific requirements, is used directly or indirectly in both military R&D and countermeasure development.

While it was Soviet practice in the 1950s and 1960s to copy Western military technology and in some cases entire weapon systems (for example, the Sidewinder air-to-air missile, which became their ATOLL missile), their present inclination is to be far more discriminating, evaluating the foreign technology carefully and choosing only those design elements and engineering approaches that best fit their military needs and industrial capabilities. More and more, Western technology is needed only on a selective basis to upgrade key subsystems to achieve new performance objectives. The acquisition and copying of US inertial guidance components, for example, is believed to have helped the Soviets in achieving their

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current ballistic missile accuracy. Soviet antisubmarine warfare (ASW) capabilities have been significantly upgraded as a result of illegal acquisitions of Western equipment and technology, and Soviet tanks have profited from acquired Western technology. To date we have not been able to assess the military and industrial implications of many known Soviet technology acquisitions: we plan to, as time and resources permit, in the future. [redacted] 25X1

### **The Role of the Intelligence Community**

The role of the Intelligence Community concerning unauthorized and illegal transfers of US technology to Communist countries includes the following:<sup>3</sup>

1. Collecting information on and monitoring the transfer of controlled technology to foreign countries and disseminating relevant intelligence to the appropriate US export control agencies.
2. Producing finished intelligence on the military, economic, and political implications of actual and proposed technology transfers to controlled-country destinations.
3. Providing support to the NSC and high-level policy and decisionmaking organizations within the US export control community—that is, Commerce, State, Treasury, Energy, Defense, and the several interagency bodies that exist.
4. Providing intelligence support—as requested—to US Departments and Agencies (Commerce, State, Treasury, and Energy) that are responsible for administering export controls.
5. Disseminating that foreign intelligence information concerning possible violations of US export control statutes to the Department of Justice and to the appropriate investigative and enforcement agencies.
6. Disseminating intelligence and foreign counterintelligence information to the National Disclosure Policy Committee to aid in making decisions concerning the release of US classified military information and material to eligible foreign nations.

<sup>3</sup> The IC's responsibilities concerning the loss of US technology are derived from a number of executive policy and decision memorandums as well as executive orders, including Executive Order 12036 and related Attorney General Guidelines concerning the reporting of possible export control violations, Presidential Review Memorandum (PRM-) 31 and its NSC Decision Memorandum, and NSC 953 establishing the Interagency Working Group on Export Control. Specific statutory responsibilities, however, are limited to the foreign availability responsibilities cited in the Export Administration Act of 1979 and to the Espionage Statutes [redacted] 25X1

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7. Providing current reporting and analysis of foreign intelligence on illegal, including clandestine, acquisitions of US technology to those export control organizations responsible for domestic and foreign compliance actions.

8. Using foreign counterintelligence operations, as appropriate, to prevent US technology losses involving hostile intelligence services.

Table 1 lists the principal responsibilities of the Community and identifies the support of the IC organizations that perform them

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The FBI is the primary member of the Intelligence Community with law enforcement responsibilities related to technology losses, but it has no statutory responsibility for enforcing the Export Administration Act or the Arms Export Control Act. The enforcement responsibilities for these statutes are assigned to the Department of Commerce (Export Administration Act) and the Department of State (Arms Export Control Act); these Departments call on the Customs Service for inspection and investigation assistance. The FBI does become involved in the prevention of US technology losses, however, when such losses are encountered in the course of its foreign counterintelligence investigations and in the course of its enforcement of espionage, foreign agent registration, and other criminal statutes. Other members of the IC (CIA and the military services) also conduct counterintelligence investigations which relate to US technology losses.

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Although the IC has very limited responsibilities concerning the prevention of technology losses, its normal collection, analysis, and intelligence-production efforts regularly result in the production of foreign intelligence useful to the export control policy and enforcement agencies. These efforts have been of some assistance in strengthening US Government enforcement of national security export controls, in preventing potential unauthorized and illegal transfers, and in avoiding potential technology losses.

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The IC supports US export controls by providing timely reporting and analysis to those government agencies and interagency working groups concerned with domestic and international compliance. With respect to domestic efforts, the IC provides foreign intelligence support to the Commerce Department's Office of Export Administration compliance

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effort and to the Customs Service through regular dissemination of unevaluated intelligence, as well as through analytical support on particular export cases, as requested. The IC also participates in the new Interagency Working Group on Export Control, chaired by the Department of Justice, which is responsible for the oversight and coordination of domestic enforcement activities of the US Government

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Similarly, the IC provides analytic and advisory support to the US Government's international monitoring and enforcement efforts through the Economic Defense Advisory Committee's (EDAC) Working Group II (WGII). This group is responsible for coordinating US Government positions on illegal diversions and enforcement issues involving negotiations bilaterally with other governments and multilaterally in the Coordinating Committee (CoCom).<sup>4</sup>

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The DCI's Committee on Exchanges (COMEX) coordinates IC efforts concerning official US Government exchanges and bilateral cooperative agreements, as well as commercial visits and related activities, with the USSR, China, and East European countries. COMEX advises the State Department and other agencies involved regarding possible science and technology gains and losses and the potential intelligence benefits to the United States of proposed, ongoing, or contemplated exchange programs. The committee advises State and others regarding ways that visits might be constrained in order to reduce the potential for adverse technology transfer. Under US national security export control regulations, the release of technical data to foreign visitors may be a form of export. When the program of a prospective visitor might require review by licensing authorities in Munitions Control or Commerce, these agencies are so advised.

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At the present time the responsibilities and activities cited above are diffused throughout the Intelligence Community, and there is no central focus within the IC for overseeing and coordinating their execution.

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<sup>4</sup> Composed of the following countries: the United States, United Kingdom, France, Italy, the Netherlands, Belgium, Luxembourg, Norway, Denmark, Canada, Federal Republic of Germany, Portugal, Japan, Greece, and Turkey.

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## The Technology Loss Problem

### The Nature of the Losses

The USSR has traditionally given high priority and devoted large amounts of resources to the acquisition of US and Western technology by all means at its disposal. The efforts include legal acquisitions through legitimate trade, scientific and technological exchanges, open source publications, and international organizations and conferences; illegal purchases and trade activities, including diversions through trade channels that evade US export control, as well as traditional clandestine acquisitions through recruited agents, industrial espionage [redacted]

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Table 2 provides a general view of some of the many technology transfer mechanisms that must be monitored to detect illegal and unauthorized transfers. The table also identifies some of the control mechanisms that help stem our technology losses. [redacted]

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Among the many sources of Western technology accessible to the Soviets, the acquisitions that have the most immediate impact on Soviet military development have resulted from clandestine collection and trade diversions of defense-related technology. The most significant Soviet military acquisitions have been weapon designs, manufacturing plans and drawings, critical components, subsystems, and some complete weapon systems. The Soviets also have profited from the exploitation of captured Western military equipment (as in Vietnam). [redacted]

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The Soviet clandestine collection program is approved at the highest levels of the government—that is, the Central Committee of the Communist Party and the Council of Ministers. These illegal acquisition efforts are driven first by the needs of the military, the defense industrial ministries, as voiced through the Military-Industrial Commission (VPK); and, secondly, by the needs of the civilian sectors of Soviet industry that support defense production. The technology acquisition efforts of the Soviet intelligence services are worldwide, centrally directed, and very selective. They are closely coordinated with overt acquisitions and legitimate purchases, particularly those efforts under the auspices of the State Committees for Science and Technology (GKNT). The USSR's acquisition efforts are extensively supported by the other members of the Warsaw Pact. [redacted]

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The Soviets and their Warsaw Pact allies also have acquired—mainly through illegal trade means—export controlled dual-use and defense-related production equipment. Over the last five years, Soviet illegal trade efforts have concentrated on computers, microelectronics, airbreathing propulsion technology, guidance and navigation systems, acoustic sensors, optical technologies (including lasers), and modern production equipment

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**Table 2****Selected Technology Transfer Mechanisms and Controls****Mechanisms <sup>a</sup>**

- Direct investment
- Complete (turnkey) plant sales
- Patents and licenses with extensive teaching effort
- Joint ventures and joint production development
- Technical exchanges with ongoing contact
- "Know-how"—training, consulting in high-technology areas
- Processing equipment (with know-how)
- Technical data and engineering documents
- Proposals, presale negotiations, and sales presentations
- Commercial visits
- Governmental- and industrial-equipment sales
- Sales of products
- S&T and student exchanges
- Open literature (journals, magazines, technical articles, for example)
- S&T conferences, trade shows, and exhibits
- Hostile intelligence service acquisitions
- Recruited agents and industrial espionage
- Illegal arms trade
- Illegal trade
- End-user diversions
- Third-country diversions
- Foreign SIGINT
- Capture in war

**Controls**

- Export controls (national and international)
- Government security and regulations
- Industrial security
- Company management
- Visitor control (governmental and industrial)
- Prerelease reviews of open literature

<sup>a</sup> All transfer mechanisms can be employed with or without the participation of hostile intelligence service personnel. The involvement of such personnel can range from the overt, legal collection of unclassified, unembargoed technology to the clandestine acquisition of classified, military technology by agents working pursuant to the direction of hostile intelligence service personnel. Furthermore, most of the transfer mechanisms can be legally or illegally employed. Some of the mechanisms, such as capture in war, make the concept of legality moot.

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and technology. Detected diversions and evasions over the last several years were particularly heavy in the field of semiconductor manufacturing equipment, and they indicate Soviet and East European efforts to improve their whole electronic components industrial sector. The controlled technologies being acquired by the Soviets and the Warsaw Pact are a revealing indication of their defense needs [REDACTED] 25X1

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**Major Loss Problems**

The USSR and its Warsaw Pact allies are acquiring militarily critical and other significant Western technology through almost all possible technology transfer mechanisms. Because of their well-planned and exhaustive technology acquisition effort, the Soviets are able to fully exploit the open and legal sources available in the West at minimal cost and risk before employing their intelligence services to acquire the more difficult export controlled and classified technologies they need for defense purposes. We have identified below some of the most serious technology transfer problems currently facing the United States and its allies

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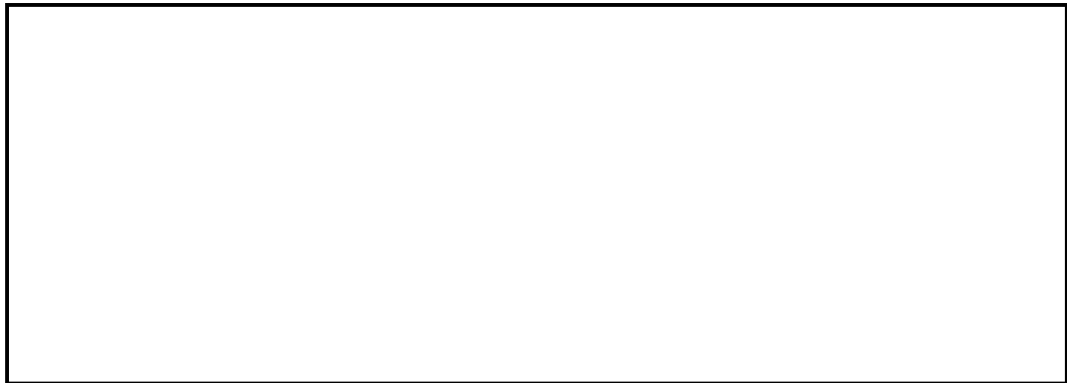
1. *Losses resulting from Soviet and East European intelligence service operations (that is, recruited agents and industrial espionage), particularly abroad:* The problems of protecting US technology from hostile intelligence services abroad are particularly difficult because the United States must rely mainly on the domestic security and counterintelligence services of host governments.

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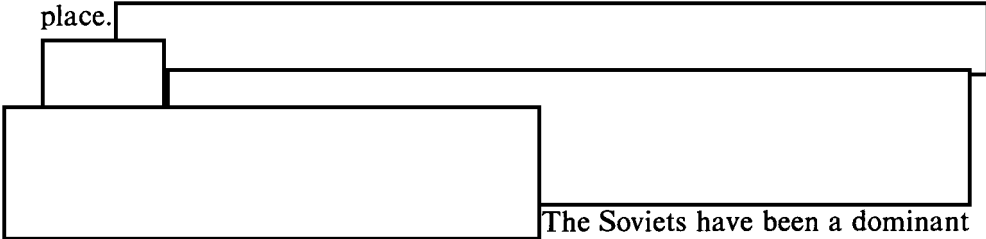


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**2. US technology losses through trade diversions abroad:** Whether the losses are the result of hostile intelligence operations or just illegal trade practices, the United States must in large part rely on the law enforcement efforts of those of its allies in whose countries these trade diversions take place.



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The Soviets have been a dominant force behind these illegal trade diversions of Western technology, with Poland and Hungary being their major East European surrogates. The US Government framework for dealing with these diversions is not now adequate to deal with large-scale, widespread losses or illegal losses involving US technology and US people abroad. The related task of coping with the possible end use or in-place diversions (that is, from civil to military applications) of equipment sold legally to the Communist countries is very difficult; this situation reflects both the great ease of affecting such diversions in closed societies and the enormous difficulties of detecting them.

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**4. Legal sales that contribute to Soviet defense capabilities:** Legal purchases of Western equipment have played a major role in developing the Soviet industrial base. The Soviets have purchased billions of dollars

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worth of Western equipment and machinery over the last decade. These purchases have included a number of categories having potential defense application—advanced materials and fabrication equipment, modern electronic componentry, laboratory and industrial test equipment, and automated production equipment and technology. Such purchases, requiring hard currency, are closely controlled by the State Committee for Science and Technology (GKNT) and those meeting the direct or partial needs of Soviet industry for defense purposes are given the highest priority.

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The present Commodity Control List concentrates heavily on electronic technologies and treats to a lesser degree many industrial technologies—for example, metallurgy and chemical areas which are needed to manufacture modern weapons. The US system of general license authorizations permits legal sales of equipment and relatively low-level technical information without specific government review. The general license authorizations also permit the possession of equipment from which design details may be extracted, provide vast quantities of commercial technical literature, permit detailed contract bid documentation during negotiations for prospective sales, facilitate personal contacts and plant visits, and continued commercial relationships using normal maintenance, repair, and operation arrangements.

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**5. Transfers resulting from Soviet and East European exploitation of S&T exchanges pose a continuing loss problem:** Soviet and East European efforts to acquire US technology are extensively abetted by the overt (and essentially legal) collection activities of their scientists and engineers that participate in academic, commercial, and official S&T exchanges. The S&T agreements are judged to provide valuable scientific information and technology for the USSR. The Soviets believe that their scientists participating in these exchanges are able to acquire Western technology of considerable S&T and military benefit. Soviet and East European students and visiting technical delegations to the United States are generally of high quality, and we suspect many of them are associated with classified work in the country from which they come. These visits and various arrangements that permit direct Soviet access to US companies are considered to be among the more important sources of technology loss.

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**6. Open source publications, particularly US Government documents, in which sensitive technology is made available prematurely, provides a major opportunity for Soviet and East European acquisitions:** Soviet use of overt collection methods to acquire Western information and technology is so extensive that it is almost impossible to assess; no thorough study has ever been made on the subject. The Soviets have certainly recognized the value and utility of the open source literature—they regularly purchase almost all US Government – published S&T documents. The USSR

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maintains an elaborate network for collecting, processing, and disseminating information on Western science and technology. In all, 100,000 to 130,000 people are believed to be employed in this network. Soviet weapons designers are reported to follow such open source information very closely.

[redacted]

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US Government publication, dissemination, and classification/declassification procedures provide the Soviets an ever-increasing source of S&T information. Automatic—and often premature—declassification of government R&D reports and their availability to the public at large offers the Soviets access to US technology that is very valuable to them in building their own industrial-military capability and countering US weapons development. US Government sales and information exchanges of unclassified S&T information with our allies, as well as with Communist countries, facilitates this access.

[redacted]

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**7. Losses through Communist-owned, locally chartered firms in the United States, Japan, and West European countries:** There are at least 30 of these firms in the United States (five Soviet, 17 Polish, five Czechoslovakian, and three Hungarian); most European countries have at least 20 each, with some having as many as 50. The location of Communist-owned firms abroad (both legitimate firms and dummies) facilitates the acquisition of US technology due to the sharply limited US oversight overseas.

[redacted]

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[redacted]

Over the past few years there has been evidence of the increased use of Communist-owned firms by Soviet and East European Intelligence Services in the United States to acquire controlled technology. These firms can legally purchase controlled US technology and study it without actually violating US export controls unless they attempt to ship the equipment or related technical data out of the United States. Such activity is difficult to assess because these companies are formed under state laws and are thus not registered with the US Government. Furthermore, since representatives of Communist-owned but US-chartered companies are not obligated to identify themselves as agents of foreign governments, there is a great risk that joint ventures between such firms and US corporations could result in serious technology losses.

[redacted]

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8. *Losses through Soviet and East European personnel in key positions in international S&T organizations:* Examples of such organizations include the International Institute for Applied Systems Analysis (IIASA), the International Atomic Energy Agency (IAEA), and various S&T offices associated with the UN. The Soviets and East Europeans have taken advantage of their positions in these organizations to acquire Western S&T information and proprietary technology. All Soviet personnel in such organizations are required to acquire such information. There also have been instances where these positions have been used to facilitate the acquisition of controlled Western technology and to mount traditional clandestine intelligence operations. [redacted]

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[redacted] indicates that the Vienna-based IIASA, jointly funded by 17 member nations from the East and West, is increasingly being used by the Soviets for technology transfer purposes and for intelligence activities directed at the United States and its Western allies. The Soviet technology acquisition efforts there include: influencing the selection of research programs at the Institute that produce greater benefit to the Soviets than the West; exploiting assigned Western S&T personnel and their sponsors, particularly those from industry; and, the massive exploitation of IIASA's computer access to Western S&T computer data bases. [redacted]

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9. *Losses of newly emerging and commercial technologies by all mechanisms:* One of the most significant future loss problems concerns the lack of protection for commercial and emerging technologies. Many of these advanced technologies today will become the critical technologies of future Western weapon systems. Applications for new technologies just emerging from the research stage are often not yet firmly identified, and, consequently, there is a period when such technology is not protected by classification, export control, or proprietary means. [redacted]

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[redacted] Moreover, as commercial interests continue to replace governmental programs as the primary impetus behind US research and development, a larger sector of our advanced technology will fall initially outside the normal defense security sphere. The protection of such technology early on, and its denial to Communist countries, poses a significant and intractable problem. [redacted]

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**Benefits to the Soviet Military and Defense-Industrial Sectors**

For the past 15 years the Soviet Union vigorously pursued a program to develop and modernize its strategic forces. This program continues unabated into the 1980s as the Soviets expand an already large military R&D and production establishment to provide the weapons needed to support their

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leadership's broad military and political objectives. A basic component in the advancement of this military-industrial establishment has been the acquisition and exploitation of both technology and hardware from the West. Examples of systems and technologies acquired are listed in the tabular appendix.

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The Soviets have been able to satisfy three basic R&D objectives through the selective acquisition of Western technology:

- First, the reduction of risk by following or copying proven Western designs.
- Second, the reduction of R&D time and costs by the use of Western designs and technology, including production-related technology and equipment.
- Third, the incorporation of countermeasures early in the Soviet weapons development process.

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Similarly, the Soviets have been able to upgrade critical industrial sectors such as computers, semiconductors, and metallurgy, as well as to modernize Warsaw Pact industrial manufacturing capabilities in order to keep military production costs under control.

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The fact that the Soviets historically have given high priority and devoted large amounts of resources to the acquisition of Western technology using all means at their disposal indicates that such technology is of great value to them. One way to measure the value of Western technology to the Soviets is to compare the technologies they have been acquiring to what we estimate their technological needs and gaps are for projected future weapons systems.

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At present, the Soviets have under way about 90 major military programs, at least a dozen of which are devoted to strategic ballistic missile systems. We expect the numbers of new or modified Soviet weapon systems reaching operational status in the 1980s to remain near historical levels, some 200 weapon systems in each of the past several decades. While the Soviet approach to military R&D relies mostly on evolutionary steps to minimize risks and avoid production problems, new generations of existing weapons requiring significant improvements in technology and some high-risk, innovative approaches also are undertaken. It is in these areas that Soviet illegal acquisition efforts are most likely to be concentrated. A selection of future systems projected for the Soviets in significant mission areas for the 1990s is shown in the left column of Table 4.

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**Table 4**

**Selected Soviet Systems Projected for Initial Operational Capability in the 1990s**

System/Concept	Potential New Performance	Key Technology <sup>a</sup>
<b>Projected High Probability of Occurrence</b>		
Improved air-superiority aircraft	Advanced lockdown/shutdown; possibly control configured	Materials, guidance, computers, microelectronics
New weapon system for Typhoon ballistic missile submarine <sup>b</sup>	Accuracy (CEP) of 500 to 600 meters	Computers, guidance/navigation, materials
Modernized theater command, control, and communication systems (widespread deployment)	Versatile survivable equipment, automated control system	Microelectronics computers, production communication
New class of attack submarine	High speed, great depth, quietness	Production, materials, propulsion
T-80 tank follow-on <sup>b</sup>	Improved day/night cross-country mobility; armor protection	Sensors, materials
Advanced space station (permanently manned) <sup>b</sup>	Permanently manned, multimission	Sensors, signal processing
<b>Projected Medium Probability of Occurrence</b>		
Space-based laser antisatellite system	Multiple target capability	Directed energy, power sources
Improved Moscow ABM system	Reentry vehicle discrimination, improved target-handling capability	Computers, signal processing
<b>Projected Low Probability of Occurrence</b>		
Enhanced neutron warheads (for artillery rounds)	Broad-area antitank weapon (limited collateral damage)	Production
Air- and space-based submarine wake detectors (feasibility has not been established for these concepts)	Broad-area search (if concept feasible)	Signal processing, sensors

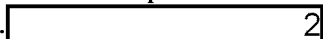
<sup>a</sup> Key technology available for systems development.

<sup>b</sup> May reach initial operational capability in the late 1980s.



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The key technologies that are required by the Soviets for these potential systems are displayed in the right column of Table 4.



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A Soviet technology is considered key or critical if it is basic to a number of significant military functions or concepts, or if it is a pacing factor for a specific military capability. For example, among the Soviet military systems projected for the 1990s (Table 4), computer technology is basic to new performance in strategic and tactical systems for command, control, and communications; in a follow-on to the Typhoon ballistic missile submarine (SSBN/SLBM) system; and in an air-superiority fighter (including control configuration). As another example, the development of high-bypass-ratio turbofan engines in the propulsion technology area is the pacing factor in our projection of new Soviet performance capability in large transport aircraft capable of strategic airlift missions

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The Department of Defense's initial list of militarily critical technologies, as placed in the Federal Register in October 1980, was prepared in response to the Export Administration Act of 1979. DOD's critical technologies list does not contain an explicit list of technologies critical to the USSR. It is principally a list of those technologies critical to US weapons that should be "protected" from the Communist countries. A comparable list of critical Soviet technologies has not been developed by the Intelligence Community for export control applications.

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**Benefits From the Acquisition of Selected Key Technologies**

**Microelectronics.** Since about 1965, the Soviets have placed a high priority on microelectronics R&D, and their military oversees the development and production of advanced integrated circuits. The Soviet practice has been to copy US devices. Many of their own devices are designed for compatibility with Western parts, and they rely on legally or illegally obtained Western parts to supplement their own base. The latest Soviet device design capability is now only about three years behind that of the United States while the production capability lag is about nine years.

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We expect Soviet military systems designers to continue to use devices that are pin-for-pin compatible with Western parts, thus decreasing the development time for their new systems. Indigenously produced parts can then be used when they become available. Thus, through the acquisition of Western components, the Soviets' future military applications of microelectronic technology may be more advanced than their general technology level would suggest.

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There has been substantial evidence over the past decade that the USSR has obtained large amounts of Western materials and manufacturing and test equipment for microelectronic fabrication. These acquisitions cover nearly every area of the material input and manufacturing steps of microelectronic production. From this we have concluded that Western materials and equipment have played a very important, if not crucial, role in developing Soviet microelectronic manufacturing capability and production capacity.

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There has been little evidence to suggest that the Soviets have made significant progress in reducing their dependence on Western technology. Moreover, with the rapid progress that has continued in Western microelectronic technology and means of production, we estimate that the USSR will remain dependent on Western technology acquisitions well into the late 1980s.

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Among the Eastern European countries, only East Germany appears to have concentrated its efforts on the development of advanced microelectronic production equipment. Recent evidence indicates that the Soviets have pressured East Germany to assume an expanded role in supporting Soviet needs.

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We believe that more effective international control of microelectronics fabrication equipment and materials exported to the USSR and Eastern Europe would have a serious impact on the Warsaw Pact countries' future development of military-related electronics. The USSR and, to a more limited degree, the East European countries are about to enter large-scale production of LSI devices and will require increasing amounts of Western equipment and materials. It is unlikely that individually or collectively the Warsaw Pact countries can accomplish this modernization quickly and effectively without access to Western technology.

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**Computers.** Soviet computer technology has been limited by fabrication and production technology problems and by difficulties in software development. Since 1969 the USSR and East European countries have been developing a family of general purpose computers known as the Ryad series. These computers essentially make up the total Soviet and East

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European effort in general purpose computers, and they have been and will continue to be used in a wide variety of civil and military applications. The architectural designs of the Ryad computers are patterned after those of the highly successful US IBM 360 and 370 series of computers; the Ryad computers also use some Western engineering concepts in the implementation of IBM designs. [redacted]

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Western technology has been important to the Ryad development because it has provided proven design directions both at the system and component levels. Thus, Soviet and East European computer production efforts have been devoted to the most successful Western computer designs that have ever been mass-produced, computers that could be used in a wide range of applications and could be highly serviceable in the field. With this approach the Soviets and East Europeans eliminated many of the risks in undertaking the development and production of a new series of general purpose computers, and in some cases they saved considerable manpower and time. [redacted]

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Soviet and East European development of the Ryad computer systems has been aided by virtually all available acquisition means—legal and illegal, including clandestine—for acquiring technical know-how. [redacted] information (mainly acquired by clandestine means) and [redacted] openly available data, however, was of greater benefit to the Ryad developers than were the acquisition (including illegal diversions) and study of actual IBM hardware. [redacted]

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***Production Technology.*** A major weakness in the Soviets' ability to incorporate advanced component technology in military systems lies in their outdated manufacturing equipment and production technology. The Soviets generally are not advanced by Western standards in production processes where large quantities of high-technology products are concerned. Their industrial production is generally marked by deficiencies in quality control, automation, and mechanization. As a result, Soviet production performance even in high-priority military areas, has been uneven. [redacted]

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Defense hardware production—characterized at present by labor-intensive processing—will continue to need key technological acquisitions from the West. Some improvements in productivity and machining accuracy will come from the introduction of Western automated manufacturing centers and other numerically controlled machine tools. Recent large purchases of machining centers from Japan and Western Europe may have already benefited some military manufacturing sectors, particularly the Soviet aircraft industry. [redacted]

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Current Soviet foreign technology acquisition efforts seem most concentrated in obtaining numerically controlled machines (including robots) for precision, repeatable machining operations. They are also interested in materials and materials processing, including powdered metallurgy processes and powder forming and pressing equipment, with some emphasis on steel casting methods and composite materials (carbon-carbon, metal matrix, ceramic matrix, and high-performance polymer matrix) production. They have sought electron-beam and other automatic welders, casting and drilling techniques and equipment, and chemical milling processes.

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**Radar and Acoustic Signal Processing.** The Soviets' theoretical understanding of most aspects of signal propagation, as well as of signal processing techniques and algorithms, probably is on par with that of the West. They lag the West, however, by five to 10 years in the speed of digital computer signal processing equipment and in its production. Because of their new military needs, as well as this lag, they have been attempting to acquire this Western technology.

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To make up for some of their sonar signal processing deficiencies, for example, the Soviets purchased a number of real-time, narrowband acoustic signal analyzers (CoCom controlled) from Denmark in the mid-to-late 1970s. The Danish firm claimed it was unaware that the processors were CoCom controlled. The technology in the processors is more advanced than the technology the Soviets have, and it could significantly improve Soviet ASW capabilities to passively classify US submarines and extend passive sonar detection ranges against US submarines.

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**Airbreathing Propulsion Technology.** Soviet indigenous R&D in airbreathing aerospace propulsion technology shows a strong commitment to high-temperature operation of turbine-based systems through advances in materials, cooling, and surface coating and manufacturing technologies with the goal of building more efficient, more compact jet engines. The Soviets are somewhat deficient in the development of these technologies, which are key for use in C-5A-sized transports or cruise missile carriers and for improved turbojet and low-bypass-ratio turbofan engines used in strategic bombers, fighters, and attack aircraft.

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Western technology acquisitions by the Soviets over the last five years have been effected by a wide range of requirements in these same technological areas. Inquiries, acquisitions, and acquisition attempts include almost all technologies and equipment to build high-temperature, jet engine, gas generator cores including cooling technology and film-cooled turbine-blade

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designs; turbine-blade fabrication processes and equipment; and high-temperature superalloys used in the actual blade-fabrication process including pressing, stamping, forging, drilling, casting, and welding techniques. In addition, the Soviets have been very active, although unsuccessful, in efforts to obtain very large, high-bypass-ratio, turbofan engines which use high-temperature engine cores.

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