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THE PRESENT DANGER
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25 AUG 1981

S221

Strictly Private

24 August 1981

To: Members of the Advisory Board on East-West Trade and Technology Transfer

From: Charles Tyroler, II

Here is Bill Van Cleave's draft of a proposed final report. May we have your comments and suggestions no later than Thursday 10 September?

We hope to have a final report ready for publication before CPD's annual meeting on 12-13 November.

Enclosure

Strictly Private

Van Cleave

FOR COMMENT DRAFT

TECHNOLOGY TRANSFER AND U. S. NATIONAL SECURITY

I. INTRODUCTION

The Committee on the Present Danger has undertaken a study of U.S.-USSR technology transfer and trade. The study has reviewed recent U. S. policy and its rationale, the arguments for tightening controls over trade and technology transfer, and several case studies that reveal our experience and the consequences of specific transfers. This report summarizes the study and forms the basis for CPD conclusions and recommendations.

The principal sources for this summary report are listed in Attachment A.)

During recent years, U. S. trade with and transfer of technology to the Soviet Bloc have become controversial policy issues as it has become more widely recognized that (a) the Soviet Union is implacably an adversary of the United States, determinedly mounting the most severe challenge to American security in our history, and (b) the Soviet Union's adversarial capability has been enhanced by American trade and technology transfer.

This recognition, however, flies in the face of the more traditional American view of the benefits of international trade. Trade, which may include the transfer of technology, has been traditionally regarded as normal, cooperative, economically beneficial, and even politically stabilizing in its effect on East-West relations. To Western businessmen, it has meant the promise of profits; to Western politicians, it has often symbolized the normalization of relations, and at times it has been seen as an instrument in the improvement of those relations.

At the same time, it is clear that the Soviet Union has benefitted in various ways from access to Western goods and technology. The question is raised then: Who <u>really</u> benefits from this trade? Is it in fact mutually beneficial in a balanced manner, a "non zero sum game," rather than a "zero sum game" in which Soviet gains are ultimately Western losses? If benefits do accrue to the West, do they override or compensate for losses that result from contributing to Soviet military or economic strength?

These questions are purposefully couched in terms somewhat broader than the question of the extent to which technology transfer contributes directly to Soviet <u>military</u> capability. The competitive strategic relationship between the United States and the Soviet Union is broader than that.

It is perhaps best expressed by the Soviet term, the "correlation of forces," which encompasses all aspects of relative national power in a basically competitive situation. Viewed appropriately, then, any assistance that strengthens Soviet competitive strength affects our strategic relationship, and, therefore, takes on national security aspects.

There is no doubt that the transfer of U.S. technology to the Soviet Union has contributed to both the military and economic capability of the Soviet Union. The Office of Technology Assessment of the U. S. Congress, in a 1979 report, concluded, inter alia:

> "Most observers of the export-licensing process would agree that U.S. and other Western technology has contributed to Soviet military capabilities."
>
> "There is no doubt that imports of certain commodities -- capital equipment and associated technology in particular -- have played a large role in the expansion of key sectors [of the Soviet economy] , and have thus made a significant contribution to total economic growth."

Subsidization of Soviet industrial and economic development contribute to the Soviet ability to compete with the West, to the ability to release resources for military purposes, and to the ability to sustain high rates of military investment. There is no "non-military" economic sector in that sense. Consequently, it is not only technology that can be used or diverted ("dual-use"

technology, in Western terms) for military purposes that is of potential strategic significance, but also technology and trade that strengthen the Soviet industrial base, or that permit easier allocation of resources to the military; or for that matter that reduce the strain of economic weaknesses in the Soviet system.

On the other hand, prohibition of such trade may contravene American business and political interests. And continuation (if not expansion) of trade with the Soviet Union has powerful support in the West. One Congressional subcommittee, after acknowledging the risks of technology transfer that bolstered Soviet military and economic strength, warned against overly restrictive restraints:

> "The guidelines must essentially reflect a political judgment, because too severe an interpretation of what might enhance Soviet military capabilities could frustrate the development of friendly relations and lead to the reductio ad absurdum of no trade at all."

The editorial "reductio ad absurdum" might be challenged but the prevalence of that view, and its dominance over U.S. policy cannot be. Others argue that trade remains an American advantage that should be exploited rather than constrained. Professor Samuel Huntington, for example, has argued that denying trade and technology transfer would deny an opportunity to use our economic-technological superiority as leverage; it would be opportunity lost.

The question is whether we can effectively use our economic advantages for gain or leverage, without losing more in the long term, and without strengthening the Soviet threat in the process.

These issues become particularly pertinent as Soviet military power continues to expand awesomely and as the prospects for a "detente" clearly in Western interests dim.

As the Committee on the Present Danger has pointed out, the Soviet Union has been steadily engaged in the most determined and ambitious military buildup of modern times. This buildup, along with the political uses to which it seems likely to be put, constitutes a clear and present danger to the West.

Soviet leaders have regarded the development of a modern, militarily oriented industrial base as the sine qua non of successful competition with the West. For this, the development or acquisition of modern technology is essential. Years ago, Marshall V. D. Sokolovskii set forth the Soviet view in his definitive work on Soviet strategy:

> "In the present epoch, the struggle for peace and the fight to gain time depends above all on the unremitting increase in Soviet military power, and that of the entire Socialist camp, based on the development of productive forces and the continuous growth of its material and technological base."

The key to what is progressively unfolding as a successful drive toward military superiority over the West has been military technological development. While retaining its traditional quantitative advantages, the Soviet Union has steadily and sometimes dramatically improved the quality of its military systems.

Over the past decade, Soviet military expenditures have grown to as much as 18-20% of the Soviet gross national product. Over the same period, the Soviet Union has out-invested the United States in the military area by the equivalent of $350 to $450 billion. By 1981, annual Soviet military investment -- RDT&E, procurement, and construction -- had become double that of the United States. Military R&D spending is three times that of the U. S. What this means is that the already impressive Soviet military gains are likely to become even more impressive in the coming years as this investment produces modern fielded capabilities, while U.S. underinvestment, by comparison, results in slower modernization and less readiness.

The Soviets have done poorly in terms of reducing their chronic economic and industrial handicaps and economic growth and productivity (except in certain special sectors) remains sluggish. A decade ago these problems also inhibited military development in critical areas of high technology. To reduce these

handicaps, Moscow embarked upon a program to develop or otherwise acquire the technology necessary for a modern military-industrial base. A formally structured system was established to identify the technologies and products needed, to determine potential sources, and to acquire the needed goods and technology, through legal or extra-legal processes, directly or through the use of third parties.

Soviet military developments reflect the success of that program.

There is little doubt that the major part of that success has been through indigenous development. Soviet military investment, including R & D expenditures, have surpassed that of the United States for several years. But Moscow has also sought to assist this effort by importing advanced technology, production equipment, and goods from the West. It has also sought through trade that seems benign -- e.g., the massive purchase of grain and other farming products -- to relieve strains produced by the overriding priorities given to military investment.

Through trade and importation of technology, the Soviets have avoided economic reform and the reorientation of priorities, sustained a marginally acceptable (although now diminishing) rate of economic growth, and continued to increase their military strength.

There are four general ways in which trade and technology transfer from the West might bolster the Soviet Union. Trade and technology transfer might:

1 - Contribute directly to Soviet military strength or military productive capacity.

2- Strengthen aspects of the overall Soviet economy so that Soviet leaders might find it easier to "release resources" to the military and continue its rate of military expenditure.

3 - Alleviate economic weaknesses, contributing both to internal stability and to Soviet ability to compete with the U. S. politically and economically.

4 - Enable our allies or third countries to assist the Soviet Union in any of the above.

The West has not been entirely unmindful of the potential contribution of Western trade and technology to Soviet strength and competitiveness, but it has been unable/to or unwilling fashion a consistent and coherent policy taking this into account. The thrust of Western trade and technology transfer policies over the span of half a century has been that they have been far more lax and liberal than they have been carefully attentive or restrictive.

A half a century ago, the same twin incentives -- Western governments expecting political benefits and Western businesses anticipating profits -- combined to produce a massive infusion of Western industry and technology that rescued a dying Soviet economy and helped solidify the Soviet regime. A decade ago, the same incentives resurfaced, adorned by a new theory of "detente," and the inducement of access to Western goods and technology became the key to improved communist behavior.

Since World War II yet another factor has contributed

to a permissive American attitude toward technology transfer (to friends and allies as well as to adversaries). During most of the twentieth century, the United States has been the undisputed leader in industrial technology. With World War II this leadership expanded, as did the pace of American technological development. An abundance of technology coupled with dynamic R&D served to produce the rapid turn-over and replacement of technology with even newer technology. American corporations became insouciant about the transfer of their rapidly developing technology in return for immediate profits; technology was sold as a product. And why not? American technological dynamism turned the transferred technologies into out of date technologies; leadership was maintained; and few risks were seen.

As J. Fred Bucy, President of Texas Instruments, observed:

> "United States industry and government developed a prodigal attitude toward technology. Technology, which is the know-how to produce products, was often viewed as just another product off the assembly line, to be sold for relatively short-term gains, rather than a resource that leads to new products and markets."

This short-sighted attitude has tended to persist even though the situation has changed. Critical technologies have advanced to the point where non-leading-edge technology may be quite significant economically and militarily; American leadership is no longer so secure or

so clear (and has become a precious commodity where it still exists); and in recent years the dynamism of American R&D has turned increasingly conservative.

II. TECHNOLOGY

> "Technology is not science and it is not products. Technology is the application of science to the manufacture of products and services. It is the specific know-how required to define a product that fulfills a need, to design the product, and to manufacture it. The product is the end result of this technology, but it is not technology." (J. Fred Bucy)

Science is knowledge, or the pursuit of knowledge; technology is the successful application of this knowledge to the development of industrial processes that produce goods or services; goods are the end product. Science tends to cross international borders rather freely, and, particularly with the free institutions of the West, is not subject to tight control (except in some particularly sensitive activities; for example, the development of the atomic and then the thermonuclear bombs). Goods are produced to be sold, internationally as well as domestically. Technology, however, the bridge between the two, confers competitive advantage, forms the basis of industrial and economic strength, and often determines military advantage. It carries more significance than the sale of goods because it enables the recipient to produce those goods. In

the military realm, this has been put succinctly:

> "the situation is not one of selling our adversary 'a club,' but machines which help produce better 'clubs,' faster and cheaper." (Henry Konet)

The sale of a product, even one so important as computers, does not neccesarily bestow on the purchaser the ability to produce such products, unless the sale includes such information (a condition commonly insisted upon by the Soviets in commercial transactions). The product itself may make a major contribution to the purchaser's economic or military strength; it may even be key to the success of an industrial establishment; but it is still different from the transfer of technology.

Of course, the distinction is not always easy to make. Products may embody technology, which may possibly be extracted from the products. Products themselves may be essential components of the technology of larger scale systems, rather than purely end use products. Semiconducters and integrated circuits, for example, are essential components of computers; computers may be end-use products or may themselves be essential components of a technology or of other end-use products, such as weapon systems. While technology is design, process, and manufacturing know-how, goods may constitute the building blocks of the technology of higher products.

Purchase of products meets immediate and short-term needs; purchase of technology enables future production of goods, and may support indigenous technological advance. "Once a technology transfer is made, there can be no effective control of either the flow of products or the future applications of the technology." (Bucy)

In other words, when it comes to technology, "end-use" controls, or safeguards against diversion, are self-contradictory.

Technology may be transferred to other nations in a variety of ways:

- outright sale of technology: processing equipment, engineering and technical data, manufacturing know-how
- licensing
- sale of turnkey factories (built for and turned over to the recipient ready to begin production)
- training and education of technical personnel
- consulting
- submission of proposals with detailed information
- joint ventures, co-development, or co-production arrangements
- multinational corporations, which transfer technological processes to international affiliates
- government-to-government scientific exchanges
- weapons sales that include manufacturing know-how
- sale of products that embody technology that might be extracted through "reverse engineering."

III. CONTROL REGULATIONS AND POLICIES

Most exports of goods and technologies by American companies are not restricted by the U. S. government. Free trade is regarded as economically beneficial and consistent with the American political system and its values. Regulations do apply, however, to the export, or transshipment through third countries, of certain goods and technologies to Soviet bloc countries. This is because such transfers raise questions pertaining to national security. The issues are how narrowly or broadly national security considerations should be defined, and how liberal or restrictive the controls should be. The official response to these issues has changed over time.

In 1949, Congress passed the Export Control Act, which restricted exports to the USSR that would "contribute to either their military or economic potential." In doing so, Congress officially recognized the national security significance of strengthening the Soviet Union militarily and economically through transfer of American technology.

To internationalize these controls in coordination with our allies, the Truman administration in the same year organized informally the Coordinating Committee for Multilateral Export Controls, eventually comprised of the NATO allies (except Iceland) and Japan. COCOM, as it has come to be called, has since been the only Western multinational

institution to coordinate common export controls. Its members have frequently been in disagreement. COCOM has no formal jurisdiction, it lacks policing and sanctioning authority, but it has generally been dominated by the U. S. attitude toward controls.

In 1969, the U.S. loosened the interpretation and restrictions of the 1949 act. In the spirit of detente policy, transfers that would strengthen the Soviet Union's economic potential were not only permitted, but even encouraged. Only exports that could be shown to "significantly enhance" Soviet military capability would be restricted, and the burden of proof rested with the agency that would impose the restriction. This policy was further elaborated in the 1979 Export Administration Act, which attempted to clarify and tighten restrictions, but which still banned only that technology or equipment "which would make a significant contribution to the military potential" of the Soviet Union," or which would prove detrimental to the national security of the United States.

Moreover, additional liberalization was provided by the application of "end-use" and "foreign availability" tests. Dual-use technology that might make a significant contribution to the military potential of the Soviet Union

might still be transferred if its "end use" was monitored to prevent "diversion" to military purposes. Even if this was not possible with confidence, and even if the technology might have critical military purposes, technology and goods might be sold the Soviet Union if they were judged available elsewhere (foreign availability).

The legislative and policy changes resulted in an easing of both American and COCOM controls on exports. The number of restricted items on the U.S. Commodity Control List was reduced, and licenses granting exceptions for listed items were more liberally granted. Lawrence J. Brady, then Acting Director of the Department of Commerce Office of Export Administration and now, testified in 1979 to Congress that only 200-300 applications to export to the Soviet Union were denied in 1978 compared with some 7,000 transfers of advanced technology that were allowed.

The American policy of granting exceptions to restrictions on controlled items was accompanied by a loosening (or undermining) of the multilateral control system through an increase in exceptions requested in COCOM. The COCOM list of embargoed items (always narrower than the U.S. Control List) had been reduced from 265 items to 149 by 1976, and requests for exceptions grew steadily and were steadily granted. According to the Office of Technology Assessment,

836 COCOM exception requests were approved in 1977, while only 31 were denied. Over half of the exception requests in recent years have come from the United States.

IV. DETENTE AND TECHNOLOGY TRANSFER

In 1969, the then incumbent Administration adopted a policy of detente with the objective of moving us from "an era of confrontation to an era of negotiation" in our relations with the Soviet Union. Cooperative initiatives and negotiations were emphasized in arms, trade, and various other dealings with the USSR. In particular, liberalized trade and technology transfer would be seen to be a key element in the creation of "a web of international Soviet-American arrangements that would demonstrate to the Kremlin that cooperation was more productive than confrontation."

The previous "political benefits" arguments for trading with the Soviet Union were restructured into a theory of leverage and interdependency. Soviet political behavior would be influenced and moderated through a delicate balancing of rewards and penalties; the rewards being economic inducements in trade, technology, and credits; the penalties being the withholding of such inducements. According to the theory, once Soviet leaders saw the benefits to be accrued through cooperative behavior, then the threat to withhold the benefits would become the leverage

to promote that cooperative behavior.*

Henry Kissinger, the chief architect of such a policy, also argued that "trade and investment may leaven the autarkic tendencies of the Soviet system, invite gradual association of the Soviet economy with the world economy, and foster a degree of interdependence that adds an element of stability to the political equation."**

In this way, Soviet dependence upon the West would increase and a "web of constraining incentives" would envelope Soviet behavior.

The "web" was further described by President Nixon as a "cloth:"

> "Just as a cloth is stronger than the threads from which it is made, so the network of agreements we have been weaving is greater than the sum of its parts. . . .Thus each new agreement is important not only for itself but also for the added strength and stability it brings to our relations overall."

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* Unfortunately, the Soviets were willing to accept the rewards, but were not much impressed by the threatened penalties and refused to pay the price expected. The threatened penalties were unpersuasive because the U. S. continued to confer economic awards (and to follow arms and arms control policies advantageous to the Soviets) despite mounting evidence that they were not producing the desired results. U. S. self-constraint provided opportunities for the Soviets to exploit, which offered rewards far beyond the value of the economic inducements that were threatened to be withheld.

** One is reminded here of a 1922 statement of David Lloyd George: "Trade, in my opinion, will bring an end to the ferocity, the rapine, and the crudity of Bolshevism surer than any other method."

The idea behind liberalized trade and technology transfer policies, then, was not that liberalization would secure economic benefits, but that it would produce political ones. Trade and technology transfer were closely linked with the success of detente, and with the moderation of Soviet international (and even domestic) behavior.

If detente has failed -- as evidenced by continued Soviet repression at home, Soviet aggression and bellicosity internationally, and the continued Soviet military buildup -- then it is clear that technology transfer has not produced the political benefits that might override the costs and risks involved.

The question arises then of what contribution the more liberal trade and technology transfer has made to the Soviet ability to challenge the West. What is the wisdom of contributing to the Soviet economy when the highest priority of that economy seems directed toward the sustenance of a massive military machine? How has technology transfer contributed to the Soviet military-industrial base, or permitted the release of resources to that base?

For that matter, although it was not a part of this study, a question that should be asked is to what extent the U. S. is hurting itself commercially by the transfer of its technology to allies and friendly nations, who then might compete with the United States in international trade?

V. CASE STUDIES

Numerous specific examples illustrate the extent to which technology transfers have directly contributed to Soviet military capabilities; other examples indicate a high probability that diversion of U.S. technology to military end uses is occurring without the U.S. being fully able to monitor or control such diversion. Other examples raise the issue of indirect contributions to Soviet strategic enhancement through strengthening of areas in the Soviet economy and/or compensating for weaknesses or failures in certain areas.

This section summarizes and discusses some of the leading case studies covered by the project.

Bryant Case

In 1961, the Bryant Chucking Grinder Company applied for an export license to sell Centalign-B ball bearing precision grinders to the Soviet Union. Congressional hearings were held, and Defense Department spokesmen testified against the proposed sale. They argued that the USSR did not have the machine tool technology for quantity manufacture of high precision ball-bearings, which were critical to certain sophisticated military systems, and that the Bryant machines could be used to manufacture such ball-bearings.

As a result, President Kennedy personally disapproved the Bryant application for an export license.

Eleven years later, in 1972, the Bryant Chucking Grinder Company applied again for an export license to sell 164 Centalign-B precision grinders to the Soviets. This time, the license was granted. Rather than attempt to deny the strategic significance of the grinders, the Nixon Administration -- in its eagerness to grant the license -- argued "foreign availability" (an argument that rested upon a mere 24-hour round trip made by a businessman to determine the extent to which these machines were available overseas).

In testimony before the General Procurement Subcommittee of the Senate Armed Services Committee in November, 1979, Dr. Jack Vorona of the Defense Intelligence Agency stated: "We have no doubt that these machines are making a distinctive contribution to the Soviet military effort, and could very well be producing the precision miniature ball-bearings used in current and follow-on high quality MIRV guidance systems."

The conclusion is inescapable that the Bryant sale has aided Soviet development of an ICBM hard-target kill capability of profound strategic significance. It is

this capability that has placed our land-based ICBM force in jeopardy, necessitating expensive new basing countermeasures, which themselves are faced with the challenge of Soviet MIRV potential. U. S. strategic vulnerability and Soviet strategic superiority were to some extent promoted by this case of technology transfer.

Kama River Truck Plant

In 1971, the United States began transferring automotive production equipment and technology to the Soviets for construction of the Kama River Truck Plant, an enormous industrial complex, despite Defense Department warnings that this could be used to manufacture military vehicles. Nearly 130 export licenses totalling over $350 million were involved in the American contribution to the Kama River project. The U. S. transferred assembly lines, foundries, molding machines, and computer technology; and, for good measure, the transfers were subsidized by direct loans made by the Chase Manhattan Bank and the Export-Import Bank.

There has since been conclusive evidence that the plant has been used extensively to provide the Soviet military with military vehicles. In 1979, military trucks manufactured at Kama River were used in the Soviet invasion, occupation, and subsequent suppression of resistance in Afghanistan.

ZIL

The Soviet network of ZIL truck plants already had a known dual manufacturing role when the U. S. Government allowed the transfer of a six million dollar computer to a ZIL truck plant in 1977. ZIL truck plants manufacture military trucks, armored personnel carriers, and even missile launchers. One quarter of its truck production is devoted to the military. Despite Department of Defense opposition to the computer sale, the transfer was permitted on the grounds that any diversion for military purposes would not significantly contribute to additional Soviet military production capability. In other words, since the plants were already capable of producing military equipment, and were doing so, helping them improve that capacity was not a "significant" contribution.

Volgograd

The United States also supplied critical automotive technology to the Volgograd Plant from 1968-1971. The majority of the machine tools transfer lines and other gear-cutting equipment came from the United States, even though the Italians spearheaded the deal (known as the Fiat Deal, for production of Fiat sedans). The transfer was allowed on end-use grounds -- civilian, rather than military --

despite the fact that the plant clearly has had a dual-use manufacturing capability.

Oil, Gas, and Technology Transfer

Soviet imports of American equipment for oil and gas production rose from less than five million dollars in 1972 to nearly thirty million in 1977. The majority of these imports, according to a 1978 study by the Department of Energy Office of International Security Affairs, involved the sale of priority equipment for exploration, drilling, and production, including offshore. Production and offshore sales accounted for 55.7% of the sales. The ISA report noted that the equipment imported was being used in "mature producing fields," leading to the conclusion that the Soviets needed such equipment in order to increase oil and gas production at existing Soviet oil fields.

It has been estimated by former National Security Council staff member, Samuel Huntington, that Soviet oil production would be 10-15 percent less, were it not for Western transfers of equipment and technology.

The Carter Administration took a remarkably tolerant view of the strategic significance of assisting Soviet oil and gas production. In response to a question by Senator Heinz, Carter Administration spokesman Dr. William J. Perry rationalized:

"Substantial additions to Soviet oil production would not necessarily increase Soviet military capabilities directly . . . because Soviet military forces continue to have priority over non-military requirements."

What this rather obtuse statement implies is that since the Soviet military gets the oil it needs anyway it is of no significant consequence that we reduce the strain on the non-military sector while the military commands the petroleum it requires.

The Soviet Union increases its military spending in real terms by an annual rate ranging from 3-5 percent to 8-10 percent, according to various estimates. As the burgeoning military commands more and more oil and gas, a more limited supply for the non-military sector could be expected to impose limitations upon Soviet economic growth; and, hence, possibly limitations on the rate of increase of military expenditures. Leslie Drenes, an expert on Soviet energy, has estimated that if Soviet oil and gas industries were limited in their expansion capacity, it would result in "declining growth in energy production, provided current energy/capacity utilization ratios do not change." This constraint might well affect the growth of Soviet military strength.

In the fall of 1978, the Carter Administration approved some 74 export licenses for the sale of oil and gas exploration and drilling technology to the Soviet Union. The most important sale was the one involving the export of a $144 million oil drill bit factory by Dresser Industries to the Soviet Union. A Defense Science Board task force, Secretary of Energy James Schlesinger, and spokesmen for the National Security Council Staff recommended against the Dresser sale. They argued that it would help fill Soviet energy requirements in such a way as to free resources for the military sector, that its computerized electron beam welding machine could be used in the manufacture of jet aircraft, and that the tungsten carbide used to produce the drill bits could be used to manufacture armor-piercing projectiles.

Computers

The Soviet lag in computer technology is an unquestioned fact. The inferiority is apparently across the board, involving both hardware and software.

Two major computer transfers have particularly raised questions of national security: those involving the Cyber 73 and the Univac 1100/10C.

The Cyber 73 computer had been used in the United States for military R&D and for antisubmarine warfare purposes,

The Department of Defense expressed concern over intended Soviet use of the computer since it would be located "in an area that contains a large Soviet radar site and a laser-research laboratory."

Computers sold presumably for civilian purposes cannot be monitored closely enough to assure non-military use. For example, there are recent reports that the Sperry Rand Univac 1100/10C computer and a computer scheduling system sold to Aeroflot have been used for military purposes. In 1979, the sale was allowed following an Administration determination that it would not be used for military purposes, even though it was sold to a Soviet research institute located near a Tupolev military aircraft factory. By late 1979, reports from U. S. diplomatic sources in Moscow indicated that the Univac computer was being used in stress analysis of Soviet aircraft designs, including the Backfire bomber.

The computerized scheduling system sold to Aeroflot also has potential military application. According to a CIA analyst, it "can raise the level of expertise of military specialists involved in command and control and logistics." The same source points out that the computers involved in the Kama River sales contributed to increasing

Soviet truck production 5-10 years earlier than otherwise likely. "Since many of the trucks almost certainly will be used by both military and civilian organizations, the Soviets gain military as well as economic benefits from the purchase of these computers."

Growing awareness of the military applications of advanced American computers finally led to the denial of one well-publicized proposed transfer. An effort by Control Data Corporation to obtain a license to sell the sophisticated CYBER 76 (which can do five million 15-digit calculations per second -- 40 times faster than any Soviet computer known at the time) was denied by the U. S. Government--but only after the proposed transfer was publicized and met with strong Congressional opposition.

This is an interesting case of a strategically significant technology transfer that was prevented, but barely in time. The computer is the mainstay of American nuclear weapons laboratories, and has been used in research and development having to do with ballistic missiles, ballistic missile defense, and space. It was only public exposure and Congressional pressure that stopped the sale of the computer to the Soviets.

Such publicity, in fact, is the exception rather than the rule. Export licenses for the transfer of technology or high technology items are generally closely held by all parties involved. The Export Administration Act considers

export applications to be "proprietary" commercial information. Of the thousands of applications for export to the Soviet Bloc countries, relatively few become publicly known, particularly prior to the license approval and actual sale. In the past, Congress itself has not been well informed in a timely manner. The Cyber 73 sale, for example, became general public knowledge and known to Congress only after the deal had been completed.

Missile and Aerospace Technology Transfer

The U. S. has transferred technology, experience, and knowledge in the aerospace field in a variety of ways. Given the Soviet military emphasis in space missions, these transfers must a priori be highly questionable from a national security perspective, whatever their symbolic political value. An interesting example was the Apollo-Soyuz Test Project (ASTP)

The 1975 joint U.S.-Soviet Apollo-Soyuz space mission resulted in a major aerospace technology transfer to the USSR. The Soviets had experienced serious problems in the Soyuz space program; for example, with inertial guidance systems

and on board computers. As part of the project, Soviet scientists visiting U.S. mission-control in Houston, Texas, were given the opportunity to study the Apollo guidance, control, and propulsion systems. The knowledge, experience, and technology shared with the Soviets during the ASTP had obvious strategic implications. Zbigniew Brzezinski termed ASTP:

> "a vehicle for the most one-sided transfer from the United States to the U.S.S.R. of a technology that has obvious military applications."

Others have argued that the ASTP experience contributed to the Soviet ICBM program, toward development of more maneuverable space and strategic systems, and to ICBM targeting and accuracy.

Dr. Jack Vorona of the Defense Intelligence Agency pointed out the inseparability of Soviet civilian and military space efforts. The space program, he said, is "overshadowed numerically by the military space program which includes . . . orbital interceptor, communications, meterological, naval support, and reconnaissance and surveillance systems."

Jet Engine Technology

The United States has allowed the export of the RB-211 high bypass ratio turbo-fan engine to the U.S.S.R. This engine, subsidized by $300 million in federal R&D grants to Lockheed, has distinct military applicability and conveys important advanced technology to the Soviets. For example, it provides much of the technological base for the development of state-of-the-art U. S. strategic and tactical cruise missiles.

At this time, there apparently remain pending 1979 applications by Detroit Diesel Allison for export licenses for the sale of C-20B components of the advanced 250 series jet engine to Poland. These components, turbine wheels and nozzles, are of the same type used in the U.S. cruise missile program. The Department of Defense recommended against the license, and also recommended that these components be placed on the COCOM restricted list. The components have not been transferred, but neither have they been placed on the restricted list.

Wide-Bodied Aircraft Technology

This technology has been imparted to the Soviet Union largely through technical briefings and information provided by U. S. aircraft and engine companies. In 1973, the State Department permitted a Soviet technical delegation to visit Boeing, General Electric, Lockheed, McDonnell-Douglas, and

Pratt and Whitney. The delegation received briefings on wide-bodied technology, including the jet engines used on the Boeing 747. The rationale was that the briefings and information were not "security-sensitive," even though wide-bodied aircraft can be used for military functions, including strategic cruise missile carriers.

In 1977, the Soviet Union almost acquired the General Electric CF-6 engine (used in the 747) for the IL-86 cargo aircraft. The engine certainly could also have been used for military transport or strategic bomber aircraft. Only following a Congressional protest led by Rep. Paul Trible (R-Va.) did GE withdraw its application for the export license.

Bilateral Technical Agreements

One of the least controlled areas of technology transfer concerns the bilateral scientific and technical exchange agreement between the United States and the Soviet Union. Between 1972 and 1974, the U.S. entered into eleven such agreements with the Soviet Union, with two of the most important being in energy and atomic energy. (Activities under the agreements have been suspended since the Soviet invasion of Afghanistan.)

The "technology exchange" involved in the agreements has been exceptionally one-way, and hardly mutually benef-

icial to the United States. The Soviets have balked at giving U. S. representatives access to advanced Soviet laboratories, particularly those involved in pulsed-power research. They have denied the U.S. any reciprocal information on their accelerator system. Further, the Soviets have not abided by the terms of the 1974 Energy Agreement, calling for exchange of information on each other's projected energy requirements, output, and balance.

Student Exchange

For years, the U. S. has been training Soviet graduate students in the hard sciences and engineering. According to the DIA, the "typical" Soviet exchange student (sometimes very questionably a "student") is 35 years of age, with 8 years of professional experience, studying engineering or science, and specializing in such areas as digital control, solid state physics, thermodynamics, conversion of hydraulic into electrical signals, and the like. (U.S. exchange students, by contrast, generally study language, culture, or history.) Dr. Vorona testified before the Senate Armed Services Committee that the student exchange program serves "as a very effective transfer mechanism."

Dr. J. Fred Bucy has noted that "a high percentage of these technical 'students' have missions well beyond the areas of academic inquiry."

Private Sector Agreements

The U.S.-Soviet science and technology agreements fostered and encouraged the development of agreements between private companies -- over which the U.S. Government has had no formal control or oversight. The DIA regards these agreements as "still another mechanism for the potential transfer of technology" to the Soviets. The agreements have resulted in plant visitations by Soviets at several U.S. aerospace and aircraft factories.

VI. TECHNOLOGY TRANSFER AND GRAIN EMBARGOES

In response to the Soviet invasion of Afghanistan in December 1979, the Carter Administration placed an embargo on grain sales to the Soviet Union, which the Reagan Administration -- following a campaign pledge -- has since lifted. The grounds for lifting the embargo were that it was ineffective, since the Soviets acquired grain from other sources (another "foreign availability" loophole), and that only the American farmer suffered.

The Carter Administration also suspended existing and pending export licenses for several hundred high-technology exports to the Soviet Union. The ineffectiveness of this ad hoc temporary embargo demonstrates the need for a coherent longer term policy on trade and technology transfer.

The embargo has been ineffective because:

(1) It did not include an embargo on such exports to Soviet Bloc nations. A DIA response to Senator Garn (R-UT) pointed out that the satellite countries are used by Moscow "to acquire equipment, data, and technology, . . . (and) it can be safely said that to be completely effective any embargo must also include Soviet bloc nations."

(2) It did not involve U.S. allies. Transfer of technology from allies, always difficult to control, was not affected by the embargo particularly since they doubted Carter's resolve and saw the embargo as only a temporary measure. It would take an established, long-term policy to have any chance of closing this avenue of transfer.

(3) It was not firmly enforced. The U.S. was not only unable to enforce it in COCOM, but also it made exceptions itself. (For example, sale of an oil drilling rig to Japan for use by the Soviets in oil exploration and drilling off the island of Sakhalin was allowed.)

(4) It covered only about one-third of all manufactured goods exported to the USSR. The restricted list continued to exclude goods and technologies of importance to the Soviet Union, which continued to be sold under general licenses.

(5) Only a small number of the 700-800 export licenses and applications covered by the embargo were actually revoked. The suspension was clearly temporary, to be lifted following resumption of "normal trade relations." (E.g., even the

export licenses for equipment and technology transfers to the ZIL truck factories were not revoked by the embargo, despite clear knowledge of the manufacture of military vehicles at those factories.)

VII. CONCLUSIONS AND RECOMMENDATIONS

The Soviet invasion of Afghanistan presented an opportunity for a fundamental review and revision of U. S. trade and technology transfer policy insofar as the Soviet bloc is concerned. It was not done. The election of Ronald Reagan and the beginning of the Reagan Administration has presented an even better opportunity, especially given the known views of many of the Administration's key policy makers concerning the adverse effects of the leakage of Western technology to the Soviets.

A new policy must take account of the significant role U.S. trade and technology transfer have had in contributing, directly and indirectly, to Soviet military strength and overall national strength. And it must take into account the potential and risks of future transfers.

It is significant that both President Reagan and Secretary of State Haig have publicly and officially branded the Soviet Union as a country that has instigated and supported acts of international terrorism. Unless these statements are meaningless, the Reagan Administration seems

now obligated to implement Section 6(i) "Countries Supporting International Terrorism" of the Export Administration Act of 1979. That Section states:

> The Secretary (of Commerce) and the Secretary of State shall notify the Committee on Foreign Affairs of the House of Representatives and the Committee on Banking, Housing, and Urban Affairs of the Senate before any license is approved for the export of goods or technology valued at more than $7,000,000 to any country concerning which the Secretary of State has made the following determinations:
>
> (1) Such country has repeatedly provided support for acts of international terrorism.
>
> (2) Such exports would make a significant contribution to the military potential of such country, including its military logistics capability, or would enhance the ability of such country to support acts of international terrorism.

This consideration, in addition to all of those discussed above, justifies a fundamental change toward a far more restrictive policy and set of controls over trade and technology transfer. This change should be based upon the following conclusions and recommendations:

* "Strategic significance" should be interpreted more broadly than the narrow standard of direct and "significant" military contribution; it should reflect the basic adversarial relationship between the U.S. and USSR.

* Commercial technology has progressed so rapidly that in many cases it leads military technology and can be applied to military capability; dual-use technologies should be more stringently controlled.

* Even though we must be concerned about Soviet diversion of dual-use commercial technology to military ends, technology transfer and trade that helps free the release of resources for the military sector should be of equal concern. Trade and transfer that contribute to filling important Soviet industrial and economic gaps should be controlled because they promote resource allocation to the military and because they contribute to overall Soviet strength. The development of Soviet industrial and economic capability cannot be separated from the development of its military potential.

* Trade and technology transfer should be restricted because the U. S. has not received either the political or the economic benefits expected. To the contrary, rather than encouring Soviet docility, they have abetted Soviet bellicosity. Rather than promoting cooperation, they have strengthened the Soviet ability -- and, hence, the Soviet inclination -- to challenge and to threaten.

* There is very little economic reason for U.S. trade with and technology transfer/ to the Soviet Union. The trade is one-sided, and often results in a loss of technological and industrial edge, which even in a non-military sense can hurt the U. S. economically, reduce trading advantages, and result in the loss of U.S. income and jobs.

* As part of tighter controls, the U. S. should develop a comprehensive list of goods, technologies, and processes that should be controlled because they directly or indirectly aid the Soviet military, Soviet technology and industry, or the Soviet ability to pursue its adversarial aims. This should include computer technology, automotive production technology, chemical industry technologies, and oil drilling and exploration.

* Export restrictions should be established for third countries that serve as a conduit to the Soviet Bloc.

* Pending a comprehensive policy review and the establishment of export control machinery that works far better than the existing machinery, an embargo similar to that of the Carter Administration, but much tighter and more comprehensive, covering all Bloc nations, should be established, and a major effort should be made to obtain allied cooperation.

* COCOM should be made a formal arrangement with sanctions.

*The Office of Export Administration should be removed from the Commerce Department, and either placed in the Department of Defense or given an independent status under the purview of the National Security Council. Congressional oversight committees should be encouraged.

The major sources used in the preparation of this summary are the following:

(I) Research work conducted by research assistants in the University of Southern California Defense and Strategic Studies Program under the direction of Professor William R. Van Cleave; particularly the following two products:

(a) Wayne Schroeder,

(Doctoral Dissertation, Defense & Strategic Studies Program, USC, 1980)

(b) David E. Hoppler, et al., "The National Security Implications of Strategic Technology Transfer," DSSP Working Paper 3-81

(2) Discussions and inputs of the Technology Transfer Project Advisory Board, which, at one time or another, included:

Richard V. Allen
Lawrence Brady
Carl Gershman
Fred C. Iklé
Thomas Kahn
Charles Kupperman
Paul Nitze
Richard Pipes
Wayne Schroeder
Charles Tyroler II
William R. Van Cleave

(3) Congressional Materials, such as:

(a) U. S. Congress, Office of Technology Assessment, Technology and East-West Trade (Washington, D.C., GPO, 1979)

(b) Congressional Hearings (Sample list attached)

(4) Interviews with Department of Defense, Department of State, Department of Commerce, and Congressional officials and staff involving in technology transfer and trade policy.

(5) U. S. Government Executive Branch documents

(6) Articles and published materials. Particularly worth noting as being of value were:

(a) American Enterprise Institute, Proposals for Reform of Export Controls for Advanced Technology (August, 1979)

(6) (b) J. Fred Bucy, "On Strategic Technology Transfer to the Soviet Union," International Security, Spring 1977

(c) _____, "Technology Transfer and East-West Trade: A Reappraisal," International Security, Winter 1980/81

(d) Miles M. Costick, "The Strategic Dimension of East-West Trade," American Council for World Freedom, 1978

(e) _____, "Soviet Military Posture and Strategic Trade," in W. S. Thompson, ed., National Security in the 1980s, 1980

(f) Michael J. Deane and Mark E. Miller, "Science and Technology in Soviet Military Planning," Strategic Review, Summer 1977

(g) Robert Dornan, "Exporting American Technology: A National Security Perspective," Social and Political Studies, Fall 1977

(h) Carl Gershman, "Selling Them the Rope," Commentary, April 1979

(i) Samuel Huntington, "Trade, Technology, and Leverage: Economic Diplomacy," Foreign Policy, Fall 1978

(j) Maurice Mountain, "Technology Exports and National Security," Foreign Policy, Fall 1978

(k) R. Sean Randolph, "Trading with the Enemy," National Review, September 19, 1980

(l) Antony C. Sutton, National Suicide: Military Aid to the Soviet Union, 1973

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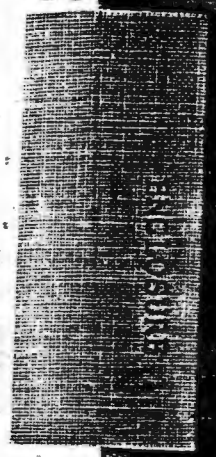

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