ABSTRACT

Title: MINDING THE GAP: WESTERN EXPORT CONTROLS AND SOVIET TECHNOLOGY POLICY IN THE 1960s

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This thesis examines the origins and evolution of Western export controls intended to limit the transfer of high technology, particularly computers, to communist countries, and how technology policy within the Soviet Union and other communist states was shaped by these controls. This work intends to demonstrate that Western attempts to control trade in high technology were responsive to changing economic and political realities and that changes in export controls produced corresponding changes in policy within the USSR. Ultimately, policies on both sides served to maintain and widen the technology gap between East and West far more dramatically than anticipated, deepening the economic stagnation of Eastern Europe and hastening the collapse of communism.

MINDING THE GAP: WESTERN EXPORT CONTROLS AND SOVIET TECHNOLOGY POLICY DURING THE 1960s

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Introduction

In 1996, when Carly Fiorina became CEO of Hewlett-Packard, the company enjoyed a decades-old reputation for engineering genius along with a comfortable market share. Fiorina has since become notorious in technology circles as someone who failed to see the big picture; in an effort to reduce company expenditures, she carved away mercilessly at what was by far its most expensive endeavor: research and development. Her decision quickly removed from the field what had been one of its most innovative and competitive players. Ultimately she sold off HP's research division entirely, and the company took a dive from which it has never completely recovered.[1]

The lessons of Soviet R&D are timely ones, and its example is still valid in demonstrating how important investment is in scientific advancement. Soviet science thrived in the late 1950s largely because it was among the most lucrative and prestigious professions in the communist world. By the early 1960s, the tremendous cost of domestic research made it a target for budgetary reductions, while the growing importance of applied research to economic success fostered increasing state

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1 Craig Johnson, "The Rise and Fall of Carly Fiorina: An Ethical Case Study". Journal of Leadership & Organizational Studies, (Nov. 2008). http://www.entrepreneur.com/tradejournals/article/187962046_1.html

involvement in the sciences.[2] At the same moment, the option of purchasing foreign licenses for high technology presented itself for the first time, and the Soviet Union was faced with a choice between its own struggling efforts to efficiently mass produce advanced technologies, or to purchase similar items from the West.[3] The Soviet choice would be what historian Anne Fitzpatrick calls the "Make-or-Take" Decision of 1967. Resolution No. 1180/420, passed by the Central Committee and Council of Ministers, made importation of foreign computers part of an ambitious plan to jump start computer production in the Soviet Union.[4] By the time this resolution was passed, the technology gap in computing already made foreign models far superior to Soviet ones, and in the judgment of many well worth the time and cost to acquire them. In the process, however, a branch of research and industry containing some of the USSR's best minds, which had already struggled against ideological and practical obstacles, found much of its original work abandoned as the machinery of state science turned its efforts to reverse-engineering of Western models. Regardless of how unlikely Soviet domestic computing was to either catch up with or overtake the West,

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2 V. Yevropin, and Ye. Sopilov. "The Effectiveness of Scientific Research," Issue No. 18, December 1969, p. 81-90, cited in Mose L. Harvey, Leon Goure, and Vladimir Prokofieff, Science and Technology as an Instrument of Soviet Policy, (Coral Gables, FL: University of Miami Center for Advanced International Studies, 1972), p.184.

3 Marshall Goldman, *Détente and Dollars: Doing Business With the Soviets*. (New York: Basic Books, 1975), p.33

4 Anne Fitzpatrick. *Pioneers of Soviet Computing*. (e-book) http://sovietcomputing.com, Ch. 6

the decision to tie Soviet progress to Western innovation would have dire economic, social and political consequences.

The costs of research and development on paper may appear to dwarf any immediate benefit, but the impact of curtailing that investment may ripple across all sectors and reverberate for decades into the future, resulting in an overwhelming loss of revenue and, in all likelihood, hastening the collapse of the entire enterprise. Martin Malia described the folly of central planning in its inability to reconcile the true wants and needs of the population with production as planners can only judge the needs of citizens based on what has already been produced.[5] The same phenomena applied to scientific innovation; it could not be determined in advance what scientists would need to produce the next breakthrough, and so the economy was inherently ill-equipped to provide the material support researchers required.

The inability of the centrally-planned economy to foster and integrate technological advances in the USSR arguably has roots much deeper than the Revolution. A number of historians, economists, journalists and political theorists, among them David Saunders, Alexander Gerschenkron and Peter Amann, have claimed this as a pattern in the history of the region.[6] For Gerschenkron, Russia's

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5 Martin Malia, *The Soviet Tragedy: A History of Socialism in Russia*. (New York: Simon and Schuster, 1995), p.70.

6 Timothy Luke, "Technology and Soviet Foreign Trade: On the Political Economy of an Underdeveloped Superpower," *International Studies Quarterly*, Vol. 29, No. 3 (Sept., 1985), p. 327-353, p. 328.

technological lag itself was in a sense unique, an extension of the backwardness that had affected most of the region for centuries.[7] Amann, however, cites the general difficulty societies face in making great leaps forward without subsequently taking great steps back, taking as an example the wild pendulum of the French Revolution and its corresponding fluctuations in social attitudes toward science, religion and morality.[8] Despite its self-imposed economic, social and political distance from the West, the socialist world was hardly a system in isolation. It was profoundly affected by the external decisions of its adversaries as well as its allies, who were simultaneously experiencing their own cycles of reaction and reform. For many, the continuity between the historical reliance on foreign technology and the behavior of the USSR reflects much larger trends in the global economy, and cannot be ignored.[9]

Computers are the focus of this thesis because in many ways the field of computer science represents a microcosm of Soviet achievement and failure, and the differences in development between East and West. Socialism as a system profoundly failed some of its best scientific minds and its entire domestic computing industry. At its height during the late 1950s, the USSR represented a real challenge to Western

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7 Alexander Gerschenkron, *Economic Backwardness in Historical Perspective*, (Cambridge, MA: Belknap Press, Harvard, 1962), p.134.

8 Peter Amann, *Revolution and Mass Democracy: the Paris Club Movement in 1848* (Princeton: Princeton U. Press, 1975), p.29.

9 Luke, p.329.

computing, both in technical and intellectual terms.[10] However, the conditions of communism and a centrally-planned economy made progress difficult, and the wide-scale, dynamic, market-driven development of computers that was to revolutionize the economies of the West impossible.

Computers were seen as a key strategic item, and were among the most tightly controlled by Western export restrictions.[11] As the power and influence of computers became more apparent, their use as a tool in widening the technology gap between East and West was increasingly appreciated by Western policymakers. Simultaneously, their value and use was apparently profoundly misunderstood by those in socialist state planning circles, and mistrusted within the industrial leadership, rendering many costly investments in foreign technology meaningless.[12]

In researching the history of computing in the Soviet Union, and examining the changing relationship between East and West during the 1960s, a number of parts seemed to cohere as a continuous narrative. This thesis will attempt to relate in more

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10 Slava Gerovitch, *From Newspeak to Cyberspeak: A History of Soviet Cybernetics*, (Cambridge, MA: MIT Press, 2002), p.13.

11 "Balancing the National Interest: U.S. National Security Export Controls and Global Economic Comptetition," Committee on Science, Engineering, and Public Policy (U.S.). Panel on the Impact of National Security Controls on International Technology Transfer. (Washington, DC: National Academy of Sciences, 1987), p.95.

12 George Holliday, *Technology Transfer to the USSR, 1928-1937and 1966-1975: The Role of Western Technology in Soviet Economic Development*. (Boulder: Westview Press,1979), p.104:
"In the words of Joseph Berliner: 'There is some disposition among the governors of the Soviet economy to regard borrowed technology as the deus ex machina. It offers a way of attaining the high rate of technical advance greatly sought, without having to tamper once again with the fundamental economic structure.'" (p.104)

or less chronological order the political, scientific and social developments that allowed a technology gap between the socialist and capitalist worlds to form and grow. Eventually, this gap would contribute to the erosion of an ideological, political and economic system thought for decades to be immutable. However, at the opening of the 1960s, the USSR was at its scientific and political zenith. There was little reason to believe that a chain of decisions made within the USSR and abroad would begin the unraveling of a scientific superpower. The story of computing technology in the USSR encompasses most completely and elegantly the motivations behind and effects of these decisions.

The first chapter will deal with the political environment of the late 1950s and early 1960s, and the scientific landscape within the USSR, particularly computing. The period here is treated as one of embryonic détente, in which the U.S. and USSR were perceived to have achieved scientific and military near-parity, and were forced to confront one another diplomatically for the first time. This period saw the groundwork laid for future foreign policy, including increased trade and future diplomatic engagement.

The second chapter will focus on the changing political and economic landscape in both the communist and capitalist worlds. A sharp increase in East-West trade begins to change the relationship between the U.S. and its allies, upon whom it relies to enforce export restrictions. Within the USSR, economic slowdown and political instability result in a number of restructuring and reform efforts, growing the Soviet bureaucracy while failing to produce desired results.

The third chapter contains what this thesis holds to be a pivotal moment in Soviet history and in the relationship between East and West. The year 1967 saw tensions shift from Eastern Europe to China, and also witnessed the exhausted patience of American allies with what they saw as an absurdly restrictive technology export policy. On the Soviet side, an increasing acceptance of and demand for foreign technology as both a time and cost saving measure made the pursuit of foreign licenses irresistibly appealing. Within months of the U.S. relaxing its policy to allow licenses for low-performance computer production lines to Eastern Europe, the Soviet Council of Ministers voted to divert resources away from domestic computing research. It would instead focus on the acquisition of foreign licenses and hardware.[13] Almost immediately, an entire branch of Soviet science was hamstrung; the USSR had effectively made itself dependent on the West for innovations in the field of computing.

In examining this period, the picture that emerged was one of a two superpowers, acting somewhat blindly in their own self-interest, inevitably forced to deal with the ramifications of that status in relation to their allies. For the USSR, this meant moving from an economic model based on heavy industry to one more equipped to provide consumer goods, to build its wealth and the reputation of communism upon quality of life for its citizens and trade with the world.[14] For the

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13 Fitzpatrick, Ch. 6

14 William Taubman, *Khrushchev: The Man and His Era*. (New York: W.W. Norton, 2003), p.509.

United States, this meant learning to cooperate with allies it had become accustomed to dominating. Pressure from Western Europe ultimately caused the US to permit trade in computers with communist Eastern Europe. At roughly the same moment, the USSR began crafting state policy around the possibility of purchasing licenses from abroad rather than conducting costly domestic research and development.[15] This thesis intends to demonstrate that, given the speed with which one decision followed upon the other, they constitute an interconnected chain of events. The changes that swiftly followed in the balance of global economic power following 1967 indicate that the USSR's decision to import foreign technology and abandon domestic R&D in computers was momentous. In addition to chaining Soviet progress to the whims of its adversaries, it indicated a crumbling of Soviet ideology, and an erosion of Soviet exceptionalism. In the estimation of former Deputy Minister of the Radio Industry and Academician Mikhail Sulim, "I have to say that of the two possible paths of development, we chose the wrong one."[16]

Knowing (but only half accepting) the failures of its own system, the USSR had empowered its greatest enemy to restrain its technological development. Accepting (but never fully knowing) the Soviet Union's advanced technological capacity, the United States continued to push hard against technology transfer. What leniency COCOM showed in granting computing licenses to socialist countries

15 Goldman, p.34

16 Fitzpatrick, Ch. 6

seemed to give the communist world enough rope to hang itself. At times, it appears US policymakers were either unaware or refused to believe how successful export controls had been in widening the technology gap.[17]

Among the primary sources consulted at the National Archives were the records of the State Department, Commerce Department, and Department of Defense. These agencies played major roles in the administration of international export controls among NATO nations and the members of the NATO-controlled Coordinating Committee for Multilateral Export Controls (COCOM). Various organs within the State Department and NATO, such as the Office of European Regional Political and Economic Affairs (EUR/RPE) and the Organization for Economic Cooperation and Development (OECD) sent representatives into the negotiations that determined which items were subject to embargo. Industries and agencies whose affairs were subject to export control scrutiny, specifically the nuclear, munitions and high technology fields, were also directly involved in policy negotiations. The CIA devoted significant resources to acquiring and translating reports on Soviet computing technology, and also on the participation of scientists from socialist states in international trade fairs and conferences.[18] Unfortunately, the files pertaining to

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17 "Computer Exports to the Soviet Union: Hearing Before the Subcommittee on International Economic Policy and Trade of the Committee on International Relations," June 27, 1977. Government SuDoc (Y4. In.8/16:C73/32), p.5.

18 "General Report on the Work of the Study Group for Electronic Components, Leipzig Spring Trade Fair 1965," National Archives and Records Administration, Washington, DC, RG 263, CIA Foreign Broadcast Information Service. Foreign Documents Division, Inf. Reports, Code 00-X, 1949-77. Job#78-04396A, NN3-263-99-003, p.2.

technology exchange at the National Archives have been heavily redacted or reclassified within the past five years, and much information regarding the internal discourse shaping U.S. policy seems to be unavailable.

It was also a challenge to locate accessible materials in the State Archives of the Russian Federation. A number of other repositories that might have held useful information have been closed to Western researchers in recent years. It was possible, however, to consult the holdings of the Russian State Library.

Having been a prevailing concern for the United States government, literature on technology transfer and export controls in this period abounds from many sectors. Among the dominant historical voices speaking to the subject of Soviet Science, Nikolai Krementsov's exhaustive work on the structure of the Soviet Academy of Sciences and the ideological war waged most visibly within Soviet biology during and after the Stalin era paint a vivid picture of the scientific system in the USSR as a whole, and the obligations and expectations carried by its members.[19] Ethan Pollock's work in the same field gives important background to the various scientific controversies that shaped the practice and application of science in the Soviet Union.[20] The relationship between science and the Communist Party apparatus are treated more

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19 Nikolai Krementsov, *Stalinist Science*. (Princeton: Princeton U. Press, 1997).

20 Ethan Pollock, *Stalin and the Soviet Science Wars*, (Princeton: Princeton U. Press, 2006).

closely in Stephen Fortescue's concise and effective work,[21] as well as in Paul Josephson's research on science cities and scientific administration in the USSR.[22] Perhaps the greatest debt this paper owes regarding Soviet science and society belongs to Loren Graham, the veritable don of the history of Soviet science, who has couched a host of relevant topics within admirably readable and compelling prose.[23]

Speaking to this topic on its most specific terms, Anne Fitzpatrick has done a much needed service in adding to the literature on the under-represented subject of computing in the USSR with her biographies of Soviet computing pioneers.[24] Among the most notable historians of this subject, Slava Gerovitch reaches beyond his favored topic of cybernetics to provide valuable background on the material reality of computing in the USSR.[25] Gerovitch also contributed to the singularly useful collection of essays, *Computing in Russia: The History of Computing Devices and*

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21 Stephen Fortescue, *The Communist Party and Soviet Science*. (London: Macmillan, 1986).

22 Paul Josephson. *New Atlantis Revisited: Akademgorodok, the Siberian City of Science.* (Princeton, New Jersey: Princeton University Press, 1997).

23 Loren Graham, *Science and Philosophy in the Soviet Union.* (New York: Borzhoi Books, 1966).

24 Fitzpatrick, Anne. *Pioneers of Soviet Computing*. (e-book) http://sovietcomputing.com

25 Slava Gerovitch, *From Newspeak to Cyberspeak: A History of Soviet Cybernetics*, (Cambridge, MA: MIT Press, 2002).

Information Technology Revealed, which includes the writings of engineers Alexander Nitussov, Sergei Apokin, Friedrich Naumann, B.N. Malinofsky, and others.[26]

Since much of the most relevant literature on this topic departs from the field of history, a number of non-historical sources have proved the most useful. The writings of Dzherman Gvishiani, Soviet economic theorist and planner and Deputy Chairman of the Committee for Science and Technology of the Soviet Union (as well as Alexei Kosygin's son-in-law) were insightful in their repeated reference to Western studies on management and efficiency.[27] They are also a testament to the fact that Western ideas on management and automation were present and circulating in the USSR, even if the means to implement them were not. Alec Nove's work on Soviet economics and science policy,[28] and David Dyker's study of technology lag in the USSR and Eastern Europe demonstrate quantitatively the economic impact of the technology gap.[29] R.E.H. Mellor's slim, accessible volume on COMECON helped elucidate an economic alliance that now seems a barely-comprehensible relic in

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26 Georg Trogemann, and Wolfgang Ernst, eds. *Computing in Russia: The History of Computer Devices and Information Technology Revealed*, (Wiesbaden: Friedrich Vieweg & Sohn Verlagsgesellschaft mbH, Braunschweig, 2001)

27 Dzherman Gvishiani, Dmitri Bobryshev, Bentsion Milner and Vladimir Rapoport, *Scientific and Technical Progress and Social Advance*. (Moscow: Novosti, 1980).

28 Alec Nove. *An Economic History of the USSR: 1917-1991, Third Edition*, (New York: Penguin Economics, 1993).

29 David Dyker. *Catching Up and Falling Behind: Post-Communist Transformation in Historical Perspective*, (London: Imperial College Press, 2004).

today's global economy.[30] William Taubman's Pulitzer Prize-winning biography of Khrushchev gives an account of perhaps the most influential personality of the Cold War, examining his influences and motivations, and giving an unprecedentedly detailed explanation of many of his seemingly inscrutable political and economic decisions.[31] Charles Maier's work on the collapse of the East German state was useful in demonstrating the economic consequences of the events discussed on Eastern Europe, as the East German experience with technology transfers from the West reflects a broader Eastern European experience.[32]

This research attempts to take a broad view of the period in question including, to varying degrees, the perspectives of the United States, the Soviet Union, Western and Eastern Europe, and the political, economic and business interests within each. Marshall Goldman's *Détente and Dollars: Doing Business With the Soviets* presents a view of East-West trade that is both broad and deep, spanning many years and uncovering numerous useful details about the experience of Cold War-era trade with the USSR.[33] Joseph Finder's colorful account of industrialists such as Armand

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30 R.E.H. Mellor, *COMECON: Challenge to the West*. (New York: Van Nostrand, 1971).

31 William Taubman, *Khrushchev: The Man and His Era*. (New York: W.W. Norton, 2003).

32 Charles Maier, *Dissolution: The Crisis of Communism and the End of East Germany.* (Princeton: Princeton University Press, 1997).

33 Marshall Goldman, *Détente and Dollars: Doing Business With the Soviets*, (New York: Basic Books, 1975).

Hammer and Cyrus Eaton, who pioneered trade with the USSR in defiance of American public opinion, also reveals the experience of other Americans engaged in business with the USSR.[34] Vladislav Zubok expertly narrates the political currents and events of the early 1960s and succeeds in making the tensions of that period almost palpable to the modern reader; a sense for the urgency which surrounded contemporary political and economic decisions is essential to understanding the climate in which these policies developed.[35] However, the most oft-referred-to work encountered was certainly that of French journalist Michel Tatu, who apparently spent every waking moment between 1957 and 1968 compiling an exhaustive record of the Soviet press. His book, *Power in the Kremlin; From Khrushchev to Kosygin,* provides an almost unbroken linear account of the period drawn directly from Soviet newspapers and broadcasts, and was tremendously helpful in placing events in their proper political and chronological context.[36]

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34 Joseph Finder, *Red Carpet*. (New York: New Republic Books, 1983).

35 Vladislav Zubok, "Khrushchev and the Berlin Crisis, 1958-1962," *Working Paper No. 6, Cold War International History Project*. (Washington, D.C.: Woodrow Wilson International Center for Scholars, May 1993).

36 Michel Tatu,. *Power in the Kremlin; From Khrushchev to Kosygin*. (New York: Viking Press, 1968).

Soviet Science and Computing as a Discipline

Much research into the nature and practice of Soviet science has focused upon the academic structures within the Soviet Union, and the controversies that characterized them throughout much of the Stalin Era. Chief among these is Stalin's championing of Lysenko and Michurin's theories within the biological sciences, the promotion of which formalized rituals of self-criticism within the sciences, the lionization of a series of state-sanctioned "Great Scientists," and the possibility of rejecting certain disciplines as "bourgeois".[37]

The latter had a tremendous impact upon the history of cybernetics, upon which historian Slava Gerovich has written extensively. He asserts that the the institutionalized self-criticism within the sciences encouraged many to reject cybernetics as bourgeois fallacy, to toss an entire branch of research under the bus, so to speak.[38] Gerovitch describes computing as "an interesting borderline case", caught between debates in physics where the goal was to "overtake and surpass" Western capabilities, and in biology where the trend was to "criticize and destroy." "Soviet computer specialists had to walk a fine line between two mortal dangers: falling behind the West in computing and following Western trends too closely." Besides this,

37 Nikolai Krementsov, Stalinist Science. (Princeton: Princeton U. Press, 1997), p. 221.

38 Gerovitch, Newspeak to Cyberspeak, p.79

strict boundaries between the disciplines were favored by Stalin and this served to block interdisciplinary cooperation and the sharing of ideas.[39]

Cybernetics would later be rehabilitated, and eventually come into an astonishing scientific 'vogue' in the 1960s. “Cybernetics became synonymous with computers, and computers synonymous with progress.”[40] The fate of cybernetics does not relate directly to the focus of this research, except perhaps in the sense that by the 1960s, Soviet conceptions of what computers were and their role in society had diverged significantly from those of the West, at least on the levels of established research and production. The numerous cybernetics institutes that sprang up subsequently could develop theories regarding the power of computers, but the means of applied science and production had already been dedicated to different ends, largely military. Gerovitch cites an episode wherein the newly established Institute for Economic Cybernetics asked the Ministry of Defense to share access to a new network of computers. “The reply was curt: ‘We are getting as much money for technological development as we ask for. You are getting nothing. If we cooperate, neither of us will get any money.’”[41] This example serves to demonstrate both the disconnected nature of computing development, and the lack of committed financial support for development of computers beyond a certain narrow focus.

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39 Gerovitch, Newspeak to Cyberspeak, p.104-105.

40 Slava Gerovitch. “The Cybernetics Scare and the Origins of the Internet,” *Baltic Worlds*, Vol. II, 1 (2009), p. 32.

41 Gerovitch, “The Cybernetics Scare,” p.35

Contact and Trade with the West

While the scientific community beyond the Iron Curtain had developed into a global one, with steadily multiplying opportunities for interaction, Soviet scientists would become more isolated from one another as funding for collaboration dried up. However, among the most enthusiastically embraced aspects of the limited détente of the 1960s were scientific exchanges.[42] As their advancements placed them at the forefront of innovation in many fields, Soviet scientists had more opportunities to communicate with their foreign peers than they had since the 1930s, even as opportunities for face-to-face communication and collaboration with their domestic colleagues contracted; professional conferences were slowly displaced by ideological seminars held for the benefit of scientists by institutional party organs.[43] In many cases, these contacts would persist, and in some cases they would defy the political and economic conventions of their respective systems in the name of science.

Add to this mix the rising pressure of Western businessmen and political leaders who advocated for increased trade. NATO member nations of Western Europe had rarely expressed the profound distaste for Socialism on a national level that the

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42 "International Scientific and Technological Activities," a report to the Federal Council for Science and Technology by its International Committee, June 20, 1961. National Archives and Records Administration, Washington, DC, RG 59, Bureau of European Affairs- Regional Planning, UN Advisor – Records Relating to Planning and UN Activities, Entry A1 5886, 1959-67, Box 2.

43 Bruce Allyn. "Fact, Value and Science," in *Science and the Soviet Social Order*, Loren Graham, ed. (Cambridge: Harvard U. Press, 1990), pp.225-259.

United States had shown during the 1950s, and there was growing dissatisfaction with the economic restrictions being enforced on it by an ally who seemed unconcerned with their sovereign national interests.[44] These interests also found support among a growing number of Americans who were at least willing to consider the Socialist nations of Eastern Europe as something other than a direct threat.[45] Whether they saw the Soviet Union's satellites as oppressed by a dictatorial regime and deserving of support, or merely as fertile markets for American goods, it became ever more difficult for hardliners in American politics to defend their unyielding position on trade, particularly in high technology.

East-West Technology Transfer in the 1960s: Unprecedented and Unreliable

By virtue of increasing permissiveness in trade during the 1960s, socialist Eastern Europe was able to enjoy access to superior Western technology long enough for policy to be made on the assumption that such access would continue, and that they were moving toward "a non-emergency type relationship".[46] The fundamental flaws of the various centrally-planned economies ensured that their own domestic

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44 "Confidential Memo RE: French Threat of Withdrawal from COCOM," from Economic Defense Advisory Board Chairman Anthony M. Solomon, Aug. 28, 1967. National Archives and Records Administration, Washington, DC, RG 59, E5605, Box 16, Folder, STR13-1 COCOM 1966-69.

45 Joseph Finder, Red Carpet. (New York: New Republic Books, 1983), p. 86.

46 Goldman, p.176.

research and development could never yield anything comparable in terms of computer production. Thus Eastern Europe found itself dependent on the West for innovations in computing. Yet the increasing access it enjoyed during one period might be subject to reversal in the next.

In a best-case scenario, it might take months or years to engineer a computer based off of an IBM model; given the unreliable status of licensing procedures on the part of COCOM and the unpredictable nature of socialist bureaucracy and production, the process might take years longer than intended.

Among the most common tenets of computing in the second half of the 20th century was Moore's Law, which posited that processor capacity would double every eighteen months.[47] Among the greatest causes of delay for Soviet computing specialists was a delay in processing documentation, which included translation and, to some extent, censorship. In the late 1960s, it was estimated that the average time elapsed between receipt of foreign documentation and its release to the scientific community was eighteen months.[48] Licensing review by COCOM might take several years, even for a machine already nearing obsolescence in the West. Beyond this delay, there was general difficulty in assessing the readiness of Soviet industry to absorb purchased technologies. According to one Soviet source:

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47 Alfred Brenner, "Moore's Law," Science, New Series, Vol. 275, No. 5306 (Mar. 14, 1997), p. 1551.

48 David Wellman, A Chip in the Curtain: Computer Technology in the Soviet Union, (Washington, DC: National Defense University, 1989), p.59.

> "In some cases putting licenses to use is held up because of inadequate analysis of the capacities of domestic industry. One cause of the slow incorporation of licenses lies in the fact that production preparations are not started immediately after the conclusion of the license agreement, but only after the entire volume of technical and technological documents has been received. This inevitably leads to a delay of 1.5-2 years in putting the license to use."[49]

In the time it took for a Soviet institution to apply for and receive a license, conclude a business agreement, receive and translate all associated documentation, implement and integrate the machine with a combination of incompatible domestic technologies, and perhaps also overcome internal resistance to the license or the computer itself, the capacity of Western machines had doubled at least four times. And that would be four times over the most cutting edge computer available when the license was first sought; the actual computing power any machine likely to be licensed to a Socialist country would be many times less. At any stage in these negotiations, an external diplomatic crisis might derail years of effort. Still, purchase of foreign hardware, licenses and production lines was attractive enough that an ever-increasing portion of the Soviet economy would be dedicated to this end. These factors allowed the Soviet Union's technological disadvantage to grow exponentially throughout the 1960s and into the 1980s.

The systemic inability of the Soviet Union to either support domestic innovation and apply it to production, or effectively adopt and implement foreign

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49 M.L., Gorodissky, *Litsenzii vo Vneshnei Torgovli SSSR*, (Moscow: Izdatel'stvo Mezhdunarodnye Otnosheniia, 1972). Translated by National Technical Information Services, COM-73-10738, May 2, 1972, p.136. Cited in Holliday, p. 92.

innovations within its economy left the USSR on the south edge of an ever-widening technology gap. The combination of Western export controls and socialist technology policy had the effect of making the technological gap between capitalist and communist societies spread wider and faster than many had feared or imagined.

The Postwar Period and the Origins of Western Export Controls

In the immediate aftermath of WWII, the Soviet Union advanced upon Eastern Europe, establishing a series of socialist satellite governments among the ruins of Nazi retreat. The USSR also established economic dominion over the region, either by establishing Soviet-controlled joint operations or by appropriating means of production and transporting them wholesale deep into the Eurasian interior.[50] It soon became clear that the Soviet Union's domination of the region would not soon pass, and that what Stalin demanded amounted to more than a buffer region against future German aggression. By 1949, seven socialist states had been declared in Eastern Europe, states which the USSR would largely politically and economically dominate for the next forty years.

The divide between Western and Eastern Europe was made more economically concrete by the implementation of the Marshall Plan, and the birth of the Common Market in the capitalist West. Stalin was prepared to violently resist efforts by the new Eastern European satellites to sign on to the Marshall Plan,

50 R.E.H. Mellor, *COMECON: Challenge to the West.* (New York: Van Nostrand, 1971), p. 13.

instead subsidizing their socialist economies with Soviet raw materials and, to some extent, scarce finished goods.[51] The Council for Mutual Economic Assistance (known as COMECON in the West, or as CMEA in English-language documentation originating from within Eastern Europe) was established in 1949 as a response to the Marshall Plan and the foundation of the Organization for European Economic Cooperation. From its founding until the late 1950s, COMECON would exist largely on paper, and have little administrative reality aside from the memo which created it. That situation would change dramatically in subsequent years, but until the mid-1950s, the USSR exerted primary control over the economies of Eastern Europe.

The period from the late 1940s through the Korean War brought ever-tightening trade restrictions between East and West. The Iron Curtain drew tight around the Soviet Union and Eastern Europe in Stalin's final years, a period of profound isolation for the USSR and its satellites. The Berlin Crisis of 1948 had pushed the US and Soviet Union to the brink of war, and Soviet acquisition of the atomic bomb in 1949 raised a terrifying new prospect for international conflict. War plans were drawn up on three and six month scales throughout the late 1940s until the mid-1950s. Strict export controls were to be arranged and enforced between NATO member nations. War, most likely nuclear war, seemed inevitable

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51 Mellor. p. 17

and trade, any trade, with the Soviet Union seemed a dangerous gamble.[52] East-West trade almost entirely disappeared over the course of the Korean conflict.

Strict export controls were to be arranged and enforced between NATO member nations. From the beginning, it was clear that the United States expected compliance with its judgments regarding export licenses from its European allies. During the post-war WWII years, the United States had little interest in supporting trade with the socialist world, and a great deal of interest in discouraging the same.[53] However, this arrangement was naturally to become strained as the economies of Western Europe recovered and wished to take advantage of contiguous Eastern markets, whether socialist or not.

The Export Control Act of 1949 strictly limited trade with communist countries after the Soviet takeover of the Eastern bloc. In response to the lack of resolution over Berlin, and the escalating Korean Crisis, in 1951 the Mutual Defense Assistance Control Act was passed. It gave the president power to revoke any and all aid given to countries that sent restricted goods to countries under embargo. This policy of economic warfare was enacted to ensure the slow growth

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52 Saul Marantz, "Prelude to Détente: Doctrinal Change Under Khrushchev." *International Studies Quarterly*. Vol. 19, No. 4 (Dec. 1975), pp.501-528, p.505.

53 Goldman, p.35

of Soviet economic power.[54] In 1951, the Coordinating Committee for Multilateral Export Controls (COCOM) established to enforce export restrictions. This would be the organ of Western approval for trade with the Socialist world for the remainder of the Cold War. COCOM lives on today in a similar agreement known as the Wassenaar Arrangement, whose members agree to restrict trade in strategic technology and materials.

The Export Control Act was an accompany piece to the Marshall Plan, and granted authority to the President of the United States to determine which exports from the US should be subject to embargo. The president delegated the functions of the Export Control Act to the Department of Commerce, specifically the Office of Export Control within its Bureau of Foreign Commerce.[55] The level of restriction for a given item was indicated in the Commodity Control List, which indicated what type and level of license was required for export, and for which items licenses would be explicitly denied.[56]

The Mutual Defense Assistance Control Act created the legal frameworth through which NATO allies, at the request of the Unites States, could jointly enforce

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54 Angela Stent, "Technology Transfer to Eastern Europe: Paradoxes, Policies, Prospects, Central and Eastern Europe", in *Central and Eastern Europe: The Opening Curtain?,* ed. William Griffith. (Boulder: Westview Press, 1989), p. 80.

55 Johnson Foreign Securities Act (Ch. 112, 48 Stat. 574, 18 U.S.C. § 955, 1934-04-13)

56 Richard Bilder, "East-West Trade Boycotts: A Study in Private, Labor Union, State, and Local Interference with Foreign Policy," University of Pennsylvania Law Review, Vol. 118, No. 6 (May, 1970), pp. 841-938, p. 845.

export controls. COCOM existed to review and license exports from NATO member states to communist countries. The functions of COCOM were expanded significantly during the Korean War. Fifteen member nations, including all the NATO member nations except Iceland and with the addition of Japan, agreed to abide by the strict licensing procedures required by COCOM when considering exports of potentially strategic goods to communist states. COCOM made its decisions by maintaining a secret, internationally approved list of controlled items.

Items were grouped into various categories under the COCOM restrictions, and subject to five possible levels of control. Among the most salient questions applied was the possibility of "dual use"; could an item with a civilian, non-strategic function also be used for military purposes? This was a litmus test nearly all computers would fail. Items declared to have dual-usage, including most computers, would be found on the International List, meaning that review was required for all potential sales to proscribed destinations. One of the characteristics that could relegate an item to the International List was the existence or potential of a strategic technology gap. The International List requirements clearly state that an item is subject to control and review if "proscribed nations have a deficiency that hinder development or production of arms, ammunitions, or military systems, a deficiency they are not likely to overcome within a reasonable period."[57] Not only did the COCOM International List identify as a specific goal the fostering of technology lag in embargoed nations, but

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57 "Balancing the National Interest: U.S. National Security Export Controls and Global Economic Comptetition", p.97.

provided highly effective tools for the purposeful monitoring and expansion of the technology gap.

Devices with a widely varying degree of sophistication, such as computers (category no. 1565) might then be subject to varying levels of control.[58] Items under "General Embargo" required a unanimous vote from the member nations before an export license was granted. "Favorable consideration" indicated the item would likely be cleared pending deliberations and provided certain conditions were met. "One time review" or the "45-day procedure" meant that determinations needed to be made as to what category the item belonged to and the level of control applied. Items cleared at this level would henceforth be permitted for sale, either with no restrictions or under the "Administrative Exception Note" level of control, which dispensed with future COCOM review for licenses provided monthly statistics on items exported were submitted to the Committee. The fifth level of control was "Notification", under which no review by COCOM was required, but the Committee received 30 days' notice of the sale before shipment.[59] Non-strategic items cleared for trade were granted a "general license"; items requiring review were issued a "validated license", and it was for these licenses that were most hotly debated. The U.S. Department of Commerce

58 Ibid., p.98.

59 Ibid., p.96.

also maintained a list of strategic items that would automatically be declined (the "positive list").[60]

The United States and other countries were permitted to export items at their own discretion under COCOM's "Administrative Exception Note", but disagreements regarding the level of control that should be applied to new items caused tension among COCOM's member nations.[61] Applications from U.S. companies for sales of advanced technology to communist countries were subject to review by the Department of Defense, and licenses were issued by the Department of Commerce. While small, low-capacity computers might be licensed with minimal review, medium or high-capacity computers were categorically denied.[62] Through the Department of Commerce, the U.S. could also put pressure on its allies to comply by scrutinizing the export of U.S.-produced components used in their models.[63] Thus the U.S. held a substantially greater share of power over COCOM than any of its individual member nations, and thus if COCOM would be swayed, the U.S. had to be convinced that licensing the transfer of technology was in its interests. How

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60 Goldman, p.49.

61 "Balancing the National Interest: U.S. National Security Export Controls and Global Economic Comptetition," p.97.

62 "Computer Exports to the Soviet Union: Hearing Before the Subcommittee on International Economic Policy and Trade of the Committee on International Relations," June 27, 1977. Government SuDoc (Y4. In.8/16:C73/32), p.5.

63 "Action Memorandum, RE: Computer Manufacturing Licenses in Eastern Europe," to Anthony Solomon, EDAC Chairman, July 17, 1967. National Archives and Records Administration, Washington, DC, RG 59, E5605, Box 16, Folder, STR13-1 COCOM 1966-69, p.6.

dangerous, how strategic were the computers coming up for licensing? What was the threat they posed in Communist hands? On these questions the U.S. was apt to take a significantly more conservative position on this question than its Western allies.[64]

In the early 1960s, the U.S. Department of Commerce maintained an embargo list of over 1,000 strategic items, and restrictions were only made tighter by amendments to the Export Control Act in 1962.[65] However, as the Cold War reached its hottest point and export controls received greater scrutiny, the economies of Western Europe began to lose their postwar dependency on the United States. The USSR and other socialist countries promised to make trade in technology very lucrative for Western countries, and American corporations were beginning to put internal pressure on policymakers to ease the restrictions, lest valuable business be lost to the Europeans.[66]

East-West trade has been used to describe both trade from the United States to the USSR and its satellites, but the term also applies to collective trade between the US along with its Western European allies (particularly NATO member states), and the USSR and Eastern Europe nations. Yugoslavia was often excluded from definition as an "Eastern Bloc" nation because its historically antagonistic political relationship

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64 Ibid., p.2

65 Goldman, p. 49

66 Goldman, p. 50

with the USSR and unique autonomy placed it outside the orbit of many trade restrictions.[67]

Export controls left the socialist world at more than a military and strategic disadvantage. The existence of internal industrial standards unique to COMECON countries often resulted in production standards well below those of the West.[68] The inability to either develop or import the technological means to improve their infrastructure or production capacity meant that Eastern Europe became trapped in a cycle where increasingly poor sources of raw materials had to be exploited to support production of poor-quality items that failed quickly or soon needed to be replaced. Improvements to factory production lines, integration of power grids, and assessments of natural resources were stalled. Eastern European states sold off the subsidized petroleum they received from the USSR for desperately needed hard currency, burning their own less-efficient, environmentally disastrous brown coal to cover domestic energy needs.[69]

The idea of an East-West gradient in terms of culture and technology is a deeply-ingrained one, and continues to affect perceptions between countries today. The idea that the Soviet Union might suddenly appear to have surpassed the West in rocketry and space science was shocking and troubling on many levels, not in the least

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67 Bilder, p. 844

68 Charles Maier, Dissolution: The Crisis of Communism and the End of East Germany. (Princeton: Princeton University Press, 1997), p.53.

69 Ibid. p. 91

because the US had apparently underestimated its chief adversary. The secrecy that shrouded many Soviet programs would keep the West on edge for years, leaving the true state of affairs obscured until a great deal of Western foreign policy assumed near technological parity. Decades later, many American policymakers would refuse to believe the Soviet Union had, in fact, fallen so far behind. Western accounts of Soviet technological capacity from the 1950s onward frequently overestimated its "quality and complexity", placing it on equal footing with the West and ignoring the larger Soviet economic reality.[70] Both the loosening and the tightening of export controls seemed to serve to widen the technological gap to an extent that few on either side fully appreciated until fairly late. Thus the US and its allies maintained intense pressure through export controls right up until the collapse of the Soviet Union.[71]

Leadership within the United States also underestimated the lengths to which its allies would go to defend their own sovereign interests. In a very real sense, it failed to see the impression its resistance to their demands was making. However, when faced with the implosion of the entire NATO export control structure, the US conceded to revise the embargo lists.[72] Within a year of the US conceding to the sale

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70 Luke, p. 331

71 "Computer Exports to the Soviet Union: Hearing Before the Subcommittee on International Economic Policy and Trade of the Committee on International Relations," SuDoc (Y4. In.8/16:C73/32), p.6.

72 "Review of the International Embargo List in the Coordinating Committee (COCOM)," from Anthony Solomon, November 11, 1968. National Archives and Records Administration, Washington, DC, RG 59, E5605, Box 16, Folder, STR13-1 COCOM 1966-69.

of a French computer to Czechoslovakia, the Soviet Union altered its own technology policy to abandon many domestic efforts and instead focus on foreign models obtained through connections with Eastern Europe.

The Soviet bid to reverse-engineer legitimately acquired technology from the West was part of a massive effort to transform its centrally-planned economy through automation. Working backwards from Western models was intended to be a fast-track, money-saving approach. Unfortunately, the very structure of the economy at its most fundamental levels kept this process from proceeding in a timely manner or producing anything resembling the desired results.

The access that Soviet allies within COMECON enjoyed proved unreliable, and technology exchange often fell victim to wider political and social upheavals. What was offered in a transient moment of détente might soon become unavailable, and once the socialist world began to look to the West for innovations, it could no longer recover any kind of parity in its own domestic research. The costs rose higher, and the gap yawned wider, as the West learned to take advantage of its position, and the East sacrificed ever more dearly to acquire long-obsolete technologies.[73]

The example of computer imports and the enforcement and exploitation of export controls by both sides in the Cold War reflects a cycle of reaction and reform. The Soviet Union saw access to Western exports increase during periods of détente, and altered their domestic policies to reflect the promise of continued access. It permitted its allies to cultivate relationships with the West under the premise that

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73 Maier, p.92

innovations would be more readily shared with them than with the USSR itself. A loosened its grip on Eastern Europe soon became an uncomfortable loss of control for the USSR, resulting in the violent reactionary response of the Prague Spring. However, the new economic reality of technological dependence on the West meant that such responses in the future would have dangerous domestic repercussions, both economically and socially. The assumption that access to foreign computers would continue unabated was flawed, and trapped socialist economies in a loop that robbed them of more scientific, economic and political autonomy with each cycle.

Proxy struggles in the underdeveloped world would require not only a commitment of military resources from the USSR, but came with serious costs in trade. Technology transfer would become more important than ever as a tool the West could leverage. Each hostile action, or return to reactionary, isolationist policies would set the Soviet Union further behind as the US and its allies could easily deny applications for the exchange of high technology. With little entirely domestic research to fall back on, the USSR would simply have to wait for, or cultivate, détente in order to reach its production goals for computers. These goals, it should be noted, were modest compared to Western production, and were seldom reached.[74]

It is often asserted that much of the technology the Soviet Union developed during the last twenty-five years of its existence was stolen; while it is true that some portion of its capacity was acquired by illicit means, this accounts for a fraction of the

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74 Seymour Goodman, "Soviet Computing and Technology Transfer: An Overview," *World Politics*, Vol. 31, No. 4. (Jul., 1979), pp. 539-570, p. 556.

expense and energy which went into the legitimate acquisition of computing hardware and production lines. These computers were often stripped to a minimum of their original capacity, and at times even came with human "minders", among others in a long parade of concessions.[75]

By allowing itself to become reliant on the West for the latest innovations in computing, the socialist world submitted itself to monitoring by its political adversaries, and allowed its progress to be determined at the will of its alleged enemies. This act admitted as clearly as any purge that the USSR saw its best minds as expendable. Its institutions, policies and practices could not produce the reforms needed for material support of innovation. Not only this, but the freedom of thought necessary for innovation was in practice deemed too dangerous to be granted, even if this were the socialist world's only hope. Regardless of what Soviet minds might have produced, the vast bureaucracy and atomized social climate that both pervaded and surrounded the scientific community prevented the kinds of collaboration that drove research and absorption of innovation in the West. The failure of Soviet computing was not in its intellect, but in the skewed perception of scientific progress that drove the entire system surrounding it. The linear model embraced by those at the highest levels within the Soviet Union did not allow for the kinds of indirect associations and trial and error that drove innovation in the West. Adherence to this model made the

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75 "The United States Needs an Embargo on Aid to Our Enemies", speech by Senator Karl Mundt, 114 Congressional Record, (1968), p.11,309-14.

idea of purchasing innovation, accessing scientific advancement at the midpoint rather than the beginning, both feasible and desirable in terms of policy. Within a short period, a number of communist countries made purchase of technology from the West a prominent priority. In the process, these socialist states altered their ideologies, raped their environments, and mortgaged their futures, leading to a long period of stagnation and decline, and communism's ultimate collapse.

It is often asserted that much of the technology the Soviet Union developed during the last twenty-five years of its existence was stolen; while it is true that some portion of its capacity was acquired by illicit means, this accounted for a fraction of the expense and energy which went into the legitimate acquisition of computing hardware and production lines. These legitimately-acquired computers were often stripped to a minimum of their original capacity, and at times even came with human "minders", among others in a long parade of concessions.[76]

After 1967, the communist world more and more resembled a system that no longer believed in itself. The ideological will that had vaulted the country forward in the past would henceforth ring hollow, and the shambling economy would only provide mounting evidence of the Party's disregard for the minds and bodies of the people it claimed to represent. Vast sums (not easily quantifiable due to the nature of Soviet economic data and the secretive nature of many contracts) were diverted from domestic works each year and poured into obtaining computers that would do little to

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76 "Computer Exports to the Soviet Union: Hearing Before the Subcommittee on International Economic Policy and Trade of the Committee on International Relations," SuDoc (Y4. In.8/16:C73/32), p.7.

improve the security or well-being of ordinary citizens. The Soviets did not steal this technology; they sold their souls for it.

Chapter 1

Détente, Reform, and Technology in the Post-postwar World

A Foundation for Increasing Exchange with the West

> "The dynamism of forward movement must be met by more than intellectual sentry duty. If we could provide a hope and a goal instead of trying merely to hold what we possess we could have a much more positive appeal, one which might have some effect on Khrushchev's grandchildren."
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> -"Planning Paper on European Unity", September 5, 1961[77]

In the late 1950s, the USSR somewhat unexpectedly presented a scientific and military challenge to the United States. For the first time, the two superpowers were perceived to have achieved a kind of parity. In addition, both had strong, popular leadership in place, leadership which had indicated a desire and willingness to diffuse the tensions between them.[78] Eisenhower and Khrushchev both enjoyed support at home, and could entertain the possibility of negotiations from a position of relative strength.[79] An unprecedented, though short-lived, improvement in

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77 "Planning Paper on European Unity," September 5, 1961.

78 M.L. Dockrill, *The Cold War, 1945-63*. (Atlantic Highlands, NJ: Humanities Press International, 1988)., p.85

79 Richard Stevenson, *The Rise and Fall of Detente*. (Urbana, Chicago: University of Illinois Press, 1985), p. 29.

relations between the United States and the USSR took place as the decade drew to a close. However briefly, within this period the two powers began to develop the foundation of for future diplomatic relations.[80]

Among the drivers of this early détente was the scientific ascendancy of the Soviet Union. The surprise launch of Sputnik caught Americans off guard, and the relative success of Soviet space exploration efforts (concurrent with a string of American disasters) engendered a widespread belief that the Soviet Union was or would soon be scientifically superior. In early 1959, a Gallup poll revealed that 43% of Americans believed that the Soviet Union would hold the leading position in science ten years in the future; only 13% believed that technological dominance would belong to the US.[81] Another Gallup poll in the same period showed that 34% of Americans believed the US was dropping behind the USSR in terms of military power, while only 25% believed we were still ahead.[82] Not only did the Soviet Union need to be taken seriously as a military threat to the continental United States, but it had issued a virtual mandate for American science and policy to rise to the challenge.

In the spring of 1959, the Council of Ministers met in Geneva in hopes of easing tensions in Berlin. The conference was inconclusive, but did produce a

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80 "Basic National Security Policy; Short Version," Department of State Policy Planning Council, May 9, 1962. National Archives and Records Administration, Washington, DC., RG 59, Entry 5586, Box 1; 150/76/16/3, Section 6.

81 *The Gallup Report*, (Princeton, NJ: Princeton U. Press, 1981), volumes 59-60. Gallup Poll, Feb. 14, 1959.

82 Gallup Poll, March 6, 1959.

remarkable thaw in U.S.-Soviet relations, including a promised exchange of visits by their respective leaders. Harold Macmillan, the British Prime Minister, said of Geneva, "When we look back upon the story of the last few months we realize how great an advance there has been. Last November we were talking in terms of threats and ultimata. Now we are talking in terms of personal visits and discussions."[83] In 1959, Nikita Khrushchev became the first Soviet General Secretary to visit the United States in peacetime. The amicable nature of his visit represented tremendous progress in relations between the two nations. The importance of this meeting, and the possibilities it presented were not lost on the public at large; a 1959 Gallup poll rated the meeting of Khrushchev and Eisenhower the most important event of the previous decade, and both men topped an international poll as the most outstanding and influential living leaders.[84]

Another important development during the late 1950s was a changing attitude towards trade and exchange with the Soviet Union and its satellites. By 1959, 55 percent of Americans thought that the US and USSR should buy and sell more goods to one another, compared with 27 percent who opposed increased trade.[85] The Soviets often had significant motivation to seek increased trade, yet these practical

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83 Halle, *The Cold War as History*, p. 345

84 Gallup Poll, Dec. 30, 1959.

85 Gallup poll, March 4, 1959.

motivations were often inextricably bound up in political and ideological ones. Western businesses not only found their efforts to trade with socialist nations hampered by strict embargoes and incongruous currencies, but also by a series of complex and inflexible bureaucratic organs. On the socialist side, a political agenda seemed apparent at every phase and level, from visa office to permit office, and from factory to shipping yard.[86] Little recourse was available to Western businesses if they attempted trade despite all these obstacles and a socialist trading partner failed to honor an agreement.[87]

Beyond this was the constant, and typically confirmed, suspicion that the Soviets harbored ulterior motives. In the early 1950s, a recurring scenario occurred in which the Soviet Union opened a dialogue on trade for non-strategic items only to reveal its true desire for raw materials or goods under embargo. This pattern encouraged a prevailing logic in the US that trade with the Soviets, along with being morally offensive, would be futile. Western Europe, however, was already pressing for greater trade, even though it often came at a price.[88] A 1953 Time magazine article

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86 Goldman, *Détente and Dollars: Doing Business With the Soviets,* p.60.

87 Finder, *Red Carpet,* p.93.

88 "Europe Wants It, While Russia Laughs," *Time Magazine*, July 6, 1953:

"For the Communists, trade is not a business, but a political weapon. In Italy, every businessman who deals with the East must pay a brokerage fee to a Communist Senator, Egisto Cappellini. The fees provide the chief financial support of Italy's Communist Party. Individual businessmen cannot trade with state monopolies on anything approaching equal terms. In trying to deal with Soviet monopolies, businessmen have to pay in advance for imports which may take months to arrive, often have their own shipments arbitrarily rejected at great loss." (p.17)

encouraged revision of the Embargo List, if only to cure a deluded Europe of the urge to trade with the communists: "Despite all the pitfalls of trade with Russia, the clamor for it by European businessmen who are being shut out of the U.S. market will probably increase. To lessen it, the U.S. will have to revise its list of strategic goods, try to eliminate all the borderline products whose export must be approved by a NATO-wide committee in Paris. If the list were more precise, a needless source of anti-American irritation would be removed, and more European businessmen could learn firsthand the Soviet shell game." [89]

Trade with socialist countries would continue to be a political and business gamble for the West, but after death of Stalin, the status quo was continually challenged by both sides. The 1955 Geneva Summit saw the first signs of easing tensions between the two. Both President Eisenhower and CIA chief John Foster Dulles saw trade as a potential diplomatic tool, and looked to reduce restrictions on East-West trade.[90] The grip of the USSR on its satellites in Eastern Europe began to loosen, especially after new Soviet Premier Nikita Khrushchev's 1956 "Secret Speech". Beyond its veiled condemnation of Stalin's "cult of personality", Khrushchev's speech allowed for individual interpretations of socialist doctrine, sparking a wave of resistance to Soviet authority in the Eastern Bloc.[91] However, the

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89 Ibid., p.17.

90 James Nathan, "A Fragile Détente," *Military History*, Vol. 39, no. 3 (October 1975): 97-104. p.97

91 Taubman, p.300.

Eastern Bloc countries' efforts to assert their sovereignty were sharply curtailed once such independence threatened Soviet influence. Violent repression of the Hungarian uprising that year demonstrated how narrow the limits of still were. However, once set in motion, the steady drift of the satellite states, their demonstrated resistance to Soviet authority, and their status as unwilling thralls to Soviet power made them not only increasingly attractive trading partners but sympathetic parties in the struggle against communism.[92]

By the mid-1950s, however, proponents of détente on both sides saw promise in the idea of more open trade. Even before the rise of Khrushchev and the subsequent shift in mutual perceptions that preceded the first détente, trade was seen by some as a tool to normalize relations between the two powers. The US Chamber of Commerce itself was in favor of increasing East-West trade, supported by a number of American businesses and industries, which began petitioning for the right to sell to Soviets.[93] Policies to deal with such pressures would be required alongside a cohesive foreign policy.

While COCOM rules had governed exports for the past decade, as more incentive to trade with the Soviets and other socialist states accumulated, it was clear that greater specificity and publicity regarding export restrictions would be

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92 Norman Pounds, "Fissures in the Eastern European Bloc," *Annals of the American Academy of Political and Social Science; Realignments in the Communist and Western Worlds*. Vol. 372 (July 1967), pp.40-58, p.42.

93 Finder, p.114

needed. The US State Department and the Bureau of Foreign Commerce within the Department of commerce outlined the US Export Control Program in a 1960 pamphlet.[94] The Bureau of Foreign Commerce was to be responsible for the controlled sale of all but a few specified items. Atomic energy and equipment would be overseen by the Atomic Energy Commission, while arms, munitions and other implements of war (including helium) would be the responsibility of the State Department. The term "implements of war" invites broad interpretation, and left all potentially strategic items within the State Department's purview.

Two supplementary laws governed the administration of the export control system within the US. The Administrative Procedures Act required that regulations and subsequent changes issued under the Export Control Act be disclosed to the Public. The Federal Reports Act made all regulations requiring information or reports from ten or more persons, "including those required from exporters in connection with export licenses, must be reviewed and approved by the Bureau of the Budget."[95] Since the Bureau of the Budget resides within the Executive branch, this provided another way in which Presidential authority was extended over

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94 "Briefing Pamphlet on United States Export Control Program, Administered by the Bureau of Foreign Commerce of the United States Department of Commerce," National Archives and Records Administration, Washington, DC, RG 59, Records of the State Department, Deputy Assistant Secretary for Politico-Military Affairs, Subject Files of the Special Assistant for Atomic Energy and Aerospace, 1950-1966. Box 15, Folder "Export Contols- NSAM 294- July-Dec. 1964".

95 "Briefing Pamphlet on United States Export Controls", p. 1

export controls. Export controls, and the administration thereof, could be greatly affected by the attitudes present within the current administration.

Coupled with the growing demand for foreign technology within the Soviet Union, changes to the Export Control Program allowed for a rapid expansion of trade. Between 1957 and 1964, East-West trade had nearly doubled.[96] Granted, a doubling of the small amount of trade that had existed prior to this period still accounted for only a tiny portion of the U.S. Imports or exports, but the potential profits were dwarfed by the political significance of this trend. Trade with the USSR had powerful adversaries within government. Senator Karl Mundt, a Republican from Montana, proposed several pieces of legislation in the 1960s that would have barred the extension of credit from the Import-Export Bank to communist countries for purchases of American commodities; this legislation cleared the house but failed in the Senate.[97] Given the unpredictable political climate in the wake of the Cuban Missile Crisis, the effectiveness of export controls, and whether to eliminate export controls entirely or expand and extend them indefinitely was open to debate.

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96 Timothy Luke, "Technology and Soviet Foreign Trade: On the Political Economy of an Underdeveloped Superpower," *International Studies Quarterly*, Vol. 29, No. 3 (Sept., 1985), pp. 327-353, p.344.

97 "Memorandum From President Kennedy to the Export Control Review Board," Washington, May 16, 1963. U.S. Department of State, FRUS, 1961-63, Vol. IX: Foreign Economic Policy, Office of the Historian, Editorial Note #330. Kennedy Presidential Library, National Security Files, Subject Series, Trade, East/West. Secret. Published online at: http://dosfan.lib.uic.edu/ERC/frus/frus61-63ix/16_Section_16.html

Shortly before his assassination, John F. Kennedy wrote to the Export Control Review board regarding recent developments in East-West trade and relations with the following questions:

> "1. Do we now deal with the Soviet Union on the export of technically advanced machinery and equipment in a manner which adequately protects U.S. interests? Where a national security issue is presented, we of course deny an export license. There are, however, many cases in which no clear security issue arises and yet we know that the Soviets are using American machinery and equipment as a basis for copying our technology. Are we being adequately compensated in these sales?
>
> 2. Is there any method of organizing these transactions which would secure a better quid pro quo than the present method of leaving it to the individual seller to secure the best price he can in the transaction, in the light of the fact the Soviet Union does not ordinarily respect the patent and copyright arrangements on which we rely in our commercial transactions with other nations?
>
> 3. Should we reconsider the whole of our trade with the Soviet Union in the light of trade between Western Europe and the Soviet Union and its European satellites? Considering the character and volume of that trade, would a generally less restrictive policy be more in keeping with the interests of the United States? How much possibility is there for a significant broadening of trade that is consistent with our security interests? Would this possibility be such as to justify a general negotiation on trade and commercial matters with the Soviet Union?" [98]

The response issued later that summer by the State Department's Policy Planning council responded to the President's concerns by downplaying the potential

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98 "Memorandum From President Kennedy to the Export Control Review Board," Washington, May 16, 1963. Kennedy Presidential Library, National Security Files, Subject Series, Trade, East/West. Secret. Published online at: http://dosfan.lib.uic.edu/ERC/frus/frus61-63ix/16_Section_16.html

impact of increasing trade or reducing export controls for the USSR, but granted that easing restrictions on trade with Eastern Europe might prove far more strategic:

"The prospects for influencing Soviet policies, at least for the nearer term, would be modest at best; but they could be of very considerable significance in the case of the Satellites. We have good reason to believe that the forces now making for unrest and change in Eastern Europe will mount. The ability to use trade flexibly and actively in Eastern Europe would add greatly to the presently limited capacity of the U.S. to shape the course of these events. In any case, from the point of view of dealing with either the USSR or the Satellites, we would surely be in a stronger position if trade were active (and thus subject to change) than if it was virtually stagnant (and played in only one key). [99]

Another memorandum in this series responding to the President's question, this time from the Export Control Review Board on Aug. 15, 1963, proposes "a discussion with our Allies of the implications that a change in U.S. policy would have on the multilateral system of controls and the possible need we may face to modify its overtly discriminatory form without damage to our ability to maintain collective surveillance and the control of strategic commodities as multilaterally defined."[100] This suggestion

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99 "Report Prepared by the Policy Planning Council," Washington, July 26, 1963. Department of State, S/P Files: Lot 70 D 199, Economic Policy, 1963. Published online at: http://dosfan.lib.uic.edu/ERC/frus/frus61-63ix/16_Section_16.html

100 "Memorandum Concerning East-West Trade Policy," Washington, August 15, 1963. From the Export Control Review Board to President Kennedy. Kennedy Presidential Library, President's Office

was subsequently dismissed the following month by the National Security Council, which believed current controls had been liberalized more than enough.[101] Since COCOM was administered through American agencies, and export controls were under the auspices of the Executive Branch, no review could be called without internal agreement within the United States.[102]

Kennedy himself declined to press for a review of the COCOM lists in 1963, but stressed that he was "strongly in favor of pressing forward more energetically than this report and its recommendations imply, in our trade with the Soviet and Eastern Bloc." On September 19th, Kennedy wrote, "In the light of the rapidly changing conditions in Eastern Europe, Export Control Review Board should prepare guidelines for a less restrictive, step-by-step expansion in trade with individual nations of Eastern Europe, within the present legal structure."[103] Two months later, Kennedy was gone, but Lyndon Johnson continued to press for trade with the Eastern Bloc.

Files, Commerce, 1963. Secret. Published online at: http://dosfan.lib.uic.edu/ERC/frus/frus61-63ix/16_Section_16.html

101 "Memorandum: NSC Standing Group Meeting--Discussions of East-West Trade," Washington, September 7, 1963, from David Klein of the National Security Council Staff to the President's Special Assistant for National Security Affairs. Kennedy Presidential Library, National Security Files, Subject Series, Trade, East/West. Secret. Published online at http://dosfan.lib.uic.edu/ERC/frus/frus61-63ix/16_Section_16.html

102 "Briefing Pamphlet on United States Export Control Program, Administered by the Bureau of Foreign Commerce of the United States Department of Commerce," National Archives and Records Administration, Washington, DC, RG 59, Records of the State Department, Deputy Assistant Secretary for Politico-Military Affairs, Subject Files of the Special Assistant for Atomic Energy and Aerospace, 1950-1966. Box 15, Folder "Export Contols- NSAM 294- July-Dec. 1964", p.6.

103 "Memorandum From President Kennedy to the Export Control Review Board", Sept. 19, 1963.

Soviet Science and Computing

> "The history of computers in the Soviet Union is a graphic example of the failure of that country to blaze an independent path, another case of the erosion of Soviet exceptionalism."
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> – Loren Graham, *What Have We Learned About Science and Technology from the Soviet Experience?*[104]

During the postwar period, the USSR offered scientists a number of financial and other incentives to conduct and share their research. Premiums and prizes were awarded at an increasing number of domestic conferences, providing scientists with rare and vital opportunities to travel and meet with others in their field. Honoraria were given to those who published regularly, or prepared descriptions of their work for laymen and those outside their field.[105]

Science was not only highly regarded in Soviet society, but relatively lucrative, and scientists were materially rewarded in much the same way that highly productive workers in other fields were. A true 'scientific Stakhanovite' would not only be well-respected by his peers and neighbors, but enjoy prosperity in keeping with his diligence in promoting Soviet science. During the Stalin era, scientific administration under the Academy of Sciences combined basic and applied research. The Academy

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104 Graham, *What Have We Learned About Science and Technology from the Soviet Experience*, p. 39

of Science heavily favored basic research over applied; basic research would account for a majority of projects, and the Academy would continue to support this even while political pressure for more applied research increased.[106]

World War II saw many theoreticians and laboratory scientists transfer their skills to applied science and technology for the war effort. The advancement they achieved in wartime forever altered the role of Soviet scientists; the wartime practice of sending brigades of scientists to solve practical problems continued until Stalin's death.[107] The effectiveness of these science brigades made more direct government involvement in research difficult to resist.[108]

By giving such incentives, the USSR promoted the active work and interaction of its best minds. For several decades, they had imported and adapted technology from abroad in metallurgy, refining and heavy industry, seldom innovating but often improving upon foreign models.[109] With an infusion of military resources both foreign and domestic over the previous decade, by the 1950s the Soviets presented a true

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106 Casey Stroud Machula, "Centralized Planning of Science, Technology, and Society in the Soviet Union and its Impact on Educational Policy, 1966-1984," (PhD diss., U. Illinois Urbana-Champlain, 1991, p. 128.

107 Machula, p.130

108 Machula, p.126

109 Machula, p.52

technological challenge to the West in many fields.[110] Among these was computer science; US and Soviet computer development was on more or less equal footing as of the mid-1950s.[111]

The structure of Soviet science was nonetheless not conducive to computing research, and would only become less so with time. Economist Marshall Goldman cites the inflexible nature of Soviet economic planning; "Some of the blame must be shouldered by the rather inflexible Soviet planning system, with its traditional emphasis on increasing the *quantity* of output...Such a system, however, provides planners and managers with little incentive to innovate or experiment with technology. Any interruption of the production line in order to experiment with new products or production methods risks underfulfillment of the all-important quantitative production goals."[112]

Also diminishing was the financial incentive for scientists to share their work, and funding for travel and conferences. In September of 1962, G.N. Petelin issued a report signed by himself and the other heads of the Profsoyuz to the Central Committee on how the agency intended to respond to new policies of fiscal restraint that accompanied recent bureaucratic restructuring by cutting back its budget. Among the cost-saving measures Petelin's commission advocated were reducing the number of

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110 Mellor,. p.16

111 Gerovitch, *From Newspeak to Cyberspeak: a History of Soviet Cybernetics*, p.51.

112 Goldman, p. 32.

members of participants in scientific conferences, lowering fees paid for lectures at scientific conferences by 80%, dispensing with the practice of paying judges for juried competitions in the sciences, limiting extended study tours and cutting back on honorariums provided to scientists who published brochures and other writings sharing their experiences.[113] Opportunities for communication and financial incentives for sharing information and resources suddenly contracted at the same time as the USSR desperately sought ways to improve the interconnections between research and practice. Besides this, the shifting of a surprisingly large percentage of the population into engineering professions resulting in a leveling of wages; by the 1970s, many engineers in fields such as construction would earn less than laborers.[114]

While the USSR achieved great success in the production of raw materials and heavy industrial goods, its ability to reliably produce innovative technology had seldom been able to keep pace. Scientific research and development might yield advances that globally were on the cutting edge, but production on any scale inevitably suffered from chronic problems. In 1965, Peter Kapitsa, an influential scientist and director of the Institute of Physical Problems of the USSR Academy of Scientists lamented (in an official report to the Academy), that "The assimilation of

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113 Докладные записки комиссии (председатель Г.Н. Петелин), направленные президиуму ВЦСПС во Исполение его постановления от 12 сентября 1962 года "О Необходимости экономного расходования средств на социально-Культурные и другие мероприятия" (Memoranda of the Commission of the Bureau of Trade Unions (chairman GN Petelin) on the need for economical spending on socio-cultural and other events) September 12, 1962. The Russian State Archives, Papers of G.N. Petelin, No. 37, Index NA.

114 Harley Balzer, "Engineers: The Rise and Decline of a Social Myth," in *Science and the Soviet Social Order*, Loren Graham, ed., pp.141-168. p.161

achievements of science and technology takes place slowly and with difficulty among us."[115]

Since the 1930s, Soviet planners had looked towards a future when automation would facilitate the precise administration of the Soviet economy, allowing them to gauge production capacities and demand levels with great precision.[116] However, central planning itself hindered the development of reliable computers for large-scale production and use.

Many areas of Soviet industry suffered from problems related to the adequate supply of replacement parts. Among the greatest challenges to central planning was the accurate estimation of resources for machinery maintenance. Specialized parts were especially problematic and prone to failure. In 1966, Soviet televisions had a mean-time-to-failure average of 500 hours due to faulty vacuum tubes.[117] In the case of machine lathes, a 1971 issue of *Pravda* noted that "The system of capital repairs...with inadequate development of a centralized production of spare parts has led to the creation of a large and little-specialized repair industry...This "second machine-construction industry" is occupied in reality with

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115 Peter Kapitsa, *Teoriia, Eksperiment, Praktika*, (Moscow: Znanie, 1966), p.13, quoted in Harvey, p. 31.

116 Gerovitch, *From Newspeak to Cyberspeak*, p.50.

117 "Avtomaticheskoe Upravlenie I Vychislitel'naia Tekhnika," 1967:7, p. 207, cited in Campbell, Robert. *The Failure of Soviet Economic Planning; System Performance, Reform*. (Indianapolis: Indiana U. Press, 1992.), p. 98

the reproduction of obsolete equipment."[118] Such workarounds were apparently a necessity in many Soviet industries, but were not feasible for the kinds of specialized components required for computers.

Soviet self-criticism on this subject sought to spur reforms, but the problems associated with potential solutions were not only myriad, they were also cyclical. "Control computers must solve the problems given to them within a given time. However, the reliability of contemporary computers as things stand now is too low to meet this requirement."[119] The problems associated with producing effective computers domestically could not be solved without them, a conundrum that would haunt Socialist economists for decades. According to computing pioneer B.N. Malinovskiy, "Experts were often invited to share their opinions with economic planning committees, arriving only to learn that the critical decisions had already been made."[120]

Two of the most advanced computing systems ever produced by Soviet domestic research, the BESM (Bol'shaia Elektronicheskaia Schetnaia Mashina, or "Large Electronic Calculating Machine"), and the MESM (Malaia Elektronicheskaia Schetnaia Mashina, or "Small Electronic Computing Machine")

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118 *Pravda*, Sept. 1, 1970, II-22. Quoted in Harvey, p. 37.

119 "Avtomaticheskoe Upravlenie i Vychislitel'naia Tekhnika," 1967:7, p. 207, cited in Campbell, p.99

120 Alexander Nitussov and B.N. Malinovskiy, "Economic Changes in the Sixties and Internationalisation of the Soviet Computing," in *Computing in Russia: The History of Computer Devices and Information Technology Revealed*, ed. Trogemann, Georg and Ernst, Wolfgang (Wiesbaden: Friedrich Vieweg & Sohn Verlagsgesellschaft mbH, Braunschweig, 2001), 163-167. p. 163

were produced in the late 1940s and early 1950s, and represented a major international achievement in computing. However, these machines were plagued by the same problems that affected nearly all industries and subsequent computer designs. Replacement parts could not be reliably produced, and so few attempts were made to operate the machine at full capacity either in testing or actual use. Practices adopted to conserve the fragile parts resulted in a "dumbed down" machine that could not operate as effectively as it had been designed. While the MESM was the first computer to implement the principle of parallel processing, its designers disabled these functions of the machine and omitted circuits for reasons of economy, cutting its performance drastically.[121] It was simply too costly to risk damaging the limited number of switches available. The BESM and similar computers were nonetheless still in use in a variety of institutions well into the 1970s.[122]

Soviet attitudes and ideologies regarding computing, including entire branches of theory, also determined the course of computer science research in the USSR. The ideological crusade against cybernetics in the early 1950s is sometimes

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121 Apokin, Iurii. "The Development of Electronic Computers in the USSR," in *Computing in Russia: The History of Computer Devices and Information Technology Revealed*, ed. Georg Trogemann. Vieweg, Weisbaden, 2001. pp. 22-26, p. 81.

122 "Computer Exports to the Soviet Union: Hearing Before the Subcommittee on International Economic Policy and Trade of the Committee on International Relations," June 27, 1977. Government SuDoc (Y4. In.8/16:C73/32)

blamed for the subsequent lag in Soviet computing. However, the backlash may have been more of a symptom than a cause; after Stalin denounced the new idea of cybernetics as "bourgeois" science, a number of voices within the field of computing joined in discrediting it. Years later, some would recall that this was part of the ritual of scientific self-criticism, and described the blacklisting of cybernetics as a symbolic sacrifice, throwing one field of research "under the bus" to spare others.[123]

Soviet computer science continued to develop at the same pace as the West in some areas for many years afterward, and in some fields, such as the mathematics of complex computing algorithms, the USSR never fell behind at all.[124] However, the blacklisting of cybernetics as a branch of computing kept researchers from seriously considering modeling of natural or social phenomena, including economic concepts such as consumption patterns and management theories. With less focus given to studying the ways computers might help manage a society, economic planners in the Soviet Union were unable to foresee the myriad ways in which computers might be applied.[125] "As a result, the digital computer

123 Gerovitch, *From Newspeak to Cyberspeak: a History of Soviet Cybernetics*, p.19-23.

124 Graham, "Science and Computers in Soviet Society." *Proceedings of the Academy of Political Science* 35, no. 3.: The Soviet Union in the 1980s: 124-134. p.132

125 Martin Cave, *Computers and Economic Planning: The Soviet Experience*. (Cambridge, University Press, 1980). p.2

was initially conceptualized in the Soviet Union as a giant calculator and stripped of all cybernetic metaphors."[126]

Cybernetics would later be rehabilitated and come into vogue in the USSR, but in the West much important ground had been covered by this time, and by the early 1960s computers were beginning to revolutionize business in the capitalist world. This was not lost on Supreme Sovnarkhoz Chairman Dzherman Gvishiani, who had long analyzed Western theories of management and social science, and who was a major proponent of automation. In his 1962 work *The Sociology of Business: A Critical Essay on American Management Theory* he cites the interpersonal theories of sociologists Rensis Likert, DouglasMac Gregor and Robert MacMurray,[127] which complimented contemporary interest in building cybernetic networks for economic management. Gvishiani cites Peter Drucker's classic text, "The Practice of Management" repeatedly[128], along with a study of American innovation by one Herbert Apteker titled "Laureat of Imperialism", which held up the effectiveness of the American telephone and telegraph systems, and the corporate model of General Electric, as examples of how American appreciation for connectivity helped it establish the most functional systems on

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126 Gerovitch, *From Newspeak to Cyberspeak: a History of Soviet Cybernetics*, p. 105

127 Gvishiani, Dzherman. Sotsialogia Biznesa; Kriticheskii Ocherk Amerikanskoi Teorii Menedzhmenta. ("The Sociology of Business: A Critical Essay on American Management Theory"), Social and Economic Literature Press ("Sotsekgiz"), Moscow, 1962. p.70

128 Ibid. p.79

earth.[129] Gvishiani was Kosygin's son-in-law, and may very well have brought these theories and influences not only to his reports, but to the premier's dinner table, reinforcing the assumption that those at the highest levels were aware of the capacity of computers and the need to ease the flow of information in the USSR. Achieving this in practice was an entirely different story; between the vision of computers and the reality stretched a gap nearly as wide as that between East and West.

The correspondence of G.N. Petelin is revealing regarding the use and perception of computers in the Soviet Union during this period. Petelin was a labor economist and central committee member with many connections abroad, and an advocate of disarmament. He was also the head of the Profsoyuz for workers in state institutions, a broad-based trade union which included, among other things, a broad range of academic and research institutions. The Profsoyuz headed by Petelin listed among its activities the organization and funding of conferences for scientific research and other skilled trades. In May 1962, the Profsoyuz ordered ten calculating machines for the use of the Calculations Bureau. The committee issued a report declaring the machines necessary, and entrusted one of its members, P.F. Ladikov to negotiate the production of these machines through the appropriate government channels. The machines and the personnel required are described only in terms of their cost and labor-saving ability, and less in terms of the result they are intended to produce. The Profsoyuz justifies the machines primarily in order to stay within

129 Ibid. p.171

its state-mandated budget, and describes how the machines will save the work and expense of several clerks.[130] How the machines might alter or improve the work of Profsoyuz, or even how they will be incorporated, is not mentioned in the brief request.

Changes in the Scientific Community in the USSR

Automation was an oft-declared priority for the Soviet Union in the 1950s into the 1960s, but automation was not always synonymous with computer-controlled production or economic modeling.[131] The term more typically described automation in advanced assembly line production, regulation of devices used in heavy industry, and more specific automated calibration methods. Automation of this kind took precedence over computer-assisted management in industry into the 1950s.

The scope of the term "automation" grew significantly in the West during these years, but in the Soviet Union it seems to have been primarily associated with its more traditional connotations for far longer. The Soviets were pioneers in

130 Докладная записка по вопросу разработки условий применения механизированного счета в аппарате ВЦСПС с приложением проекта постановления секретариата ВЦСПС по этому вопросу. ("Memorandum on the question of mechanized calculators for the calculations unit, with the draft decision of the Secretariat of the Central Committee on this issue"), May 1962. The Russian State Archives, Papers of G.N. Petelin, No. 37, Index NA.

131 Alexander Nitussov, and B.N. Malinovskiy. "Economic Changes in the Sixties and Internationalisation of the Soviet Computing," in *Computing in Russia: The History of Computer Devices and Information Technology Revealed*, p.163-167.

the automatic regulation of heavy industry, but automatic regulation of electrical systems, including the development of computers, was for much of its history subset of industrial automation.[132] A number of ministries connected to various industries within the Soviet Union oversaw computer research and production.

Those in the research community often understood far more about the potential scope of automation than their superiors within regional planning commissions or the Central Committee. A.I. Kondalev, a member of the Academy of Sciences of the Ukranian SSR, described the proceedings of a 1959 conference in Kiev with the following;

> "It is now evident that the effective solution of many scientific problems, involving huge computations, as well as of problems of complex automation, control of economic activity, planning, accounting and statistics is impossible without a highly-developed computer machine technique, mainly in the form of high-speed digital machines with program control."[133]

More than 300 scientists, men and women engaged in various aspects of computing research, from across the USSR, Eastern Europe and Central Asia

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132 "Growth of Automation in the USSR, 1917-1957," *Automation and Remote Control*. Vol. 18, No. 11, November 1957. National Archives and Records Administration, Washington, DC, RG 263, Records of the CIA, Entry 7 ("Finished Soviet Intelligence").

133 A.I. Kondalev, "New Developments in Computer Mathematics and Techniques; Proceedings of a Conference at the Kiev Computer Center," *Uspravlenie Materialy Nauk*, vol. 14, No. 4 (88), 1959, p. 237-241. Translated by Morris D. Friedman, Electronics Research Directorate, US Air Force Cambridge Research Center. National Archives, RG 263, Entry 7, Box 73, Folder "Reports Filed Under Code OO-X," CIA Foreign Broadcast Information Service, Foreign Documents Division.

attended the scientific-technical conference in question. As the 1960s progressed, the changing economic and political landscape of the Soviet Union would have profound effects on how scientific work was done, and with whom scientists in a given field might communicate. Khrushchev's dubious efforts at reforming the Soviet economy in the early 1960s involved the splitting of the Party into agricultural and industrial branches, and the creation of regional economic subdivisions devoted to each.[134] On one level, this was supposed to improve the agility and responsiveness of Soviet industry and agriculture, improving efficiency and allowing the USSR to move into a period of economic diversification. These regional divisions and specifications within the party were intended to speed the development of light industry, including production of consumer goods and more varied foodstuffs.

Khrushchev's efforts to grow the economy and raise the standard of living also involved the intense application of scientific and technological solutions to these problems. Towards these ends, the standard Soviet practices of centralization and control were increasingly applied to the scientific community. The founding of new scientific centers and entire towns devoted to a single field of research made Soviet and international headlines.[135] What could not be gauged from public and

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134 R.W. Davies, *Soviet Economic Development from Lenin to Khrushchev*, (Cambridge, UK: Cambridge University Press, 1998), p.78.

135 Paul Josephson. *New Atlantis Revisited: Akademgorodok, the Siberian City of Science.* (Princeton, New Jersey: Princeton University Press, 1997), p.21.

Party enthusiasm, or alarm overseas, regarding these measures was the degree to which researchers were becoming entirely dependent upon the Party for their livelihoods, from their research space to their apartment homes. In myriad science towns, typically many kilometers from the nearest urban center, not only the scientists' own advancement, but the food they ate and the schools their children attended had become more dependent on their compliance with Party measures that determined the direction of their work than ever before.[136]

Soviet leadership sought ways to explain how its new economic strategy fit into Marxist-Leninist constructs on the nature of the state economy. This manifested itself most directly in what was almost certainly a deliberate alteration of Lenin's words to suit the needs of the moment. In the fall of 1962, a young researcher uncovered a "new document by Lenin" which stated that the path to socialism would lead through a stage "where political tasks must be subordinated by economic ones."[137] The lack of official fanfare which greeted the researcher's finding, as well as the explanation for why such a vital opinion of Lenin's had been previously lost to history cast doubt upon the circumstances of its emergence, even though no subsequent questioning of the document's authenticity emerged. The immediate publication of the document by the Supreme Sovnarkhoz (and virtually

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136 John Turkevich, "Soviet Science Appraised," *Foreign Affairs*. Vol. 44, No. 3 (Apr., 1966), pp. 489-500, p. 492-493

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137 Tatu, p. 258.

no one else) raised eyebrows, as well as the cool response to the document among top Party leaders.[138] In 1963, theoretician G.E. Glezerman, reflecting on the longstanding party slogan "Politics cannot fail to dominate economics," noted that Lenin "was not above contradicting himself on occasion."[139] Regardless of its intentions, ideology is eroded by such treatment. In a social and economic system built entirely upon an ideology represented by a handful of seminal political philosophers, to chip away at the legacy of those figures is to hack at the foundation of the system itself.

It is often the view of government that science should serve the needs of the nation; indeed, a contemporary internal paper from the US State Department commented that scientists should be "on tap, but not on top."[140] However, in the view of the Soviet Communist Party, science existed primarily to serve the state and its economic and social ends. The level of control the Party would come to exert over scientific practice and the scientists themselves would soon approach a stranglehold, preventing communication and stifling the free thinking and interdisciplinary experimentation required for innovations in high technology.

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138 Tatu, p. 259

139 Tatu. p. 260

140 "Planning Paper Toward European Unity", Sept. 5, 1961. RG59, Entry A1 5586, Box 2: US State Dept., Bureau of European Affairs, Regional Planning & UN Advisor, Records relating to Planning and UN Matters, 1959-1967. p.3

B.N. Malinofsky, who stood at the forefront of many early computing efforts, recalls in Chapter 6 of *Pioneers of Soviet Computing*, "The separation of science and manufacturing into different departments was not the most efficient method of production, although it had positive aspects- the operational assistance to companies was approved much faster and implemented more efficiently."[141] To Party leadership, the free flow of ideas among scientists working at the highest levels seemed not only an unproductive use of their time, but an extremely dangerous proposition. Empowering managers within the state industrial structure to interact with and draw from scientific developments in computing was also avoided, as it might threaten Party control.[142]

During the early 1960s, the USSR responded to its changing needs by restructuring the state organs responsible for research, and the tight controls imposed on all would serve to splinter the concerted efforts of its best minds. The Soviet scientific establishment would expand more rapidly between 1960 and 1972 than it ever had, with ever-more specific institutes established inside and outside of

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141 Fitzpatrick. Ch. 6 (http://sovietcomputing.com)

142 Tatu, p. 253:

> "Any increased autonomy for local mangers worries the central planning officials, who are used to the traditional chain of command: it is also bound to worry Party officials, who live in fear of a managerial class emerging and escaping their ideological and political grip. If nevertheless, pressed by circumstances and the need for efficiency, the Party leaders agree to the relaxation of state control, it must be on condition that the Party's control over these sectors is strengthened. Khrushchev's plan of 1962 for dividing the Party was clearly intended to fulfill this condition."

major cities.[143] Unlike research institutes in the U.S., these facilities were unlikely to be connected to any academic function.

Scientific and political leadership slowly merged as the prestige of science also became a respected political credential; a man at the top of his field might carry significant influence over both research and policy. However, this made for an increasingly conservative and industry-focused top layer among the strata within the scientific community.[144] There is evidence to suggest that such conservative elements within Soviet education were reluctant to embrace computers, and that this resulted in a lack of available training and a depressed demand for hardware, even within institutions ostensibly dedicated to their study.[145] At every level within the Soviet system, both before and especially after Khrushchev's reforms, the development and adoption of computers seemed to encounter virtually unmovable obstacles.

In addition to the scarcity of materials and production capacity for computer components, lack of development of peripheral devices (which might

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143 Graham, *Science and the Soviet Social Order,* p. 82

144 Graham, *Science and the Soviet Social Order,* p. 109:
"Between 1959 and 1986, the percentage of members of the Politburo who had received their educations in technical areas rose from 59 percent to 89 percent. These were men who favored heavy industry above all other priorities."

145 Harvey, p. 51. "An article by Dr. Zubov, Chairman of the Applied Mathematics Department of Leningrad State University", in *Izvestiya* on February 25, 1970:
"Zubov hinted at the resistant of old-line mathematicians to computers. Zubov asserted that training of computer specialists "is unjustafiably attached to a mathematical specialty, where machines are regarded as a 'makeweight' to general mathematical education" and "at the same time there is little education for a specialist in the field of computer technology."

require the cooperation of an entirely different branch of Soviet research and industry) held back the development of practical computer models for mass production and limited the functionality of existing models. By the mid-1960s, the USSR began to look outward to both the West and its allies in Eastern Europe, to share in the process of development and the production of computer hardware and peripherals. This openness to outside innovation and cooperation represented a sea-change in the Soviet Union's attitudes towards both global economics and its relationship with the West. It could also be interpreted as a symptom of Soviet opportunism taken to the point of self-destruction.

The Rise of COMECON

Among the factors affecting international trade in the 1960s was the advancing role of the Council for Mutual Economic Assistance, or COMECON (also known as CMEA). A number of economic and infrastructure-related reforms undertaken by COCOM countries in the late 1960s depended heavily on computerization. Stalin had envisioned COMECON as a counterbalance to the Common Market and the economic collaboration between the U.S. and Western Europe resulting from the Marshall Plan. However, until the late 1950s, COMECON had little reality beyond the declaration that created it.[146] The favorable trade arrangements between member states facilitated technology

146 Mellor, p.12

transfer between member states, and also formed the basis for cooperation on large, multinational projects related to energy and industry within Eastern Europe.

One of the chief undertakings of COMECON in the 1960s was the development of an international power grid, first established in 1962.[147] Lenin had envisioned electrification as an integral part of socialist development, and such projects had an almost incomparable social and industrial impact. Computers were essential to the efficient and reliable operation of such a grid, and a reliable grid required reliable computers, and much research and discussion had already taken place regarding the automated control of such systems.[148] This was, unfortunately, something socialist Eastern Europe was unable to supply for itself.[149]

Production of iron and steel in Poland, Czechoslovakia and the USSR was to be coordinated by computers through the COCOM programming agency "Intermetal". In 1962, a COMECON international power grid was established to make up for shortcomings in domestic power production among some members.[150] Improvements to this grid, and its administration center in Prague, required significant investment in computerized switching systems. Acquisition of such

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147 Mellor, p. 113

148 "Report on the Scientific and Technical Conference on the Use of Computing in the Design and Operation of Power Systems." National Archives and Records Administration, Washington, DC, RG 263, Records of the CIA, Entry 7 ("Finished Soviet Intelligence").

149 Graham, *Science and Philosophy in the Soviet Union*, p.330.

150 Mellor, p. 96.

power-switching technology was among the key drivers of East-West technology transfer.

As the post-war period drew to a close, the contrast in living standards between Western and Eastern Europe was growing impossible to ignore. The violent Soviet repression of political and economic reforms in the late 1950s was an episode that could not be repeated if the USSR were to claim a legitimate leadership role in global politics.[151] The development of an international economic alliance between communist states would not only give the USSR a diplomatically acceptable organ through which assert its dominance over states that were no longer the satellites they once were, but would allow communist countries an avenue for participation in an construction of an international socialist economy.[152] A massive push for computer development by Central Committee in 1959 coincided with plans for central economic and industrial planning on an international scale.[153] Significant investment and modern management methods would be required for COMECON's ambitious goals of economic and communist construction to be realized.

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151 Taubman, p.542

152 Mellor, p.34

153 Tatu, p.268

Chapter 2

Changes in Export Controls and Socialist Economies, 1962-66

> "The history of the U.S.S.R. provides a unique example of the rise and development of a great power. It took its mortal enemy as a model, and legally or illegally adopted all the technical, industrial and scientific achievements from the whole of Western Europe and America for its own use, claiming them as its own...If the Soviets had succeeded, as Bolshevism continuously boasts, then this would have been a triumph for international capitalism, which supplied the credit, the machinery, the designs, the patents, the engineers and the technicians, everything indeed of decisive importance, the whole of capitalist production in fact for the Russians' use."
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> --Werner Keller, *East Minus West Equals Zero*, quoted by Sen. Karl Mundt before Congress as part of an argument to strengthen export controls, July 13, 1967.[154]

> "However unusual this may sound to some conservatives who do not wish to comprehend elementary truths, we will be building communism on the basis of the most broad use of electronic machines, capable of processing enormous amounts of technological, economic, and biological information in the shortest time...These machines, aptly called 'cybernetic machines', will solve the problem of continuous optimal planning and control."
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> --Engineer Admiral Aksel' Berg, Chairman of the Academy Council on Cybernetics, 1962.[155]

The warming relations between the U.S. and Soviet Union rapidly chilled in the wake of the U-2 Incident, and flared terrifyingly hot with the Cuban Missile Crisis

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154 "The United States Needs an Embargo on Aid to Our Enemies", speech by Senator Karl Mundt, 114 Congressional Record, (1968), p.11,309-14, p.S9535

155 Slava Gerovitch. "*The Cybernetics Scare and the Origins of the Internet," Baltic Worlds*, Vol. II, 1 (2009), p.20.

in 1962. The intentions of each side in the détente of the late 1950s and early 1960s were often unclear to the other. This was partly due to the lack of adequate peacetime diplomatic precedent or policy on the part of the US and the inherently insular and secretive decision making processes at work in the Soviet Union.[156] However, even as the first détente came grinding to a halt, it was clear that the process would almost certainly resume at some point. By 1963 there emerged a series of policies that would form the foundation of US-Soviet relations for the next thirty years.

The period from 1958-1968 saw a general liberalization of East-West trade. By 1960, the postwar economy had stabilized, and a largely recovered Western Europe was testing the waters of trade with the Eastern Bloc. West Germany was among the first to quietly resume a trading relationship with the more accessible socialist states on its border, and shortly reaped an impressive profit.[157] France, Britain, and other NATO member nations were soon engaging in a brisk trade of non-strategic items. Although this was a small fraction of their overall trade commitments, Eastern Europe was increasingly seen as a developing market where trading opportunities should naturally be exploited.[158]

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156 Saville Davis, "Patterns and Problems in U.S. Foreign Policy," *International Affairs*, Vol. 41, No. 4, (Oct. 1965), p. 629

157 Seooaub, Helene. "The Divided West: Contrasting German and U.S. Attitudes to Soviet Trade," *The Political Quarterly*, Vol. 61, 1990, pp. 51–65, p. 54

158 Marshall Goldman, *Détente and Dollars: Doing Business With the Soviets*, (New York: Basic Books, 1975), p.50.

In retrospect, it seems inevitable that Western Europe would resume trade with its contiguous neighbors, many of whom had deep historical trading relationships regardless of political conflict. However, the United States was quick to remind its fellow members in NATO of the risks of doing business with socialists. Throughout the early 1960s, as Western Europe increasingly came to chafe at the restrictions imposed upon trade by the US State Department and Department of Commerce. It had become increasingly difficult to enforce certain restrictions, as European businesses and foreign subsidiaries of American companies found ways to subvert the restrictions.[159]

As détente seemed about to crumble in the months before the Cuban Missile Crisis, the American Secretary of State Dean Rusk was asked in a televised interview why American citizens seemed to proclaim their political opinions more loudly than Europeans. Rusk mentions "aristocratic tradition" at work in Europe; this explains why more Americans have strong opinions about foreign relations than their European counterparts. Europeans are more inclined to leave international matters to be handled

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159 Goldman, p. 72:

> "Inevitably the refusal of the United States government to sell to the USSR became a futile gesture. Of course, in areas such as computers and certain specialized machine tool products in which the United States had a monopoly, the East Europeans had to settle for second best or nothing. But increasingly, an American refusal to sell often amounted to little more than flag waving and less competition for the products of foreign manufacturers. One way or another, the Russians and the East Europeans found it possible to buy what they wanted- often from overseas subsidiaries of American firms."

by their leaders.[160] In a second TV interview, he calls American and European defense "indivisible" and "vital to both", and flatly explains that he does not think Europe wants to expend the effort to defend itself without help from the United States.[161] This dismissive attitude, coupled with aggressive American efforts to establish missile bases in Europe, gave the impression that the US was not especially concerned with the fates of its closest allies.

Lack of diplomatic skill on the part of American representatives, among other factors, contributed to a drift in opinion on economic and foreign policy matters. By 1961, the United States was actively reviewing what until then had been enthusiastic support for increasing European unity; on one hand, a Western Europe that enjoyed greater political gravity might draw the nations of Eastern Europe further out of Moscow's orbit.[162] On the other hand, the competition that might be created by an economically and politically united Europe would create an uncomfortable degree of competition for the US in both arenas. One possible answer to this was for the US to try to strengthen its trans-Atlantic alliances, ensuring itself an integral role in Europe's

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160 "Washington Conversation: An Interview with Secretary of State Dean Rusk," CBS News, September 1962.

161 "Focus on World Affairs: The Citizen's Responsibility," an interview with Dean Rusk, WRC-TV-ERTA, 1963.

162 "Planning Paper on European Unity," September 5, 1961. National Archives and Records Administration, Washington, DC, RG 59, Bureau of European Affairs, Regional Planning Committee, from Records Relating to Planning & UN Matters, 1959-67, A1 Entry 5586, Box 1, p.10.

future without directly asserting itself.[163] The fact that the US was considering this possibility in 1961 makes it plausible that this reasoning played a role in its later compromises to preserve the system of international export controls. If COCOM had collapsed and its member states gone their separate ways, it would have dealt a tremendous blow to American influence abroad.

Between 1960 and 1970, trade between Eastern and Western Europe increased 280 percent. In the same period, US-Eastern European trade increased by only 60 percent, and amounted to less than US trade with the Philippines.[164] Throughout the 1960s, many American businessmen and industrialists pressed for increased trade, joined by those who believed in trade as a path to more normalized relations with the socialist world.[165] Part of the reason for the mounting pressure was the economic threat of a resurgent Europe, the interests of which had begun to conflict with American foreign policy goals.

In 1963, a State Department circular warned that current détente and Soviet willingness to open up to trade may tempt NATO allies away from political goals, and

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163 Ibid. p.6

164 James Baker. "United States Business Opportunities in Eastern Europe," in *China, the USSR, and Eastern Europe: A US Trade Perspectiv*e. Kent State University Press, 1974, p.99-100.

165 Ibid. 101

expressed a desire to avoid a credit race with Western Europe.[166] In any case, it was clear the U.S. would need to respond to its allies' increasingly enthusiastic extensions of credit. From 1962-65, France extended a total of $10 million US dollars in credit to the USSR. In 1966, that figure jumped to $116 million. Italy went from offering no long-term credits to offering $318 million in US dollars in 1966. Belgium, W. Germany, France and Italy all extended more credit to Eastern European nations (in this case Poland, Czechoslovakia, East Germany, Hungary, Romania and Bulgaria) in 1966 than they had in the preceding 3 years combined. The UK lent less, as did Japan and Austria. These credits had a repayment schedule exceeding five years, presuming continued détente and an ongoing financial relationship with the Eastern Bloc.[167]

Once the Berlin Wall had gone up, stabilizing (if unsatisfactorily) the political situation, West Germany almost immediately began exploiting trade loopholes, and was soon reaping an enviable profit from its trade with Eastern Europe.[168] By 1964, West Germany had become the largest exporter to the Soviet Union, despite the fact

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166 "Confidential Ambassadorial Circular", Oct. 26, 1963. National Archives and Records Administration, Washington, DC, RG 59, Bureau of European Affairs- OECD European Community and Atlantic Political-Economic Affairs, Records Relating to Economic Matters, 1953-1979, Box 13, Folder "FN 11-1 – Export Credits, 1963-67".

167 "Memo to Rep. Paul Findley, U.S. House of Representatives, from Douglas MacArthur II, Assistant Secretary for Congressional Relations," February 17, 1967. National Archives and Records Administration, Washington, DC, RG 59, Bureau of European Affairs- OECD European Community and Atlantic Political-Economic Affairs, Records Relating to Economic Matters, 1953-1979, Box 21, Folder: "NATO, ECONAD, East-West Trade, USSR, 1967-71"

168 Thomas Finletter, *Foreign Policy: The Next Phase, the 1960s*. (New York: Harper & Brothers for the Council on Foreign Relations, 1960), p.112.

that no formal trade agreement or long-range deferred payment plan existed between the two governments.[169] In 1965, the West German government approved the exportation of a petrochemical refinery worth $150 million US dollars. The payback terms indicated that the West German business group anticipated working closely with the USSR for at least the next seven years, and extended a term of credit for the following decade.[170]

Central Europe was also rapidly becoming a major market for Eastern European agricultural goods:

> "No one who has seen the large Bulgarian semitrailers and trailers, built incidentally in West Germany, on their regular journeys from, say, Plovdiv or Pazardzhik to Central Europe, with cargoes of lettuce, artichokes, or dessert grapes, can doubt that foreign markets are becoming increasingly important for Bulgarian agriculture."[171]

The traffic in seasonal produce demonstrates that trade with Eastern Europe was becoming an integral part of the improving standard of living in Western Europe, and these Western markets a lucrative outlet for whatever the East could produce. However, it was difficult to pay for licenses and production lines with

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169 "Role of Deferred Payment Conditions in Japan-Soviet Machinery and Plant Trade in the Light of Current Western European Machinery and Plant Exports to the Soviet Union, 1965," National Archives and Records Administration, Washington, DC, RG 263, Records of the Central Intelligence Agency, Job #78-0496A, NN3-263-99-003, p.ii.

170 Ibid. p.iv

171 Norman Pounds, "Fissures in the Eastern European Bloc," *Annals of the American Academy of Political and Social Science; Realignments in the Communist and Western Worlds*. Vol. 372 (July 1967), pp.40-58, p.48.

either fruit or COMECON's precious hard currency, and so the availability of credit would play a pivotal role East-West technology transfer.

While more conservative voices tended to prevail within the Amercian government, there were many who favored increased trade with communist Eastern Europe. For some, including the Policy Planning Commission within the State Department, trading relationships could prove strategic in promoting détente without sacrificing American interests. Trade would reduce Eastern European dependence on the USSR, and draw the former satellites further out of Soviet orbit. Whereas direct political or military interference would likely only destabilize the region, trade could yield mutual benefits as well.[172]

Makers of foreign policy also had to contend with pressure from the business and scientific communities, who saw the restrictions on commerce as missed opportunities.[173] Trade in commodities such as grain rose steadily throughout the early 1960s. Socialist states seeking to acquire raw materials and non-strategic items

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172 "Steps in a Process Toward Détente," State Department Policy Planning Council, August 23, 1963. National Archives and Records Administration, Washington, DC., RG 59, Entry 5586, Box 1; 150/76/16/3, p.3

173 Goldman, p.90

from the West would often supplement their limited hard currency with specialty goods and basic manufactures such as Polish meats and Czech glassware.[174]

In a series of State Department documents used in development of the 1963 policy paper "Steps in a Process Toward Détente," various parties from within the Policy Planning Council weigh in on the possible steps that could support American interests in future détentes with the USSR.[175] The particular mindset at work within the US State Department is evident from such documents. By 1963, détente is already being described as a "ploy", and the authors attempt to determine a historical pattern previous détente-seeking on the part of the Soviets.[176] Previous "détentes" are cited, including Stalin's cooperation during World War II, and the brief outreach of Soviet leaders as they sought stability after Stalin's death. The fact that these were considered periods of détente is revealing, and provide evidence as to why subsequent attempts to improve relations between the US and Soviet Union failed.

The "peaceful coexistence" sought by Eisenhower and Khrushchev in the late 1950s was fundamentally different from previous periods of cooperation or laxity in that the Soviets were acknowledged to have obtained a position of strength. Public

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174 Richard Bilder, "East-West Trade Boycotts: A Study in Private, Labor Union, State, and Local Interference with Foreign Policy," *University of Pennsylvania Law Review*, Vol. 118, No. 6 (May, 1970), pp. 841-938, p. 544.

175 "Steps in a Process Toward Détente", p. 4

176 Ibid. p.6

opinion at the time placed the technological advantage, especially in the field of missile technology and rocketry firmly in the USSR's court.[177] The launch of Sputnik had placed the US on notice and shaken the West to its core. Khrushchev seized this advantage to advance a muscular foreign policy, pushing the socialist agenda forward on a global scale.

However, from the point of view of the State Department, the Soviets offered détente only when they wanted something, particularly to "cut a loss" as they did in Korea, or "get rid of a particularly dangerous irritant" in the case of the Berlin blockade. Most damning is the charge that the USSR "used détente to cover a planned specific act of aggression" during the weeks preceding Cuban Missile Crisis.[178] In any case, moves toward improved relations were to be viewed with suspicion and handled with a minimum of enthusiasm.

This interpretation of Soviet actions by the by the State Department would color future interactions, and no approach by the USSR for improved relations could be trusted. This was a perfectly valid interpretation, as previous progress had been quickly reversed, and the possibility of détente used unsuccessfully as leverage by

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177 A Gallup Poll conducted Feb. 14, 1959, revealed that 43% of Americans believed that the Soviet Union would hold the leading position in science ten years in the future; only 13% believed that technological dominance would belong to the US.

178 "Steps in a Process Toward Détente", p. 3

Khrushchev.[179] By American estimation, the Soviets viewed détente as a "continuation of war by other means," easily abandoned when their immediate needs had been served.[180] In this, they were at least half right; "peaceful coexistence" was not intended to be true peace, but the transfer of the struggle against capitalism from a military playing field to an ideological one. In the era of "Sputnik Diplomacy", the Soviet Union had worked hard to increase its influence abroad and win allies in the anti-colonial revolutionary movements taking place across the developing world. It had alarmed the West with its technological capacity, and with so much Soviet research shrouded in secrecy, its potential destructive power in terms of missile capacity could not be conclusively determined.[181] However, the idea that violent struggle need not be inevitable was an increasingly important message in the nuclear age, and with Khrushchev that possibility had finally been voiced by a Soviet leader.

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179 Vladislav Zubok, "Khrushchev and the Berlin Crisis, 1958-1962," *Working Paper No. 6, Cold War International History Project*. (Washington, D.C.: Woodrow Wilson International Center for Scholars, May 1993), p. 6

180 "Steps in a Process Toward Détente", p.6:

"A more important tactic has been to limit commitments to those necessary to meet their immediate requirement, whether that be to eliminate a direct danger or simply to secure a general relaxation based on atmospherics...This brings into focus the most striking feature of the détente ploy as it has been used by the Soviets in the past: The leadership has always stopped far short of anything like a general and comprehensive settlement of differences. It has usually launched its détente drive with noises indicative of a desire for such a settlement. But it has never followed through on these noises. Usually, it has selected one or two of the variety of issues in dispute at the moment, pressed for quick resolution of these, hailed the result as the precursor of an era of good feeling, and then fallen into a state of lethargy with regard to other issues."

181 Mose L. Harvey, Leon Goure, and Vladimir Prokofieff, *Science and Technology as an Instrument of Soviet Policy*, (Coral Gables, FL: University of Miami Center for Advanced International Studies, 1972), p. viii (from introduction by Ambassador to the USSR Foy D. Kohler)

Khrushchev's Late Reforms and their Effects on the Sciences

Khrushchev's reforms in the late 1950s had streamlined some of the byzantine bureaucracy that had evolved under Stalin; 1957 had been a triumphal year for Khrushchev, and he had been empowered to push through a series of changes that alienated much of the old guard.[182] Subsequently, his significant reductions in the size of the military during 1960 and 1961 further removed top Red Army brass from influence, and the Party began to reassert control over the armed forces as it had not for many years.[183] However, the reforms undertaken by Khrushchev as the 1960s began would be compromised by the a series of national embarrassments, political miscalculations, and the General Secretary's decreasing personal power, resulting in the proliferation of bureaucratic functions and loss of effectiveness.

During the late 1950s and early 1960s, the decidedly military bent of the Soviet economy, with its intense focus on steel, was being reconsidered. Khrushchev railed against proponents of heavy industry, the "steel-eaters", who he charged with holding back needed reforms.[184] The "steel-eaters" typically represented not only the old Stalinist economy, but the Stalinist ideologies that were slowly being driven from the ranks. In the field of computing research, a great number of endeavors were tied to

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182 "Man of the Year: Nikita Khrushchev," *Time Magazine*, Jan. 6, 1958.

183 Michel Tatu, p.75

184 Tatu, p.174

military research institutes. The defense ministerial system oversaw much of the total applied science research in the USSR.[185]

The impressive economic gains made during the 1950s and first years of the 1960s were sharply curtailed by 1962. Accurate and easily translatable economic figures were not always easy to come by in these years, but in 1965 a series of revealing gaffes on the part of economists and the state-run press showed how badly the Soviet economy had been affected by agricultural failures and industrial decline.[186] For most of the 1950s, the Soviet economy grew at a rate of at least 6% per year; by 1962, that rate had slowed to 2.5%; the CIA speculated that the USSR was already exhausting itself by "attempting to match U.S. outlays for national defense, space, and industrial investment."[187] "Further, the Soviets had eroded their gold holdings through over-ambitious purchases from the West of industrial plants and equipment."[188] By 1965, even inflated Soviet official statistics could no longer be manipulated to disguise this decline.

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185 Loren Graham, ed. *Science and the Soviet Social Order*, (Cambridge, MA: Harvard U. Press, 1990), p.82

186 "Memorandum, RE: CIA-Soviet Controversy on Recent Rates of Economic Growth," Aug. 3, 1965. National Archives and Records Administration, Washington, DC, RG 263, Records of the CIA, Soviet Finished Intelligence, Acc.#NN3-263-06-003, p.1

187 Ibid. p.2

188 Ibid. p.3

Domestically, there had been a series of poor harvests, which in one notorious case led to troops firing on a crowd protesting high meat prices in Novocherkassk in 1962. Beyond Soviet borders, Khrushchev's poor showing in handling the issue of Berlin, the deep rift that had developed between the USSR and China, and the fiasco surrounding the Cuban Missile Crisis had all eroded Khrushchev's support within the Presidium and the Central Committee.[189] The Cuban crisis had also exposed the Soviet Union's technological vulnerability; the embarrassment of this would not be lost on policymakers in the years to come, and would become and important driver for new forms of state involvement in the sciences.[190] The poor economy, and efforts to cut spending, had led to general cutbacks in domestic spending; in the sciences, this was seen most notably in support of scientific publishing and conference attendance.[191] While overall science budgets would remain large, individual institutions would be expected to carry a greater portion of the financial burden of

189 Tatu, p. 360

190 Timothy Luke, "Technology and Soviet Foreign Trade: On the Political Economy of an Underdeveloped Superpower," *International Studies Quarterly*, Vol. 29, No. 3 (Sept., 1985), pp. 327-353, p. 345

191 Dokladniye zapiski komissii (Predsedatel' G.N. Petelin), napravlenie prezidiumu VTsSPS vo Ispoleniye evo postanovlenia ot 12 Sentyabria 1962 goda "O Neobkhodimosti ekonomnogo raskhodovania sredstve na sotsial'no-kulturniye i drugiye meropriyatia"(Memoranda of the Commission of the All-Union Central Council of Trade Unions (Chairman GN Petelin) on the need for economical spending on socio-cultural and other events) September 12, 1962. The Russian State Archives, Papers of G.N. Petelin, No. 37, Index NA.

research out of their own budgets, paying for their expanding rolls and research obligations by contracting with factories or collective farms.[192]

By early 1963, it was clear that Khrushchev's plans to reform the economy would not take shape without significant concessions to his adversaries. Khrushchev's plan to divide the Party into agricultural and industrial branches, and the Soviet economy, into administrative regions would be coupled with the creation of other administrative organs favorable to opposing elements within the Central Committee.[193] These included the creation of a "Supreme National Economic Council", or "Supreme Sovnarkhoz" at the head of each branch of industry, responsible to the USSR Council of Ministers. Khrushchev had objected to the idea during the 1957 reforms, but by March of 1963 he lacked the political strength to fight its passage by the Supreme Soviet. In this one move, management of the Soviet economy was balkanized both horizontally and vertically, creating a series of bureaucracies that were rife with redundancy and lacked any clear accountability, authority or clear chain of command.[194] Nearly 100 federal ministers would now report to Supreme Sovnarkhoz leadership on the activities of the various branches of the economy as well as the work of "planning committees" and "coordination

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192 M. Belusov, "The Academic Institutes and Production," *Ekonomicheskaya Gazeta*, No. 24, June 1968, cited in Harvey, p.45.

193 Tatu, p. 330

194 Tatu,p. 331.

councils" composed of dozens of people, some with overlapping responsibilities within different economic and industrial organs and the Party itself.

One group who clearly gained an advantage by the creation of the Supreme Sovnarkhoz system was military leadership. Khrushchev had dealt the military a devastating blow with his reforms, reducing the size of the Red Army considerably. As Khrushchev's power waned, however, the military became a resurgent force in Soviet politics.[195] This was significant in that the military aligned themselves with Khrushchev's economic adversaries, the "steel-eaters" who favored a Stalinist approach focused on heavy industry and steel production. Khrushchev and his allied reformers wished to place more emphasis on chemicals and consumer durables, which to date had been weak points.[196] When the Supreme Sovnarkhoz was created on March 13, 1962 Marshal D.F. Ustinov, who had suffered a demotion under Khrushchev, was promoted to First Deputy Prime Minister and placed at the helm. Five of the eight other deputies would report directly to him, including the heads of Gosplan, Gosstroi, Sovnarkhoz, KNIR (Committee for Scientific Research) and Defense. The last word on numerous sectors of the economy, including "defense technology, aeronautics, electronics, radio-electronics, naval construction, atomic

195 Tatu, p. 331

196 Machula, p.130

energy and medium-scale mechanical engineering," among others, now fell to one individual with intense connections and interests in the war industry.[197]

Further reforms were required, and had been planned by Khrushchev and like-minded leadership, for whom the development and application of new technologies would be paramount, but before they could be implemented the leader himself found his influence slipping.[198] With the diplomatic failure of Berlin, the economic and resulting social disruptions of the poor harvest, and the disastrous international revelations regarding Soviet military power in the wake of the Cuban Missile Crisis, first years of the 1960s had already seen a number of economic and political failures for Khrushchev and his approach to government.[199] The mastery of applied research to revolutionize the economy was still a primary goal, but how to successfully implement programs to do so in a centrally-planned economy was unclear. Meeting the challenge of the West was perhaps the most widely agreed-upon priority; during the early 1960s, the USSR attempted a "brute approach", dedicating vast budgets and small armies to the aim of surpassing the West.[200] Still, these vast budgets devoted to

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197 Tatu. p..330

198 Tatu, p.329

199 William Taubman, *Khrushchev: The Man and His Era*. (New York: W.W. Norton, 2003), p.549

200 Harvey, p.30

"science" did not necessarily add up to greater resources at the disposal of researchers, and could be largely accounted for by personnel.[201]

The establishment of the State Committee of the Council of Ministers for the Coordination of Scientific Research in 1961 served to extend bureaucratic control over R&D within the Soviet Union. This organ was a modern counterpart to the earlier NTO (Nauchno-tekhnicheskii otdel Vysshego Soveta Narodnogo Khoziaistvo), the scientific-technical wing of the Supreme Economic Council established in the 1920s.202 According to Soviet historian Alexander Vucinich, "the State Committee was a single organization entrusted with planning and directing both applied and basic research on a national scale."[203] This entity determined "the main lines of capital investment in science [and]...plan the establishment of intersectoral research centers." Under the State Committee, nothing less than an attempt to plan both scientific and technological progress in tandem became state policy.[204]

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201 Harvey, p.70

202 Paul Josephson, "Science Policy in the Soviet Union, 1917-1927," *Minerva*, Vol. 26, No. 3 (Sept.1988), pp. 342-369, p.343

203 Machula, p.135.

204 Machula, p.134

There was a decided bias within the Academy of Sciences, and also within the research community, towards theoretical rather than applied work.[205] This was partly due to prestige and also to the fact that applied research was not materially provided for by institutional budgets.[206] Akademician V. Trapeznikov, a former First Deputy Chairman of the State Committee for Science and Technology commented in *Ekonomicheskaia Gazeta* in 1968 that "We spend on scientific research approximately as much as on the preparation of technical documentation, the creation of experimental samples and technological processes, instead of spending on the latter three times as much as on research. Therefore, the experimental base has become the bottleneck of science, delaying the assimilation and implementation of scientific findings."[207] A contemporary article in *Voprosy Filosofii* asserted that Soviet scientists had "only about 40 percent of the space and equipment available to their American counterparts."[208] This was the case even after Soviet central planning asserted itself

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205 Harvey, p.44

206 Harvey, p.42

207 Trapeznikov, V.A. *Ekonomicheskaya Gazeta*, No. 27, July 1968, cited in Harvey, p.43

208 *Voprosy Filosofii*, No. 10, 1968, p.32, cited in Harvey, p.48.

most completely over the sciences with the construction of new scientific centers throughout 1960s.[209]

Much like the notorious "monogorods" based on production of a single commodity, these "scientific towns" focused the bulk of high-level research in specific fields within a single space, a town entirely driven by and devoted to the work of an institute. These research towns were often set on the outskirts of a city, planned and constructed with a research institute and testing facilities as their focal point.[210] On one hand, they brought together and supported the best minds in a given field. On the other, they isolated their scientists from the wider research community, and made them even more dependent on political favor than they had been in the past. Thus the Central Committee, along with the various organs through which it administered to national scientific priorities, came to exercise more closely vested control over scientific inquiry.

Brezhnev's Reactions and Reforms

In 1964, a number of reforms to the Soviet economic and industrial planning organ, GOSPLAN, were introduced. With the Eighth Five-Year Plan to begin in 1968,

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209 *"Scientific Information Report: Organization and Administration of Soviet Science,"* National Archives and Records Administration, Washington, DC, RG 263, Records of the CIA, Central Intelligence Agency Summary No. 5111, Oct. 18, 1963, p.3

210 Josephson, "Science Policy in the Soviet Union, 1917-1927," p. 16

the new GOSPLAN promised to unravel a Gordian knot of bureaucratic calculations and estimate with a fleet of computers generating statistics and production plans automatically.[211] The *sovnarkhozy* were abolished in 1965, but the positions they encompassed predated them and persisted afterwards, and the additional powers the *sovnarkhozy* had bestowed upon them were not revoked, leaving the individuals filling those positions with greater freedom to control the economic life of their regions. These local bureaucrats would fight for the status quo, and often stood in the way of technological advancement if they felt it endangered stability.[212]

Until 1965 all scientific computing research was overseen by the State Committee on Radio Electronics. A restructuring effort then placed it under the auspices of both the Ministry of the Radio Industry and the Ministry of Machine Construction. The former was to handle "universal and specialized" computers, and the latter "automation and control" systems. In addition to the confusion this restructuring created, quotas and timetables were imposed on both sides, meaning that research and construction frequently took place concurrently, often involving entirely new and untried components and technologies.[213]

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211 David Wellman, *A Chip in the Curtain: Computer Technology in the Soviet Union,* (Washington, DC: National Defense University, 1989), p. 64

212 David Dyker. *Catching Up and Falling Behind: Post-Communist Transformation in Historical Perspective*, (London: Imperial College Press, 2004), p.28

213 Fitzpatrick, Ch. 6

The agencies named above were not, strictly speaking, the only ones involved in the production of computer components or in research. The Ministry of the Communications Equipment Industry, the Ministry of the Electro-technical Industry, the Ministry of Electronics Industry and the Ministry of the Appliance Industry were all at some point responsible for projects related to computer research or production.[214] Lack of communication or channels for sharing of ideas between these agencies further slowed their collective progress. The Central Committee demanded that these issues be dealt with, and insisted that the nation's computing capabilities must triple within five years.[215]

Communication between scientists and technologists hindered the effective deployment of innovations within the Soviet economy, an administrative shortcoming lamented by many reformers, including men close to Khrushchev such as economist Dzherman Gvishiani, and Premier Alexei Kosygin. In Gvishiani's view, "Planned and purposeful development of a country's scientific and technological potential is governed by objective laws; it calls for the establishment of correct proportions between its structural elements and regulation of factors leading to disproportions."[216] This reveals that central to the ideology surrounding Soviet science was the idea that scientific progress could be dictated

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214 Wellman, p. 55

215 Fitzpatrick, Ch. 6

216 Dzherman Gvishiani, Dmitri Bobryshev, Bentsion Milner and Vladimir Rapoport, *Scientific and Technical Progress and Social Advance*. (Moscow: Novosti,1980), p. 143.

from above and administered in a controlled fashion like any other economic matter. Innovation, however, did not flourish amid the constant bureaucratic restructuring and scientific attempts to quantify and render governable all the needs and wants that it should serve. This idea was further reflected in the birth of a new field of social science known as "science management", or "prognostication," which essentially amounted to the study of studies, only its determinations were vital to prioritization of projects and funding for the Council of Ministers.[217]

In 1966, Leonid Brezhnev cited computers as an especially important area that was not meeting expectations before the 23rd Communist Party Congress:

> "Mention should be made of the deficiencies that hold up [Soviet science's] development. The gravest of these is the slow introduction of completed scientific research into production. There is an unjustifiable gap between theoretical research and its technological and design development. Often, years pass before a discovery is applied in production – a fact damaging to the national economy and science itself. Poor use of electronic computer techniques is one example of this."[218]

Unfortunately, regardless of what powerful personages voiced the importance of computing, without direct and carefully administered support, no progress could be made. Bureaucrats and factory directors alike were under intense pressure to make regular quotas, and were thus disincentivized from experimentation; applied

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217 Machula, p. 140

218 *Pravda*, March 31, 1966.

computing research found minimal funding from institutes or from parties who might have funded it through contract work.[219] According to Slava Gerovitch:

> "The potential computerization of economic decision-making threatened the established power hierarchy and faced stubborn opposition at all levels of Soviet bureaucracy. Through an endless process of reviews, revisions, and reorganizations, Soviet government agencies were able to slow down the cybernetic reform and eventually brought it to a halt. As the idea of an overall economic reform withered away, so did the plans for a nationwide computer network, which no longer had a definite purpose."[220]

An ambitious plan within the Cybernetics Institute to build "a single automated system of control of the national economy"[221] found few backers willing to dedicate the necessary resources to such a task. "With the lack of political and financial support, the Institute soon dropped the automated economic management information system from its research agenda and focused on the development of optimal mathematical models. Practical reform was supplanted by optimization on paper."[222] The USSR, despite all of its investments in personnel, found it extraordinarily difficult to progress past square one in terms of experimentation or hardware, making production and successful implementation of computers an increasingly distant dream.

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219 Harvey, p. 51

220 Gerovitch, *The Cybernetics Scare and the Origins of the Internet*, p.21-22

221 Ibid. p.19

222 Ibid. p.36

East-West Trade: Support and Resistance

> "Every merchant selling a Communist import, every American citizen buying a Communist import, helps by just that much to keep the Communist munitions program geared up and fully operating. This is inevitable when we pursue the profane policy which promotes trade with an enemy while we seek at the same time to defeat it...This is why the Soviet Union does not have engineers to design automobiles, petrochemical plants and all the rest of the civilian products embodied by our modern economy- they are off building weapons of war."
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> – United States Senator Karl Mundt (R-Montana), before Congress, July 13, 1967.[223]

As the main point of conflict with the USSR shifted from Berlin to Vietnam after the death of Kennedy, many voices within the government objected to trade with communist states, especially the USSR. However, it was clear that the Johnson Administration saw more good than harm in opening more avenues to trade with Eastern Europe; even as the situation in Vietnam worsened, Johnson demonstrated a commitment to 'incremental détente' by improving access to credit through the Import-Export Bank for Poland, Hungary, Bulgaria and Czechoslovakia.[224] This offer was strategic on multiple levels. In 1964, Dean Rusk felt that the ability to be flexible on trade controls increased the diplomatic options available to the US. By "treating different Communist States differently" as the situation demanded, the US could

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223 "The United States Needs an Embargo on Aid to Our Enemies", speech by Senator Karl Mundt, 114 Congressional Record, (1968), p.11,309-14.

224 John Dumbrell, *President Lyndon Johnson and Soviet Communism*. (Manchester: Manchester U. Press, 2004), p. 43.

create leverage in negotiations while possibly drawing the former Soviet satellites further out of the USSR's orbit.[225]

Soviet Premier Alexei Kosygin, who took office in 1964, hoped that establishing trade ties with the West would encourage peace and strengthen both sides. He himself was a strong proponent of technological exchange, not only because of the opportunities for civil discourse between nations, but because it would "permit saving hundreds of millions of rubles on scientific-research work."[226] Kosygin faced opposition from others within the Party hierarchy, including Brezhnev and Suslov.[227]

This attitude indicated a profound shift in global affairs, and a departure from the hardline tactics of the 1950s. It became possible to embrace the philosophy that the Iron Curtain no longer veiled all communist nations equally, and the US had little to gain by denying trade privileges to countries willing to challenge Soviet control. Khrushchev's ouster in the spring of 1964, and the subsequent plans for rapid realignment of the Soviet economy gave encouragement to many who hoped further economic autonomy would be granted to Eastern Europe.

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225 Dean Rusk, "Why We Treat Different Communist Countries Differently", U.S. Dept. of State, Publication 7999, *General Foreign Policy Series* (Washington, DC: Superintendent of Documents, U.S. Gov't. Print. Office, 1964)

226 Richard Anderson, *Public Politics in and Authoritarian State: Making Foreign Policy in the Brezhnev Years* (Ithaca: Cornell University Press, 1993), p. 127.

227 Tatu, p. 431

After Khrushchev's ouster, Brezhnev was skeptical of the kinds of reforms that had taken place under his predecessor, and the USSR witnessed a brief return to conservatism and a slackening of trade with the West.[228] Imports to the USSR from the UK, France, Germany, Italy and Japan declined from 1963-1967. However, by 1966 Kosygin and Brezhnev were both convinced that reform was needed, and that those reforms should encourage trade with the West.[229]

Several Eastern European states had historically been given preferential treatment by the West, even though their governments were still communist, and they would likely share any technological advancements with the USSR. Following the political upheavals of 1948, treatment of Yugoslavia by both the US Department and COCOM was significantly relaxed, and Yugoslavia had long history of exemption from trade control rules. After 1956, Poland was perceived to have slipped from the Soviet Union's grip, and thus was granted increasingly liberal trade privileges with the West.[230] In Czechoslovakia during the mid-1960s, economist Ota Šik successfully advocated for a system which allowed industry to respond to demand as well as dictate supplies in advance, and that allowed prices to better reflect the market. Šik's influence brought a measure of autonomy to Czechoslovakian business ventures, limited central planning, and allowed for market determination of prices.231 These

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228 Goldman, p.29

229 Goldman, p.31

230 Goldman, p. 59

231 Maier, p.86

reforms made Czechoslovakia a relatively attractive trading partner among socialist countries, and its defiance of Soviet economic control was a promising political sign.

During the 1960s, one of the most widely-embraced methods of engaging the socialist world was through scientific exchanges of researchers and technicians, and through international conferences.[232] The United States actively participated in a number of European scientific and trade fairs throughout this period, both for intellectual exchange and for purposes of intelligence-gathering. Trade fairs, especially those held regularly in Eastern Europe such as Leipzig in East Germany and Brno in Czechoslovakia, were of special importance to Soviet science, and the USSR took great care to send their most qualified experts to observe what the rest of the world had to offer.[233] These trade fairs often provided the most accessible exposure to foreign technology and to the work of colleagues abroad.

Trade shows also provided the most logical way for a Western company to enter the consciousness, and the markets, of Eastern Europe. Doing business within the USSR required working with the various Foreign Trade Organizations (FTO) under the Ministry of Foreign Trade, a byzantine and alien experience for most Western businessmen. The Ministry, through the FTOs, handled virtually all

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232 "International Scientific and Technological Activities," a report to the Federal Council for Science and Technology by its International Committee, June 20, 1961. National Archives and Records Administration, Washington, DC, RG 59, Bureau of European Affairs- Regional Planning, UN Advisor – Records Relating to Planning and UN Activities, Entry A1 5886, 1959-67, Box 2, p. 1

233 Goldman, p. 164

international transactions, and controlled the flow of limited Soviet hard currency. Locating a buyer, or seller, within the FTOs could be a tricky process, as the organizations were intended to act as a filter between Soviet manufacturers and foreign businessmen. While they could aid a Western business in navigating through the layers of Soviet bureaucracy, their control of the process gave them the power to stop commerce in its tracks, with little recourse available to foreign sellers.[234]

Among the chief challenges to conducting business with communist partners were lack of appropriate forums and provisions for settling disputes and claims. In 1960, the U.S. concluded a claims settlement agreement with Romania, and as Romania further asserted its economic independence from the USSR throughout the 1960s, its relations with the U.S. improved, leading to an overall relaxation off international restrictions on trade.[235] While Romania pursued a heavily Stalinist vision of industrial development, it continually asserted its sovereignty in the face of Soviet control.

The U.S. also granted Most Favored Nation (MFN) status to Poland in 1960 after President Kennedy declared that "it was no longer dominated or controlled by the Soviet Union."[236] However, during the subsequent collapse of détente, the Trade Expansion Act of 1962 imposed the same high tariff rates of 1930 on all countries

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234 Goldman, p. 165

235 Bilder, p.852

236 Bilder, p.853

dominated or controlled by the USSR. President Johnson fought the Trade Expansion Act, and determined that it was in the mutual interests of the U.S. and of Poland and Yugoslavia for those countries to be eligible for MFN status.[237] Johnson, as a major advocate of "bridge building" measures with the Eastern Bloc, was a strong advocate of trade liberalization both for the economic opportunities it prevented and the diplomatic options it engendered.[238] In February of 1965, Johnson created a special committee for United States Trade Relations with Eastern European Countries and the Soviet Union (The Miller Committee); the committee determined that it would be strongly in the national interest to increase East-West trade.[239]

Although political and trade relations with the Eastern Bloc may have shown warming trends throughout the early 1960s, they did not always reflected the opinions of many Americans on trading with communist states. The U.S. Congress was not alone in opposing in increase in trade with socialist countries. "In addition, private groups organized boycotts of Communist goods and of businesses engaged in East-West trade; maritime unions sporadically refused to load or unload goods destined for or coming from Eastern Europe; and a number of municipalities enacted ordinances

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237 "Presidential Memo, March 26, 1964," 29 Federal Register 4891 (1964).

238 Finder, p.62

239 Bilder, p. 546

intended to discourage local merchants from selling goods of Eastern European origin."[240]

Domestic resistance was no small part of the problem, in the eyes of National Security Council member David Klein. In 1963 he wrote regarding the strategic use of East-West trade:

> "...[T]he exercise is somewhat more complicated, for as pariahs in our market place, the Soviets have several additional problems to contend with:
>
> (1) The Soviets and their satellites are not entitled to MFN privileges (and are unlikely to get them) and therefore must face unequal competition.
>
> (2) In the sale of their goods here, the Soviets and their satellites have to contend with importer and consumer resistance, and, in some cases, boycott.
>
> (3) Moreover, the Soviets and their satellites do not have easy access to credits. The Battle and Johnson Acts cut off the most important sources, although by recent rulings on the Johnson Act, the Justice Department has in fact made it possible for the Communist states to apply for short-term commercial credits.[241]

Resistance to trade with the socialist world was carried out on a grassroots level in some communities. In 1962, the mayor of Fort Wayne, Indiana praised a local shopkeeper, along with conservative youth group Young Americans for Freedom (YAF) and the local Council of Veterans, for holding a public burning of wicker

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240 Bilder, p. 841

241 "Memorandum Concerning East-West Trade Policy," Washington, August 15, 1963. From the Export Control Review Board to President Kennedy. Kennedy Presidential Library, President's Office Files, Commerce, 1963. Secret. Published online at: http://dosfan.lib.uic.edu/ERC/frus/frus61-63ix/16_Section_16.html

baskets imported from Yugoslavia.[242] In 1965, the Firestone Tire and Rubber Company was forced to scuttle negotiations with Romania for construction of a 50 million dollar rubber factory after several groups, including the YAF, waged a public campaign against it. The final straw came when the YAF threatened to bombard the Indianapolis 500 with propaganda condemning Firestone, and fly "airplanes trailing streamers" with anti-Firestone messages above the track throughout the race.[243] The YAF would lead the charge against IBM for its sale, under approved licenses by the Department of Commerce, of computers to Eastern Europe in 1967. American unions also frequently posed their own obstacles to trade, as the International Longshoreman's Association (ILA) did from the 1950s on. The ILA was remarkably effective in nearly upending a $140 million sale of wheat to the USSR in 1964, and its members routinely refused to load or unload ships carrying goods or passengers en route to or from communist nations.[244]

In other words, the costs (and thus the disincentives) for the Soviets would be steep, markets for reciprocal trade would be hostile, and credit would be hard to come by. All of these factors would limit the effectiveness of trade as a diplomatic and

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242 Bilder, p. 863

243 Bilder, p. 869

244 Bilder, p. 878

strategic tool. And yet the demand from the USSR for American and Western European-made goods only seemed to increase as the 1960s wore on.[245]

With the ever-greater demand for Western goods on the part of socialist Eastern Europe came internal pressure within the US to liberalize trade. In 1965, a group calling itself the Committee for Economic Progress, composed of 200 leaders in business and education, issued a manifesto titled *East-West Trade; A Common Policy for the West*.[246] This indicated that grassroots *support* for East-West trade was taking root on some level in the United States, at least among some of the nation's elites. On July 31, 1964, David Rockefeller visited the Kremlin office of Nikita Khrushchev, and spent two hours in intense personal discussion with the Soviet leader. Khrushchev had already met with the heads of Westinghouse and Dupont earlier that year.[247] Among Khrushchev's comments Rockefeller reported, was that the General Secretary thought "it would be very useful if our two countries were to establish broader ties, especially in the field of trade."[248] Where diplomats and elected officials dared not tread, the captains of industry were blazing unprecedented ground in the USSR.

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245 Goldman, p.35

246 James Baker. "United States Business Opportunities in Eastern Europe," in *China, the USSR, and Eastern Europe: A US Trade Perspectiv*e. Kent State University Press, 1974, p.100.

247 Finder, p.183

248 Finder, p.184

The Challenge of NATO

> "...Finally, we must develop with our allies new means of bridging the gap between the East and the West, facing danger boldly wherever danger exists, but being equally bold in our search for new agreements which can enlarge the hopes of all, while violating the interests of none."
>
> --Lyndon Johnson, First State of the Union Address, delivered before Congress January 8, 1964[249]

> "Politicians are the same all over; they promise to build a bridge even where there is no river."
>
> --Nikita Khrushchev[250]

In 1964, reacting to what the U.S. perceived as an increasingly comfortable attitude with socialist Eastern Europe on the part of Western Europe, Secretary of State Dean Rusk warned the NATO allies that no true détente had been reached with USSR, and that every precaution must be taken to contain the spread of communism. In response, retiring NATO chairman Dirk Stikker had warned that NATO had reached a "challenging" phase; French opposition to the organization's military structure was placing pressure on the alliance, and within five years NATO's members would be able to withdraw freely. It is unlikely that Rusk's simultaneous appeals to

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249 American Rhetoric Online Speech Bank, http://www.americanrhetoric.com/speeches/lbj1964stateoftheunion.htm

250 Taubman, p. 643

Western Europe for military and financial assistance for Vietnam while insisting that no concessions be made regarding East-West trade helped the situation.[251]

In 1965, the Joint Committee on Atomic Energy of the Departments of State and Commerce set forth new regulations for export control.[252] Part of the motivation for this was a push against nuclear proliferation after Chinese acquisition of the atomic bomb in 1964. Along with a renewed effort towards a non-proliferation treaty, export controls for items that could be used in the development, testing and guidance of nuclear arms came under more robust scrutiny.[253] Among these were the granting of additional powers of review to the U.S. Departments of State and Commerce, and demands that a wider range of cases be called in for review. The staff director of the Joint Committee at the State Department, John Conway, "hoped that the review mechanism in Commerce and State would not become merely a rubber-stamping operation and that technical advice would be sought as might be needed." Indeed, many of cases would be referred to other agencies and commissions for approval. During 1965, the Atomic

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251 Drew Middleton, "Rusk Warns NATO Against Assuming A Détente Exists," *The New York Times*, May 13, 1964, sec. A1.

252 "Confidential Memorandum for the Record, RE: Export Control," from S. George, Undersecretary of State, May 12, 1965. National Archives and Records Administration, Washington, DC., RG 59, Entry 5181, Box 15, Folder "Export Control-Commerce Cases".

253 Dimitris Bourantonis. "The Negotiation of the Non-Proliferation Treaty, 1965-1968: A Note," *The International History Review*, Vol. 19, No. 2 (May, 1997), pp. 349-357, p. 349

Energy Commission saw the number of COCOM licensing cases referred to it jump from about 400 per year to nearly 2200.[254]

Among the tighter measures proposed was one to extend the Export Control Act of 1949 indefinitely, a move that Assistant Secretary of State Douglas MacArthur II wrote would "imply that the Cold War situation is so much worse than it has been in the past that longer-term export control authority is now necessary. Such an implication would seem particularly inappropriate at this stage of overall relations with the U.S.S.R. and the countries of Eastern Europe."[255] That such a move was proposed indicates an element of public opposition to the increasing trade with the USSR and the gravity with which non-proliferation was pursued. Ultimately, an open-ended provision for strict export controls was voted down in favor of a four-year extension. However, pressure to revise export control procedures was already building within COCOM.

By 1966, American allies began to rebel against what they saw as excessively restrictive and preferential policies carried out through COCOM for the benefit of the United States. A confidential memo drafted by Policy Planning Committee member Robert B. Wright dated May 2, 1966 theorizes possible withdrawal of France from

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254 "Confidential Memorandum for the Record, RE: Export Control"

255 "Letter RE: Export Controls," from Douglas MacArthur II, Assistant Secretary of State for Congressional Relations, to Senator A. Willis Robertson, Chairman, Committee on Banking and Currency, United States Senate. Mar. 18, 1965. National Archives and Records Administration, Washington, DC., RG 59, Entry 5181, Box 15, Folder "Export Control-Commerce Cases".

COCOM over export restrictions.[256] By mid-1967 both France and the UK had advanced cases before COCOM for the sale of computer CPUs and tape handlers to Czechoslovakia. A similar request was pending from Belgium for tape handlers to be sold to Poland. The Japanese were also making deals with the Bulgarians for the manufacture Japanese-designed oscilloscopes which, like computers, were heavily restricted due to their potential use in radar installations. This time, COCOM members presented the US with a challenge; review the export list and licensing procedures, or take the risk that they would opt out of the export control structure entirely.[257]

State Department correspondence from that period indicates the internal struggle being waged within COCOM over restrictions barring the sale of licenses and production lines:

> "The UK has informed us of their disappointment and concern about the U.S. Objection to their central processor case; they are not pressing their tape handler case "for the time being". The French Delegate has indicated the strong possibility his government would ignore any objection and proceed with the export. Belgium has not been heard from. Japan continues to press for approval of the oscilloscopes."[258]

The push for these licenses, the memorandum reveals, did not come solely from government sources, but from international firms. The manufacturers involved

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256 "Memorandum RE: French Threat of Withdrawal from COMCOM"

257 "Action Memorandum, RE: Computer Manufacturing Licenses in Eastern Europe," to Anthony Solomon, EDAC Chairman, July 17, 1967. National Archives and Records Administration, Washington, DC, RG 59, E5605, Box 16, Folder, STR13-1 COCOM 1966-69, p. 1

258 Ibid., p.1

included General Electric, its European subsidiary Bull Electronics, and International Telephone and Telegraph (the ITT Corporation, which early on had expanded into computer processors and peripherals).[259] The difference between this sale and those of the past was that these licenses were not only for the machines, but for the means of production. The US and its allies had sent more advanced computers to Eastern Europe in the past, but the technology for producing them had never been part of the transaction.[260] Thus this license request drew significantly greater scrutiny than many that had gone before, and made the flaws of the COCOM system more apparent than ever.

Among the complaints from the British was the perception that the U.S. had manipulated COCOM rules to its own benefit. In 1966, the United Stated had moved to remove advanced computers from the Administrative Exceptions Note qualification of the embargo rules, limiting its own and its allies' ability to sell advanced technology at their own discretion. The British charge was that this allowed U.S. industrial giant IBM to flood the Eastern European market with obsolete, low-performing models while restricting U.S. allies from the same markets.[261] The French argued that the computers produced with the technology they wished to license had passed COCOM

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259 Ibid., p.3

260 "Action Memorandum RE: Export of Computer Technology to Czechoslovakia," from Abraham Katz, OECD, to Walter J. Stoessel, Foreign Service Officer, July 20, 1967. National Archives and Records Administration, Washington, DC, RG 59, E5605, Box 16, Folder, STR13-1 COCOM 1966-69, p.1

261 "Action Memorandum RE: Computer Manufacturing Licenses in Eastern Europe," p.3

review and were freely exported under the Administrative Exceptions Note, thus the technology used to produce them should be included as well.[262]

At the same time, there began to be real concern that rejection of the French license request would cause France to pull out of the COCOM arrangement entirely, and that the U.S. would need to be more flexible if the export control system was to be maintained. Even if COCOM did not collapse, the French were also likely to make a sale without COCOM approval, and a delay or denial on the part of the United States would only further antagonize the British, who would not only have their own request denied, but potentially a lucrative sale to the Czechs if France moved to sell first.[263] In order to press the U.S. for action, the French and Czechs were ready to move on a sale with or without COCOM by the late summer of 1967.[264]

Anthony Solomon replied with a series of recommendations that included a number of conditions for the sale. The UK-designed computer license would not include semi-conductor technology, the manufacturing technology would not be exported, and the computers produced would only be sold in Eastern Europe and the USSR. Also, the COCOM International List would not be revised; future

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262 "Action Memorandum RE: Export of Computer Technology to Czechoslovakia," p.2

263 Ibid. p.6

264 Ibid. p.7

licenses would not be subject to an Administrative Exception Note and would still need to be reviewed on a case-by-case basis.[265]

Abraham Katz, Director of the OECD in Paris, wrote in regard to the matter that “the computers in question do not represent any technology not already available to Eastern Europe,” and “would not significantly enhance the ability of Eastern Europeans to produce more sophisticated “third generation” computers.”[266] He supported Solomon's suggestions, and noted that “COCOM is more likely to continue as a useful organization if we grant a no-objection than if we object.”[267]

Abraham Katz of the State Department's Office of European Regional Political and Economic Affairs describes the nature of international export controls; "COCOM is a brittle organization, held together by the slimmest bonds. If participating countries come to feel their interests are too seriously compromised, COCOM will disintegrate. Accumulating resentments threatened just that until the current List Review provided a safety valve." [268]

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265 Ibid. p.8

266 “Action Memorandum RE: Export of Computer Technology to Czechoslovakia,” p.2

267 Ibid. p. 3

268 Abraham Katz, “Memorandum: Your Call on Assistant Secretary of Defense Warren Nutter,” July 17, 1969, RG 59, Entry 5605, Box 16.

In May 1966, the Johnson Administration submitted the East-West Trade Relations Act to Congress. The act would have ranting the President authority to negotiate trade agreements and permitting the socialist Eastern Bloc nations to obtain MFN status. However, with the situation in Vietnam rapidly escalating, voices less amenable to the idea of trading with communists won out, and the act died in Congress in 1967. Legislation to curb the expansion of trade with Eastern Europe found more support, such as legislation cutting off credit through the Import-Export Bank to communist states until the cessation of hostilities in Vietnam.[269]

In October of the same year, the COCOM Commodity Control list was revised to permit nearly 400 items to be shipped to Eastern Europe under "general license" as opposed to the more restrictive "validated license".[270] This relaxation was deemed by many within the U.S. government to have been a sufficient concession. However, as has been demonstrated, this slight revision would in no way satisfy American allies; the United States Departments of State and Commerce were forced to relent, rather than risk the collapse of the entire COCOM operation.[271] The sale of the British and French computers to the Czechoslovakians

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269 Bilder, p.857

270 Bilder, p.855

271 "Letter RE: Transfer of British Computer Technology to Romania Following a French-Romanian Transaction Earlier in the Year," from Abraham Katz, to Mr. Leddy, December 19, 1968, with attached letter from Anthony M. Solomon, Chairman of the Economic Defense Advisory Committee. National Archives and Records Administration, Washington, DC, RG 59, Bureau of European Affairs- OECD European Community and Atlantic Political-Economic Affairs, Records

did in fact go through, and more thorough reform of the export control lists would take place in short order. In January of 1967, Soviet policymakers in the area of technological research and development had proposed copying the "logical structure and command system" of the IBM 360 series. [272] By the end of the year, the USSR would make reliance on foreign computing technology an official part of its domestic science policy.

Relating to Economic Matters, 1953-1979. Box 20, Folder: "NATO, ECONAD, East-West Trade, Romania, 1965-69".

272 Alexander Nitussov and B.N. Malinovskiy, "Economic Changes in the Sixties and Internationalisation of the Soviet Computing," in *Computing in Russia: The History of Computer Devices and Information Technology Revealed*, ed. Trogemann, Georg and Ernst, Wolfgang (Wiesbaden: Friedrich Vieweg & Sohn Verlagsgesellschaft mbH, Braunschweig, 2001), 163-167. p.165

Chapter 3

The Late 1960s and the Make-or-Take Decision of 1967

Economic Pressure for Automation in the USSR

> "The real meaning of computing was well recognized in the USSR, and appropriate efforts were produced in the fields of research and development. However, the specific social features were not always properly considered."
>
> -- Akademician Igor Apokin, Institute of Natural Sciences and Engineering of the USSR[273]

> "Eventually, in the 1970s, [the USSR] gave up the attempt to develop an independent series of manufactured computers and shifted over to IBM architecture and standards. After that it fell further and further behind."
>
> --Loren Graham, *What Have We Learned About Science and Technology from the Soviet Experience*?[274]

The economic and political crises of the early and mid-1960s, and the shifting intellectual paradigms within the socialist world had resulted in a pronounced technological lag in Eastern Europe. By the mid-1960s, the Soviets recognized that they had been technologically overtaken. Even before Khrushchev's unsuccessful efforts at reform, the Soviet economy was groaning under the weight of its own

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273 Apokin, Iurii. "The Development of Electronic Computers in the USSR," in *Computing in Russia*, ed. Georg Trogemann. (Weisbaden: Vieweg, 2001), p.79

274 Loren Graham, *Science and Philosophy in the Soviet Union.* (New York: Borzhoi Books, 1966), p. 39

unwieldiness, and constant disruption and diversion of resources during subsequent years had only served to erode scientific community and the advancements it might have produced.

Plans for modernization and reorganization often included an expansion of automation, and the use of computers to streamline decision-making and more accurately assess resources, schedules, and demand.[275] Lack of computational or automated equipment meant that millions of economic decisions fell to an army of bureaucrats who were frequently disconnected from one another. As late as 1961, some Soviet economists still doubted that computer-based solutions such as cybernetics should be used in economic planning.[276]

According to Soviet economist V.D. Belkin, cybernetics and automation were especially important and well-suited to socialism, because centrally-planned economies could employ such technologies more directly to production and stood to benefit more greatly, as opposed to the West, which employed them with an "absence of purposefulness."[277] Without such innovations, the Soviet bureaucracy was becoming so notoriously out of hand that in 1967 Senator Karl Mundt referenced a 1962 quotation from P.N. Glushkov, Director of the Ukranian Institute of Cybernetics, before Congress in defense of strengthening export

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275 Graham, *Science and Philosophy in the Soviet Union,* p.331

276 Ibid., p.332

277 Ibid., p.331

controls: "If present day methods do not change, by 1980 the entire adult population will be employed in administration."[278] Keeping computing technology out of Soviet hands would weaken communism and neutralize whatever threat the USSR might pose militarily, technologically, or economically.

"Science is a Unity"

> "Science and its applications in technology are exerting a revolutionary influence on the destinies of nations and mankind. Our domestic and foreign policies must be attuned to this revolution and to its implications of change in the pattern of world relationships... Science is a unity. Science is the inquiry into nature. Its limits are the universe and the capability of the human mind. It possesses unity, universality, and independence which make it truly supranational in character[279]
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> --"International Scientific and Technological Activities", a report to the Federal Council for Science and Technology by its International Committee, June 20, 1961.

Due in part to the rising Soviet interest in cybernetics and computing, American computing innovators were able to build upon their research and

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278 "The United States Needs an Embargo on Aid to Our Enemies", speech by Senator Karl Mundt, 114 Congressional Record, (1968), p.11,309-14, p.S9534

279 "International Scientific and Technological Activities," a report to the Federal Council for Science and Technology by its International Committee, June 20, 1961. National Archives and Records Administration, Washington, DC, RG 59, Bureau of European Affairs- Regional Planning, UN Advisor – Records Relating to Planning and UN Activities, Entry A1 5886, 1959-67, Box 2, p. 1

innovations in an unrestrained (and often well-funded) manner.[280] The U.S. government saw a potential national security concern in the Soviet mania for cybernetics, and freed the resources and investments necessary to examine and assess the threat. It also saw its prestige and scientific advantage was at stake, and did not wish to be caught off guard by the Soviet Union as it had at the end of the 1950s. The arms race and the space race were truly both part of one great technology race, one the U.S. did not intend to lose.[281]

The advanced computing community within the U.S. was still a relatively small and well-connected community, and it was to this community that the CIA turned for their opinions on Soviet computing, specifically cybernetics. Future Nobel laureate in economics Herbert Simon, a leading artificial intelligence expert, was one member of the panel convened to assess the threat.[282] Simon later recalled how "the CIA had submitted a thick report to President Kennedy about an alleged 'great Soviet plot to conquer the world with cybernetics.'":

> "Alas, our panel was too honest. If we had reported back...that the Soviet cybernetics project was genuinely dangerous, American research in artificial intelligence would have had all the funding it could possibly use for years to come. Putting temptation

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280 Slava Gerovitch. "*The Cybernetics Scare and the Origins of the Internet," Baltic Worlds*, Vol. II, 1 (2009). p.39.

281 Martin Malia, *The Soviet Tragedy: A History of Socialism in Russia*. (New York: Simon and Schuster, 1995), p.375

282 Gerovitch, *The Cybernetics Scare and the Origins of the Internet*, p.38

behind us, we reported that the CIA document was a fairy story — as events proved it to be."[283]

The refreshing honesty of this is remarkable, and speaks to the nature of the computing community within the United States and its relationship with the federal government. Gerovitch also notes that unlike the Soviet Union, where military computing was a highly guarded and secretive field, "the US government facilitated the transfer of new technologies from the military sector into civilian economy by making them freely available and by providing incentives for further development."[284]

Knowing the conditions under which Soviet military scientists worked, this level of trust between science and state was not something to be taken for granted. Freedom of and enthusiasm for communication among American computing experts also helped foster new developments. Upon hearing of the Soviet vogue for cybernetics, the founder of one of the earliest linked networks, MIT psychologist and later Kennedy advisor J.C.R. Licklider, sent a memo to members of his informal social network in 1963, urging them to standardize their systems so that data could be communicated from one system to another. "Consider the situation in which several different centers are netted together", he wrote, arguing that it was

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283 Gerovitch, *The Cybernetics Scare and the Origins of the Internet*, p.37

284 Slava Gerovitch. "InterNyet: Why the Soviet Union Did Not Build a Nationwide Computer Network," *History and Technology*, Vol. 24, No. 4 (December 2008), 335–350, p.346

important "to develop a capability for integrated network operation".[285] In the U.S., the importance of compatibility had been realized and a network implemented through casual communication by the early 1960s. In the USSR, achieving something similar would require many years and the investment of multiple sectors of the economy, and yet yield few practical advances.

Licklider recounted to Slava Gerovitch that Norbert Wiener, the father of cybernetics (and coiner of the term), "ran a weekly circle of 40 or 50 people who got together. They would gather together and talk for a couple of hours," at MIT, presumably about cybernetics and related computing work.[286] There were few barriers between the ideas shared casually at MIT and those born at Harvard, the Institute for Advanced Studies at Princeton, federal agencies such as NASA and DARPA, and numerous corporate labs across the United States. These scientists came from a variety of fields, brought a range of perspectives to a single problem, and had the physical resources to test their theories, and the professional and financial motivation to put to them to best use. Feedback from experimental studies, applied automation in industry and business figures regarding the performance of computer models was readily available and subject to analysis.[287] Besides the fact that technical documentation was scarce and carefully guarded,

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285 Gerovitch, *The Cybernetics Scare and the Origins of the Internet*, p.37

286 Gerovitch, *The Cybernetics Scare and the Origins of the Internet*, p.41

287 Nathan Ensmenger, *The Computer Boys Take Over*, (Cambridge: MIT Press, 2010), p.35

accurate statistics of any kind were almost impossible to come by in the USSR.[288] It is difficult to imagine such fruitful conversations having taken place among scientists in a single room anywhere in the Soviet Union, much less among groups of researchers spread across vast distances, various fields and sectors of the economy.

Early on, the U.S. perceived that stymieing computing research in the USSR would greatly weaken its adversary's ability to compete on the world stage, and that it was also necessary to support similar computing efforts within the United States.[289] In 1961, a reviewer of the Soviet volume *Cybernetics in the Service of Communism* posited that cybernetics "may be one of the weapons Khrushchev had in mind when he threatened to "bury" the West."[290] This was a call to action within the U.S., and attracted not only the interest of America's best minds, but ample funding in the interest of national security. As Gerovitch observes, "The priorities of the US government...were dictated by the Cold War, and it funded, through the Department of Defense and other agencies, a wide range of computer

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288 Mose L. Harvey, Leon Goure, and Vladimir Prokofieff, *Science and Technology as an Instrument of Soviet Policy*, (Coral Gables, FL: University of Miami Center for Advanced International Studies, 1972), p.54

289 Gerovitch, *The Cybernetics Scare and the Origins of the Internet*, p.33

290 Gerovitch, "InterNyet: Why the Soviet Union Did Not Build a Nationwide Computer Network," p.335

initiatives, including the first packet-switching network, the ARPANET."[291] "This story is profoundly ironic: America rejected cybernetics but implemented the cybernetic vision, while the Soviet Union did just the opposite: it paid lip service to cybernetics and stalled practical cybernetic projects."[292]

Aside from the military and technological vulnerability lack of adequate computing resources created, economically it resulted in constant shortages, backups and hoarding. The grey market that emerged to fill gaps in the official economy had by the late 1960s become entrenched, and its patterns increasingly difficult to break. It was hoped that computers would eliminate loopholes and graft, and allow central planning to account for misdirected and inadequate resources.[293] At this critical moment, a new generation of young economists heavily influenced by Western models began to exercise influence over Kremlin policymakers. While not reformers in a strict sense, in their view growth was created by encouraging efficient management and scientific innovation, and in order to achieve the planned reforms, and develop the consumer goods and agricultural sectors, resource planning and market research would need to be

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291 Gerovitch, "InterNyet: Why the Soviet Union Did Not Build a Nationwide Computer Network," p.346

292 Gerovitch, *The Cybernetics Scare and the Origins of the Internet,* p.36

293 Robert English, *Russia and the Idea of the West.* (New York: Columbia University Press, 2000), p. 96

expanded.[294] The resurgence of cybernetics, once a science in disgrace, was owed in part to the conclusions of younger economists on the model of Western-Influenced Dzherman Gvishiani.[295] Their economic ideologies often departed from traditional Marxist-Leninist ideology and ethics, instead embracing utilitarian efficiency; Nikolai Shmelev, a reformist economist himself, described the worldview of state economists in late 1960's as "anything that is economically efficient is moral".[296] By the late 1960s, no newly uncovered opinion of Lenin was required to sanction the idea that socialist construction and ethics could come second to economic concerns.

Even after the initial vogue for cybernetics began to fade, the call for advancements in computing came louder than ever from economic planners.[297] And yet the academic and industrial communities were apparently not prepared to embrace and support such efforts. The head of the Academy of Sciences, Mstislav Keldysh, noted in 1967 "It seems to me that the psychological change connected with the application of computer technology is taking place among us very slowly.

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294 Ibid.p.142

295 Gerovitch, *From Newspeak to Cyberspeak*, p.220

296 English, p.142

297 Gerovitch, "InterNyet: Why the Soviet Union Did Not Build a Nationwide Computer Network," p.350.

Therefore, its propaganda [popularization] has great significance."[298] Propaganda, however, could only take computing so far; cybernetics had become an impressive buzzword, to the point where even Gvishiani himself complained of having to include it in the title of his book in order to attract interest, but little physical support materialized for domestic computing research efforts.[299]

As the 1960s wore on, it was becoming clear that it would be nearly impossible for the USSR to match the astounding success of computing technology as it was developing in the West. The proliferation of smaller, more flexible systems affected every segment of the American economy by the mid-1960s, and the near-universal adoption of automation by American business seemed imminent.[300] The automated and fully accountable economy that Lenin had envisioned was far closer to reality in the United States than in the Soviet Union by 1967. These were market-driven changes in the West; for the USSR to achieve the same result through central planning would be the ultimate test of socialism.

In 1965, the State Committee for the Coordination for Scientific Research established in 1961 was rechristened the State Committee on Science and Technology. The primary difference was that the SCST more discretely separated its administrative

298 M. Keldysh, quoted in *Vestnik Akademii Nauk SSSR*, No. 5, May 1967, cited in Harvey, p.20-21.

299 Gerovitch, "InterNyet: Why the Soviet Union Did Not Build a Nationwide Computer Network," p.341

300 Gerovitch, *From Newspeak to Cyberspeak*, p.45

oversight of basic research from that of technological applied research, but the SCST still demonstrated the state's commitment to planning the progress of both from the top down.[301] At the helm were the influential V.A. Kirillin (later a deputy chairman of the Council of Ministers), and economist Dzherman Gvishiani, both of whom favored increased trade with the West.[302] These economic opinions were bolstered by the support of men like Soviet Premier Alexei Kosygin, who to a certain extent carried Khrushchev's legacy of reform into the Brezhnev era. In 1966, Kosygin addressed the Twenty-Third Party Congress with the following:

> "Heretofore, we have underestimated the importance of trade in patents and licenses. At the same time, throughout the world such trade is playing an increasingly noticeable role and is developing more rapidly than the trade in manufactured goods. Our scientific and technical personnel are capable of creating-- this has been proven in practice-- advanced machinery and equipment. Therefore, we can and should hold a worthy place on the world license market. In turn, in a number of cases it is more profitable for us to purchase a license than to work on the resolution of a given problem. During the new five-year plan, the purchase of patent rights abroad will make it possible to save hundreds of millions of rubles on scientific research."[303]

Another feature of the SCST was its access to a reserve fund and special supplies for distribution to projects of special importance. "The SCST approves research plans, allocates money, and checks on the results of engineering research

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301 Casey Stroud Machula, "Centralized Planning of Science, Technology, and Society in the Soviet Union and its Impact on Educational Policy, 1966-1984," (PhD diss., U. Illinois Urbana-Champlain, 1991, p.136

302 George Holliday, *Technology Transfer to the USSR, 1928-1937and 1966-1975: The Role of Western Technology in Soviet Economic Development*. (Boulder: Westview Press,1979), p.78

303 "Materialy XIII S'ezda KPSS, Moscow," 1966, p.171, quoted in Holliday, p.79

conducted by the USSR Academy of Sciences, the local academies of science in the Soviet republics, and research institutes in industry, medicine, and agriculture. Before the creation of the SCST, the *glavki* were required by the council of ministers to reduce production costs in its enterprises by a certain percentage, which was often translated by the minister's technical staff into orders to introduce small-scale innovation capable of greater efficiency. But the SCST was empowered to aid in the replacement of old production processes with entirely new technologies, concentrating on radical, large-scale innovation."[304] This approach would rival acquisition of foreign licenses in its impact on the future direction of civilian computing research in the USSR.

"The All-Union Institute of Scientific and Technical Information," the "Institute of Problems of Control," and the "All-Union Information Center" focus their efforts on "the flow of information from basic to applied science."[305] However, the bureaucratic hurdles these agencies erected, and the cost-saving policies they recommended (such as long amortization schedules for state-produced machinery) were reflected in their material impact, which was that "...new equipment was frequently described as inefficient or even less economical

304 Machula, p.139

305 Machula, p.140

than the machinery it replaced."[306] Even as increasing resources were thrown behind domestic efforts in the development of computers, the administration and control seemed to self-sabotage at every step.

East-West trade had been steadily increasing for nearly a decade at this point. In 1967, combined trade between Bulgaria, Czechoslovakia, East Germany, Hungary, Poland and Rumania amounted to 177 million dollars in imports and 195 million dollars in exports from the US.[307] This is not to mention the healthy business being done between other non-communist states and Eastern Europe. Total East-West trade for 1967, between Eastern Europe and non-communist nations (including Japan), was over 15 billion US dollars. Even though East-West trade accounted for only 0.7% of total US trade in that year, the balance of trade was tilted firmly in the West's favor, and as Eastern Europe's economies stagnated, they became even more dependent on the West for innovations in technology and consumer goods.[308]

Resistance to trade with Eastern Europe within the US legislature continued throughout this period, concurrent with the escalation of the situation in Vietnam.

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306 Machula, p.133.

307 Richard Bilder, "East-West Trade Boycotts: A Study in Private, Labor Union, State, and Local Interference with Foreign Policy," *University of Pennsylvania Law Review*, Vol. 118, No. 6 (May, 1970), pp. 841-938, p.844

308 Bilder. p.850

Numerous unions, citizens' groups, and local governments participated in boycotts and picketing throughout the 1950s and 1960s.[309] Several localities passed "Communist Goods Ordinances", forcing merchants to purchase municipal licenses in order to sell products produced in socialist countries, and at times post signs on their premises loudly advertising that the owners did business with communists. These ordinances were typically enforced with fines or even threat of imprisonment. However, challenges to the "Communist Goods Ordinances" typically led to the law being overturned as unconstitutional.[310] Still, the passing of such ordinances revealed significant opposition to trade between socialist governments and American businesses when the goods in question were Czech glassware and Yugoslav coat hangers. When potentially strategic items such as computers were slated for export, concern over such an exchange came from a much broader cross-section of American society.[311] Nonetheless, trade with Eastern Europe was too profitable a business and too useful a diplomatic tool to go unexploited, especially Soviet control over its former satellites seemed to be slipping, and global tensions shifting towards Asia.

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309 Bilder. p.852

310 Bilder, p.878

311 Bilder. p.868

Given encouraging signs from the Johnson Administration throughout the mid-1960s, the Soviet Union had every reason to believe it will have steadily increasing access to Western technology. In 1966, to accompany Soviet economic reforms, it is determined that a series of compatible, scalable computers should be developed.[312] While there had been ongoing debate about the best methods for developing a series of compatible systems, the suggestion of working from successful Western models had gained support as signs of trade liberalization increased. Some computing specialists within the USSR were not opposed to a collaborative approach; Mikhail Sulim of the Ministry of Radio-Engineering Industry and Communications had been engaged in negotiations with West German computing firm Siemens and British firm ICL in 1966.[313] However, the Council of Ministers, impressed with the successes of the IBM 360, chose this as their desired model, even though IBM was not a willing collaborator.[314] However, IBM's push to sell computers in Eastern Europe, despite protests within the U.S., may have been viewed as a positive sign.

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312 Kazimierz Poznanski, "Technology, Competition, and the Soviet Bloc in the World Market", *Research Series 70*, (Berkeley, CA: Berkeley Institute of International Studies, UC, 1987), p.85.

313 Alexander Nitussov, and B.N. Malinovskiy, "Economic Changes in the Sixties and Internationalisation of the Soviet Computing", in *Computing in Russia: The History of Computer Devices and Information Technology Revealed*, ed. Georg Trogemann, and Wolfgang Ernst (Wiesbaden: Friedrich Vieweg & Sohn Verlagsgesellschaft mbH, 2001), 163-167, p.166

314 Ibid. p.163

By 1967, IBM had sold versions of its 1400 Series to Bulgaria, Poland, Czechoslovakia and Hungary, and was planning a controversial sale of one of its 360 Series to East Germany the following year.[315] Word of the sale and pressure from citizens' groups within the U.S. led to introduction of a Congressional resolution that the United States government should cease purchasing computers from companies making computer sales to communist nations. External pressure on the part of the same citizens groups and elected officials had derailed an arrangement between the American Motor Company and the Soviet Union in 1967, but IBM refused to yield, eventually winning out on the sale.[316] The growing determination of Western firms to sell such technologies in Eastern Europe could only be viewed as a positive sign by the USSR.

The steadily increasing access to Western technology enjoyed by the USSR's Eastern European allies, and the promise that such access would continue to improve, likely made the comparatively expensive and often fruitless process of developing domestic computer models economically unappealing. Why should the USSR invest so heavily in projects that produced computers that would only be immediately superseded if an Eastern Bloc nation were able to purchase a Western model? Regardless of the promise of domestic computing research, if the USSR

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315 "The United States Needs an Embargo on Aid to Our Enemies", speech by Senator Karl Mundt, 114 Congressional Record, (1968), p.11,309-14, p.11,309.

316 Bilder, p.862

and its COMECON associates were to undertake the rapid conversion of the economy envisioned by its central planners, time was of the essence. All avenues needed to be considered, even those which, some argued, would prove disastrous.[317]

Acquisition of IBM machines and production lines would be achieved by cooperation with the USSR's COMECON allies:

> "The idea behind the joint program was not just to pool all the national resources in the region, but also to get different countries to buy different pieces of computer technology from the West. The Soviet Union was interested in this cooperation only partly in order to save on the costs of Western imports. More importantly, it expected the East Europeans to obtain those technologies which Soviet industry, the prime target of Western restrictions, could not purchase on its own."[318]

However, the resources dedicated to purchasing these foreign models did not necessarily include the efforts required to redevelop and integrate them, or train sufficient personnel in their use. In retrospect, given the practical conceptions of computers in the USSR, and the dominant linear notions of economic development, it is not surprising that these vital aspects of applied innovation were not adequately accounted for. Economist David Dyker describes the failure of the system as follows;

> "Whereas the Fordist technologies transferred, with substantial success, during the earlier period of socialist

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317 Nitussov, p.164

318 Poznanski, p.83

> development were generally amenable to 'arms-length' technology transfer procedures (purchases of licenses and manuals, reverse engineering, etc.) transfer of the post-Fordist technologies of the 1970s and 1980s demanded a completely different approach. In a situation where 'tacit' knowledge, not readily transferable except within very tightly-knit groups, took on an ever greater importance and where 'hands-on' contact took on and an increasingly important role at the more practical end of the technology transfer process, the learning patterns of the past became increasingly obsolete."[319]

The Soviet computing industry had suffered not only because of cutbacks in support for science as a whole, but because of the nature of the Soviet economy, and now vast sums were to be spent, directly or indirectly, for foreign innovations which again, given the nature of the system, had little chance of fulfilling policymakers' goals.

Make-or-Take

> "The final government decision was made in favor of the second variant and it still remains the most disputable moment in Soviet computer history."
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> --B.N. Malinovsky, Akademician of the Ukrainian National Academy of Sciences and designer of the "DNEPR" computer.[320]

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319 David Dyker. *Catching Up and Falling Behind: Post-Communist Transformation in Historical Perspective*, (London: Imperial College Press, 2004), p.22

320 Fitzpatrick, Anne. *Pioneers of Soviet Computing*. (e-book) http://sovietcomputing.com, Ch.6

On December 30, 1967 the Communist Party of the Soviet Union and the Council of Ministers passed Resolution No. 1180/420, an order intended to create a string of computer collectives to produce machines that would be seamlessly integrated across all areas of the economy and building up a profitable technology industry.[321] This would be accomplished by complete dedication of Soviet scientific resources, but the resolution also made allowances for the importation of Western technology and expertise. It acknowledged that its goals could not be reached without legal contracts for purchase of equipment manufactured abroad, and diverted focus from domestic research.[322] This would become known as the "make-or-take" decision, and it was not reached without controversy. The USSR had essentially tied the fate of one of its most important industries to the global capitalism it purportedly sought to destroy.

The decision to adopt foreign models instead of investing heavily in domestic R&D was made on the basis of practicality and cost-effectiveness, at the expense of the socialist ideal. This approach toward efficiency represented a break with the past. In this sense, the economic planners found themselves in direct conflict with many scientists, not only for their perceived drift from orthodox Marxism-Leninism, but also for the lack of confidence it demonstrated in

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321 Fitzpatrick, Ch.6

322 Fitzpatrick, Ch.9

indigenous scientific talent.[323] For some, the make-or-take decision would prove to be the final insult after numerous slights on the part of the Council of Ministers; the field of computing shortly lost a number of its most dedicated and productive members.[324]

Besides the cost and inefficiency of purchasing foreign licenses, obtaining validation from COCOM for said licenses often required submitting to certain conditions set forth by the manufacturer or their government. The first set of standard safeguards for a foreign computer was developed in response to the sale of a large British-made computer to the USSR in 1949.[325] These might include certain limits on the capacity of the model to be shipped, restrictions on the location and method of its use, a requirement that the Soviet plant or agency provide regular reports on the use of processor time, and in some cases provisions for actual personnel trained by the manufacturer to work on site. Such personnel might offer training and to assure proper operation of the machine, but would also track spare parts requested and provide constant surveillance of usage and records

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323 Nitussov, p.164

324 Nitussov, p.160

325 Seymour Goodman, "Soviet Computing and Technology Transfer: An Overview," *World Politics*, Vol. 31, No. 4. (Jul., 1979), pp. 539-570, p. 546

for an indefinite period.[326] By requesting foreign computers, the USSR had invited foreign supervision of the most direct kind.

With Brezhnev's power fully established, the year 1967 saw a renewed conservatism emanating from Moscow, and with it the renewed repression of dissidence in the scientific community.[327] This reactionary process had begun with Khrushchev's fall, when Party organizations within scientific institutes began holding lectures to counter "the influence of bourgeois ideology".[328] By 1967, the increasing boldness of dissident scientists like Andrei Sakharov had reached its limits, resulting in a wave of much more forcible censorship.[329] In what had previously been a surprisingly liberal atmosphere where academies had relative freedom in their selection of seminar speakers (even controversial samizdat writers), "the Sovetsky raikom took over the management of the seminars in Akademgorodok, setting the topics for discussion and giving recommendations on

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326 "The United States Needs an Embargo on Aid to Our Enemies", speech by Senator Karl Mundt, 114 Congressional Record, (1968), p.11,309-14, p. 19

327 Machula, p.140

328 Machula, p.143

329 Machula, p.145

how they should be run."[330] In such an atmosphere, it is less surprising that the research community did not launch a somewhat more vociferous protest of Resolution No. 1180/420.

The military, which oversaw a great deal of computing research in the USSR, was also staunchly opposed to working from foreign models, seeing it as a security risk as well as a disgrace to Soviet pride.[331] The military's projects were closely guarded and its structures especially rigid, and the decision to use foreign models as templates drove military computing deeper into secrecy, and further from the mainstream of computing research.[332] Nonetheless, since its research and funding were considered separately from that of non-military computing, the decision to embrace foreign models for economic planning and industrial automation resulted mainly in the creation of two increasingly distinct magisteria of computing.[333]

Scientists were becoming more sharply divided into "military" and "civilian" groups, the former often enjoying greater resources, but in ever greater isolation, a problem the state was both aware of and yet unable to rectify, given the

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330 Stephen Fortescue, *The Communist Party and Soviet Science*. (London: Macmillan, 1986), p.126.

331 Gerovitch, *The Cybernetics Scare and the Origins of the Internet*, p.22

332 Harvey, p.17

333 Harvey, p.50

fear of communication its own policies engendered.[334] The terms of state secrecy were laid out in intensely specific terms, and violations were punishable by harsh sentences.[335] Leonid Vladimirov, an engineer-journalist who defected to the U.S. in 1966 described how "...Soviet specialists work in a state of really frightful isolation, not only from the outside world, but from other Soviet industrial plants and research establishments...The fear of "giving away" something secret keeps the lips sealed even of those scientists who are working on non-secret subjects...Because of this the bogey of secrecy holds up the progress of non-secret scientific work as well."[336] Nowhere was secrecy more a priority than in military research, which may explain why a number of the most advanced programs were run by the military, yet some computers in use by the Red Army were still reliant on vacuum tubes well into the 1970s.[337]

Dr. Sergei Lebedev, one of the foremost researchers in computing during the discipline's founding years in the USSR, staunchly opposed the importation of foreign technology. A lifelong Slavophile and isolationist, he believed that the

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334 Leonid Brezhnev, quoted by Colonel S. Baranov, *Krasnaya Zvezda*, March 5, 1971, cited in Harvey, p.17

335 Harvey, p.55

336 Leonid Vladimirov, *The Soviet Space Bluff*. (London: Tom Stacey Ltd., 1971), p.180

337 David Wellman, *A Chip in the Curtain: Computer Technology in the Soviet Union*, (Washington, DC: National Defense University, 1989), p.90

USSR must make its own path in this field.[338] On the other hand, the heads of several influential and relatively reform-minded institutes, including Georgy Arbatov of the USA Institute, Oleg Bogomolov of IEMSS and Nikolai Inozemtsev of IMEMO reflected a powerful interest in speeding the development of the technology sector in the USSR.[339] However, Mikhail Sulim, Deputy Minister of the Radio Industry, staunchly opposed the decision to import Western technology, correctly fearing that domestic development would shortly be abandoned entirely.[340] A number of computing researchers left the field in response to the "make-or-take" decision, as in time they saw more and more funding for their independent research cut.[341] Sulim later lost out in a second argument over whether or not a foreign model should be the basis for the planned Edinnaia (Unified) System, the first compatible series of computers produced by the USSR and its allies. Sulim resigned his position in 1970, partly because the IBM360 was selected as the basis of the Unified System even after he had warned it was

338 Ibid., p.91

339 English, p. 143

340 Nitussov, p.166

341 Nitussov, p.167

already dismally obsolete. Sulim later was quoted as having said, "I have to say that of the two possible paths of development, we chose the wrong one."[342]

Trade Liberalization and U.S. Foreign Policy

> "The intimate engagement of trade, over a considerable period of time, when taken with the process of change already underway, can influence the internal development and the external policies of European Communist societies along paths favorable to our purpose and to world peace. Trade is one of the few channels available to us for constructive contacts with nations with whom we find frequent hostility. In the long run, selected trade, intelligently negotiated and wisely administered, may turn out to have been one of our most powerful tools of national policy."
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> --Hearings from Miller Committee, United States Trade Relations with Eastern European Countries and the Soviet Union, 1968 Hearings, p. 793

> "When the time comes to hang the capitalist class, they will compete with each other to sell us the rope."
>
> --V.I. Lenin[343]

The violent oppression of the Prague Spring in 1968 produced a sharp but temporary reversal in support for increased trade to Eastern Europe; at the same time, the new Republican administration under Nixon took an initial hard line against trade

342 Fitzpatrick, p. 6

343 Allen Saeks, "East-West Trade: Time for a Reappraisal," *American Bar Association Journal*, No. 55, Nov. 1969, p.1041-1046.

with socialist countries.[344] However, the actions of the USSR also served to cement the perception of Eastern Europe as an unwilling thrall to Soviet power, and perhaps engendering a measure of what might be called 'subversive goodwill'. Assisting the nations of Eastern Europe in developing their own economic identities would draw them away from dependence and alignment with the Soviet Union, a valuable long-term strategy for the United States, if carefully administered.[345]

American business continued to press against restrictive controls in 1968, arguing that they did little to prevent strategic items out of socialist hands and merely excluded US businesses from the international marketplace.[346] Even after the 1966 amendments and 1967 concessions, in 1968 American control lists included 1300 categories not covered by COCOM restrictions, including 1100 items readily available to Eastern Europe through America's European allies.[347] Beyond the restrictions imposed by COCOM, the United States had its own system of controls based on several pieces of Cold War legislation. The Invention Secrecy Act of 1951 gave the U.S. Patent Office authority to determine whether a piece of technology was

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344 William Wallace, and Roger Clark, *COMECON Trade and the West. (*London: Frances Pinter Publishers, 1986.), p.136

345 Dyker, p.31

346 Marshall Goldman, *Détente and Dollars: Doing Business With the Soviets,* (New York: Basic Books, 1975), p.56

347 Bilder, p.858

dangerous enough to be officially classified, and the Atomic Energy Act of 1954 further defined "restricted data" that might be too dangerous to be freely circulated.[348] Once the United States was perceived to have acquiesced to the demands of its NATO allies on East-West technology transfer, internal pressure from American businesses became harder to resist. The need for further COCOM review and further pressure for trade liberalization was now compounded by the fact that foreign models had become integral to socialist technology policy, and Eastern Europe now constituted a reliably lucrative market.[349]

In 1968, in response to escalating hostilities in Vietnam and the violent Soviet reaction in Czechoslovakia, the State Department suggested a special panel be established within the Economic Defense Advisory Committee to review difficult COCOM cases in the area of digital computers. Such a panel would include representatives from the Department of Defense, CIA, Army Environmental Command, NASA, Arms Control and Disarmament Agency, Treasury and Commerce Departments, in addition to representatives from the Bureau of Intelligence and

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348 Sandra Milevski, "Federal Policy-Making and National Controls on Information," *Library Trends* 39, no. 1 Summer/Fall 1990.

349 William Wallace, and Roger Clark, *COMECON Trade and the West. (*London: Frances Pinter Publishers, 1986.), p.127

Research.[350] This broad, largely militaristic and intensely bureaucratic approach toward export control on the part of the United States threatened to slow an already unwieldy process. The United States was determined not to allow the transfer of technology to socialist countries to become the status quo. However, balancing the interests of the U.S. with those of its allies would be an ongoing process if the system of export controls was to persist at all.

According to Abraham Katz, Director of the Office of OECD, European Communities and Atlantic Political-Economic Affairs in the State Department (1967-74), the slow U.S. response to licensing requests was trying the patience of other COCOM members; "There has been a real failure on the part of the US in dealing with 'exception' cases. Some of these, currently awaiting US reply, have been pending since last year."[351] Katz encouraged his associate, Joseph Greenwald, to remind the Assistant Secretary of Defense that "COCOM is a voluntary organization", and that its members "rely far more on international trade for their economic wellbeing than does the US."[352]

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350 "Action Memorandum RE: EDAC Panel to Review Difficult COCOM Exceptions Cases," from Abraham Katz, October 17, 1968. National Archives and Records Administration, Washington, DC, RG 59, E5605, Box 16, Folder, STR13-1 COCOM 1966-69.

351 "Memorandum: Your Call on Assistant Secretary of Defense Warren Nutter," from Abraham Katz,. National Archives and Records Administration, Washington, DC, RG 59, E5605, Box 16, Folder, STR13-1 COCOM 1966-69.

352 "Memorandum: Your Call on Assistant Secretary of Defense Warren Nutter," July 17, 1969

As the situation in Vietnam worsened, the U.S. attempted to retreat to its traditional embargo strategy, becoming increasingly restrictive.[353] These tensions placed tremendous stress on its relations with other COCOM members. Katz advised that "We must give to get, be prepared to yield old controls to add new ones." An updated embargo list would include some American demands, especially tighter controls on computers and special machine tools, but sharply reduce the number of "strategic" items requiring validated licenses.[354]

While a more liberal approach to technology exchange might have appealed to many in the US on a philosophical level, the need to balance America's foreign interests played a more practical role in the occasional laxity shown toward controls in Eastern Europe. Assistant Secretary of State for Economic Affairs Anthony Solomon suggested some talking points concerning the 1968-69 COCOM list review:

> "We see the objectives of the COCOM negotiations as being twofold: a) to update the list from a technical standpoint, and b) to assure the continuation of adequate controls towards Communist China. We realize that this means the deletion of many exceptions for the Soviet Union and Eastern Europe...This year we are trying to confine most of the relaxation to Eastern Europe so that controls can be maintained or strengthened towards Communist China." [355]

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353 Saville Davis, "Patterns and Problems in U.S. Foreign Policy," International Affairs, Vol. 41, No. 4, (Oct. 1965), p.648

354 Ibid. p.2

355 "Review of the International Embargo List in the Coordinating Committee (COCOM)," from Anthony Solomon, November 11, 1968. National Archives and Records Administration, Washington, DC, RG 59, E5605, Box 16, Folder, STR13-1 COCOM 1966-69.

In satisfying Western Europe by relaxing restrictions on Eastern Europe in exchange for cooperation on strengthening the embargo towards China, COCOM inevitably incurred tensions with the Japanese, for whom heightened restrictions on Chinese trade were a major disadvantage. In subsequent decades, as computers became commonplace and difficult to control, Japan would develop a reputation for bypassing COCOM.[356]

The State Department engaged in a long, arduous negotiation process with COCOM members regarding reform of the Embargo List. Anthony Solomon wrote of the ongoing COCOM embargo list negotiations, "We have had frank discussions with the British on the control of digital computers. They have rejected US proposals to strengthen computer controls (now exportable by member countries on the basis of unilateral administrative interpretations)....The British position is that the present list is out of date politically and technically and that a drastic pruning is long overdue."[357] Given that many licenses were ultimately approved, and that American businesses faced more hurdles than anyone else in selling items readily available elsewhere,

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356 Gary Bertsch, Richard T. Cupitt, and Steven Elliott-Gower, *International Coopeation on Nonproliferation Export Controls: Prospects for the 1990s and Beyond,* (Ann Arbor: University of Michigan Press, 1994), p. 47.

357 "Review of the International Embargo List in the Coordinating Committee (COCOM)," from Anthony Solomon, November 11, 1968. National Archives and Records Administration, Washington, DC, RG 59, E5605, Box 16, Folder, STR13-1 COCOM 1966-69.

support within the U.S. for such stringent export control measures was swiftly eroding.[358]

In 1969, a newly amended Export Administration Act essentially declared American intentions of increasing trade with Eastern Europe. Broader powers to determine if export of strategic goods endangers national security or interest would rest with the president, giving the executive branch greater leverage in foreign policy.[359] Items freely available from American allies would be cleared for licensing by the Department of Commerce except in special cases, and justification for denial of the license would be required in the Department's quarterly report.[360]

The Act included more provisions for updating and revision of control lists, and efforts to increase transparency on the part of the US and involvement on the part of the potential purchasers of restricted items, including the opportunity to make their case for approval, and at least a partial commitment to speedier review of licensing cases.[361]

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358 Saeks, p.1046

359 Ibid. p.1044

360 Bilder, p.860

361 "Memorandum: Your Call on Assistant Secretary of Defense Warren Nutter," from Abraham Katz, July 17, 1969. National Archives and Records Administration, Washington, DC, RG 59, E5605, Box 16, Folder, STR13-1 COCOM 1966-69.

The Export Administration Act also provided a basis in law for businesses embroiled in contract or labor disputes.[362] The Act reduced the effects of judicial reluctance in local and federal courts to grant relief to businesses engaging in trade with socialist countries. Federal law now made it clear that private efforts to boycott or protest trade with communist countries stood in unambiguous opposition to established foreign policy.[363]

This acknowledgement by the Unites States government also provided some cover for American businesses which feared public disapproval of their business dealings with the socialist world. Senator Walter Mondale issued the following comments on the Export Administration Act before Congress in 1969:

> "It is important by virtue of its own terms. But it may be that its symbolism is even more important, because, for years, deeply patriotic U.S. businessmen, seeking to sell peaceful, nonstrategic items to Eastern Europe have been subject to the charge that there is something wrong with their patriotism, even though they knew that such efforts were in this Nation's best interests ....Repeatedly, throughout this act, we have declared it to be the policy of the United States to support such a movement on the part of U.S. businessmen." [364]

Senator Edward Brooke also cited the diplomatic latitude the Act provided for the executive branch; "The central point is that, if the opportunity does arise for the

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362 Bilder. p.859

363 Bilder, p.860

364 "The Export Administration Act" speech by Senator Walter Mondale, December 23, 1969, 115 Congressional Record (1968), p. 17,737.

President to establish more fruitful trading relationships with one or more members of the Soviet bloc, the bill will enable the United States to do so."[365] This approach to export controls in Eastern Europe did not equate to a 'normalized' relationship with the socialist world, but allowed for more strategic crafting of policies and procedures by moving from an implied state of constant embargo to one where functional relationships and true diplomacy might take root.

A Rock and a Hard Place

> "Integrating computing into a large national economy is not like building army tanks. Users must have the motivation to go through all the trouble that is involved in learning to apply this technology effectively. They also need a great deal of help."
>
> --Seymour Goodman, Professor of International Affairs and Computing, Georgia Institute of Technology[366]

Developing the Soviet computer industry by reverse-engineering Western models would perhaps be more difficult than the Council of Ministers had assumed. The USSR had placed itself in the uncomfortable position of waiting years for the approval of licenses, which might be dependent on its "good behavior" in the political arena, in order to obtain outdated computers at absurdly inflated prices. It would then

365 Bilder, p.861

366 Seymour Goodman, "Soviet Computing and Technology Transfer: An Overview," *World Politics*, Vol. 31, No. 4. (Jul., 1979), pp. 539-570, p.570

attempt to recreate these machines using domestic research, development and production capacity and that of the other COMECON member states.[367]

While the practicality of purchasing foreign licenses often appealed to economic planners, and in theory to managers within production sectors, in reality there were a number of negative attitudes towards computing technology that would hinder their adoption and effective use.[368] These would manifest in a resistance to the introduction of new machines into manufacturing, business and educational environments. It has already been mentioned that within academia, some considered the computer a "makeweight", and thus proper priority was not given to the study of computing or computer training. This left the need for skilled computer technicians chronically unfulfilled.[369]

Purchase of licenses, while sensible from a financial and efficiency perspective, also struck a painful chord for many Soviet managers as well as researchers, an awareness that Soviet exceptionalism was not, in fact, immutable.[370] This likely engendered the defensiveness perceived by economist E. Artimiev:

> "There are many shortcomings in the work connected with the purchase of licenses. Considerations of prestige often take precedence over economics. The directors of a number of organizations and

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367 Luke, p.346

368 Harvey, p.50

369 Harvey, p.51

370 Holliday, p. 90

> enterprises frequently regard the decision to buy a foreign license as a mark of their own scientific and technical incompetence and as a slur on the honor of their department. That is why a certain percentage of them strive to solve every new scientific and technical problem with their own resources, which leads to an unjustified proliferation of research topics, the scattering of funds and a considerable delay in the creation of new manufactured articles."[371]

At times, industries made only partial use of their licenses, feeling some obligation to do at least some portion of the work themselves, or to save money after purchasing the expensive license: "...Soviet industrial officials sometimes insist on buying unpackaged technology from the West, and supplying part of the technology from their own resources in order to economize on hard currency expenditures. This can create special problems of technological inputs and lead to further delays."[372]

Besides responding to the very real threat of force from the Soviet Union, among the advantages Eastern Europe gained from cooperation with the USSR was the provision of subsidized raw materials in exchange for manufactured goods. One development in this longstanding arrangement was that by the 1970s, many of the COMECON member countries had long-term agreements in place with the USSR promising Western technology in exchange for raw materials such as oil, coal and

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371 E. Artemiev, "Patenti i Litsenzii: Vazhnoe Uslovie Tekhnicheskogo Progressa." *Pravda*, July 30, 1975, p.2. Cited in Holliday, Ch.4, p.90.

372 Holliday, p.90

lumber.[373] Subsequent sale of these raw materials provided valuable hard currency with which to purchase more goods and licenses from abroad.[374] A thriving black market in computer components and intelligence existed within Eastern Europe, the USSR and third-party states not covered by COCOM; illicit exchanges within the socialist world might have perhaps even overshadowed the much-examined illicit acquisition of technology from the West.[375] Not every advantage or failure of Eastern European industry was revealed to the USSR or to the public; Central and Eastern Europe had long honed the practice of "creating fictions to please authorities", whether that meant fudging statistics, to fabrication of industrial committees and other entities.[376] In this way, Eastern Europe attempted to leverage whatever hard currency it could obtain, and maximize the profits from whatever technology it could import.

Regardless of whether models originated at home or abroad, Soviet researchers could not simply request components to test their theories; the entirety of the elaborate Soviet command system had to be consulted before production of

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373 Holliday, p.64

374 Charles Maier, *Dissolution: The Crisis of Communism and the End of East Germany.* (Princeton: Princeton University Press, 1997), p.86

375 Dyker, p.31

376 Janine Wedel, *Collision and Collusion: The Strange Case of Western Aid to Eastern Europe, 1989-1998*. (New York: St. Martin's Press, 1998), p.74

this kind could take place, and such requests were often turned down.[377] One goal of Resolution No. 1180/420 was the production of microchips, an industry that was practically nonexistent in the Soviet Union in the mid-1960s. Another was the increase in the number of mainframe units and small to mid-range computers for use in government and industry, and for sale to Soviet allies abroad. From 1966-1970, the USSR produced 5,800 computers. The goal for 1971-1975 was 20,000, a level that was not attained until the late 1970s.[378] By contrast, in 1967 the IBM Corporation was installing over 1,200 units of its System/360 *each month*.379 The production of a single model by private industry in the United States vastly outstripped even the loftiest Soviet expectations for its own manufacturers.

Compatibility was among the chief attractions of the IBM models, a feature that the Soviet government would require computers to possess if they were to maximize their impact. The first Soviet effort to develop an upwardly compatible (stackable) computer was the Ural-10 in 1965. The Ural-10 suffered from poor design and hardware issues, and fewer than 1,000 were produced.[380]

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377 Wellman, p.43

378 Fitzpatrick, Ch.6

379 "Telex v. IBM: Implications for the Businessman and the Computer Manufacturer," *Virginia Law Review*, Vol. 60, No. 5, May, 1974,p. 884-909, p.885

380 Goodman, p.548

At the same time, IBM was experiencing tremendous success with its new System/360, which led to its selection as the working model for the future Unified Series. Another reason for its selection was the successful licensing agreement struck by the German Democratic Republic. The GDR began its first efforts in adopting international standards using the System/360 as a model in 1966.[381] According to 1967 COCOM regulations, any CPU with a bus rate of 40 or above, or a specially-calculated COCOM processing rate of 8 or above would be denied export license. Only the smallest model of the IBM 360 series fit these qualifications, and this was the model in use in East Germany.[382] In 1966, the USSR attempted to adopt the System/360s instruction set when designing the M-2000, the first Soviet effort to copy a Western system for purposes of compatibility. However, due to faulty circuitry, the project failed to produce useful results.[383]

Soviet computers, produced at a range of facilities scattered across a vast continent, were frequently incompatible with one another or with available peripherals despite efforts to build compatible systems.[384] The military was by far

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381 Goodman, p.546

382 "COCOM Computer Guidelines Applied to Typical US and Foreign Computers, 1966," US Department of State. National Archives and Records Administration, Washington, DC, RG59, Entry 5605, Box 16.

383 Goodman, p.549

384 Gerovitch, *InterNyet: Why the Soviet Union Did Not Build a Nationwide Computer Network.* p.346

the largest investor in computing research, but the highly classified efforts relating to military computing and the atomized community of scientists working on them produced a tangle of computer models, platforms and hardware, few of which were compatible with any other machine.[385]

> "Many military control systems based on mobile computers were aimed at small-scale (separate specimens, tens or hundreds of pieces) production and use. Therefore, programmers made use of ingenious designs and ignored hardware and software unification and standardization. Consumers did not coordinate the specifications for computer aids, each of which had to be individually adjusted to consumer's tasks. Hence there emerged a real "zoo" of different computers and software complexes often solving the very same problems, especially in airborne and missile systems."[386]

It would be remarkable if this situation did not negatively impact Soviet military readiness, but given the secrecy surrounding these machines, their use and development, the frequency of problems caused by incompatible systems will likely remain unknown.

The expense of relying on foreign technology became an integrated part of the Soviet economy by the 1970s; it is estimated that ten to twelve percent of Soviet investment during that decade went toward imported technology.[387] The year 1967

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385 Apokin, p. 84

386 Vladimir Lipayev, "*History of Computer Engineering for Military Real-Time Control Systems in the USSR"*, accessed October 29, 2010. http://www.computer-museum.ru/english/milhist.htm

387 Luke, p.345

would prove to be the last in which the USSR had a positive balance of trade with the West; between 1968 and 1975, the hard currency trade deficit of the USSR grew from US $109 million to over $6.2 billion.[388]

Eastern Europe also found itself deeply in debt owing to the unfulfilled promise of costly Western technology. Charles Maier, writing on the stagnation and decline of East Germany in the 1970s, describes the vicious cycle that developed in Eastern Europe:

> "Accelerating inflation and the glut of dollar reserves in Europe that accumulated during the 1970s made it easy for Western banks to extend credits, whether in Latin America on the part of North American banks or in Poland and East Germany on the part of West Germany. By exporting inflation the United States helped conceal the weakness of socialism."[389]

The initial victory of successfully securing licenses and business deals with the West soon yielded to bitter disappointment and increasing desperation within the Eastern Bloc. The only markets for COMECON-built computer were within COMECON itself, with some limited sales to underdeveloped nations, and a scant few elsewhere. During the 1970s, Bulgaria constructed twelve computer production plants equipped with Western machinery, and the output of these plants was sold almost

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388 John Farrell, and Paul Ericson, "Soviet Trade and Payments With the West," Joint Economic Committee, U.S., Department of Commerce, 1973, p. 278, cited in Holliday, p.65 (Table 3.6)

389 Maier, p.94

exclusively to the Soviet Union.[390] Since many COMECON trade deals were conducted with an exchange of goods, it is entirely possible that the USSR paid for many of these computers with raw materials such as oil or coal, which then stood an excellent chance of being sold for hard currency, and this hard currency in turn used to purchase more technology from the West, and the cycle began anew.[391]

During the oil crises of the early 1970s, the USSR restricted the subsidized oil sales that had funded hard currency transactions and had allowed CMEA nations to cover the interest on their growing debts to the West. The pattern of behavior in terms of technology imports and acceptance of Western credits continued although Eastern Europe's ability to make good on these loans had been sharply restricted. The gap grew, and the Bloc's ability to catch up became an ever more distant possibility.[392] "Immediately following its collapse in 1991, it was revealed that CMEA's member nations had accrued a gross debt of $186 billion American dollars in Western credits."[393]

According to Marshall Goldman, "For the Russians, imports are primarily a way of compensating for innovational shortcomings. Therefore, when the United

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390 Poznanski, p.86

391 Maier, p.66

392 Wallace, p.128

393 Gabor Hunya, ed. "Economic Transformation in East-Central Europe and in the Newly Independent States", in *The Vienna Institute for Comparative Economic Studies Yearbook 5*. (Boulder: Westview Press, 1994), p.33

States withheld a particular item such as titanium, this usually had only short-run impact, because sooner or later the U.S.S.R. would find substitutes or local supplies, although at a higher price. When, however, the U.S. sought to prevent the sale of technology, this often had a long-term effect on Soviet growth."[394] The USSR held self-sufficiency as a goal for much of its initial period of industrial development; in many respects it came close to near-perfect subsistence. However, it continued to import foreign industrial designs, and never fully developed the capacity to produce all the innovations required to make technological progress across multiple sectors of its economy. It may be true that no state can reliably produce innovation in isolation; in this regard the political and economic isolation of the USSR compounded its internal institutional and social isolation, and contributed to its heightened dependence on foreign advances.

Among other issues holding back socialist integration of computing was the inflexibility of the educational and employment systems. Maier defines the problem in terms of central planning: "One does not simply move workers from hewing coal or rolling plate to assembling microchips....For decades socialism had pursued the romance of coal and steel without calculating the opportunities forgone in other

394 Goldman, p.47

activities....The system depended on more muscle and more people to bend more steel-not on ingenious breakthroughs."[395]

Economist Olivier Bertrand points to the root of the problem in the way these societies poorly prepared their members to respond to social and technological changes; "Flexibility and responsiveness of educational and training systems are often seen as the best response to change and uncertainty. They are often associated with decentralization at the regional, local, and/or school level and they require more cooperation with enterprises and local authorities."[396] This suggestion is supported by the revealing fact that while computer development was declared an economic and scientific priority of the highest order in the USSR by the late 1950s, the first courses in computer use and technology were introduced into technical schools only during the 1969-1970 academic year.[397]

Beyond failure to prepare its research institutions and industries for technological change, the nature of social control under communism often rendered automation ineffectual for the most basic tasks. Until the late 1980s, processes that had become mundane in the West, such as photocopying, could only be done under strict supervision in the USSR. This was to prevent them from being co-opted by samizdat

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395 Maier, p.99

396 Olivier, Bertrand. "Education, Training and Economic Change in Advanced Market Economies," in *Technological Lag and Intellectual Background: Problems of Transition in East Central Europe.* (Aldershot, UK: Dartmouth Publishing Company, 1995), p.232

397 *Pravda*, September 1, 1969, cited in Harvey, p.51

publishers hoping to subvert state censorship.[398] Because of the nature of Soviet society, a small change to an airline booking system might require the signing off of three or four levels of management, thereby nullifying any improvements in efficiency the computer might have offered.[399] While the key to IBM's success in the West had been effectiveness and impeccable service, any institution lucky enough to possess a computer at all in the socialist world would likely find that the machine spent much of its lifespan awaiting repairs, sometimes for years at a time.[400]

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398 Hans Van Zon, et al. *Central European Industry in the Information Age*. (Hampshire, UK: Ashgate, 2000), p.21

399 Ibid., p.23

400 Graham, *Science and Computers in Soviet Society*, p.131

Conclusion

We can look back on the Soviet example and countless others that seem to demonstrate that intellectual freedom and dedicated investment are both prerequisites for innovation to have a positive social impact. Innovation is most readily translated into advancement when it is able to grow and develop in ways that suit the actual needs of society, and not a preconceived notion of what will be profitable or desirable. Just as "Technology is firm-specific, and external R&D cannot be a substitute for in-house R&D,"[401] innovation is society-specific, and cannot be substituted by foreign developments with complete success. It is possible that the costs of attempting to replace one with the other could consume any gains it allows, and the shortfalls in overall effectiveness will likely result in persistent net losses.

The socialist world reached deep into its pockets for this technology, hoping that the next innovation would produce the kinds of solutions its struggling economies desperately needed. The evolving nature and administration of Western export controls created sufficient reason within the Soviet Union for it to alter its domestic science policy. This resulted in the abandonment of many domestic research and development efforts in favor of adaptation of foreign models. However, acquisition of foreign licenses and machines did not produce the social and economic benefits

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401 Michael Fritsch, and Horst Brezinski, eds. *Innovation and Technological Change in Eastern Europe: Pathways to Industrial Recovery. (*Cheltenham, UK: Edward Elgar Publishers, 1999), p.145

anticipated largely due to the nature of economic and educational institutions within the USSR. Innovation without subsequent development and improvement, or effective education and adoption within society failed to produce economic benefits in proportion to their expense. For reasons of ideology and politics, and despite significant effort the Soviet state failed to develop structures that could effectively exploit its native talent for broad social and economic ends. Its model of scientific progress did not fully account for the fact that research and development often do not produce their greatest results along purely pragmatic lines. The Soviet Union sought perfect order in computing; despite the order implied by elegant algorithms and precise technology, history tells us that the realities of innovation are far too unruly to be subject to human command. By maintaining control over sales of high technology to the communist world, the capitalist West reinforced the isolation and privation that had kept Soviet research efforts from succeeding; both tightened and relaxed controls were calculated to serve Western political aims as well. The Soviet Union attempted purchase the advancements of its stronger adversaries effort to compensate for a host of internal flaws; by leveraging the West's political and technological advantages, export controls ensured that these sales amounted to one thing: enough rope.

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