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Perestroika and Change in Soviet Weapons Acquisition

Arthur J. Alexander

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Focusing on two major issues--the "conversion" of defense industry resources to civilian uses and the influence of contemporary weapons technology and complexity on the Soviet Union's ability to meet military requirements--this report identifies and explains the major elements of continuity and change in Soviet military organization, concepts, and goals since the emergence of Mikhail Gorbachev and his "new political thinking." Soviet military research and development and production evolved from the 1930s to the 1980s in a manner that was consistent with the political-military doctrine and economic base that supported it. Now, with the dramatic changes in Soviet political choices, doctrine, economics, and technology, the Soviet Union's defense production complex is engaged in adapting to a conversion to civilian production as it tries to meet military demands for higher performance, increased reliability, lower costs, and the application of new technologies. Analysts must now shift from dealing with established and familiar elements to grappling with the uncertainties of evolving Soviet politics and policies.

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Perestroika and Change in Soviet Weapons Acquisition

Arthur J. Alexander

June 1990

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PREFACE

The RAND Corporation is providing analytical assistance to the Office of the Under Secretary of Defense for Policy on the subject of recent developments in Soviet military affairs. This two-year effort seeks to identify and explain the major elements of continuity and change in Soviet military organization, concepts, and goals since the emergence of President Gorbachev and his "new political thinking." It looks beyond the rhetoric of *glasnost* and *perestroika* to the underlying motivations that account for the many departures that have lately occurred in such areas as Soviet declaratory rhetoric, operational doctrine, national security decisionmaking, and defense resource allocation.

This report reviews two major issues. The first is the application of defense industry resources to civilian uses—commonly called "conversion." This review places the ongoing process in a broader economic, organizational, and political context. However, since the process continues to unfold, often in unplanned ways, some guidelines are given for evaluating the shifting picture of Soviet behavior. The second issue involves the effects of contemporary weapons technology and complexity on the ability of the Soviet Union to design, develop, and produce military systems that meet the requirements of the military.

The research reported here was conducted in the International Security and Defense Policy program of RAND's National Defense Research Institute, a federally funded research and development center sponsored by the Office of the Secretary of Defense and the Joint Chiefs of Staff. It should be of interest to members of the U.S. defense policy community concerned with evolving Soviet military policy, civilian-military relations, defense policy-formulation, and arms control behavior.

The cutoff date for this research is the end of 1989.

SUMMARY

Soviet weapons acquisition has been an effective enterprise since the 1930s. This effectiveness arises from four principal sources: (1) the allocation of sufficient resources, (2) implementation priority ensuring that the allocational choices are actually carried out, (3) a buyer's market in which the Defense Ministry has been granted the privilege of not accepting inferior products, and (4) an R&D approach that has dealt with the shortcomings of the Soviet economic system. Soviet political choices since mid-1987 have radically altered the political structure of defense, reducing the resources going to new weapons and diluting the priority of defense production. A second major change is the role of weapons technology and complexity in reducing the power of the buyer's market and the capabilities of the Soviet weapons R&D style.

For 25 years, Soviet leaders have attempted to transfer features of defense industry—mainly managers and methods—to the civilian sector to improve productivity and output. On assuming leadership, Mikhail Gorbachev followed this same approach in what turned out to be a first phase of his effort of enlisting the defense sector in the aid of the economy. However, something new is now being added to past policies: Two key elements allowing Soviet defense industry to be effective at developing and producing military systems—allocational priority and implementation priority—are now being transferred to civilian production. This reallocation of resources and partial reassignment of priority mark the second phase of an evolving policy toward defense industry—the conversion of defense industry capacity to civilian purposes.

Since the beginning of 1988, the direct consequences for weapons development and procurement of defense industry conversion to civilian output have all been negative.

- The transfer of enterprises from the dissolved ministry of light and food industry to the defense complex absorbed defense managers' attention, diverted defense production capacity, and redirected new investment to food processing equipment.
- Implementation of plans for the defense industry to make further contributions to the production of consumer goods and light industry equipment drew on additional management and production capacities and required more diversion of investment.
- Defense procurement reductions arising from Gorbachev's policy announced in December 1988 immediately began to influence

factory orders and production lines, further deepening the effect of conversion.

- *Khozraschet* and self-financing in defense enterprises will raise the visible cost of procurement to the military and further emphasize the resource burden of defense.
- The broadened conversion responsibilities of the Military Industrial Commission (VPK) and the Party apparatus for defense industry reduce the Party's ability to maintain and implement priorities for defense production.
- *All of these activities signal a change in political choices away from the military and toward civilian welfare.*

These policies will influence the military's ability to develop and produce the systems it desires. Defense industry's ability and willingness to develop and produce technologically advanced and complex equipment have depended on the availability of inputs, especially of new types. If supply becomes more uncertain, the effectiveness of defense R&D will be considerably impaired; and if the coordinating role of the VPK and Party apparatus is diminished, the fulfillment of complex tasks will be delayed and rendered less likely.

An important factor in predicting the continuity of the policies and their implementation, therefore, is the institutionalization of the changes and the deinstitutionalization of the former structure of preferences. Much will depend on the future of the VPK and the Central Committee apparatus, for it is in these two bodies that politics finds its extension into action. The early evidence is that the authority of these organizations over defense industry has been diluted through the broadening of responsibilities. The future course of these organs will provide important clues to the process of conversion.

Implementation of conversion follows classic Soviet lines: large resource transfers directed by a campaign approach to mobilizing energies and managing details. This campaign, though, has had neither the advantage of centralized plans and coordination nor the benefits of Gorbachev's early economic reforms—wholesale trade, price reform, profit incentives, reduced centralization of authority—none of which have proceeded according to plan. As they enter the civilian industrial world, Soviet defense production managers have confronted the usual supply uncertainties, weak ties between producer and user, and poor incentives. Therefore the efficiency of conversion will be considerably below 100 percent; VPK chairman Belousov summarized these developments by noting that the defense complex's contribution to practical needs "is turning sour." Nevertheless, civilian output will benefit in the short run from the resource base and experience of defense

industry. Over the longer run, there will be unfulfilled plans, shortfalls, and lower technical standards than contemplated, but also some increased and improved civilian output, perhaps even visible to the average consumer.

Financial budgets have not been a principal source of control over military expenditures but rather were an after-the-fact accounting device that followed the planning of physical programs and material balances. This situation is being drastically altered by the political leadership's attention to the reduction of aggregate expenditures, by the budget review process of the Supreme Soviet defense committee, by the transition of defense industry to self-financing, and by the necessity to create an actual financial budgetary base for the Defense Ministry to purchase products from industry. The Soviet defense budget, which has largely been an artifact of Western analysts, is now becoming a principal tool in the control of the Soviet armed forces.

The Soviet military has implemented its authority as a buyer of defense systems through military representatives in design bureaus and factories, comprehensive testing of new equipment, and sanctions for nonperformance. However, the technical feasibility and administrative methods of buyer authority have been compromised by the technologies and complexities of contemporary weapon systems.

The advances in electronics, computerization, information, and miniaturization since the 1970s have left Soviet military industry in a vulnerable position. The speed of change, the complexities of design, the integration of many different technologies and inputs from diverse sources, and the high precision and reliability needed in production strike at traditional weak points of the Soviet economy, which are now affecting weapons acquisition.

The integrative role of the chief designer and the VPK is being undermined by the number of participants and the complexity of the interfaces of modern weapon systems. Flexibility and motivated discipline are needed, but both are largely missing in Soviet organizations. The kind of focused, centralized campaigns used in the past to develop nuclear weapons and long-range rocketry cannot be mimicked today by commands to build a microelectronics capability or a data bus. Systems designers can no longer count on slowly evolving technologies and a stable set of suppliers but must confront sharp changes in the talents of their own design bureaus and new capabilities in their suppliers.

Evidence is now surfacing of serious shortcomings in Soviet weapon systems in both reliability and performance. These problems have been particularly severe in advanced electronics, sensors, communications, and computers. As more testing is needed to discover problems before fielding, pressures from the military leadership are trying to

stimulate shorter times to field new systems. Growing deficiencies in the science and research sectors compound the technology problems; Soviet fundamental science has been described as "too weak to contribute much to practical applications."

Much of the Stalinist structure supporting Soviet weapon acquisition is now beginning to crack. It has not crumbled, and it is even far from collapsing, but it is beset by forces that reduce its capabilities and place a premium on those economic traits in which the Soviet Union is weakest.

The effect of conversion and defense cutbacks is occurring at a time when the adequacy of defense R&D is being questioned. Soviet military leaders are calling for weapons of qualitatively new capabilities as the military leadership wrestles with the simultaneous issues of their own new doctrine of reasonable sufficiency and new technological challenges from NATO.

These developments on the military side point to military demands that place less emphasis on the mass-production base, but perhaps even more on the advanced industrial capabilities and R&D resources of defense industry. The demands for higher performance, increased reliability, lower costs, new and nontraditional solutions to military tasks, and greater speed of introduction of new technologies will require a reorientation of Soviet defense R&D away from its Stalinist heritage. Such a reorientation will conflict with the demands on these same resources coming from the conversion to civilian production.

From the 1930s to the 1980s, Soviet military production and R&D developed along one dominant path, evolving and refining its practices and approaches into a clearly identifiable style and culture. This path was consistent with the requirements of political-military doctrine and with the economic base supporting it. Participants and foreign analysts alike grew comfortable with the operation and the understanding of this enterprise. Now, politics, doctrine, economics, and technology are changing. The Soviet defense production complex and the military are adapting to forces imposed by the leadership and by life itself. The fog and confusions of war are matched by the uncertainties of evolving Soviet politics, policies, and accomplishments.

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I. INTRODUCTION

MAIN THEMES: THE CHANGING CONTEXT OF SOVIET WEAPON ACQUISITION

Soviet weapon design, development, and production have been effective enterprises since the 1930s. Although often lacking the most advanced technologies appearing in contemporaneous Western systems and sometimes exhibiting lower performance measures in direct comparisons, the operational capabilities of Soviet weapons have been the backbone of the Soviet Union's military competency. Not only have these weapons provided the offensive and defensive capabilities of the Soviet military, they have also been delivered in great quantities to Soviet friends and allies, and have formed an important segment of Soviet external trade—arms sales having consistently earned the Soviet Union a significant proportion of its foreign exchange.

The effectiveness of defense industry stands in sharp contrast to the largely inferior performance of Soviet civilian industry. These differences in performance are not independent of each other; they have emanated in part from the set of policies that has favored the one sector at the expense of the other. An ongoing process of change is now unraveling many of the weapon acquisition policies, organizations, and management approaches set into place in the early Stalinist period. Interwoven with that process is the current process of converting defense industrial capabilities to civilian use. The changing nature of defense technology—in the context of the prevailing deficiencies of the Soviet economy—further undermines defense industry effectiveness.

THE SOURCES OF DEFENSE INDUSTRY EFFECTIVENESS: IN BRIEF

Defense industry effectiveness arises from four principal sources: (1) the allocation of large quantities of resources to the defense effort; (2) the assurance that the allocational choices are actually implemented through priority over the supply of materials and other inputs and through close Communist Party and government oversight and supervision of weapon acquisition; (3) a buyer's market in which the customer—the Ministry of Defense—has been granted the political privilege of not accepting inferior products; and (4) a design and R&D philosophy and management approach that has effectively dealt with

the shortcomings of the Soviet economic system. In short, these four sources of effectiveness may be designated allocation priority, implementation priority, a buyer's market, and design philosophy.

This report will describe how Soviet political choices since mid-1987 have altered the structure of defense industry privileges with negative consequences for weapon acquisition effectiveness. Later sections will address the problems introduced by the widespread use of electronics, communications, and sensor technologies in weapon systems and the difficulties encountered by the traditional design and production philosophy in coping with the complexities of the new technologies.

II. THE PLIGHT OF SOVIET CIVILIAN INDUSTRY

PHASES IN DEFENSE INDUSTRY SUPPORT OF THE ECONOMY

Soviet defense industry is different from civilian industry. Believing that such differences have been the major source of the relative success of defense production and that these differences are transferable from the defense to the civilian sector, for the past 25 years Soviet leaders have attempted to seize a small part of the defense industry magic and bestow it on civilian industry through the transfer of defense managers and methods. Such attempts were accelerated in the early Gorbachev years in what we can now recognize as a first phase of enlisting the defense sector in the aid of the economy.¹ However, an important new element has been added to the earlier attempts at stimulating civilian innovation and output. In addition to magic, the present Soviet leaders are now seizing things that have hitherto been closely guarded: defense industry resources and privileges. The second phase of the evolving policy is the conversion of defense industry capacity to civilian purposes. A review of the causes for the different results in civilian and defense innovation and technology, especially the plight of civilian industry, will aid in understanding and evaluating the evolving policies and behavior.

SOURCES OF SOVIET CIVILIAN INDUSTRY PROBLEMS

Two Kinds of Priority

Within the Soviet system of a planned economy, civilian industry suffers on two counts: (1) the political authorities allocate a comparatively large volume of resources, especially of more advanced materials

¹These periods, from 1965 until mid-1987, and from then to the present, were almost certainly not planned as a phased program by the Soviet leadership but rather grew out of major changes in perceptions and politics that, in retrospect, may be identified with different phases. For an analysis of the "first phase," see Arthur J. Alexander, "Soviet Weapons Acquisition in the Age of Perestroika," in H. Rowen and C. Wolf, Jr., *The Impoverished Superpower: Perestroika and the Soviet Military Burden*, Institute of Contemporary Studies Press, San Francisco, 1990. The political struggle is analyzed by Harry Gelman, *The Soviet Turn Toward Conventional Force Reduction: The Internal Struggle and the Variables at Play*, R-3876-AF, The RAND Corporation, forthcoming.

and supplies, to defense, starving civilian production; and (2) unrealistically high output targets (taut plans) result in shortfalls of planned inputs; these shortfalls, which create great uncertainty in civilian production, are alleviated in defense industry through special access to authority and to supplies.

These two methods of transforming preferences into results can be termed "allocational priority" and "implementation priority." Allocational priority exists when a particular sector or recipient is favored, for example, compared with another country's sectoral share or level of resources, or the same country at a different time. One could say that allocational priority is granted to Soviet defense, compared with the pattern of defense expenditures in most Western countries; or priority is now shifting away from defense, compared with the situation in the past fifty years of Soviet experience.

Implementation priority can arise whenever financial or other kinds of allocations are insufficient by themselves to accomplish desired detailed objectives. For example, dealing with complex bureaucratic or regulatory processes in any country is often eased by access to sources of authority able to cut through red tape. In the bureaucratic, planned, conservative processes of the Soviet Union, implementation priority is a customary method by which political preferences are realized.

It is not logically necessary that allocational and implementational priorities coexist. Indeed, many cases of enormous expenditures in the Soviet Union represent major commitments of allocational priority without a concomitant flow of implementation priority: West Siberian gas development is one example.² Also, many examples of rhetorical priority have had neither the resources nor the implementation commitment to back up the rhetoric, as witnessed in the periodic computerization and agricultural development campaigns. Politburo member Ligachev, for example, complained that the State Planning Committee had submitted a draft annual plan for the agroindustrial complex containing lower commitments than envisioned in the Five Year Plan: "While lip service is paid to the priority of the food program, the resources are actually being cut back."³ Defense, though, is an example of the coming together of rhetorical, allocational, and implementation priority in the Soviet Union—the alliance of word, ruble, and deed. The necessary complement to such priority is the low status of civilian industry and its consequences: neglected material base, low technological levels, insufficient output, and poor quality products.

²Abraham Becker, *Soviet Central Decisionmaking and Economic Growth*, R-3349-AF, The RAND Corporation, January 1966, pp. 21-22.

³"Rethinking the Party's Function and Role in Society," *Pravda*, July 21, 1969 (FBIS-SGV-69-139, July 21, 1969, p. 62).

Allocation to Civilian Industry

Civilian industry is defined as production for civilian use, regardless of the source. Not all nondefense production, however, goes to the immediate benefit of individuals; a considerable portion of total output in the Soviet Union is devoted to investment. Estimates of the defense share of GNP fall in the range of 15-17 percent, and the share allocated to gross fixed investment is close to one-third of the entire GNP.⁴ In the Western industrialized countries, in comparison, the defense share is 1-5 percent and investment about 20 percent of GNP. Defense plus investment in the Soviet Union, therefore, absorbs roughly 45 percent of the economic output of the country versus 20-25 percent in the other developed industrial economies. The high Soviet share of both of these end uses of economic output is a direct result of the political determination to become a world power in economic and military terms. Arithmetic logic dictates that, given such choices, consumption must suffer. Private household consumption absorbs less than 50 percent of GNP (60-65 percent elsewhere), and total private and public consumption (which includes public services such as transportation and health) stands at 55 percent in the Soviet Union and 65-70 percent in other countries.

As large as the defense share of GNP appears to be, it imposes an even larger burden on specific sectors, especially machinery output and R&D. The lion's share of investment funds allocated to the machinery sector has gone to the defense industrial ministries. Several estimates place the defense share of total machine-building output at the 40 percent level.⁵ For R&D, total Soviet expenditures grew very slowly from 1976 to 1985, essentially flattening out in the latest five year period. Military R&D, however, continued to grow, and since 1976 most of the growth in military expenditures has been due to the R&D account. These differential growth rates imply that defense R&D has been crowding out civilian R&D in the decade before 1986. This starving of civilian R&D has been occurring at the very time that Soviet leaders have been counting on technology, innovation, and productivity increases to move the economy to an intensive growth trajectory.

⁴Gur Ofer, "Soviet Economic Growth: 1928-1985," *Journal of Economic Literature*, Vol. XXV, December 1987, Table 3, p. 1788. In constant factor costs, 1980 gross fixed investment was 33.0 percent of GNP, and 23.0 percent when measured in current established prices.

⁵This figure was repeated by Politburo member Ligachev, who noted, "In 1985, military output accounted for almost 40 percent of production in the machine-building complex." "Rethinking the Party's Function and Role in Society," *Pravda*, July 21, 1989 (PRIS-SOV-89-139, July 21, 1989, p. 61).

Since at least the 1930s, then, Soviet political-economic strategy has emphasized defense and heavy industry growth in allocating the nation's available resources. But under the conditions of the Soviet planned economy, priority of allocation is insufficient to guarantee that plans will be met. Additional steps are required to assure the desired outcomes. A method of implementation priorities is also necessary.

Supply Uncertainties

Innovation always involves the uncertainty of the unknowable future where affairs are, by design, intended to deviate from contemporary circumstances. But for the Soviet civilian innovator, the economic system produces additional risks, the most important of which arise from the supply of inputs. Weakness of the interenterprise supply system has been a shortcoming of the Soviet economy since the 1930s. Uncertainty over supply is a major concern of managers, and for innovating managers the problems are multiplied. A great deal of management effort is normally devoted to developing reliable relations with suppliers, tracking down late or missing supplies, sending dispatchers to problem enterprises, and dealing with local Party and government organs in attempts to obtain support in these activities. Once a set of suppliers, components, and materials has been identified and incorporated into an enterprise's plans and operations, a manager is very reluctant to disrupt these arrangements; since innovation generally involves disruption of familiar routines, managers naturally shun innovation activities.

Supply problems arise from faulty planning procedures, overcentralization of planning and allocation, an underdeveloped supply infrastructure, and complexity of the economy with its tens of thousands of enterprises and millions of commodities, but mainly it comes from the tautness of the planning system.⁶ Tautness is another name for excess demand, which arises from the attempts of planners to motivate workers and managers by stimulating effort throughout the hierarchical management system. When tautness is combined with an incentive system that primarily rewards the meeting of gross output targets, a permanent seller's market is produced, one of whose outcomes is a state of constant shortage. Despite repeated attempts since the 1960s to replace gross output targets with more complex indices of plan fulfillment⁷—including profit-like measures—short-term output continues to dominate the reward structure

⁶Joseph S. Berliner, *The Innovation Decision in Soviet Industry*, MIT Press, Cambridge, Mass., 1976, pp. 70-72.

⁷The introduction of profit-oriented, self-financing practices (*khozraschet*) has not improved matters markedly. A head bookkeeper complained of "the immense number of additional indicators and systems of incentives. Five years ago the *Report on the Fulfill-*

for a simple and powerful reason: The outputs of one organization are the inputs of others; in a planned economy of the Soviet type, the authorities cannot tolerate schemes that could disrupt the vast number of bureaucratically contrived connections among organizations without contemplating a chaotic breakdown of the production system.⁸

As much as the risks to innovation are multiplied for the Soviet manager, the rewards for successful implementation of technological change are stunted, mainly for the reason just alluded to: a reward structure that continues, in the main, to be based on gross output. Despite several attempts to juggle new-product prices to favor innovation and to add output indices based on the number or value of innovations, these modifications have been fairly minor and ineffective. Moreover, the very system of central planning that produced the negative incentives in the first place insulates producers from pressures to innovate that are generated by competition and the potential entry of new enterprises. Enterprises are assured of customers for their production. Consequently, they face only administrative pressures (rather than economic requirements) to innovate.

Organizational Structure

In addition to the disincentives retarding productivity and technological change, organizational structure also acts to discourage innovation. Soviet economic organizations are marked by large-scale bureaucratization, complexity, hierarchical rigidity, and horizontal boundaries that are often more difficult to bridge than international boundaries between less-than-friendly states. Where technology is fluid and change is rapid, successful innovating organizations require flexible structures, lateral interactions, and organic, nonhierarchical schemes of organization. Soviet economic organizations tend to violate these norms in all dimensions. As one example, Soviet enterprises are lumberingly large. Twenty years ago, only 15 percent of Soviet enterprises employed fewer than 50 people, compared with 85 percent in the United States and 95 percent in Japan. At the other end of the distribution, 24 percent of Soviet establishments had more than 500 employees; in the United States, only 1.4 percent of the firms were as large, and in Japan the figure was a tiny 0.3 percent.⁹ In the meantime, Soviet organizations have grown even larger with the merger of enterprises and the creation of production associations and science-

ment of Norms consisted of 10 pages, and now it has 240 pages." V. I. Sidorov, "The Association's Bookkeeping Services," *EKO*, October 1986, p. 34.

⁸This point is put forward by Ofer, "Soviet Economic Growth," p. 1802.

⁹Berliner, *The Innovation Decision*, p. 33.

production associations in which many enterprises are joined under a single management. Ironically, the amalgamation of enterprises and research institutes into enormous complexes was intended to correct the organizational boundary problem.

Despite the large scale of individual Soviet research and production organizations, the Soviet industrial structure has been characterized by functional specialization. Production enterprises do little R&D; research institutes have little capacity for prototype construction and testing or for pilot plant production. Design and project organizations produce blueprints for products and factories they will never have to produce or manage. Even when a research institute is within the same ministry as a production plant, the different incentives acting on managers of the different organizations produce only weak forces for the interactions and personal energies required to develop an innovation and transfer it successfully to a producing organization. Moreover, the forces of demand are so blunted that there is often little incentive to produce even a successfully implemented innovation.

For many products and technologies, market economies can coordinate these different functions through arm's-length market transactions; but for the majority of products, the functions are integrated within single companies where intense personal communications and the movement of people who embody technical knowledge and know-how are more possible than across company boundaries. Even with such integration, however, research-intensive companies in market economies find that the management of the interfunctional flows is a critically important, difficult, and consuming activity. Developing effective links among research, design, development, production, and marketing is difficult in the best of circumstances; under Soviet conditions it is grossly ineffective.

GOAL-ORIENTED PROGRAMS: BORROWING FROM DEFENSE

One policy development in the civil sphere deserves mention because of its links to military sector practices: the use of program planning and management.¹⁰ The program approach emphasizes a set of goals or technical achievements such as the development of a specific new product or the creation of some production capability. For such programs, plans focus on the achievement of the goals, rather than on an

¹⁰Julian Cooper, "Innovation for Innovation in Soviet Industry," in R. Amann and J. Cooper (eds.), *Industrial Innovation in the Soviet Union*, Yale University Press, New Haven, 1982.

organizational unit such as an enterprise. Many of these programs in the civil sector appear to be related to high-level Party or government objectives and are managed outside the usual methods and organizational frameworks. In some cases, time schedules, resources, and participants are designated in the formal documents authorizing the project. For important interministry problems, a lead organization may be assigned authority over resources and over other participating organizations. In the most important projects, high-level political backing is used to solve the always-present problems of bottlenecks, unreliable supplies, uncooperative partners, and general disinterest in results. Such approaches have been used for major campaigns such as exploitation of Western Siberian oil and gas reserves, or for more narrowly defined goals such as a ship-building development program.¹¹ Program management effectiveness depends on the ability to isolate a high-priority goal from the general economic structure. High priority and privileged access to supplies and organizational talents, though, can disrupt the plans of others and impose an additional burden on the already taxed capabilities of less privileged managers. As Berliner notes, when the source of problems is systemic, the creation of remedies by exceptions only adds complexity and arbitrariness to resource use and decisionmaking.¹² Therefore, to the extent that program planning is effective, it contributes an additional impediment to innovation and effectiveness for the nonfavored residual claimants of resources.

¹¹Ibid., p. 479.

¹²Berliner, *The Innovation Decision*, p. 78.

III. THE FAVORED SITUATION OF SOVIET DEFENSE INDUSTRY

EFFECTIVENESS AND EFFICIENCY

Analysis of the sources of defense industry "magic" should clearly separate notions of "efficiency" and "effectiveness." Broadly speaking, Soviet weapon development and production have been effective in an international, military context. But according to a growing volume of evidence, the efficiency of Soviet defense R&D and production is questionable, especially for the more technologically advanced and complex types of equipment.

Although the defense sector has been buffered from many of the inefficient practices and incentives of the civilian economy, it is essentially part of the same system. Moreover, it supplies a knowledgeable customer who makes exacting demands with the state's resources to back them up. The combination of a weakly motivated economic system, exacting demands, and a fat-cat customer has supplied the elements for an industry with low cost-consciousness.

Anecdotal evidence describes many of the same processes in defense establishments that degrade efficiency in civilian enterprises, and for the same reasons. Soviet efficiency in producing contemporary, technologically advanced military hardware is especially low compared with U.S. practice. Recent intelligence analyses suggest that the resource cost of Soviet weapon procurement has doubled in the past decade, whereas had these weapons been produced in the United States, the cost would have grown by only about 15 percent. "They are at best slightly less productive in manufacturing trucks and ships but grossly inefficient compared to the U.S. in producing high-tech guidance systems."¹

This inefficiency of the Soviet defense production sector may not be fully apparent to Soviet planners and leaders because the full cost of output is not always reflected in the prices that the defense ministry pays for its products.² As *khozraschet* is introduced into defense plants, though, enterprise managers are making increasing numbers of complaints that they cannot generate profits under the existing pricing practices where monopsonist-established prices do not cover the costs of production.

¹Defense Intelligence Agency, *Defense Research Comment: The High Cost of Soviet Defense*, DRC118-88, December 1988, pp. 2-3.

²This point is taken up in greater detail in Sec. VIII.

MILITARY INCENTIVES

The highly skilled and experienced military professionals of the Soviet General Staff formulate weapon acquisition requirements and policies in light of the always-changing nature of the technical level and capabilities of the forces opposing them. Real, international competition generates a phenomenon that is rather rare in the Soviet Union: a buyer operating under incentives leading to choices, that—to an outside observer—appear to be rational. This rationality is combined with political authority, which transforms the defense industrial sector into a buyer's market dominated by consumers. Unlike most other actors in Soviet economic affairs, the military and the defense industrial managers in general actually choose what they *ought* to choose: They are astute buyers. This is not to deny that distorted prices and the loosened constraints brought about by long-term budget growth have induced many deviations from strictly optimal behavior, but the military has been given something that others do not have: authority to cope with uncertainty and risk, and the ability to escape the customary Soviet preoccupation with the narrowly defined efficiency of producers at the expense of the utility of users.

MILITARY INDUSTRY'S ACCESS TO SUPPLIES

Military industry has customarily been given first priority in its access to materials and the outputs of other enterprises. Beginning with planning at the highest level, the military allocation (as determined by the interplay of politics, economics, and military demands) is satisfied first, with the rest of the economy treated as a residual.³ In production plans at enterprises, military orders must be completed before the demands for other customers. Capital equipment in short supply goes first to military plants, and then the remainder is allocated to lower priority enterprises. Advanced, high productivity foreign equipment, both bought and stolen, flows to military producers. Not only supplies and equipment, but also high-quality workers and managers have been channeled to the military-industrial sector, where they have been rewarded with high salaries, bonuses, and other perquisites such as housing.

To guarantee the quality of its inputs, the military itself manages a network of military representatives at production plants producing final goods or inputs for the military customer. These representatives

³A. S. Becker, *Soviet Central Decisionmaking and Economic Growth: A Summing Up*, R-3349-AF, The RAND Corporation, January 1966, pp. 9, 19-21.

have the responsibility and authority to reject output that does not meet the contractual specifications and to work out corrective procedures with local managers.

Even more than in civilian industry, the military industrial ministries and factories try to assure that as many of its supplies and inputs are produced under its control as possible. For example, the Ministry of Aviation Industry includes aluminum production capabilities and rubber plants for tire production.

In short, military producers escape many of the effects of a seller's market. They insist on the meeting of agreed quantities, qualities, and schedules. And they have the advantage of planning priority, delivery authority, and independent on-the-scene inspection by authoritative experts to implement their demands.

Party and government organs contribute to the reduction of supply uncertainties to military industry. As part of their general function of obtaining supplies for enterprises under their jurisdictions, local Party secretaries pay special attention to military production. They can divert needed supplies from civilian plants to military plants, comb the local area for reserves, and call on their comrades in other areas to do the same in exchange for commodity trades or future favors. Local Party leaders can use political pressure on producers to speed up production to meet deadlines, find transport equipment to move available goods, and otherwise attempt to solve the thousands of bottleneck problems that afflict Soviet industry. Some analysts claim that these functions legitimize the roles of local Party leaders, impeding reforms that would eliminate these functions and therefore the local Party's status and main *raison d'être*.

When solutions to supply problems cannot be dealt with on the local level, officials can ascend the Party hierarchy, seeking resolution at higher levels. At the top, the Party Secretary overseeing the Defense Industry Department of the Central Committee can presumably call on the entire national economy to solve a critical military industrial supply problem, mobilizing the planning and supply agencies, industrial capabilities, and stocks and reserves. The Party, therefore, both establishes the priority of the military sector and, in its deployed capacity throughout the country, stands ready to help implement its own policy.

The Party is aided in this task by the VPK, an agency that is nominally attached to the Council of Ministers but is closely supervised by the Party Secretary for Defense Industry. The VPK is primarily an implementing organization of military-industrial policy rather than one that originates policy. One of its primary jobs is to coordinate and police military priorities throughout the economy and to see that decisions are actually carried out. The VPK participates in planning of

weapons R&D and procurement at the national level with Gosplan,⁴ the Academy of Sciences, and the State Committee for Science and Technology (GKNT). With a supraministerial role and commensurate authority, its instructors have the knowledge, skill, and power to enforce compliance with contracts and program plans; apparently they are not reluctant to use these powers, even if fulfilling military demands has adverse consequences for lower-priority users.

Two modifications to this rather bald description of priority are necessary to bring it closer to reality. First, although the military has priority, and this is recognized and acted upon throughout the system, the actors at all levels are not unaware of the harm done to other sectors of the society by slavish attention to military demands. Decision-makers and Party leaders will fight sharp changes in military requirements if the changes drastically disrupt established plans and relations. From the top budget and planning agencies down to the low-level supply organizations, there is evidence that "reasonable" and "customary" military demands will be more or less automatically satisfied but that unreasonable requests will be opposed or compromises sought. Over the long run, however, military industry has been successful in obtaining what it needs, while being sensitive to what the economy can provide—at least in the short run.

The second modification has to do with the proliferation or "blizzard" of priorities. As with many other units of exchange that are not backed by real resources, it is all too easy for the authorities to issue more priority than the available production capacity can support, thus leading to inflation. There has been just such an inflation of priority in military production. Enterprises overbooked with priority orders end up by fulfilling those that are the easiest to produce. Orders get Highest Party-Government Priority, Council of Ministers Priority, Ministry of Defense Priority, VPK Priority, industrial ministry priority, and so on down the list. As priorities proliferate, military industry becomes more like the civil sector, with all of the attendant problems of tautness and a seller's market.

THE POLITICAL SOURCES OF EFFECTIVENESS

The effectiveness of Soviet weapons acquisition has depended on the granting of special rights and privileges to the defense establishment by

⁴The chronicle of events in the Council of Ministers, for example, noted a joint presentation by Gosplan and the VPK on the draft plan of the defense complex for the coming year. "Chronicle, In the Presidium of the Council of Ministers of the USSR," *Pravitselstvenny Vestnik*, No. 18, September 1989, p. 3.

the political leaders. Effectiveness largely flows from political decisions and choices. The special rights granted to Soviet defense include:

1. The privilege of the customer—the Ministry of Defense—to be a demanding buyer. It can expect contracts to be honored; it can enforce performance; it can refuse to accept defective products.
2. The privilege of defense industry to receive priority in the planning and delivery of materials and supplies. It is assigned the best managers; it has been able to attract top technical specialists; in a shortage economy, it is afforded first access to supplies.
3. The defense effort has been given the right to the large volume of resources needed to meet military requirements.

These three rights granted by the political leadership to the nation's defense have permitted defense managers to operate with greater flexibility and less uncertainty than managers in the civil sector. Although the Soviet economic system and decisionmaking practices impose considerable caution and conservatism on defense industry managers and designers, they have sufficient assurances of material support to confidently develop and use new technology in military equipment. In the almost 60 years of experience with this structure of resource allocation, defense industry leaders have developed a management style and organizational approach that deals effectively with the system in which they operate. However, without the political backing for buyer dominance, supply priority, and a large share of resources, defense industry would operate at close to the levels of effectiveness exhibited by civilian industry. Although there are some high points in the product design and cost situation in Soviet civilian branches, overall performance is generally less than the purely technical abilities of Soviet civilian industry would lead a Western analyst to expect.

Over the years, Western analysts have described several methods to increase the effectiveness of the Soviet civilian economy, including: (1) reform of the economic system, bringing it more in line with Western capitalist economies to obtain greater output from available resources; (2) reallocation of resources from defense to civilian uses; and (3), in the absence of economic reform, shift of implementation priority of supply in the tautly planned economy from defense to civilian production. Economic reform, so far, is largely a stillborn policy under Gorbachev's *perestroika*. The policy of conversion, as it has evolved over the past two years, turns out to incorporate a good deal of resource reallocation. Preliminary evidence indicates at least a partial

shift in implementation priority, although the actual persistence and consequences of such a shift will have to be carefully monitored to assess the longer term effects. Underscoring the shift in priorities, prime minister Ryzhkov told the Supreme Soviet that the main value impressed upon defense production ministers was the "exceptional importance of measures aimed at conversion of defense production facilities and their redesignation to the production of consumer goods, alongside the need to equip the USSR Armed Force."⁵ Thus, the Soviet leadership has firmly embarked on at least one and a half new policies. Conversion now reflects political changes that deviate from the Stalinist value system embedded in past practice and institutions.

DEFENSE INDUSTRY GOVERNANCE

An issue of great importance is the question of governance, for it is through political and administrative governance that priority has been assigned and implemented. The chief instruments of governance are the Military Industrial Commission and the ministerial structure under it, and the Party apparatus. The fact that the former VPK Chairman was appointed head of Gosplan at about the time of increased civilian responsibilities for the defense complex may have been coincidental, but it also suggests that the political leaders wanted a knowledgeable defense manager in the chief planning job.⁶ Meanwhile, the VPK apparently has been given responsibility for coordinating the activities of civilian production in the defense complex, for producing conversion plans, and perhaps for the broader planning and coordination of food processing equipment production and the other tasks and plans assigned to the defense production complex. Some evidence suggests that a new directorate has been created in the VPK overseeing civilian output.⁷ Similarly, defense production ministries have added new directorates or deputy ministers since early 1988 with apparent responsibility for civilian goods.⁸ The VPK chairman has been a leading

⁵"Report by N. I. Ryzhkov, Chairman of the USSR Council of Ministers," *Pravda*, June 28, 1989, p. 2 (FBIS-SOV-89-123, June 28, 1989, p. 38).

⁶Prime Minister Ryzhkov, responding to criticisms of Supreme Soviet delegates over confirmation of Yu. D. Maslyukov as Gosplan chairman, remarked that as VPK chairman he had to face broad economic and technological matters, as well as complex organizational problems. "Ryzhkov Addresses Joint Chambers," Moscow Television, June 10, 1989 (FBIS-SOV-89-111-S, June 12, 1989, p. 77).

⁷For example, V. Komarov, who has been identified as a VPK department chief, has written on defense industry conversion plans. "Action," *Pravitelstvenny Vestnik*, No. 18, September 1989 (FBIS-SOV-89-191, October 4, 1989, p. 108).

⁸The Ministry of General Machine Building, for example, has a Department of Consumer Goods. "Defense on the Defensive," *Sotsialisticheskaya Industriya*, September 21, 1989, p. 2 (FBIS-SOV-89-191, October 4, 1989, p. 104).

public spokesman for the conversion to civilian output, and individual ministers have taken personal responsibility for meeting planned outputs in their own spheres of influence. At the very least, then, one can say that civilian production has the attention of the top industrial leaders. And if this effort has captured the time, concentration, abilities, and energies of management, then defense production must have less of these scarce resources.

As part of a general industrial restructuring, the defense production complex was partially reconfigured,⁹ with the new ministry apparatus intended to lay its main stress on strategic issues of technology and investment, rather than on economic management.¹⁰ Although the plan is not to create superministries that would strengthen their monopoly position and their departmental diktat, it is difficult to see how increased centralization will be avoided, especially since technology strategy and investment lie at the core of industrial control.

So far, civilian production in defense industry has not been granted the implementation priority of defense, as defense production managers have been sadly reminded when they are forced to confront the vagaries of the civilian supply system. But even though civilian output does not carry the legal stamp of priority, it is often the high-level attention to the problems and processes of production that matters. In that sense, there appears to be a transfer of priority to civilian matters. But how long will it last? Will it survive another season, another year? Since it flows from political power and administrative methods, the political pressure must be maintained—and institutionalized.

The requirement for priority in the Soviet economy was formally recognized by the government late in 1989. In a speech to the Congress of People's Deputies reporting on the state of economic reform, Prime Minister Nikolay Ryzhkov stated, "The granting of economic priorities is required for civilian production in the defense sector."¹¹ This declarative

⁹The "defense complex" now comprises (a) six production ministries, (b) two ministries for civil aviation and communications, and (c) the State Committee for Computer Technology and Informatics. The six production ministries are: aviation production, shipbuilding, defense production (ordnance and conventional weapons), general machine building (ballistic missiles), radio production (electronics products), and electronics production (components). The new communications ministry combines the old communications transmission and equipment production ministries. The former medium machine building ministry (nuclear weapons) was included in a new energy ministry in the "fuels and energy complex." See "Government of the Nation," *Pravitelstvenny Vestnik*, No. 18, September 1989, p. 2.

¹⁰Speech by Nikolay Ryzhkov to the USSR Supreme Soviet, Moscow Television Service, June 10, 1989 (FBIS-SOV-89-111-S, June 12, 1989, p. 75).

¹¹Nikolay Ryzhkov, "Effectiveness, Consolidation, and Reform are the Way to a Healthy Economy," *Izvestiya*, December 14, 1989, pp. 2-4 (FBIS-SOV-89-239, December 14, 1989, p. 64).

policy marks a sharp break from early formulation of conversion methods; however, there is no evidence yet of implementation of such a policy.

With the continued planned and centralized orientation of the Soviet economy, the reduction of military implementation priority—were it to occur—would require a rooting out of decades of practice and habit, beginning at the top-most planning levels, reaching down through Party cadres and economic managers at the lowest levels. It would mean, for example, that if aluminum sheet were in short supply, it would more probably end up at a toaster factory than at a MiG aircraft plant. Countless thousands of daily decisions, made according to powerful institutional incentives, reinforced by 50 years of habit and experience, would have to be reshaped according to new priorities. All of the Soviet experience suggests that, to be effective, such a change in values and policies would require a massive mobilization campaign, wholesale removal of old cadres and appointment of replacements, and visible punishments and rewards to emphasize that the desired performance, on which incentives are based, had indeed changed.

The most direct source of political pressure has been the Defense Industry Department of the Central Committee Secretariat, and the secretary responsible for the department. It is notable that the central committee departments with economic sector oversight were disbanded in late 1988, except for the agrarian and defense industry departments. Gorbachev stressed that the decision to retain these two departments was necessary at the current stage of reform but that they may easily be dissolved in the future.¹² The other departments were replaced by commissions with broad social and political mandates, but often with seemingly little power. For the moment, then, the Central Committee secretary and department for defense industry still exist and continue to wield Party political sanctions over defense industry activities.¹³ However, the Party secretary for defense industry also has been active in areas far removed from defense: pollution and environmental issues, to name just two additional responsibilities. Thus, the content of this position has been broadened, with presumably less attention being given to defense-industrial matters.

A new feature in Soviet politics that changes the balance of forces affecting the resource and implementation priority of defense is the process of democratization and the emergence of an independent public

¹²Alexander Rahr, "Who Is in Charge of the Party Apparatus?" *Radio Liberty, Report on the USSR*, April 14, 1989, p. 21.

¹³In addition to the Central Committee department, 42 departments and 10 "sectors" have been preserved for defense industry in local Party committees. *Izvestiya TsK KPSS*, January 1989, p. 90.

opinion as voiced through the press, elections, and the legislative organs of the Supreme Soviet and Congress of People's Deputies. Initiated by Gorbachev's reforms, popular preferences now have a more important role in establishing the leadership's policies. A strident newspaper article examining the response of the "competent authorities" to shortages of consumer goods noted, "The opinion of the public has been molded and cannot but affect (and has indeed affected!) the subsequent actions of these authorities."¹⁴ Indeed, the focus of defense industry on food-processing equipment and consumer goods directly reflects such political attention to popular concerns. Therefore, the fate of conversion is closely linked with the fate of political reform.

A standing committee on military affairs has been established in the new Supreme Soviet, a move that several Party leaders, including Foreign Minister Shevardnadze, have been promoting for several years. The chairman of this committee, V. Lapygin, has declared that it will consider the most important issues "starting from the strategy of arming and providing for defense . . . to producing and manufacturing this equipment."¹⁵ By 1989, the committee was focusing on budgetary issues, having been advised of the importance of controlling the purse by members of the U.S. House Armed Services Committee. Soviet defense committee members, however, complained of the lack of specificity of budgetary formulations and stated that they had many questions for the General Staff and Defense Ministry.¹⁶ This approach is another step in breaking down the monopoly over information and expertise formerly held by the professional military and is a major step in transferring stewardship of the defense complex to a broadly based civilian body.

The creation of the Supreme Soviet defense committee and the additional tasks of conversion placed on party cadres may have diffused the focus that Party personnel were formerly able to bring to defense production affairs: Not only has another high-powered body taken responsibility for what had been a central Party concern, but those concerns themselves no longer hold undisputed top priority. These factors evidently have begun to affect Party performance in the defense industry sphere. Politburo member and former Moscow party leader L. N. Zaikov complained to a conference on defense conversion in the capital region of "a decline in the attention devoted to the work of

¹⁴I. Klimenko, "Defense on the Defensive," *Sotsialisticheskaya Industriya*, September 21, 1989 (FBIS-SOV-89-191, October 4, 1989, p. 102).

¹⁵Remarks by Vladimir Lapygin, Moscow Domestic Radio Service, June 28, 1989 (FBIS-SOV-89-124, June 29, 1989, p. 37).

¹⁶Moscow Radio Domestic Service, October 6, 1989 (FBIS-SOV-89-194, October 10, 1989, p. 55.)

defense complex enterprises by *rayon* party committees, ministries' party committees, and the *gorkom* defense department."¹⁷ Zaikov, who also had been the Party's defense industry secretary, warned Party activists that the view embodied in the assertion, "given the division of functions, this is not the Party's concern," was "a dangerous illusion."¹⁸ It thus appears that the major political, organizational, and policy shifts of the past two years are beginning to be reflected at the working level of Party organizations and that the undisputed attention to defense is now waning.

If the Supreme Soviet Committee exercises vigorous oversight over defense matters or the Central Committee defense department is disbanded, the priority of defense could be drastically reduced and an organ like the VPK could end up with the same dilute capabilities as the civilian Machine Building Bureau. The future status of priority will be signaled by the authority, organizational changes, and cadre policies at the Central Committee, republic, and *oblast* levels. If defense industry departments are disestablished or their personnel reassigned, then the main method for implementing political priorities in defense production will have been eliminated.

¹⁷"Conversion: The View from the Capital," *Pravda*, October 24, 1989, p. 4 (FBIS-SOV-89-207, October 27, 1989, p. 95).

¹⁸*Ibid.*

IV. OVERVIEW OF POLICY ON DEFENSE INDUSTRY CONVERSION

SEEKING THE MAGIC OF THE DEFENSE SECTOR

Mikhail Gorbachev has perpetuated his predecessors' penchant for using defense industry methods and managers to stimulate civilian production. Gorbachev has transferred defense industry managers to the civil production sector, imitated the coordinating and executive functions of the VPK by establishing similar commissions for the machine-building and agroindustrial sectors, and tried to duplicate the clout of a buyer's market by establishing a civilian counterpart to the Ministry of Defense in the State Acceptance Commission (*Gospriemka*).¹ Unfortunately, none of the magic that seemed to inhere in defense production has been captured in these hapless imitative ventures.

Since the magic could not be transferred out of the defense production sphere, then perhaps, Soviet leaders seem to have concluded, civilian production within the defense complex would be touched by the elusive qualities. Since early 1988 efforts to increase the civilian output of defense industry have accelerated. This new policy marks a break with past efforts to harness defense industry to civilian output: It encompasses the application of defense resources as well as its magic.

A CONVERSION CHRONOLOGY

Conversion of defense industry capacity to civilian purposes has been the subject of at least four, possibly more, economic plans, and the number appears to be growing.² Soviet high-level economic managers have discussed these plans and goals in a consistent manner but often merge them into the general category of "conversion."

¹A list of such transfers is given in Paul Cocks, "Soviet Science and Technology Strategy: Borrowing from the Defense Sector," in Joint Economic Committee, 100th Cong., 1st Sess., *Gorbachev's Economic Plans*, Vol. 2, November 23, 1987 (S. Prt. 100-57, Vol. 2).

²VPK Chairman Belousov has spoken of ten troubled areas to which defense industry resources will be applied: (1) agricultural processing equipment, (2) light industry equipment, (3) equipment for trade and catering, (4) consumer goods, (5) electronics, (6) computers, (7) medical equipment, (8) communications, (9) civil aviation, and (10) sea transport and fisheries. Remarks by Igor Belousov, Moscow Domestic Radio Service, June 28, 1989 (FBIS-SOV-89-124, June 29, 1989, p. 37).

Plans for the use of defense capacity have been developed for (1) processing equipment for the agroindustrial complex, (2) equipment for light industry, and (3) complex goods for consumers. Party Secretary Baklanov, who is responsible for oversight of defense industry, conveniently mentioned these three plans in a single sentence: "It is already possible to say that the defense complex's scientific and production potential is starting to work soundly on increasing consumer goods production, as well as production of the latest equipment for light industry, and on the processing sectors of the agroindustrial complex."³ A plan for medical equipment may also have been formulated, since defense industry has been charged with increased production of such goods.⁴ Additionally, the projected reduction in procurement of defense equipment has inspired a more comprehensive plan; this last plan may attempt to consolidate the various accumulating demands on the defense production sector and match them with the capacity that will be freed by declining military demand.

To help clarify the evolution of the policies on conversion, the following chronology attempts to array events as they occurred; however, since some of the timing attributed to this behavior became evident a year or more after the event, some of the chronology is only approximate.

An October 1987 Central Committee conference on the food processing sector of the agroindustrial complex led to the subsequent development of a comprehensive plan, which included defense industry, for increasing output in the 1988-95 period. Apparently as a consequence of the decisions taken at that time, the Ministry of Machine Building for Light and Food Industry and Household Appliances (Minlegpishchmash) was disbanded on March 1, 1988, and 220 of its plants transferred to defense industry ministries,⁵ although the decision had apparently already been made the previous November. Party Secretary V. Filimonov of the disbanded ministry realized that something was afoot as early as November 1987. "When they telephoned me back in November and said that it was not expedient to hold a Party meeting on problems associated with restructuring in our branch, I realized that some decision was being prepared with respect to our ministry."⁶ The deputy minister of the Ministry of Defense Industry confirmed this chronology: "The decision on

³Moscow Television, "Vremya" newscast, December 23, 1988 (FBIS-SOV-88-250, December 29, 1988, p. 42).

⁴"Goods for the People Off the Military Production Line," *Sovetskaya Rossiya*, February 10, 1989, p. 1 (FBIS-SOV-89-028, February 13, 1989, p. 82).

⁵"Aiming for a Breakthrough," *Sovetskaya Rossiya*, February 28, 1988, p. 3 (FBIS-SOV-88-041, March 2, 1988, pp. 61-65). The disbanded ministry possessed 260 factories, but only 220 have figured in the transfer. The other 40 may have ceased activities.

⁶"Reportage from Abolished Ministry," *Pravda*, March 2, 1988, p. 1 (FBIS-SOV-88-047, March 10, 1988, p. 57).

the transfer of civilian enterprises turning out agricultural products processing equipment was adopted late in 1987. . . . Resources were promptly allocated from the ministry's [of Defense Industry] reserves."⁷ By mid-March, the Ministry of Radio Industry had established a ministerial review body to coordinate the transfer of Minlegpishchmash plants and the increased output of civilian goods.⁸

In early February 1988, VPK Chairman and long-time defense industry manager Yu. D. Maslyukov had already been appointed to head the state planning agency, Gosplan. This appointment was consistent with the trend of transferring defense managers to civilian jobs, but it also may have been influenced by the intention to increase involvement of defense industry in broader economic affairs.

The Council of Ministers published a package of resolutions dealing with increased output of civilian goods in August 1988. One resolution in particular instructed defense industry ministries to increase production of specified consumer products.⁹ This resolution was followed up in October 1988 with a decree on measures to raise the incentives to enterprises in defense industry and heavy industry to expand consumer output.¹⁰

About a year after the Central Committee conference on the food-processing industry, the regional press mentioned in October 1988 and VPK chairman I. S. Belousov confirmed in January 1989 the existence of a comprehensive targeted program for the agroindustrial processing industry, including the participation of defense plants.¹¹ These plans included a rigid schedule and assignments of product types and volumes to specific ministries.¹²

Then, at the United Nations in December, Gorbachev announced a 14.2 percent reduction in military expenditures, including a 19.5 percent cut in arms and military equipment procurement. Deputy Defense Minister for Armaments General B. Shabanov noted in early January that the announced cutbacks were already being implemented. By February 1989, Belousov referred to the elaboration of a plan to work

⁷V. Bykadorov, "On Peaceful Conveyors," *Selskaya Zhizn*, August 15, 1989, p. 2 (FBIS-SOV-89-162, August 23, 1989, p. 100).

⁸"Refrigerators for the APK," *Ekonomicheskaya Gazeta*, No. 48, November 1988, p. 4 (JPRS-UMA-89-003, February 13, 1989, p. 59).

⁹"In the USSR Council of Ministers," *Prauda*, August 21, 1988, pp. 1-2 (FBIS-SOV-88-165, August 25, 1988, p. 50).

¹⁰"An Addition of 15 Billion," *Izvestiya*, October 15, 1988, p. 2.

¹¹See the analysis of Erik Whitlock, "Krasnodar Conference Discusses Scientific-Technical Base of Agriculture," *Radio Liberty Research Report*, RL557/88, December 5, 1988, p. 4.

¹²"A Peaceful Vocation for Defense Industry Plants," *Izvestiya*, January 3, 1989, p. 2 (FBIS-SOV-89-003, January 5, 1989, p. 52).

out the scale and detail of defense production conversion. The new plan was explicitly tied to the reduction of military output stemming from the 19.5 percent announced defense production reduction. Belousov justified the reductions in terms of the lower demands arising from the INF treaty, the ongoing negotiations on strategic arms that foresaw 50 percent reductions, and the "significantly improving international climate."¹³

Defense industry support of light industry was mentioned by a Gosplan deputy chairman in September 1988,¹⁴ with details filled in by Belousov in early February 1989.¹⁵ His figures and his formulation of the light industry plan were repeated by Secretary Baklanov a month later.¹⁶

The defense production cutbacks announced earlier evidently began to affect specific plants almost immediately. The Minister of Defense Industry, P. Finogenov, said that in his whole career in defense industry, "I can't recall such a major switch as that which started last year."¹⁷ And a group of enterprise directors in a round-table discussion said that a "reduction of defense expenditures by five percent has produced quite an effect in virtually all branches."¹⁸ When one director mentioned that he was notified of the cancellation of one order on December 29, another responded: "That's not too bad. One of our orders was voided in March." These cancellations were sudden and unexpected, leaving the enterprises without a plan, without orders, and without inputs or financing, but with factories full of employees and managers expecting to be paid their regular salaries; this situation sent the managers scurrying to find civilian work to fill up the released capacity.

Events now seemed to be moving faster than could be accommodated by the planning process; toward the end of March 1989, Deputy Defense Minister V. M. Arkhipov could only point to "a *partially*

¹³"Goods for the People Off the Military Production Line," *Sovetskaya Rossiya*, February 10, 1989, p. 1 (FBIS-SOV-89-028, February 13, 1989, p. 82).

¹⁴L. B. Vid, "1989 Plan: Reference Points for Growth," *Ekonomicheskaya Gazeta*, No. 37, September 1988, p. 4 (FBIS-SOV-88-202, October 19, 1988, p. 81).

¹⁵"Goods for the People Off the Military Production Line," *Sovetskaya Rossiya*, February 10, 1989.

¹⁶"The Far East's Potential at the Service of Restructuring," *Pravda*, March 12, 1989, pp. 2-3 (FBIS-SOV-89-048, March 14, 1989, p. 44).

¹⁷"Instead of Missiles and Tanks," *Pravda*, March 14, 1989, p. 2 (FBIS-SOV-89-050, March 16, 1989, p. 29).

¹⁸"How to Beat Swords into Ploughshares," *Moskovskaya Pravda*, March 21, 1989, pp. 1-2, (FBIS-SOV-89-069, April 12, 1989, p. 55.) The 5 percent reduction in defense expenditures mentioned in this discussion could be the first portion of the 19.5 percent figure stated by Gorbachev.

elaborated plan for the conversion of military production, the utilization of defense industry equipment, buildings, and facilities for civilian production, and the redistribution of material thus released into the national economy."¹⁹ By the beginning of May 1989, leaders of the Ministry of Machine Building began to speak in tones of distress, if not panic: "In cutting back military programs so drastically, we had to resolve the problem of how, in a very short space of time—basically simultaneously with in-depth conversion—to fully exploit our branch's potential."²⁰

Speakers at a June 1989 military conference on defense industry conversion and *khozaschet* complained that there had not been a "comprehensive concept for the development of the Armed Forces that takes into account not only the changes in military doctrine, but also the new socioeconomic developments."²¹ By July, it could be announced that working groups for a national conversion program had been set up in the Central Committee, Defense Ministry, Foreign Ministry, Gosplan, and other ministries and departments. Work, however, was apparently at a preliminary stage; actual conversion was going on spontaneously—stimulated by the cancellation surprises of military orders.²²

The new Supreme Soviet Defense Committee in early August discussed guidelines for a state conversion plan that the Congress of People's Deputies had ordered the government to finalize by the end of 1989. This end-of-year due date for the plan became the formula adopted by most commentators on the subject, as many defense industry enterprise managers struggled to cope with their loss of military orders.

The Ministry of Aviation Production's plants, design bureaus, and research institutes have all experienced the effects of declining military demand. In a survey of the Soviet aviation industry by the magazine *Aviation Week & Space Technology*, defense cutbacks were influencing the future plans of all the establishments its journalists visited. With the decline of military orders, the defense share of output of the Zaporozhye aviation engine production association fell from 35 percent

¹⁹"Warship for Sale," *Sovetskaya Rossiya*, March 23, 1989, p. 3 (FBIS-SOV-89-056, March 24, 1989, p. 84); emphasis added.

²⁰"Goods Instead of Shells," *Izvestiya*, May 1, 1989, p. 2 (FBIS-SOV-89-066, May 5, 1989, p. 83).

²¹Major I. Ivanyuk, "Defense, Conversion, Economic Accountability," *Krasnaya Zvezda*, June 29, 1989, p. 2 (FBIS-SOV-89-130, July 10, 1989, p. 106).

²²A. Isyumov, "Conversion? Conversion! Conversion . . .," *Literaturnaya Gazeta*, July 12 1989, p. 11 (FBIS-SOV-89-141, July 25, 1989, p. 100).

in 1988 to 27-30 percent in 1989.²³ In the formerly all-military Sukhoi design bureau, four new civil designs are in progress. The goal is to expand civil aircraft activities to 50 percent of the design bureau effort. General designer Mikhail Simonov has said that the shift is prompted by substantial military spending cuts.²⁴ In the Progress engine design bureau (previously headed by general designers Ivchenko and Lotarev), the scaling back of military production has led to the recent decline in the technical work force.²⁵ The exporting agency Aviaexport is attempting to push civil aviation sales and consumer goods produced in aviation plants to ameliorate the projected 20 percent reduction in primarily military aviation production in 1989.²⁶ And in late 1989, G. I. Zaiganov, the head of the premier Central Aero-hydrodynamic Research Institute (TsAGI) was actively seeking joint ventures in the United States, noting, "I have thousands of talented scientists, engineers, mathematicians, and programmers, and unique types of equipment such as hypersonic wind tunnels, that can be put to commercial aviation use. We can offer cheap, experienced brain power to a world market."²⁷

This sequence of events indicates an accelerated pace of defense industry involvement in civilian output since early 1988. Events began to move faster than plans and enunciated policy; cancellations of defense orders occurring in late 1988 and early 1989 seem to have resulted from the defense expenditures reduction policy rather than from the narrower INF treaty obligations, for which there was considerable planning lead time. Defense plants were being told of cancellations without the opportunity to plan or prepare for alternative outputs. Oleg I. Malyga, a missile design bureau designer with 32 years experience, three special state awards, and 56 inventions to his credit told about his dismay at the turn of events: "I was shaken by the news—no one now needed what I had been doing all my life. I heard about it at a very large meeting that I attended as an expert."²⁸

²³"Motorworks Taps Skills of Several Factories to Produce Powerplants," *Aviation Week & Space Technology*, June 5, 1989, p. 50.

²⁴"Sukhoi Design Bureau Expands Civil Aircraft Development Efforts," *Aviation Week & Space Technology*, June 5, 1989, p. 90.

²⁵"Progress Engine Design Bureau Responsible for Wide Product Line," *Aviation Week & Space Technology*, June 5, 1989, p. 48.

²⁶"Aviaexport Exports Surge in Foreign Orders After Release of New Transports," *Aviation Week & Space Technology*, June 5, 1989, p. 38.

²⁷Personal communication, November 1989.

²⁸"The Economics of Disarmament," *Sotsialisticheskaya Industriya*, April 13, 1989, p. 2 (FBIS-SOV-89-080, April 27, 1989, p. 10).

THE NECESSITY OF CONVERSION PLANS

While the rapid sequence of conversion activities has overtaken the system's capacity to produce clearly articulated plans, the main goals of conversion have been stated repeatedly, and they amount to a substantial planned contribution by defense industry to civilian output in the years to 1995. One of the main reasons for the necessity of specific and detailed conversion plans is the lack of fungibility of budgets and monetary resources. Simple reallocation of budgets is insufficient in the Soviet economic system to assure the output of a new mix of products. Such a redirection must be explicitly planned and commanded by the central authorities. This requirement was graphically described by the chief designer and director of a defense industry institute:

In the absence of the ruble as a yardstick, . . . and with arbitrary prices, it is impossible to simply take a ruble out of, say, tank production and increase (let us say) the pensions of retirees. The wages that used to be paid to the workers at a tank plant will still have to be paid to them. The funds actually freed up from outlays for the metal of tanks consist of entirely different rubles, which do not turn directly into wages.²⁹

This point was reiterated by the chief designer of an aviation design bureau: "We have thirty kinds of rubles—for wages, planned materials, foreign goods, manufactured goods, profits, investment—and not one of them can be substituted for another."³⁰ In the Ministry of Instrument Making (Minpribor), *khozraschet* has given the enterprises the opportunity to earn money, but they cannot spend it at their own discretion.

Enterprises have R500 million under the mattress. . . . They have their own economic "notes"—goals, indicators, normatives, incentives—governing the tunes they can play that lead production away from the goals proclaimed in the decisions of high party and state agencies . . . and the products the country needs.³¹

Another barrier to defense industry enterprise autonomy in conversion activities is that organizations often do not possess all of the necessary functions for independent behavior. Research institutes, design bureaus, and production facilities specialize in their own narrow range of activities. Integrated firms possessing the combined capabilities of such a Western company as Boeing do not exist. In recognition

²⁹Statement of Ye. O. Adamov, general designer and director of the Power Equipment Institute, in "How to Beat Swords into Plowshares," *Moskovskaya Pravda*, March 21, 1989, p. 1 (FBIS-SOV-89-069, April 12, 1989, p. 54).

³⁰Personal communication, November 1989.

³¹*Sotsialisticheskaya Industriya*, April 25, 1989, p. 1 (FBIS-SOV-89-082, May 1, 1989, p. 83).

of this problem of fragmentation and dispersal of functions, Party Secretary Baklanov has announced the creation of large associations and amalgamations of some defense enterprises in the Kuybyshev region in preparation for the transition to *khozraschet*.³² However, there is no additional evidence of how widespread this process is likely to be.

But it is not just production and R&D that is fragmented: Investment is controlled by the ministry; supply has been organized by the VPK, the State Planning Committee (Gosplan), and the State Committee for Supply (Gossnab); and demand is formulated by the armaments directorates of the armed services. Moreover, defense industry organizations typically face monopoly suppliers of inputs and do not possess the finance, credit, or organizational freedom to create new suppliers or to recombine their own activities with other potential collaborators.

In the Soviet economy, still dominated by central planning and ministerial authority, defense industry managers see plans as essential; in any event they have little experience in operating in the more fluid circumstances of market-like conditions. As expressed by an economist attached to the Council of Ministers,

It must be said bluntly that most defense sector managers are not ready for this yet (i.e., choosing a new configuration for their output and position in the market for nonmilitary output). They have become accustomed to regular, generous clients, and are unable to analyze and forecast the market situation. . . . Therefore, a *precise, long-term program for the conversion of the military economy is needed*.³³

This expert goes on to note that even though plans are needed, defense enterprises will also have to engage in marketing and learn how to submit to market demands.

The planning process for conversion had been only partly carried out by mid-1989, as Gosplan, the Ministry of Defense, the VPK, defense production ministries, and other organizations grappled with both the theory and practical realization of large-scale and speedy conversion.

All parties do not fully accept the necessity for top-down planning of conversion, however. "Some Soviet specialists" believe that the appropriate approach is for each enterprise to develop its own transition plan.

³²TASS, September 14, 1989 (FBIS-SOV-89-180, September 19, 1989, p. 80).

³³Yu Yakovets, "This was Discussed at the Congress: Inverting the Pyramid," *Sovetskaya Rossiya*, June 23, 1989, p. 2, emphasis in original article (FBIS-SOV-89-127, July 5, 1989, p. 75).

However, others (apparently the dominant school of thought) propose that a national plan of conversion must be compiled first, taking into account changes in defense plans and doctrine, the resources that would be released, and the overall needs of the civilian economy. Only then would the lower-level organizations be able to plan their own operations in a satisfactory manner. Of course, the benefits of a planned economy are expected to give the Soviet Union a special advantage in the creation of "great national programs, as the national plan of conversion must be."³⁴

A third voice in this debate asserts that the very notion of planning conversion runs counter to Gorbachev's economic strategy.

The fact that at present, after the transition of virtually all enterprises to complete economic accountability and self-financing, we have to talk about a *planned* conversion of defense industry enterprises in itself testifies that the economic mechanisms are not working yet. . . . Administrative steps should not be necessary in an environment of efficiently operating state orders.³⁵

However, the move to economic accountability in the defense industrial sector appears to be moving slowly. Full transfer to *khozaschet* by all organizations is not to be attained until the beginning of the next five year plan; the full instructions for implementing *khozaschet* had not been issued by the end of 1989, and movement in this direction is apparently uneven across the different defense production ministries and hundreds of enterprises.³⁶

There is clearly a split in the preferences of defense industry managers between autonomy and plans, with many individuals preferring independence under a reformed economic mechanism but choosing plans under the existing system. A conference on conversion organized by the Ministry of Defense pointed up these conflicts. Many defense enterprise leaders and specialists judged that "it would be expedient if there were no centralized imposition of the full range of output for civilian purposes. Labor collectives ought to be given greater powers to resolve these questions."³⁷ However, many enterprises actually producing according to their own decisions ran into serious problems. A science-production association in the Ministry of Radio Industry lost millions of rubles "due to the demolition of the economic management system [presumably from the

³⁴V. Chernyshev, "Conversion: The First Steps," *Trud*, February 14, 1989, p. 3.

³⁵*Moskovskaya Pravda*, March 21, 1989.

³⁶Personal communication, November 1989.

³⁷I. Ivanyuk, "Defense Conversion, Economic Accountability," *Krasnaya Zvezda*, June 29, 1989, p. 2 (FBIS-SOV-89-130, July 10, 1989, p. 105).

transition to *khozraschet*] and the lack of a clear-cut concept of conversion. . . . Over a period of about 6 months, thousands of people found themselves out of a job."³⁸ This conference also identified difficulties associated with the monopoly position of suppliers, the absence of competition, and the dominance of the "cumbersome, cost-based military-economic mechanism" in relations between industry and the Defense Ministry.

With the stalled transition to wholesale trade called for in the earlier phases of economic *perestroika*, there is a natural desire to rely on the traditional methods of planned supply. A department chief of the Tatar Gosplan remarked, "It is necessary to take the production of agricultural and processing equipment at defense complex enterprises out of the decentralized order process. They should be granted state orders, which provide material-technical resources."³⁹

Full-scale planning for conversion seems to be the preferred method of attacking the problem, but there have been complaints that this process is taking too much time. The typical Soviet haste in stimulating greater output can be seen in the evaluation of the conversion process. Prime Minister Ryzhkov was already complaining of delays in October 1988.

The only thing we are not satisfied with is that things are moving here very slowly. Igor Sergeyevich [Belousov], time has been lost. Time has been wasted on organizational issues. While you were dividing up the factories, while ministers were sizing them up, getting used to them, . . . time was marching on, it was marching on inexorably. Today we do not have time to spend years resolving these questions.⁴⁰

In fact, though, many of the conversions are unplanned as enterprise managers find themselves with cancelled military orders and unused capacity. But planning does continue and forms the backdrop for the main discussions on conversion. Indeed, one military expert in the Ministry of Defense goes so far as to call for the adoption of national conversion plans in all countries contemplating reduced defense expenditures. "With the adoption by every interested party of a national plan for conversion, it will subsequently be possible to coordinate such

³⁸Ibid.

³⁹D. Bikov, "Swords Into Plowshares; How the Defense Branches Are Making the Transition to Peaceful Production," *Selskaya Zhizn*, August 1, 1989, p. 2 (FBIS-SOV-89-155, August 14, 1989, p. 116).

⁴⁰Moscow Television Service, October 21, 1988, on Council of Ministers Meeting, October 19, 1988 (FBIS-SOV-88-208, October 25, 1988, p. 55).

plans at an international level, and could make for the most effective organization of this complex process."⁴¹

QUANTIFYING CONVERSION

Plans for defense industry call for the output of enterprises of the "defense complex" designated for "peaceful purposes" to rise from the present 40 percent to 50 percent by 1991 and to 60 percent by 1995. We can decompose this growth in the share into two sources: the announced reduction of approximately 20 percent of defense output that will be transferred to civil purposes, and an additional growth in civilian production capacity in defense industry. Under these assumptions, the plans would call for an absolute growth of civilian output of 10.3 percent annually over the 1989-1995 period, or by roughly 7 percent annually over and above the gains flowing from conversion.⁴²

If the announced 20 percent arms reduction were only the first round of a series of cuts, the civilian production goals would not require the high rates of growth projected in the figures shown above. But it is unlikely that defense output can actually be converted ruble for ruble into civilian uses. Not only will additional investment be needed, but the efficiency of conversion will probably be considerably below 100 percent. Meeting the civilian output goals, therefore, will require either greater cutbacks in defense or more rapid growth of purely civilian capabilities in defense industry; consideration of the present state of Soviet politics and the economy suggests that the former is more likely than the latter, but also that the planned goals will not be achieved.

In line with the typical Soviet method of identifying output by the counting of things, VPK chairman Belousov noted that the comprehensive plan for the processing industry identified 4500 categories of new agroindustrial equipment planned for development and production by 1995, including 3000 by defense industry enterprises. When these plans have been fulfilled, defense industry enterprises will be responsible for R17.0 billion of processing equipment output, or almost half the

⁴¹Ye. Serov, "Coordinated Interstate Actions in the Sphere of Conversion Processes Should Have a Juridical Basis," *Voennyi Vestnik*, July 1989, No. 13, pp. 11-12 (JPRS-UEA-89-024-L, September 12, 1989, p. 9).

⁴²If the present levels of output are indexed at 60 for defense and 40 for civilian, the 20 percent reduction of defense output that is to be transferred to civilian uses would generate an index level of 48 for defense and 52 for civilian output by 1995. An additional growth of the civilian portion of defense industry of 20 index units to 72 by 1995, while defense output remained constant at 48, would place civilian output at the designated 60 percent share of total output.

R37.0 billion total volume of deliveries to the agroindustrial complex. In preparing to design and develop this quantity of new models, over 200 scientific research institutes and design bureaus in the defense sector have already initiated R&D activities.⁴³

The 3500 types of equipment for which defense industry is responsible constitute 36 broader groups of machine systems.⁴⁴ The Minister of Aviation Industry, for example, was given responsibility for five such groups, which include equipment for the processing of fruit and vegetables and the production of starch, syrup, and pasta products; machines for the canning industry; and equipment for the bagging and packaging of dry, free-flowing products. The Minister of Aviation Industry, A. S. Systov, personally attested to the Council of Ministers that his ministry would successfully implement production of the first modern, Soviet-made macaroni production lines within a year.⁴⁵

Between 1988 and 1995 (that is, within eight years), defense industry is being called on to increase its production of equipment for light and food industry by 130 percent, or by 11 percent annually. This production will include 140 types of complex consumer durables, 1400 new equipment categories, and "virtually the entire range of machine tools and machines" that light industry requires.⁴⁶ Indeed, it is claimed that 345 defense industry enterprises are already involved in the production of equipment for the food and light industries and in 1989 will account for more than one-fifth of such output.

Belousov noted that military plants had begun civilian production programs in the late 1960s—a move initiated by General Secretary Brezhnev—but that this process was accelerated in the last few years. Defense factories are now manufacturing 2000 categories of final consumer goods, including, in 1988, 10 million television sets, 95 percent of Soviet-made refrigerators, 62 percent of washing machines, and 69 percent of vacuum cleaners.⁴⁷ This list of final consumer goods is planned to be expanded in number and in technical quality.

By the end of the current Five Year Plan on December 31, 1990, the volume of consumer goods manufactured by defense industry is planned to increase more than R4 billion over the 1988 level; this value

⁴³"Goods for the People Off the Military Production Line," *Sovetskaya Rossiya*, February 10, 1989.

⁴⁴"A Peaceful Vocation for Defense Industry Plants," *Izvestiya*, January 3, 1989, pp. 1-2 (FBIS-SOV-89-003, January 5, 1989, p. 52).

⁴⁵Moscow Television, October 19, 1988, p. 54.

⁴⁶*Sovetskaya Rossiya*, February 10, 1989.

⁴⁷These figures probably include the output of the 220 former Minlegpiabchmash enterprises.

is R1.5 billion over the original plan figure—an increase apparently resulting from the new conversion initiatives.⁴⁸

What do these current changes and plans amount to in terms of defense industry capacity and total resources? Defense industry has always produced some supplies and products for civilian industry and consumption, just as civilian industry has supplied the military with inputs ranging from raw materials to finished products. Brezhnev gave a boost to the defense industry's involvement in helping to relieve civilian shortages in the late 1960s and by 1971 could boast that 42 percent of "defense industry" output was then serving civilian purposes. However, it was never clear just what that 42 percent consisted of. The best guess was that it included only production (and not services) of the Ministry of Defense Industry, just one of the nine defense production ministries.

Recent estimates by Blaine McCants⁴⁹ draw on the detailed investigations of Julian Cooper on the civilian production of defense industry.⁵⁰ McCants notes that not all civilian output of the defense sector is in machinery output or in manufactured goods more generally: Construction and other services are also produced, as are non-machinery manufactured goods such as furniture and china tableware. McCants estimated shares of machinery types of output (producer durables and consumer durables) for the period 1965 to 1985; for 1985, he also accounted for the transfer of Minleppishchmah and for the production of nonmachinery goods. However, since many services and some consumer durables are not included in these estimates, they should be considered as minimum lower bounds.

McCants' calculations reveal a doubling of the civilian share of output from 1965 to 1985, with estimates of the 1985 share varying around 40 percent, depending on output definition. In early 1989, Prime Minister Ryzhkov claimed that 40 percent of the products manufactured by defense industry were also nonmilitary items; these same figures have now been mentioned repeatedly. Consideration of the Soviet statements along with the McCants analysis suggests: the civilian machinery output of defense industry in 1988 was around 40 percent of defense industry's machinery production; including consumer durables and other goods, and construction and other services, would add another percent or so; and the transfer of Minleppishchmah raised the contribution by around 3 percent. Altogether, then, total defense industry production of civilian

⁴⁸*Sovetskaya Rossiya*, February 10, 1989.

⁴⁹Blaine McCants, *USSR: Composition of Defense Industry's Output*, unpublished.

⁵⁰Julian Cooper, "The Civilian Production of the Soviet Defense Industry," in Ronald Amann and Julian Cooper (eds.), *Technical Progress and Soviet Economic Development*, Basil Blackwell, Oxford, 1986.

output is around 40-45 percent of total output. Therefore, the current drive begins with a substantial contribution to civilian purposes already being made by defense industry.

The walls between defense and civilian industry that protected defense R&D and production from the deleterious effects of civilian planning and management are now crumbling, and have been for the past decade.

REDRAWING ORGANIZATIONAL BOUNDARIES AND RESPONSIBILITIES

The present plans and policies of using defense industry to bolster civilian production do not alter the fundamental orientation of the Soviet economy. Conversion is a form of the classic Soviet approach to economic growth through "extensive" methods. On the first blooming of the policy in 1987, the leadership was also indulging in an approach that has characterized many past attempts at improvement: redistributing responsibilities and redrawing boundaries. Rather than allowing autonomous units to coordinate and motivate economic behavior through markets, the Soviet philosophy has been to use hierarchical, administrative structures; if one organizational arrangement does not work, the customary solution has been either to redraw boundaries to include more operational units within a manager's authority or to expand the number of functions under the existing organization. This tendency has a long history: If a plant cannot count on its suppliers, then it produces its own inputs internally; if a ministry cannot coordinate affairs with other ministries, then it creates its own autarchic capabilities; if production enterprises cannot deal with research institutes and design bureaus, then the government organizes Science-Production Associations (NPOs); if Academy of Sciences institutes cannot transfer research results to production ministries, then it creates Inter-Branch Science and Technology Complexes (MNTKs); and if defense industry managers and methods do not perform well in civilian industry, then the government transfers civilian production to the defense sector. The redrawing of boundaries to include more activities under a unified managerial umbrella has at times ameliorated some of the systemic deficiencies of the Soviet economy, but it has not altered the main characteristics of the system and has created its own unique set of problems—organizational gigantism, to name just one.

V. APPROACHES TO CONVERSION

The planned growth of civilian output in defense industry can be accomplished in several ways: through the transfer of plants from civilian industrial ministries to the defense complex; through the conversion of entire defense plants to civilian output; and through the "reprofiling" of plants that will also continue to produce defense products.

TRANSFER OF PLANTS TO DEFENSE INDUSTRY

The experience gained with managing the transfer of Minlegpishchmash enterprises to the defense complex has demonstrated the effects of long-term neglect of light industry and of the real demands now being imposed on the defense sector. Among the first things that high-level defense managers discovered was that 60 percent of the equipment at the transferred enterprises was worn out,¹ and that only about one-third of the planned output could actually be produced.

The Minister of Medium Machine Building, L. D. Ryabev, found it necessary to go beyond simply continuing the past patterns of production of agroindustrial equipment. "We have taken upon ourselves the tasks of providing technical servicing for all systems and we are now setting up centers of that kind." The ministry also began to deliver equipment in final, assembled form instead of in knockdown kits, and to adjust it prior to commissioning so that the finished product could be handed over in turnkey condition. They found that this was necessary because "hitherto all of this was uncoordinated, things were not supplied in complete sets," equipment was not properly phased in, and "naturally there were considerable complaints and costs of production" on the part of the buyers of the new equipment.²

This same Ministry of Medium Machine Building, the production ministry responsible for nuclear weapons, was also forcefully introduced to the vagaries of civilian planning. The ministry had introduced a design for a small cheesemaking plant and received an order for 10 units signed by the leadership of the State Agroindustrial Committee. Two weeks

¹Prime Minister Ryzhkov commenting on VPK chairman Belousov's report to the Council of Ministers, Moscow Television, October 19, 1968, p. 55.

²Ibid., p. 54.

later came a request for 2300 systems of the same model, signed by the same leader. "And of course now we are somewhat bewildered."³

Further transfer of entire light industry enterprises to the defense complex will probably require considerable additions of real resources to bring them up to planned levels of output. They will need investment goods, materials, and technical and design manpower, not to speak of valuable management attention. The chairman of the Council of Ministers emphasized this point when he noted that the country's mighty defense complex, "which commands an enormous scientific, technical, and production potential, can and must cope with this problem" of the disbanded light industry.⁴ Whether the accumulating experience of working out the problems of the transferred light industry enterprises will encourage more such actions in the future remains an open question.

TOTAL CONVERSION OF FORMER DEFENSE PLANTS

The total conversion of defense plants to civilian production is another possible method of increasing civilian output. Although the possibility has been widely discussed, implementation is almost invisible. In a discussion of the serious problems that would be created by radical and rapid redesigning of production areas, technological processes, and equipment, VPK chairman Belousov described an experiment in which several defense plants would become "models" or "test sites" where conversion methods would be "broken in." However, the experiment will only involve three plants, and only the *plans* for these experimental units will be prepared in 1989, with the actual conversion to take place later.⁵ No other mention has been made of instances of total conversion. The three designated plants were described in late 1989; their full conversion was then planned to be completed from 1990 to 1992.⁶ However several defense industry ministers have described the reorientation of new factories that are under construction or that are yet to be built. The total conversion of such plants offers greater flexibility than the reorientation of those that are literally set in concrete.⁷

³Ibid., p. 54.

⁴Ibid., p. 52.

⁵*Sovetskaya Rossiya*, February 10, 1989.

⁶"Conversion—In Action," *Pravitelstvenny Vestnik*, No. 18, September 1989, pp. 10-11 (FBIS-SOV-89-191, October 4, 1989, p. 104).

⁷Belousov interview, *Izvestiya*, January 3, 1989. Also see "Goods Instead of Shells," *Izvestiya*, May 1, 1989, p. 2 (FBIS-SOV-89-086, May 5, 1989, p. 83).

PARTIAL CONVERSION OR "REPROFILING"

The planned output of civilian goods in defense industry will have to depend primarily on the partial diversion of capacity of existing plants in addition to the transferred 220 Minlegpiashchmash enterprises and the experimental units designated for total conversion. As indicated above, many defense establishments are already involved in civilian output; their activities will be expanded, and additional defense plants will be drawn into this effort. In 1988, for example, 345 "munitions factories" had become involved in the production of equipment for light and food industries.⁵ New enterprises, either on the drawing boards or just coming into a productive state, were reoriented for the output of civilian products, and 205 research institutes and design bureaus were reassigned to design equipment for the agroindustrial complex.

The transfer of Minlegpiashchmash plants was also a means to transfer responsibility for their product lines to defense industry managers—and not only the existing product lines, but improved models and products incorporating higher technological levels. It probably came as no surprise to knowledgeable Soviet industrialists, but the decrepit state of the transferred industrial equipment, the poor training of the labor force, and the laxity of quality control shocked the defense managers. To meet the planned output of the disbanded ministry, the defense production ministers found it necessary to bring in their own plants, specialists, and design bureaus.

Not only are existing resources being transferred and diverted to civilian uses, but investment funds allocated to defense industry are also being rechanneled. Much of this investment is in social construction for apartments, new plant, and equipment. Concern for the living conditions of workers in the defense sector, especially those converting to civilian output, has been a prominent topic in Party secretary Baklanov's visits to defense plants and in Supreme Soviet discussions. For example, L. Ryabev, the Minister of Medium Machine Building, has described the "lamentable state" of the units his ministry took over. Since these enterprises had not been allocated any housing, the first thing he did was to commission at least one new apartment block for each enterprise during the first year of transfer. To the ten transferred plants, he assigned 40 ministry enterprises to help fulfill specific targets. The ministry is also planning to build "four or five

⁵VPK chairman Belousov statement, reported in TASS, February 22, 1989 (FBIS-SOV-89-035, p. 104).

specialist plants for the production of dairy equipment."⁹ What are the financing sources for all these efforts? Ryabev cites several sources: retooling from the enterprises' own funds and centralized ministry funds, Gosagroprom funds for new types of food processing equipment, and the state budget for new construction. "But it is important to stress," Ryabev said, "that the USSR Ministry of Medium Machine Building will not obtain a single kopek in additional investment."¹⁰ This statement presumably means that there are new sources and new uses of investment funds, but that the aggregate amount remains unchanged.

The important point to note about the reassigned responsibilities for food processing equipment is that the policy is drawing on substantial increments of resources from defense industry, and this was occurring even before the Gorbachev announcement of military expenditures reductions. Interviews with ministers and other high-level officials of most of the nine defense production ministries confirms and generalizes the observations made by Ryabev.

The funds that have been appropriated for the Ministry of Radio Industry in 1989 for building houses and sociocultural facilities will be used for the personnel of the refrigeration equipment enterprises to their fullest amount.¹¹

The Ministry [of General Machine Building] has decided to increase the financing of [retooling of transferred plants] by a factor of 2.5 to the detriment of existing planned subjects.¹²

Our main aim [in the Ministry of Defense Industry] is not just to boost output of food industry machines but to improve their technical standard and quality. . . . This sector has been starved of modern equipment. . . . Only one-fourth of the entire range of items transferred to us last year was up to modern standards. . . . We are essentially creating a fundamentally new sector. . . . Dozens of our plants, design bureaus, and technological institutes are already involved in this work. . . . A special section for light industry machines has been set up within the ministry's scientific and technical council. . . . The first thing that surprised us [about the transferred facilities] was that a number of these plants did not have any consumer facilities. No housing had been built for many years and talented young people did not join them. Nor were there any

⁹"Goods to be Produced by Defense Industry Plants," *Izvestiya*, November 9, 1988, p. 4 (FBIS-SOV-88-218, November 10, 1988, p. 70).

¹⁰*Ibid.*

¹¹"Refrigerators for the APK," *Ekonomicheskaya Gazeta*, No. 48, November 1988, p. 4 (JPRS-UMA-89-003, February 13, 1989, p. 59).

¹²"Defense Changes Profession," *Sotsialisticheskaya Industriya*, February 7, 1989, p. 2 (FBIS-SOV-89-030, February 15, 1989, p. 81).

experimental production facilities. . . . We shared our resources and best cadres with them.¹³

Thus the Ministry of Medium Machine Building not only assumed the responsibilities of the disbanded Minlegpiashchmash in producing equipment for dairy plants, and took over these plants, but also began to turn out such products at its best enterprises. Even experimental divisions joined such operations.¹⁴

Of course, we cannot do without capital investment, (proclaimed the First Deputy Minister of Machine Building). Some production units are geared toward a specific product and cannot offer anything else. They will have to be dismantled. The remaining walls and utilities are not a bad basis for creating new capacities. . . . We are not particularly counting on the ministry's centralized funds. What is allocated to us is paid for many times over through the profits from sales of consumer goods. . . . The development and manufacture of new equipment involves 40 military plants and 20 science-production associations, institutes, and design bureaus.¹⁵

Plants [of the dissolved ministry] were operating at a loss all around; conditions there were difficult. Resources were promptly allocated from the ministry's [of defense industry] reserves, and a stabilization of the industrial base was carried out. . . . We increased production last year by 13 percent over the 1987 level, and 9 percent of that is attributable to our defense industry. . . . Forty-eight of our enterprises, 40 scientific research institutes and construction bureaus were involved. A construction bureau was allotted for each type of equipment.¹⁶

As these observations make clear, conversion requires substantial diversions of defense industry resources to meet the responsibilities of the transferred enterprises, over and above the resources required to carry out the conversion arising from defense reductions. One of the more important of these resources is management attention and energy—from the minister, to the enterprise directors, to department managers and specialists. This focus extends upward also—to the VPK and Party Secretariat. The head of the VPK has been the chief spokesman on the conversion issue and appears to have had responsibility for developing the conversion plans and perhaps even the comprehensive plan for agroindustrial

¹³"Instead of Missiles and Tanks," *Pravda*, March 14, 1989, p. 2 (FBIS-SOV-89-050, March 16, 1989, p. 89).

¹⁴M. Makalin, "How to Beat Swords into Ploughshares," *Moskovskaya Pravda*, March 21, 1989, pp. 1-2 (FBIS-SOV-89-069, April 12, 1989, p. 55).

¹⁵"Goods Instead of Shells," *Izvestiya*, May 1, 1989, p. 2 (FBIS-SOV-89-086, May 5, 1989, pp. 83-84).

¹⁶V. Bykadorov, "On Peaceful Conveyors," *Selskaya Zhizn*, August 15, 1989, p. 2 (FBIS-SOV-89-162, August 23, 1989, p. 100).

processing equipment. Belousov's television appearances on behalf of consumer goods place a political and public spotlight on the performance of defense industry in satisfying these needs.

VI. IMPLEMENTING CONVERSION

THE SPECIAL ADVANTAGES OF DEFENSE INDUSTRY

Soviet defense industry has benefited from its past privileges. It possesses a large and technologically progressive capital stock; a well-trained and experienced labor force oriented toward the production of high quality goods; managers able to deal with complex R&D and production tasks; and the technical support of research institutes, design bureaus, test facilities, and pilot-plant production capabilities. It disposes of a tightly woven system of supply, created to support the concrete requirements of well-specified end items. It has developed a set of routines and a design philosophy or culture over the past 60 years that is consistent with the planned economy of the Soviet Union, and that effectively, but not always efficiently, deals with its systemic shortcomings.

All of the above can be converted to civilian use, including the weapon development routines learned from the experience of war and technological revolution. For example, a research institute director in the Ministry of Machine Building described how he used standard weapon acquisition methods in new civilian applications:

It is necessary to carry over the principles for the organization of work. In our branch, we have developed quite particular approaches to the introduction of technologies. . . . We have an efficient, clearly thought out system of design and technological processing of new machines, including the early stages, before the working documentation is issued. We have been convinced that any changes made in later stages are detrimental.¹

In addition to resources and routines, defense industry also disposes of a most important resource that is in short supply: authority. It has been delegated the political and organizational powers of the Party and the VPK in policing, coordinating, and managing the priority granted to defense production.

However, resources, privilege, and priority do not guarantee success in converting to civilian production. One cynical observer summed up a great deal of Soviet economic experience with his own evaluation of high priority projects in the transportation industry—the automobile and truck ventures promoted by Brezhnev: “You cannot obtain good

¹“Defense Changes Profession,” *Sotsialisticheskaya Industriya*, February 7, 1969, p. 2 (FBIS-SOV-69-030, February 15, 1969, p. 81).

products without excellent machine tools, but the experience of VAZ and KAMAZ, which have mainly imported equipment, shows that we have learned quite well how to produce poor products with excellent equipment."² Even with priority and good equipment, the constraints and incentives of the broader economic system can interfere with and impede effective production and efficient processes.

DEFENSE PRODUCTION INEFFICIENCY

The defense production complex possesses two other "resources" that may be available for conversion to civilian use: excess capacity and inefficiency. Excess capacity exists by design—for mobilization purposes—and by inadvertence. Because of the priority of defense, resources have flowed to defense production, often beyond reasonable needs; the political leadership is now trying to recapture these reserves.

The new openness surrounding defense matters has shed light on the detailed practices of the industry, suggesting a level of bloated inefficiency that combines the systemic disincentives of the civilian sector, the monopsony power of the military customers, and the priority supply of production resources. One analyst, apparently a specialist within the defense production complex, claims that labor and capital productivity and energy efficiency in the defense branches correspond on the average to the indicators of the economy in general.³ According to Isayev, the growth of defense industry was controlled by the system of goal-oriented program planning in which price played a secondary role in the allocation of orders and resources. He argues that despite the better technological level of equipment, higher skills of personnel, and scientific potential of the defense complex, the type of production relations that have developed there and the absence of efficiency-promoting incentives are behind the poor utilization of productive forces.

Since the 1930s, the production of military hardware has been managed through the formation of so-called "pyramid structures," the apex of which is the output of a specific article, with the rest of the pyramid encompassing the enterprises supplying the materials and subassemblies.⁴ All the enterprises in the structure are rigidly linked together in a manner that guarantees the supply of inputs required at all

²S. Yelekoyev, "The Last Trump," *Sotsialisticheskaya Industriya*, January 28, 1989, p. 2 (FBIS-SOV-89-021, February 2, 1989, p. 80).

³A. Isayev, "Reform and the Defense Branches," *Kommunist*, March 1989, p. 25.

⁴The pyramid structure is described by Yu. S. Valkov, "The Last Trump Card," *Sotsialisticheskaya Industriya*, November 13, 1988, p. 2 (FBIS-SOV-88-233, December 5, 1988, p. 123).

levels of production and assembly. Each type of military hardware possesses its own pyramid.⁵ "With no thought of the expense, unique equipment was created for them."⁶ However effective this approach may have been for producing complex, technologically advanced products in an economic system bedeviled by supply uncertainties, "it is a rigid, inflexible process with little unplanned excess capacity."⁷ Nevertheless, the author of this article, a head designer at a large defense enterprise, believes that it is possible to carve out of the various defense pyramids a new pyramid devoted to the production of machine tools for civilian products. However, other experts with experience in the defense sector believe that will be very difficult.⁸ Even if it were possible to carve out specialized sectors, they say, the endemic problems of the Soviet economy would eventually cripple any such effort. The Soviet space program was able to achieve a successful, coordinated, scientific-production goal, but it was under the principle of "victory at any cost," which is unacceptable for widespread application.⁹

The principal charge of inefficiency against defense production is an allegation of a pure "cost-plus" approach to procurement.¹⁰ Although stated in different ways, the interpretation is clear.

Reoriented to the civilian market, they will have to give up the principle, "end results at any cost," which is natural for several military sectors.¹¹

Defense workers always achieve the necessary result because the state does not limit the cost.¹²

Unfortunately, we have seen that an expense-oriented mechanism in the hands of the military carries the danger of an explosion for the economy.¹³

⁵Goal-oriented programs and their supply pyramids are managed by the VPK through the "VPK decision" issued for each program, covering participants, tasks, funding, and schedules.

⁶Ibid.

⁷Ibid.

⁸S. Yelekoyev, "The Last Trump," *Sotsialisticheskaya Industriya*, January 28, 1989, p. 2 (FBIS-SOV-89-021, February 2, 1989, p. 81).

⁹Ibid.

¹⁰This phenomenon was noted in Arthur J. Alexander, *Decisionmaking in Soviet Weapons Procurement*, Adelphi Paper 147-148, International Institute for Strategic Studies, London, Winter 1978-1979, p. 22 and Note 148, p. 60.

¹¹V. Chernyshev, TASS, February 2, 1989 (JPRS-UMS-003, February 13, 1989, p. 60).

¹²"Defense Changes Profession," *Sotsialisticheskaya Industriya*, February 7, 1989, p. 2 (FBIS-SOV-89-030, February 15, 1989, p. 80).

¹³"How to Beat Swords into Ploughshares," *Moskovskaya Pravda*, March 21, 1989, p. 1 (FBIS-SOV-89-069, April 12, 1989, p. 53).

They harp on the fiat of the defense industry producer everywhere. This is strange to us. What we are familiar with is the fiat of the customer. We make what they tell us to make.¹⁴

There is a principle at work here: we need only victory, and we shall achieve it at any cost! This is unacceptable for widespread application. . . . The high quality assemblies . . . are achieved at the price of immense expenditures and strict military acceptance practices. The rank and file consumers would simply not be in a position to buy them.¹⁵

Under the orientation toward a civilian market, the personnel of the defense industries will also have to reject the principle, "the end justifies any means," so typical for a number of military products. And this will take a serious restructuring not only of technology, but of control over production and the market.¹⁶

The cost-plus acquisition principle indicates an absence of cost-consciousness on the part of the buyer—at least at the detailed part and project level. Such an attitude would be encouraged, or at least not punished, by free-flowing resources to a high priority sector. Moreover, procurement accounts—including overruns, shortfalls, and deficits—do not fall under the Defense Ministry's direct cognizance at all. (The budgeting process is covered more fully in Sec. VIII.) Once plans and prices are approved, the Finance Ministry establishes bank accounts for the production ministries from which enterprises are subsequently paid upon delivery of planned items. There are thus scarcely any financial ties between buyer and seller.

Our understanding of Soviet weapon acquisition practices suggests that in the systems requirements process and in design, the consequences of calling for advanced technology and complexity—high production and maintenance costs, low reliability, lengthy development schedules—are well known to the higher level decisionmakers; they attempt to avoid the consequences to the extent open to them, given their doctrine and threat environment, by calling for fairly simple and less advanced designs.¹⁷ However, when such choices are barred to them, as they increasingly seem to be, defense procurement follows the "end results at any cost" process described by knowledgeable participants; even when the classical

¹⁴Ibid.

¹⁵S. Yelekoyev, "The Last Trump," *Sotsialisticheskaya Industriya*, January 28, 1969, p. 2 (FBIS-SOV-89-021, February 2, 1969, p. 80).

¹⁶V. Chernyshev, "Conversion: The First Steps," *Trud*, February 14, 1969, p. 3 (JPRS-UMA-89-006, March 6, 1969, p. 48).

¹⁷Explaining the Soviet Union's seemingly low defense budget, General Staff Chief, General Moiseyev, pointed to a "military-technical policy aimed at creating cheap, asymmetric arms." "The USSR Defense Budget," *Pravda*, June 11, 1969, p. 5 (FBIS-89-111, June 12, 1969, p. 74).

Soviet weapons design approach is followed, the budgeting and cost incentives lead to excess capacity and considerable hidden reserves.

Even with free-flowing resources and a cost-plus mentality, the Soviet defense complex is still part of the Soviet economy and shares many of the same problems. Yu. S. Valkov, a retired chief designer at a defense plant, has described many practices he observed that would be quite familiar to a civilian manager. He related how a chief engineer obtained supplies "by fair means or foul" to properly equip the workshops and was issued with 18 ministerial reprimands in one year for his heroic efforts. Valkov complained that all attention was focused on producing basic combat equipment, with everything else left to languish. He mentioned the seven years it took to place a screw-cutting lathe into production,¹⁸ and "God forbid that you invent something new and have to introduce it. It's more trouble than its worth. Imitations of foreign innovations began to enter the system—it was less trouble."¹⁹

We are left with the question of whether the financial separation between military buyer and producer, excesses of the cost-plus approach, and other inefficiencies emanating from the incentive system can be squeezed to free up resources for civilian output, and whether defense enterprises can escape their cost-plus methods but still utilize their conservative design ethic to produce efficiently for the civilian market. The simple expedient of cutting defense procurement budgets may induce greater cost consciousness of the buyer and producer alike, depending on how it is implemented. But industry insiders such as Isayev and Valkov identify profit orientation and competition as necessary conditions for greater efficiency. With the introduction of *khozraschet* in the beginning of 1989, the defense customer will face greater pressure to pay the full cost of production, formerly often buried in state subsidies and bank loans that covered enterprise losses resulting from monopsonist pressured low prices and inefficient production. When confronted with the full costs of its demands under a regime of tighter budgets, the military may take a second look at its requirements. But if prices simply rise to cover the full costs of production, the discipline of *khozraschet* will be negated.

Even if *khozraschet* is fully implemented, the continuing multiple restrictions on enterprise behavior will cause diminished incentives for internal efficiency. For one thing, the growing complexity of

¹⁸Interviews by the author with U.S., Soviet, and East European machine tool producers in 1988 revealed a 1.5-2 year period from initial design to first delivery for many U.S. manufacturers, and 8-15 years for the socialist countries.

¹⁹Yu. Valkov, "The Last Trump Card," *Sotsialisticheskaya Industriya*, November 13, 1988, p. 2 (FBIS-SOV-88-253, December 5, 1988, p. 122).

restrictions will diffuse the already complex profitability calculations. The policy intent has been to decentralize decisionmaking, reduce mandated management reporting, and eliminate "petty tutelage," but the reverse appears to be the case.

A second possible element of reform—restructuring of defense industry to increase competition—is not a likely prospect at present, although Isayev describes some experiments in which existing enterprises are being transformed into autonomous cooperatives able to set their own wages and work rules, and not under any ministerial authority. Two cooperatives have also been mentioned in the Machine Building Ministry; attached to a production association, one specializes in trade with China, and the second (named *Ekperiment*) "creates new materials."²⁰ Such experiments, though, are unlikely to be generalized into an industry-wide policy any time soon.

In the meantime, defense industry will continue to do what it knows how to do in its civilian production and do it with diverted resources and resources set free by defense procurement reductions, rather than with the fruits of greater efficiency.

DEFENSE INDUSTRY PROSPECTS IN CIVILIAN PRODUCTION

The Realities of the Civilian Economy

The strengths of the defense complex derive from its privileged status. These strengths will be available for civilian purposes, at least for a period, but they are wasting assets. Their continued contribution will depend on their maintenance and sustenance. In addition, as defense industry enters the civilian sphere more broadly, it will confront all the impediments faced by the disbanded ministry it absorbed: low priority, uncertain supplies, inconsistent plans, misplaced incentives.

Among the first rude facts of life faced by enterprises converting to civilian production were the supply problems endemic in the Soviet economy. As one article noted, "When getting involved in civilian production, the defense enterprises will have to encounter the elements of the planned market, from which nobody has ever emerged unscathed."²¹ The Minister of Defense Industry warns:

²⁰"Goods Instead of Shells," *Investiya*, May 1, 1969, p. 2 (FBIS-SOV-66-066, May 5, 1969, p. 83). It is not known whether these cooperatives are the same ones noted by Isayev.

²¹Igor Lavrovskiy and Leonid Skoptsov, "Nature Tolerates No Void," *Sotsialisticheskaya Industriya*, April 7, 1969, p. 2 (FBIS-SOV-66-073, April 18, 1969, p. 82).

The conduct of our associates from the civilian industry and local organs of territorial management once again prompts caution. . . . There are holdups in our supply of electric motors. The shortage of progressive packing materials, which should be provided by enterprises in the chemical and light industry branches, also impedes things.²²

A military observer foresees, "With conversion to civilian production, . . . they will lose the priority right to receive financial and material resources at short notice."²³

One solution to these problems is the classical Soviet organizational response to uncertainties imposed by suppliers—to supply as much as possible oneself or under one's direct control. Of course, this rational response to supply uncertainty has been condemned since the beginning of Soviet centralized planning as inefficient because it does not allow scale economies and specialization. The director of a Ministry of Machine Building association described his own approach to the supply problem:

To be honest, I would never try to assimilate an article for which I do not have everything necessary at my disposal. Take, for instance, water-based emulsion paint. This item requires eight components, and we obtain them all through direct links. Therefore we are boldly incorporating an additional R2 million worth in the context of conversion. . . . We required subassemblies that are not produced in our country. Buying them abroad means wasting time and spending foreign currency. We had neither, so we made the subassemblies ourselves, without (please note) raising any questions with the ministry.²⁴

A deputy minister of Machine Building summed up the experiences of defense industry managers:

When we embarked on the path of conversion, something struck us immediately. The machine tool builders often supply the wrong thing for the implementation of specific tasks. Even before, the supplying branches used to let us down, but now the difficulties are even more acute. . . . Out of an order of 5000 items of equipment, Gosplan has allocated only 2700 for 1990. Many things are not produced in our country at all. So we will have to set up our own machine tool building.²⁵

²²"Instead of Missiles and Tanks," *Pravda*, March 14, 1989, p. 2 (FBIS-SOV-89-050, March 16, 1989, p. 89).

²³Chernyshev, TASS, 1989 (JPRS-UMS-003, February 13, 1989, p. 60).

²⁴"Goods Instead of Shells," *Izvestiya*, May 1, 1989, p. 2 (FBIS-SOV-89-086, May 5, 1989, p. 83).

²⁵*Ibid.*

I had an uncle in the wholesale and supply business who said, "To be a good salesman, you need a smart buyer." A universal complaint of the Soviet defense producers is that—unlike the military buyer—their civilian customers do not know what they want. The deputy minister of Machine Building complained: "Something else also causes concern; leaders of the agroindustrial complex have no clear idea of their own requirements—what kind of equipment is needed, when, and in what quantity."²⁶ This view was repeated with concrete detail by the deputy chief of the Main Scientific and Technical Directorate of the Ministry of Radio Industry:

By 1995 we must produce 1000 fast freezing systems. Unfortunately, this work is being obstructed by Gosagroprom, which—one would think—should be very interested in such equipment, but which so far has not even submitted technical specifications, not to mention engineering documentation.²⁷

Late demands, incomplete specification, and wildly erratic quantities are other complaints leveled against civilian customers. Thus, a characteristic of the defense supply-demand relationship that has helped it to perform satisfactorily—having direct relations with a knowledgeable and demanding customer—is often denied to the supplier of civilian equipment, with deleterious consequences.

Defense Industry Wages and Labor Quality

Wages and labor relations in defense industry present a mixed picture, with some Soviet analysts and managers describing highly paid workers with many additional privileges, whereas others portray equivalent pay and working conditions in defense and civilian jobs. Evidently, the situation is not uniform. Nevertheless, since mid-1969, high-level managers and political representatives have made a point of enunciating a conversion labor policy in which defense workers would not suffer from a transfer to civilian production. Leading this effort has been the Military Industrial Commission, supported and encouraged by the Party's defense department and the new legislature.

In his June 1969 acceptance speech to the Supreme Soviet following his renomination, VPK head Belousov declared that a major point of his program would be "to not permit any tension in social questions at enterprises where the partial conversion of military production will take

²⁶Ibid.

²⁷"Refrigerators for the APK," *Ekonomicheskaya Gazeta*, No. 48, November 1968, p. 4 (JPRS-UMA-89-003, February 13, 1969, p. 59).

place."²⁸ Then, in a July 1969 interview, he placed the problem of "social issues" at the same level as the solution of production problems. "It will be necessary to implement measures to resolve social issues linked with retraining specialists and the maintenance of salary levels."²⁹ Later in the year, a VPK department chief said that "additional funds must be found for compensating the inevitable losses in salaries; employees of defense enterprises that have embarked on conversion bring this up in a frank manner."³⁰ If wages are not maintained, he claims, enterprises will lose valued workers. For these reasons, the VPK is also sponsoring job placement and retraining programs.

This VPK view is consistent with the policy preferences expressed by deputies of the Supreme Soviet defense committee, who stressed the importance of "effecting conversion in a way that will not worsen the material position of personnel working in defense industry."³¹

Party secretary Baklanov has made the social and working conditions of defense industry a central point of his many visits around the country. Baklanov has been campaigning to stimulate local solutions to workers' demands rather than having enterprises rely on central programs. Housing, schools, kindergartens, and consumer goods have been the focus of his attention, even more than defense production itself. "Main attention during the party Central Committee secretary's meetings with the Volga people was devoted to eradicating this dangerous distortion—the serious and ingrained backwardness of the social and consumer conditions in which the aircraft builders [and other workers] lived and worked."³² Part of this effort is the contribution of defense plants toward production of consumer goods for their own use and for regional distribution. The party secretary has emphasized that conversion itself can go a long way toward improving the converted workers' lives.

As noted above, the wages and working conditions of defense workers appear to be quite varied. For example, in the Ministry of Medium Machine Building, "It is easy for machine builders to switch gears, and as far as remuneration for labor, workers of a military plant did not

²⁸Igor Belousov, Moscow Domestic Radio Service, June 28, 1969 (FBIS-SOV-69-124, June 29, 1969, p. 37).

²⁹L. Chernenko, "Military-Industrial Complex: Today and Tomorrow," *Krasnyye Zvezda*, July 23, 1969, p. 2 (FBIS-SOV-69-164, August 25, 1969, p. 71).

³⁰V. Komarov, "Action!" *Pravitselstvenny Vestnik*, No. 18, September 1969, p. 11 (FBIS-SOV-69-191, October 4, 1969, p. 106).

³¹TASS, August 4, 1969 (FBIS-SOV-69-153, August 10, 1969, p. 62).

³²"Level of Responsibility," *Pravda*, September 15, 1969, p. 2 (FBIS-SOV-69-196, October 12, 1969, p. 64).

have any advantages at all."³³ In a round-table discussion with three defense industry managers, an interviewer took pains to undermine the common notion of higher defense wages:

Under the influence of movies and a certain kind of literature, many people have developed the impression that workers and employees of defense industry enterprises rake in financial and social benefits using the shroud of secrecy and the lack of public control. Don't laugh. This is a serious issue. How true is it? Is the fear of losing privileges going to be an obstacle to conversion?³⁴

The managers thoroughly agreed with the implication of the question, that defense industry wages were not higher, saying that the average monthly salaries at their enterprises in Moscow were only 228 rubles, 229 rubles, and 224 rubles. Concerning social benefits, one said: "Everything was sunk into machinery, production, goods, and the human factor was not taken into account. . . . It is the customer who had unrestricted credit lines—our budgets were tight. *Khozraschet* and conversion will help our collectives to better solve social problems and retain personnel."³⁵

An economist noted that for ordinary workers, technical personnel, and scientists of defense enterprises,

conversion does not contribute a particular threat. Practically all the advantages in pay, social privileges, and so forth, which they had 10-15 years ago, have, in effect disappeared. The average level of pay at Moscow defense plants in machine building is now practically equal to the average level of this branch of industry, approximately 230 rubles per month.³⁶

Not only has the advantage accruing to defense workers vanished, but certain disadvantages have risen in relative importance. The negative aspects of work in the defense complex include "the system of secrecy, strict discipline, and tough control over product quality."³⁷

A. S. Isayev, who was quoted earlier on defense industry inefficiency, also described the equalization of wage rates, which in the past were substantially higher in the defense sector. The higher responsibility of defense workers for quality work without compensating wages and the

³³V. Romanyuk, "Molniya Changes the Program," *Izvestiya*, April 2, 1969, p. 2 (FBIS-SOV-69-073, April 18, 1969, p. 85).

³⁴"How to Beat Swords into Ploughshares," *Moskovskaya Pravda*, March 21, 1969, p. 1 (FBIS-SOV-69-069, April 12, 1969, p. 53).

³⁵*Ibid.*

³⁶A. Iyusimov, "Conversion? Conversion! Conversion . . .," *Literaturnaya Gazeta*, July 12, 1969, p. 11 (FBIS-SOV-69-141, July 25, 1969, p. 101).

³⁷*Ibid.*

lure of cooperatives were causing a steady outflow of skilled workers from defense enterprises.³⁸

Not everyone agrees with these assessments of equalization of defense and nondefense wages. A department chief of the Tatar Gosplan spoke of the difficulties experienced by defense industry workers in the process of conversion.

It is extraordinarily difficult . . . to alter the psychology of people working for the Army and receiving wages 1-1/2 to 2 times higher than those of their colleagues in the regular branches, along with various other benefits. . . . Many industries have to think first and foremost how to keep, and not lose, qualified workers.³⁹

An economist writing in *Pravda* confirms the existence of this problem: "Once high technology defense plants start producing consumer goods, they start losing their skilled work force."⁴⁰ And according to a deputy minister of defense industry, after conversion plans were adopted to produce new types of equipment, "from the workers we get letters signed by the committees of labor collectives and worker delegations: We will not do it; it is difficult."⁴¹

This selection of statements suggests that high defense industry wages and other benefits are not universal; still, on the average, they are almost certainly higher than in light industry. Nevertheless, the differentials appear to be narrowing and may not be as effective as in the past in attracting and keeping labor in defense enterprises, especially with the much greater opportunities to be found in the cooperative sector.

In the mid-1970s, we began to hear comments that better qualified technical people were avoiding defense industry because the constraints imposed by secrecy, travel restrictions, and inability to publish in scientific and technical journals were not sufficiently compensated by wages and nonpecuniary income. As housing and other elements of living standards improved, and as moonlighting opportunities and now the cooperative movement raised incomes elsewhere, the higher wages, bonuses, and benefits of defense industry looked less attractive. Although this phenomenon was being discussed in the early 1970s, it

³⁸A. Isayev, "Reform and the Defense Branches," *Kommunist*, March 1969, p. 14 (JPRS-UKO-89-011, June 13, 1969, p. 14).

³⁹D. Bikov, "Swords Into Ploughshares: How the Defense Branches Are Making the Transition to Peaceful Production," *Seishaya Zhizn*, August 1, 1969, p. 2 (FBIS-SOV-89-155, August 14, 1969, p. 116).

⁴⁰A. Kireyev, "If Peace Were to Break Out . . . Reflections on Disarmament Economics," *Pravda*, September 13, 1969, p. 4 (FBIS-SOV-89-180, September 19, 1969, p. 1).

⁴¹V. Bykadorov, "On Peaceful Conveyors," *Seishaya Zhizn*, August 15, 1969, p. 2 (FBIS-SOV-89-162, August 23, 1969, p. 101).

did not seem to be important enough to be other than something to be tracked in the future.⁴² The future has now arrived. If civilian production in defense plants reduces either worker morale or income, the outflow of labor could be expected to increase. This outcome was described as already occurring by the head of the aviation ministry:

We have already come up against a number of serious difficulties, and I consider the cadre issue to be paramount among them. It appears that a transition from most complex production to simple articles also has a painful effect on people's interest and pride. An outflow of skilled cadres has begun in places, with some of them going to cooperatives.⁴³

This is perhaps an important reason behind Belousov's emphasis on the social welfare of defense workers.

There now appears to be a general acceptance by managers within defense industry that measures must be taken to maintain worker morale and stem the outflow of an experienced work force. As a leading aviation designer told me, "Our best people are going to cooperatives, not the ones we would like to get rid of." Evidently defense industry managers are expecting central government solutions to this problem. This view is implicit in the statement of the Minister of Shipbuilding: "It is only natural that economic norms would be changed accordingly as a result of radical changes in production programs."⁴⁴ However, party secretary Baklanov's attempts to stimulate enterprises' own efforts may be an indicator that central solutions will not be forthcoming, and that it will be necessary for defense managers to solve their conversion problems through local initiatives. If so, this policy will require a radical reorientation in the approach of defense industry managers who have been protected from the many problems of the Soviet economic system.

Enterprise Incentives

Soviet defense industrial organizations—from research institutes to series production plants—were financed (until 1989) from the state budget. These organizations did not depend on sales or profits to cover the costs of their activities or their investments. However, they could earn profits—the difference between their financial remuneration

⁴²Arthur J. Alexander, *Decisionmaking in Soviet Weapons Procurement*, Adelphi Paper 147-148, IISS, London, Winter 1978-1979, p. 22 and Note 146, p. 60.

⁴³B. Grishchenko, "Conversion: An Inside View," *Ekonomicheskaya Gazeta*, No. 21, May 1989, p. 15 (FBIS-SOV-89-100, May 25, 1989, p. 85).

⁴⁴*Ibid.*

(passing from the budget to their accounts in the state bank) and their costs. Out of the profits, economic organizations could devote specified amounts to various organizational activities—both productive (e.g., R&D) and social (e.g., apartments). Excess profits were paid back into the budget. Any losses would be made up from planned budget expenditures (for “planned loss” enterprises) or from bank loans. Sales, revenues, and profits were not of major concern to defense managers; somehow their needs would be covered and, on the average, they were covered quite well.

This picture began to change in 1989 as defense enterprises initiated a transfer to a profitability standard: full economic accounting and self-financing or *khozraschet*. Although this transfer is not planned to be completed until the end of 1990, the relative profitability of civilian versus defense sales is becoming a key motivating factor. In the past, the customer could impose low profit rates and often call for a price that would not even cover costs. This was acceptable to an enterprise director who did not care about the source of his revenues, but with the introduction of a profit-based accounting system, these past practices are being challenged, and relative profitability is in a state of flux. Under *khozraschet*, large profits can directly benefit an enterprise and its personnel, although the many continuing restraints on enterprise autonomy severely limit the value of ruble profits. Nevertheless, it is still better to earn a profit than a loss—that is, profits matter.

What then is the profitability of conversion? In one production association in the Ministry of Machine Building, profitability of consumer goods is 21–22 percent, whereas in defense output, “profits are much lower.”⁴⁵ In Medium Machine Building, a reporter comments:

Wholesale prices for military products set in our country are, putting it plainly, symbolic; they are not in line with actual outlays. Paradoxical as it is, your expensive goods actually turn out to have a low profit margin. Starting up the production [of civilian goods], which have a high profit margin, will allow defense industry enterprises to generate more profit.⁴⁶

A defense manager commented, “It is difficult to understand, but the price for gold from our ministry was set at a substantially lower level than from non-defense extractive industry enterprises.”⁴⁷ Isayev notes that the monopolist defense customer can impose a very low price

⁴⁵*Izvestiya*, “Goods Instead of Shells,” May 1, 1989.

⁴⁶*Moskovskaya Pravda*, “How to Beat Swords Into Ploughshares,” March 21, 1989.

⁴⁷*Ibid.*

that does not allow for the profitability of production; and, he adds, "Today, this occurs quite often."⁴⁸

On the other side of the picture, many defense enterprises have moved into civilian production with some trepidation. VPK chairman Belousov noted refusals of defense enterprises to conclude contracts, long delays in starting production, and lags in the assimilation of new types of product.⁴⁹ An economist described the response to conversion in dismal terms: "So far, civilian production has been accepted by the country's military-industrial complex as secondary, imposed, and temporary."⁵⁰ Defense managers themselves cite a long list of reasons, in addition to those discussed above, for their reluctance to move into civilian work: the barriers erected by secrecy, the possible decline of worker attitudes toward quality in their main defense lines as they adapt to civilian norms, and the disincentives of price setting procedures for new products. The director of the Molniya machine building plant summarized his frustrations by reeling off a list of obstacles facing enterprises contemplating conversion:

Sooner or later the enterprise will encounter problems characteristic of civilian industries. They are already becoming apparent, first of all in the unsettled price-setting. . . . The infamous gross production indicator, expense orientation, and difficulties in material-technical supply stand in the way. Material deliveries are made through priority procedures when defense products are manufactured. Now supply problems will arise as is customary for "civilians."⁵¹

We are already seeing complaints of the high costs of civilian goods produced by defense industry. After only six months of involvement in food processing equipment, the State Committee for Prices was requested to analyze sharp price increases on a long list of items.⁵²

Some early losses from conversion were to be expected, as it took time to master new production lines and different products. The Soviet political-economic system, however, in its traditional appeal to "haste," demands everything at once—conversion, investment, output, profits. As a result, a transition period to properly prepare for major disruptive change and the provision of capital to finance such change

⁴⁸Isayev, "Reform and the Defense Branches."

⁴⁹*Izvestiya*, "A Peaceful Vocation for Defense," January 3, 1969.

⁵⁰B. Raysberg, "Is It Easy to Beat Swords into Plowshares?" *Nedelya*, February 22, 1969, p. 6 (FBIS-SOV-69-040, March 2, 1969, p. 80).

⁵¹*Izvestiya*, April 2, 1969.

⁵²Council of Ministers Meeting, Moscow Television, October 21, 1968, p. 53.

have been made available only with great reluctance.⁵³ The financial incentives for conversion have therefore tended to be rather negative.

The Molniya plant of the Medium Machine Building Ministry found that it was losing money on its conversion to dairy equipment production.⁵⁴ One problem was that the planned increase in wholesale trade had not taken place, and the provision of supplies was fitful. Direct contracting with other plants must often deal with the market power of monopoly suppliers who can charge exorbitant prices. Hard currency is not available for foreign purchases, and comprehensive plans have not been concluded for domestic production. The manager of the Khrunichev aviation plant who described these supply problems called for a VPK-like civilian organization—a “special center that will be engaged in economic relations between defense and civilian plants.”⁵⁵

The Khrunichev manager also revealed that although high-level policymakers “charged us not to forget about the needs of the people, still everyone secretly understood that they are not the main thing for defense industry interests.”⁵⁶ This sentiment has found echoes throughout the defense industrial sector. In Belorussia, certain defense industry leaders “regard consumer goods as something secondary.”⁵⁷ An analyst from an Academy of Sciences research institute opines that “civilian production will never have priority in defense enterprises that remain within the framework of the military complex. . . . Can we say that the quality of refrigerators, television sets, washing machines, and vacuum cleaners produced in military plants satisfies us?”⁵⁸ This sentiment was reinforced by Party secretary Baklanov: “We should not delude ourselves here. We must always remember that we are responsible for defense above all.”⁵⁹

Since civilian production requires the tireless pursuit for supplies, the identification of users and their demands, and some control over cost, it is not surprising that defense industrial managers prefer the more secure

⁵³The state budget for 1990 allocates R4 billion for conversion purposes. “On the USSR State Budget for 1990 and the Implementation of the 1989 Budget,” *Izvestiya*, September 27, 1989, pp. 4–6 (FBIS-SOV-89-187, September 28, 1989, p. 39).

⁵⁴V. Romanyuk, “Molniya Changes the Program,” *Izvestiya*, April 2, 1989, p. 2 (FBIS-SOV-89-073, April 18, 1989, p. 85).

⁵⁵M. Zakharchuk, “The Post Office Box: A View from Inside,” *Sotsialisticheskaya Industriya*, May 23, 1989, p. 2 (FBIS-SOV-89-107, June 6, 1989, p. 53).

⁵⁶*Ibid.*

⁵⁷V. Khodosovskiy, “Goods for the People,” *Sovetskaya Belorussiya*, April 19, 1989, p. 2 (JPRS-UMA-89-016, June 27, 1989, p. 40).

⁵⁸A. Izyumov, *Literaturnaya Gazeta*, July 12, 1989, p. 11 (FBIS-SOV-89-141, July 25, 1989, p. 100).

⁵⁹“*Vremya*” newscast, Moscow Television Service, July 27, 1989 (FBIS-SOV-89-144, July 28, 1989, p. 106).

world of defense orders, even if these are more demanding in some dimensions. This attitude was summed up in a journalistic investigation of the defense production ministries' response to conversion:

Increasing the volume of production of consumer goods holds no promise for the managers of defense industry plants. They receive their salary by virtue of their main products [i.e. military output], and they are primarily responsible for them. . . . They still prefer to ask and wait, when you now have to search and run ahead of yourself.⁶⁰

In explanation of this situation, a shipbuilding executive referred to the habits engendered by defense procedures: "Allocation reigns here. This circumstance has spoiled us, and it has, putting it bluntly, altogether corrupted our trade."⁶¹ A representative from the Ministry of Trade confirmed these attitudes when he complained of his fruitless attempts to get representative products for a trade show: "We have been chasing representatives of industry for weeks now. We have been unable to drag them to the fair even with the help of ministers."⁶² The chief engineer of a Department of Consumer Goods (note the creation of this new directorate) in the Ministry of General Machine Building responded to the plaintive cries of the Trade Ministry with his own confession of impotence: "The plants have become out of line. They are out of control now. There has been no response to all our calls and telegrams."⁶³

A customary Soviet approach to such situations is through *agitprop* and campaigns. The frequent trips and public appearances of Baklanov and Belousov are a visible part of this effort. The attempt to inculcate new values through repetition and rhetorical emphasis is a campaign technique now being applied for the benefit of conversion. The voices of past campaigns echo through a speech of Politburo member Ligachev:

The leaders of all defense complex ministries have not been equally responsible and party-minded in their approach to fulfilling the party Central Committee and government decisions on creating a modern food industry. . . . We believe that the ministries will draw the correct decision from the criticism. It is time now to inculcate in defense industry collectives a respect for output intended for citizens at large.⁶⁴

⁶⁰I. Klimenko, "Defense on the Defensive," *Sotsialisticheskaya Industriya*, September 21, 1989, p. 2 (FBIS-SOV-89-191, October 4, 1989, p. 103).

⁶¹Ibid.

⁶²Ibid.

⁶³Ibid.

⁶⁴"Conference at the CPSU Central Committee," *Pravda*, July 3, 1989, p. 1 (FBIS-SOV-89-127, July 5, 1989, p. 80).

VII. CONSEQUENCES OF CONVERSION FOR CIVILIAN PRODUCTION

THE CONVERSION CAMPAIGN

The Military Industrial Commission, in October 1989, evaluated the defense industries' contribution to the agroindustrial complex. VPK head Belousov summarized developments by noting that "the defense complex's attempted marriage with science and practical needs is turning sour."¹ This gloomy evaluation of the first two years of conversion experience was both predictable and inevitable, given the initial high expectations and the absence of any other real change in the Soviet economy.

The one clear political focus of conversion is the turning away from defense and industrial investment, with a shift in leadership preferences toward consumer welfare. Virtually all of the targets of conversion point directly to consumer goods or to the machinery and technology for producing them. In contrast to much of the rhetoric supporting consumer welfare of the past 20 years, rhetoric is now matched by policy and implementation.

Unfortunately for the success of conversion, implementation follows classic Soviet lines: large transfers of resources directed by a campaign approach to mobilizing energies and managing details. The conversion campaign has not even had the benefit of the integration, imperfect as it may be, of the classical Soviet planning system. The process has had to rely largely on campaign stimulation and local initiative, with little in the way of either centralized structure or well-tuned incentives to support management actions.

CONVERSION AND THE ECONOMY

The absence of coordination is felt by defense managers in two ways: There is no conversion plan and no civilian VPK. The reduction of military expenditures, the transfer of Minlegpishchmash plants, and the several plans for involving defense industry in civilian output were all put forward without an integrating overall plan. In the first years of Gorbachev's economic *perestroika*, such an approach may have appeared viable as economic policies then called for the growing importance of

¹TASS, October 11, 1989 (FBIS-SOV-89-196, October 12, 1989, p. 92).

wholesale trade, the reduction of central planning, the reform of prices, a heightened role for profit incentives, and a sharp reduction in ministerial authority and other centralized management practices. If those policies had been successfully implemented, a decentralized approach to conversion may have succeeded. However, none of these policies have proceeded according to plan: It is not an exaggeration to call them still-born. With the failure to implement the economic policies of *perestroika*, a decentralized approach to conversion was handicapped from the start.

A good deal of coordination in the defense sphere was handled, not by detailed central plans, but by the VPK and by the Party apparatus. Through the creation of supply pyramids and VPK decrees, all participants in R&D projects and production knew their assignments, regardless of organizational affiliation. These assignments were backed up by the political authority of the VPK and the Party. Such coordination is sadly missed by defense managers who have been thrown into the unplanned, uncoordinated maelstrom of civilian production.

These hapless managers are further hindered by imposed inflexibility, reducing their ability to adapt to circumstances. Ministerial constraints, organizational fragmentation, poorly developed financial and supply markets, and the power of monopoly producers impinge on the managerial discretion of enterprises.

Furthermore, both managers and workers often do not want to shift to civilian products, which are neither as glamorous nor as technically challenging as defense goods. Both managers and workers can lose pay and bonuses if they convert. And, undoubtedly, the work can be more difficult and frustrating—not in a technical sense, but in getting the job done in an uncooperative economy.

Whereas defense producers had long-standing and often intimate ties with their defense customers, who were both knowledgeable and powerful buyers, their understanding of civilian requirements is often quite poor. All of the problems arising from the separation of producer from user in the Soviet economic system are repeated here, with the additional complication of new assignments, new suppliers, and new products. Although many defense producers are actively attempting to generate better information on the needs of their customers, others are resorting to the simpler, customary expedient of waiting for the orders to arrive and then producing according to the letter of the contract without any real understanding of actual needs.

THE RETURNS FROM CONVERSION

As defense enters the civilian world, it confronts all of the usual problems plus additional ones created by the rush toward conversion and a partly reformed economy. Supply uncertainties and weak ties between producer and user are the first and most obvious consequences. High prices resulting from the defense plants' penchant for high-tech solutions, from the expensive capital equipment and labor, and from lack of experience in new product lines also mark defense output.

There will not be a ruble for ruble transfer from defense to civilian output. The efficiency of transfer, especially in the short run of perhaps five years, will be considerably below 100 percent. In addition, supplementary resources will be needed to implement conversion, with the first contribution of R4 billion explicitly acknowledged in the 1990 budget.

Real resources are being reallocated, however. Competent technical and production people have been given new responsibilities; they are struggling to find the right products and searching for the real users. As usual, the Soviet manager has been given an impossible task, and with intelligence, energy, and native wit he is marching forward in the latest campaign. As long as the political spotlight and high leadership focus can be maintained on conversion, the efficiency of resource transfer will be stimulated. As attention shifts to the next campaign, energies will start to flag, but the benefit to the consumer sector will probably persist as a result of real political change and resource reallocation.

Civilian output will benefit in the short run from the use of the high-quality resource base, experience, and management practices built up under the regime of defense industry privilege. It will also benefit in the longer run from the absolute reallocation of resources. To the degree that reallocation reduces the tautness of planned supply, it could ameliorate the endemic supply uncertainties facing civilian industry, but Soviet planners are unlikely to relax their push for output quantities greater than the system can accommodate. Over the longer run, the deep systemic problems of the Soviet economy will impose themselves on the defense industry's production of civilian items. We are already hearing high-level complaints of unfulfilled defense industry production of civilian output: delays in macaroni lines in aviation, of jam equipment in shipbuilding, and of AIDS-related medical supplies from the electrical equipment industry.² The continued commitment of

²I. S. Belousov, "Toward the CPSU Central Committee Plenum," *Pravitelstvenny Vestnik*, No. 4, February 1989, p. 2 (JPRS-UMA-89-011, May 15, 1989, p. 54). "Multiple Injections," *Sovetskaya Rossiya*, May 6, 1989, p. 2 (FBIS-SOV-89-098, May 23, 1989, pp. 76-77).

high-level managerial attention to civilian output will depend on the persistence of the political push behind the effort, and this is very likely to diminish over time. We will thus find unfulfilled plans, shortfalls, and lower technical standards and quality levels than originally contemplated. Nevertheless, civilian output will no doubt be increased and improved, at a level perhaps that will even be visible to the average consumer.³

³An analysis of the output of consumer durables of defense industry, based on figures released by the journal *Vestnik Statistiki*, May 1989, indicates that 1988 output was about 10 percent higher than in 1987 (in unweighted, physical quantity terms). John Tedstrom, "Defense Complex Contributions to Civilian Production: Is it Growing?" *Radio Liberty Report*, June 2, 1989.

VIII. SOVIET DEFENSE BUDGETS

THE RECENT BIRTH OF THE DEFENSE BUDGET

Financial incentives and constraints can be imposed on the Soviet military through the use of financial budgets; and it is through such budgets that aggregate control may be exercised by central authorities. However, from 1930 to the present, budgets have not been a principal source of control over military expenditures: They have been an after-the-fact accounting device that followed the planning of physical programs. This situation is now in the process of being drastically altered by the political leadership's new attention to aggregate expenditures and their reduction, by the budget review and authorization process in the Supreme Soviet, and by the transition of defense industry to *khozraschet* and the subsequent pressures that this will impose on Ministry of Defense financial resources.

The Soviet defense budget has heretofore been largely an artifact of Western analyses. It has now burst onto the Soviet scene and is becoming a principal tool in the control of the Soviet armed forces.

THE FINANCIAL BUDGET PROCESS

Soviet weapon acquisition and R&D have customarily been financed through the Soviet state budget. This process began to change in 1969 as defense industry entered a transition to full cost accounting. The main distinction is that under *khozraschet*, financing is provided through an organization's "own funds" (those received from the sale of goods and services) rather than from the state budget.

Under budget financing—prevailing from the early 1930s—financial plans were drawn up after the working out of material and labor plans. Acceptance of the production plan implies acceptance of the necessary budget to finance the monetary transfers associated with production and R&D. According to a textbook description of this process, the Soviet *government* controls monetary expenditures for the material supply of the Soviet military, whereas the *Defense Ministry* is responsible for operating expenditures, maintenance, and military manpower expenditures.¹ That is, the budget for weapon acquisition was assigned to other government agencies—not to the Ministry of Defense. The

¹L. D. Zlobin (ed.), *Finansy SSSR*, Finansy, 1971, Ch. 25, Sec. 4, "Expenditures for Defense."

approximately R20 billion figure attributed to defense in recent years has been the only financial budget administered by the Defense Ministry, and it did not include weapon procurement and R&D.

Appropriations from the state budget are made to enterprises, production associations, institutions, and other economic organizations for specified purposes and planned projects such as weapon production and R&D. The Ministry of Finance and its republic and local agencies perform the principal routine work of budget implementation. These financial agencies "are concerned about the uninterrupted financing of programs envisaged in the budget, while they also take into account actual fulfillment of production and financial plans."² Organizations usually assume the right to spend the budget funds from the moment of budget approval, but formally this right is authorized only on the basis of opening of budget credits. The Finance Ministry opens credits for the account of enterprises and other organizations at the State Bank (Gosbank), either on a quarterly basis according to the planned rate of expenditures, or upon evidence of plan fulfillment (delivery of planned output). Although the Finance Ministry is supposed to "take into account actual fulfillment of the production plan," the schedule of budget revenues and expenditures "is the principal operational document; . . . this is the document financial agencies use in opening credits, in financing enterprises, institutions, and programs."³

The importance of this budgeting process is that there are virtually no financial ties between buyers and sellers. Indeed the very notion of a Soviet "defense budget" among Western analysts has been a reflection of Western practice rather than Soviet reality. The Defense Ministry had no involvement at all in the payment for its hardware and R&D. It was not allocated either a single aggregated budget or separate "line item" accounts. Financial matters, at a very detailed level, were left to the technical specialists of the Finance Ministry and Gosbank.

A possible explanation for the two-year time lag between Gorbachev's announcement that the Soviet defense budget would be published and the actual disclosure of budget figures is that it took that long to compile the defense-related expenditures from all of the Finance Ministry and Gosbank accounts and organize them into a structure resembling Western accounts. This compilation process is consistent with the revelations of Marshal Akhromeyev in a television interview:

²Ibid., Ch. 28, Sec. 4, "Implementation of the Budget."

³Ibid.

Just think how we established this budget of R77.3 billion. After all, we did not have it as such. Previously, the Armed Forces were only interested in what they were given for upkeep. . . . As far as research and development were concerned, that came under the ministries of defense industry sectors. Nor did we pay for series production deliveries. First we had to bring all this together. We did indeed take as our basis the U.S. budget so that we could compare. We collected this, analyzed it, and published it.⁴

An economics professor at the Lenin Military-Political Academy also noted the difficulties involved in compiling the defense budget:

Published figures . . . reflected only a portion of the overall spending on defense, associated chiefly with the upkeep of army personnel, its combat training and housing and domestic support, including capital construction. Another portion, and moreover the larger one, was scattered among a multitude of ministries and agencies fulfilling various military orders. We thus did not know ourselves for a long time, and could not tell the world intelligibly, what the actual amount of USSR defense spending was.⁵

The finance minister, who was probably charged with the responsibility for compiling the budget, described the process in similar terms:

Defining the precise sum of the military budget is by no means as easy as it may appear at first glance. Do not forget that military expenditure comes under various articles of the state budget, and in order to define expenditures for defense purposes it was necessary thoroughly and scrupulously to analyze all these articles.⁶

Budget hearings on defense by the Supreme Soviet defense committee have followed this same separation of accounts across the Defense Ministry and production ministries. Committee chairman Lapygin noted: "Hearings on the budget for the armed forces and industrial sectors geared to defense are still under way. . . . We have not yet examined the budgets of industrial ministries connected with defense."⁷ Although consolidated accounts have not yet been implemented, the defense committee is now considering the expenditures of different organizations as a unified package.

⁴"Vzglyad" program, Moscow Television Service, October 9, 1969 (FBIS-SOV-69-197, October 13, 1969, p. 105).

⁵I. Yudin, "Economic Aspects of Reductions in the Armed Forces and the Conversion of Military Production," *Voprosy Ekonomika*, No. 6, June 1969 (JPRS-UMA-69-009-L August 8, 1969, p. 10).

⁶Yu. Kornilov, "Behind the Military Budget Figures," *Sovetskaya Rossiya*, June 2, 1969, p. 3 (FBIS-SOV-69-105, June 2, 1969, p. 61).

⁷"Defense Budget Under Examination," *Krasnaya Zvezda*, October 6, 1969, p. 1 (FBIS-SOV-69-194, October 10, 1969, p. 56).

This process of review is made more complicated by the number of organs with their own distinct accounts inside the Defense Ministry that are authorized to receive products from the civilian sector. A representative from the Central Finance Directorate of the Ministry announced that

work on the elaboration of expenditure headings in the USSR Defense Ministry estimates is approaching completion. It must be said that the list of headings will inevitably end up being cumbersome owing to the existence of a large number of fund holders⁸ within the Defense Ministry. There are, for example, more than 20 just for industrial output received from the national economy. . . . Is it any wonder that in many instances economic accountability is on the skids?⁹

CENTRAL BUDGET REVIEW

The political leadership's policy of reducing defense expenditures and the Supreme Soviet defense committee's budget review has introduced a new procedure into Soviet defense decisionmaking: the examination of aggregate expenditures and the evaluation of programs in comparable figures—ruble values. Heretofore, weapon acquisition and R&D decisions were most likely based on a "disaggregated combination of material balances" flowing from individual weapon programs.¹⁰ These choices would be in the context of detailed material plans and alternative planned uses of these specific inputs. According to Meyer's analysis, the General Staff established mission priorities and set mission resource limits and weapon cost targets, with the services then authorized to proceed with detailed technical plans, cost estimations, and contractual relationships with producers.

Since Soviet financial plans have been mere appendages to the material plans, they have not been functional. However, the financial budget has now assumed a new importance as a device to control overall resource use and, especially, to control the state financial deficit. Because of such pressures, the total budgetary effect of defense has come under an unaccustomed scrutiny. But even more innovative has been the Supreme Soviet's evaluations across defense budget accounts.

⁸"Fund holders" are organizations authorized to receive planned output directly from producers or from Gosnab rather than from redistribution through their ministries or other superior agencies.

⁹V. Martynenko, "Defense, Conversion, Economic Accountability," *Krasnaya Zvezda*, June 29, 1969, p. 2 (FBIS-SOV-69-130, July 10, 1969, p. 106).

¹⁰Stephen M. Meyer, "Economic Constraints in Soviet Decisionmaking," in Rowen and Wolf, *The Impoverished Superpower*.

Comparisons of program costs will encourage evaluations of the relative worth of weapons and missions; the startling new feature of such comparisons is that it is being performed by civilian authorities rather than the General Staff.

One major outcome of this review process has already resulted in a departure from past practice: Stressing the "long overdue need to improve the material and living conditions of servicemen and members of their families," the committee approved appropriations totaling R1 billion to raise their pay and improve conditions.¹¹ The military was also directed to focus on discontinuing production of obsolete models of equipment and to reduce the number of different types.¹²

This attention to financial budgets will affect such issues as the price of weapons, their actual resource costs, and the efficiency of defense production.

WEAPON PRICES, BUDGETS, AND KHOZRASCHET: ADDITIONAL BUDGETARY PRESSURES

In the late 1970s, after decades of growth, weapon procurement stabilized, according to CIA estimates.¹³ With greater resource stringency, Soviet political leaders and the General Staff had to pay closer attention to the subaggregations of resources going to defense. Estimated weapon costs would have become a key policy consideration in these circumstances. Prices for a handful of Soviet weapons have been announced by Soviet authorities since early 1969. Analysis of these prices and the statements of knowledgeable Soviet writers suggest that, for some products, the price is only a fraction of the estimated value of incurred costs. (See the appendix for this analysis.) This divergence between costs and prices would have been a natural consequence of the attention presumably paid to weapon costs in the past decade, which would have generated strong incentives for the individual services to negotiate weapon prices with industry that were below accounting costs to increase the likelihood that higher-level decisionmakers would approve the services' programs. So long as financial profits and losses had little influence on the welfare of enterprises, they would not resist pressures from buyers to hold down prices; such asymmetry in

¹¹V. Kozlov, "At the USSR Supreme Soviet Committee for Defense and State Security Questions: Quest for Optimum Solutions," *Krasnaya Zvezda*, October 14, 1969, p. 1 (FBIS-SOV-69-199, October 17, 1969, p. 55).

¹²*Ibid.*

¹³This slowdown is discussed by Abraham Becker, *Ogarkov's Complaint and Gorbachev's Dilemma: The Soviet Defense Budget and Party-Military Conflict*, The RAND Corporation, R-3541-AF, December 1987.

incentives would persist so long as actual expenditures by enterprises were covered.

Such attempts to squeeze more output from reduced allocations by means of lowered planned materials inputs and prices would lead to even greater overcommitment of resources and tauter plans than normal. Allocation decisions would then be made at lower decision levels according to long-held routines (e.g. satisfy military demands first, and at all costs). Under such conditions, the leadership may have believed that it was making strategic reallocations; but planning, accounting, financial, and implementation processes could have contributed to at least a partial thwarting of such strategies. (Witness, for example, the persistent inability to meet growth plans for consumer goods.)

If incentives induced the Soviet military services to negotiate prices and resource plans that did not cover costs, how could the actual costs be covered? As mentioned earlier, the military does not make procurements out of a financial budget; the Ministry of Finance establishes accounts in the name of the production ministry or enterprise to pay for costs, based on earlier plans. If actual expenditures are greater than expected, or if losses arise in *khozraschet* enterprises, the losses can be absorbed in several ways. (1) Profitable military or civilian production within an enterprise can be used to cross-subsidize the loss-making orders. (2) Profits can be redistributed within a ministry to cross-subsidize entire enterprises. (3) "Planned loss" enterprises can be covered by the state budget. (4) Unplanned losses may be financed through bank loans to enterprises.

Soviet articles analyzing the sources of the government's budget deficit attribute a large portion of it to loans made to loss-making enterprises. Already, in 1985, it was asserted that "many enterprises, associations, and sometimes entire sectors are becoming 'dependents' of the state and are basically operating through state loans."¹⁴ Birman wrote that an increasing volume of defense expenditures has been financed in excess of the budget through this technique of creation of bank credit.¹⁵ The past primacy of defense production would have encouraged local managers of Gosbank to provide credits to enterprises whose costs had exceeded planned budget amounts.

The spirited attempt to reduce the state financial budget deficit through the elimination of bank loans to loss-making enterprises will make past practices of defense financing and price formation more visible. The review of weapon prices apparently had held up publication of

¹⁴L. Shanchenko, "Are We Too Liberal in the Extension of Credit?" *Ekonomika i Zhizn*, April 1985, No. 4, p. 9 (JPRS-UEA-85-030, August 25, 1985, p. 1).

¹⁵Igor Birman, *Secret Incomes of the Soviet State Budget*, Martinus Nijhoff Publishers, 1981, p. 26.

the defense budget in 1989, as Soviet officials at first claimed that no figures could be published until after a thorough-going price reform. Although the figures were eventually published without a price reform, the internal budget review may have alerted financial experts and their political leaders to the possibility of widespread mispricing of Soviet weapons. The result of more intensive review could be even greater pressure on defense procurement than is already implicit in reduced nominal budgets.

The introduction of profitability standards to defense enterprises will alter the relative incentives between the Defense Ministry and industry concerning contractual prices. The necessity for enterprises to cover their costs will encourage counterpressures for enterprises to bargain more strenuously with the military services over prices and input plans, perhaps as strenuously as they have customarily negotiated weapon performance characteristics.¹⁶

Another aspect of *khozraschet* is that products must be paid for by customers. The Ministry of Defense will have to be allocated explicit financial resources from the budget that it will then transfer to suppliers of goods and services. Whether this process is accomplished through an aggregate financial appropriation, through disaggregated accounts, or through the fine program detail found in the U.S. defense budget, the new payment approach will establish direct links between a customer with a budget constraint and its suppliers. Although the specific incentive effects will vary with the budget process actually adopted, one major implication is predictable: Both the Defense Ministry and the leadership must pay closer attention to the absolute and relative prices of military goods and services. This attention could result in additional pressure on aggregate defense R&D and procurement as well as on its composition.

¹⁶Meeting the negotiated values of weapon performance often determined the rewards going to a design bureau. A. Alexander, *Decisionmaking in Soviet Weapons Procurement*, p. 60, Note 149, 1978-1979.

IX. THE IMPLICATIONS OF TECHNOLOGY AND COMPLEXITY

THE DECLINING EFFECTIVENESS OF THE BUYER'S MARKET

Previous sections of this report described how changes in economics, politics, and budgetary procedures are reducing the effectiveness of Soviet weapons acquisition. We now turn to a quite different category of forces: those set into motion by the technology and complexity of modern weapons.

Methods by which the Soviet military has assured itself, of capable and high-performing weapons include its active and detailed involvement in design and production, its comprehensive testing of new systems from experimental prototypes to their use by operational forces, and its application of powerful sanctions over nonperformance—including the privilege of not accepting products that do not meet its requirements. In a word, the Soviet military has been an astute and powerful customer; it has operated in a buyer's market.

However, for the network of military representatives at design bureaus and factories to root out and correct deficiencies, for rigorous testing to reveal deficiencies and verify compliance with requirements, and for sanctions to produce incentives on suppliers leading to desired results, the desired outcomes must be technically feasible and the administrative methods capable of promoting technically feasible ends. Both technical feasibility and administrative processes have now been compromised by the technologies and design complexities of the weapons and military systems appearing in the last decades of the twentieth century.

THE AGE OF THE "WEAPON SYSTEM"

The term "weapon system," which is often now used in place of the simpler and older word "weapon," adequately incorporates many of the important changes of the last 20 years or so. The weapon "platform"—the airplane, armored vehicle, ship—is today the carrier of a suite of subsystems whose coordinated actions are required to destroy the enemy. A wide variety of sensors collect information about the activities of the target, the platform, the weapons (guns, missiles, etc.), and the environment. This information is integrated by high-speed

computers and used in computations that calculate and often control the actual operations of the platform and its ordnance-delivering weapons; such activities as navigation, flight control, target acquisition and designation, weapon release, trajectory determination, and countermeasures are assisted, if not actually controlled, by computers. Not only do the weapon systems themselves now incorporate these new technologies and capabilities, but a growing number of support systems complement the operations of the weapon systems, and indeed often are critical to their success. These include communications, ground-based radars and other sensors; airborne and satellite information-gathering and disseminating systems; intelligence, reconnaissance, and countermeasure systems; information "fusion" systems; command and control networks, not to speak of the computer-managed supply and logistics networks.

Since the 1930s, the Soviet Union has built a capable R&D and production complex for the basic platforms and weapons of the industrial-age military. As new weapons and technologies entered contemporary armies, the nation mounted enormous efforts to keep up in nuclear weapons, rockets, and nuclear-powered submarines. However, the advances in sensors, electronics, computerization, information, communications, and miniaturization since the 1970s have left Soviet industry—even military industry—in a particularly vulnerable position. The speed of change, the complexities of design, the integration of many different technologies from diverse sources, and the high precision and reliability needed for production strike at traditional weak points in the Soviet economic and management spheres. These vulnerabilities and weaknesses are now manifesting themselves in Soviet weapon acquisition.

DEFICIENCIES IN THE SOVIET MILITARY R&D APPROACH

The increasing diversity of defense technologies, materials, components, and subsystems requires the coordination and integration of a vast array of suppliers, research organizations, design bureaus, ministries, and other participants. Knowledge and expertise is distributed rather than concentrated. The unique integrative role that the general designer has played in Soviet weapon development is now diffused and dissipated by the proliferation of technologies and tasks.

The chief designer of a complex weapon system must now depend on the performance of others to a much greater degree than in the past. In these new conditions, the VPK, cannot motivate and coordinate

these activities in the same thorough manner that it had formerly. Not only are the participants more numerous, but their interactions are more complex, the scheduling of tasks more formidable, and the ability to actually plan these activities in advance less feasible. Flexibility and motivated discipline are both required; the Soviet system lacks flexibility, and its discipline is heavy-handed. Presumably, the general designer, the VPK, and the Party still dispose of the same authority as formerly, but this is a less usable commodity when organizations must be responsible for their own performance in a highly complex and changing technical environment.

Soviet weapon design philosophy has dealt with the shortcomings of the economic system by minimizing risk and radical change and by confining the scale of complexity to manageable size. When risk and complexity went beyond the organizational capacity of the system, the political leadership intervened and created special, single-purpose management bodies with direct ties to the top political and economic decisionmakers. This approach was used in the development of nuclear weapons and intercontinental missiles. As these radically new weapons became more familiar, their special organizational status was transformed into the conventional ministerial structure.

This kind of focused, centralized response is not possible for many of today's weapons. The commands to build an atomic bomb or an ICBM cannot be mimicked by orders to build a microelectronics industry or an integrated data bus. These latter-day systems require a new kind of industry or, rather, many new industries. Whereas in the 1930s the Soviet Union was able to build tank and steel industries centered around enormous plants managed by centralized ministries, today's weapons depend on an array of many, small, ever-changing suppliers. Systems designers can no longer count on slowly evolving technologies and a stable set of suppliers but must confront sharp changes in the required skills and capabilities in their own design bureaus and in those they deal with.

This revolution hit the U.S. weapon producers in the 1960s; it has taken at least two decades to learn how to cope with it, and adaptation has been imperfect. One sample indicator of this shift is the proportion of development effort going to embedded computer software. The F-4, F-15, and F-18 aircraft represent 1960s, 1970s, and 1980s technologies. The prime contractor, McDonnell-Douglas, and its subcontractors for these aircraft devoted 1 percent of total engineering man-years to computer software for the F-4, 24 percent for the F-15, and 40 percent for the F-18.¹

¹Steven Glaseman, *Comparative Studies in Software Acquisition*, Lexington Books, Lexington, Mass., 1982, p. 8.

Computer hardware development demanded much less attention, mainly because a separate computer and electronics industry had independently developed its own technology base; McDonnell-Douglas devoted 1, 2, and 3 percent of its engineering effort to computer hardware on these aircraft. The U.S. Air Force was not fully aware of the enormous change embodied in the shift from the F-4 to the F-15, and similar transformations in its other systems. A decade or more of chaos and confusion in weapon electronics development resulted in high costs, low reliability, and delayed introduction of new systems.

The Soviet weapon industry appears now to be in the throes of a similar process, but without the scientific or industrial infrastructure in place to ease the problems, and without the flexibility and incentives needed to improve the infrastructure.

TRUBLE FOR SOVIET WEAPONS

Soviet military leaders and weapon designers are beginning to provide evidence of serious shortcomings in recent Soviet weapon systems. These problems were apparently surfacing in the 1970s but seem to have reached crisis proportions in the 1980s. The Deputy Defense Minister for Armaments, General Shabanov, has emphasized these points in articles and interviews since early 1988. A key point has been his acceptance of the view that the military is no longer walled off from the rest of the Soviet economy.

We are often deluded by general numerical indicators. You analyze them and everything seems normal: . . . the technical level of innovations, . . . the quality of inventions is increasing. However, this is only a general impression. Things in reality are not going nearly so smoothly. . . . The introduction of new developments is generally a weak point in our country *and in the Armed Force in particular* [emphasis added].²

Reliability Problems

Reliability—always a central Soviet requirement—is one of the most commonly cited deficiencies. General Shabanov, for example, asserted, “We need radical methods for increasing the reliability and operating technology of weapons.”³ At a major conference on improving military science, the Defense Minister, General D. T. Yazov, referred to reliability several times in his summary of the conference.

²“The Horizons of Technical Creativity,” *Krasnaya Zvezda*, November 15, 1988, p. 1 (JPRS-UMA-89-001, January 11, 1989, p. 74).

³*Ibid.*

Flaws occurred in determining the prospects for developing armaments, in the operational-tactical verification of particular models, and in ensuring that their *quality and reliability* conformed to modern requirements. . . . Under no circumstances must our scientific establishment and military scientists lose sight of the main objective—ensuring the *high quality and reliability* of armaments and military hardware” [emphasis added].⁴

VPK chairman Belousov specified as the second point of his program for defense industry, “special attention should be paid to improving the reliability and quality of military equipment.”⁵ The air force commander, General Batekhin, listed reliability as the first requirement for improving the country’s defense: “About the reliability of the hardware that the troops are receiving: What we have here is a pretence. We are hoping that soon these pretensions will be lessened.”⁶ He noted that when the producers and developers transfer to *khozraschet*, profitability will depend on how the customers evaluate the output, implying that this evaluation will provide economic levers to influence reliability.

Khozraschet, though, may not be the answer to the reliability problem. Defense industry is part of the Soviet economic system; despite all its advantages and the power of the military customer, the endemic deficiencies of the economy stubbornly seep through the wall erected to isolate defense, and the seepage may be turning into a flood. In a frank article describing equipment problems on board a nuclear-powered missile cruiser, one source of reliability problems was assigned to the constantly increasing proportion of complicated equipment—especially radioelectronics and missile ordnance. “Consequently, the Navy has to pay more and more” for less and less reliable equipment.⁷ The factories continued to ship defective equipment even though the ship’s officers would not sign the acceptance documents. “They receive money mainly for quantity, for gross output, for fulfillment of the plan, for the fact that they have ‘dispatched’ the product.”⁸ A key guarantor of quality, the military representative responsible for the shipment of this equipment, made excuses on behalf of the plant for the poor quality. In fact, the chief of the team of military representatives admitted that they acted more as a coarse than a fine filter, and that many

⁴D. T. Yazov, “Increasing the Return from Military Science,” *Krasnaya Zvezda*, August 14, 1968, pp. 1-2.

⁵Remarks by I. Belousov, Moscow Domestic Radio Service, June 28, 1969 (FBIS-SOV-89-124, June 29, 1969, p. 36).

⁶“Beyond the Sound Barrier,” *Izvestiya*, August 21, 1968, p. 3.

⁷“Ships and Rubles,” *Krasnaya Zvezda*, May 12, 1969, pp. 1-2 (FBIS-SOV-89-120, June 23, 1969, p. 71).

⁸*Ibid.*

things slipped past them that would only show up on board ship. Rather than the fiat of the buyer in this situation, naval officers spoke about the dictatorship of the producer. "Industry sells the equipment the Navy will buy."⁹ And why does the Navy purchase deficient equipment? "Because they have no choice." Indeed, the VPK chairman has called for competition in equipment development to make the best use of reduced allocations to defense.¹⁰ In the meantime, the Navy is having to pay for improved reliability through the use of hundreds of civilian technicians aboard ships.

The use of civilian technicians to correct and maintain equipment has also been cited for the strategic missile forces. A journalist

witnessed a large group of civilians leaving early in the morning in a large bus from the hotel to firing positions. It turned out these were industry employees who were making some kind of adjustments. . . . How could a missile in need of adjustment be on alert duty? What kind-hearted person, trusting the chief designer or his highly placed sponsor, authorized acceptance of the "premature" product for service, and thus yet another handing out of grandiose bonuses?¹¹

The Defense Ministry's Armaments Directorate coordinates weapon acquisition and R&D throughout the military. The hardware problems facing all the military services come to a focus in this office. Its head, General Shabanov, has been a leading critic of current practices, listing reliability as the number one problem.

Today, we cannot regard as satisfactory the technical standard of a number of models of weapons in terms of extremely important parameters such as reliability, lifetime, energy consumption, weight, and size. . . . We are particularly perturbed by the question of ensuring a long lifetime, reliability, and dependable operation for arms and military equipment.¹²

Shabanov then went on to assert that it was insufficient reliability that to a great extent forced the Soviet Union to procure greater quantities of the main types of arms.¹³ He also noted that inattention to reliability was partially responsible for recent well-publicized equipment accidents and losses: "Unfortunately, the series of submarine and aircraft accidents that have occurred lately attests to untapped reserves in

⁹Ibid.

¹⁰Remarks by I. Belousov, Moscow Domestic Radio Services, June 28, 1969.

¹¹A. Gorokhov, "Dangerous Depths," *Pravda*, June 28, 1969, p. 6 (FBIS-SOV-89-129, July 7, 1969, p. 103).

¹²General Shabanov, "The Country's Defense: New Approaches," *Krasnaya Zvezda*, August 18, 1969, p. 1 (FBIS-SOV-89-160, August 21, 1969, p. 120).

¹³Ibid.

ensuring the reliable functioning of combat equipment."¹⁴ Problems with submarines surfaced in a television investigative program on the spate of submarine accidents. A reserve naval captain involved in examining the state tests of the "Komsomolets" submarine claimed that the testing program was conducted in a shoddy way. "If a decision had been made to conduct the testing as it should have been done, a number of design faults would have been discovered."¹⁵ Another reserve naval captain suggested that such deficiencies were to be expected from the Ministry of Shipbuilding:

We have a Navy that corresponds to the standards of twenty years ago. . . . We have received nothing from this third generation [of nuclear-powered submarines]. Everything is poor: The acoustics are poor, the computer is poor, without mentioning the noise level. The noise level created by our submarines is twelve times greater than that of U.S. submarines. . . . We have craft that are not combat ready.¹⁶

As equipment becomes more complex, comprehensive testing becomes both more important and more time consuming. With the increased number of connections and interfaces among components, the possible sources of failures are multiplied; furthermore, engineering and theoretical knowledge cannot predict the modes and mechanisms of future failures.¹⁷ U.S. military jet engines, for example, typically accumulated about 10,000 test hours before qualification in the 1960s; by the 1980s, this figure had climbed to 14,000-18,000 hours.¹⁸

This need for more and better testing has been acknowledged by Soviet military leaders. But they compromise their insistence on thorough testing with an equally demanding requirement to field systems more quickly. This ambivalence was captured in a remark by Defense Minister Yazov: "It is essential to strive persistently and unswervingly to achieve high quality in testing so that with the *minimum number of tests* one can attain the maximum practical results . . . that will make it possible to make a decision about the fate

¹⁴Ibid.

¹⁵"Vzglyad" Program, Moscow Television Service, July 14, 1989 (FBIS-SOV-89-135, July 17, 1989, p. 99).

¹⁶Ibid.

¹⁷These assertions were taken from the conclusions of a study on U.S. military electronics in the 1970s: D. W. McIver, A. I. Robinson, H. L. Shulman, and W. H. Ware, *A Proposed Strategy for the Acquisition of Avionics Equipment*, The RAND Corporation, R-1489-PR, December 1974.

¹⁸Arthur J. Alexander, "The Cost and Benefits of Reliability in Military Equipment," The RAND Corporation, P-7515, December 1966, p. 60.

of a model or series of armaments" [emphasis added].¹⁹ General Yazov then went on to emphasize that new methods and means must be found to enhance "the quality and reliability of armaments, and the reduction of time necessary to develop and test them" [emphasis added].²⁰

The full effect of these contrary pressures came to bear on the development of the Soviet supersonic airliner, the Tu-144, in the mid-1970s. Although nominally a civilian project, it had full government-party priority, with the backing of the Party Secretary for Defense Industry Dmitriy Ustinov, and the VPK chief L. V. Smirnov. According to a former deputy minister of civil aviation,

In the summer of 1977, a directive came from "the top" [Brezhnev] to begin passenger flights with the Tu-144 in the fall. . . . Soon afterward, the chief [of a directorate of Civil Aviation] presented me with a joint plan with industry . . . for organizing passenger flights for my signature. All the managers had signed. . . . I would not sign the document. . . . The aircraft had not undergone state tests! They simply had not passed them. . . . This would have been a fraud agreed on by both sides and with the consent of high officials.²¹

Although the Tu-144 case was one that was pushed "by the top," this pattern has today become more generalized, as the ship ordnance example mentioned above demonstrates.

Despite the high-level complaints about reliability problems, it is necessary to approach these statements with some interpretive caution. Soviet complaints must be judged in relation to the first-order priority they put on reliable system performance and to the high standards they have often achieved in the past. Mikoyan design bureau head Belyakov claims that the mean-time-before-failure of the MiG-29 is 40-50 percent better than that of the U.S. F-16. However, the previous generation of Soviet fighters were 80-90 percent more reliable than their U.S. counterparts. Thus, if we accept the MiG-29 claims at face value, we see a relative decline in Soviet reliability, but still better than that in the United States. Nevertheless, the tenor of the Soviet writings suggests that they perceive a reliability crisis.

¹⁹D. Yazov "Increasing the Return from Military Science," *Krasnaya Zvezda*, August 14, 1968, p. 1 (FBIS-SOV-88-158, August 16, 1968, p. 66).

²⁰*Ibid.*, p. 67.

²¹V. Bedov, "The Tu-144 Has Been Left on the Ground: Was the Prestigious Project Doomed to Failure?" *Pravda*, July 28, 1969, p. 3 (JPRS-UEA-89-033, October 16, 1969, pp. 84-87).

Technology Problems

Soviet military and industry leaders have recently begun to detail specific technology shortcomings in military systems. These problems have been discussed earlier by Western analysts and will not surprise knowledgeable foreign analysts. General Shabanov has neatly summarized Soviet technology deficiencies: "Our science and industry lag behind in the sphere of developing radio-electronic weapon systems, thermal imaging instruments and night vision instruments, and communication and control systems. Yet these play a great role in ensuring reliable defense."²²

The VPK chairman, in accepting his nomination to continue heading this organization, also listed electronics as one of his main concerns: "I consider it essential to support in every way, at every stage of work, and at all levels of discussion the development of electronics and computer equipment."²³ And, among the ten troubled areas that demanded resolution, he included electronics, computing equipment, and communication equipment.

This too was the view of the minister of aviation production, A. S. Sytov: "We should put every effort into developing microelectronics as quickly as possible. We are currently lagging behind in this area. This lag will later affect aircraft construction."²⁴

Some examples from recent aircraft give concrete detail to these concerns. The Su-27 fighter aircraft's aerodynamics and size were determined by provision for accommodating the largest radar possible "as the simplest means of achieving maximum interception range."²⁵ Helicopter designer Tishchenko explained a metal plate covering an opening in the Mi-28 at the 1989 Paris Air Show by noting: "We have encountered delays in the development of electro-optical systems on this program."²⁶ Additional development problems were being encountered with the Mi-28's night vision system, which had been worked on "for about a decade" and was now behind schedule. These various equipment development problems were contributing to a planned heli-

²²V. M. Shabanov, "The Country's Defense: New Approaches," *Krasnaya Zvezda*, August 18, 1989, p. 1 (FBIS-SOV-89-160, August 21, 1989, p. 103).

²³Remarks by Igor Belousov, Moscow Radio Service, June 28, 1989 (FBIS-SOV-89-124, June 29, 1989, p. 37).

²⁴"We See Prospects for Growth," *Krasnaya Zvezda*, June 21, 1989, p. 3 (FBIS-SOV-89-121, June 26, 1989, p. 88).

²⁵John Fricker, "Russian Round-up," *Air International*, September 1989, p. 131.

²⁶Robert Ropelewski, "Glasnost Gusto Invigorates Paris Air Show," *Armed Forces Journal International*, July 1989, p. 84.

copter development period of ten years from first flight to series production.²⁷

According to MiG designer Belyakov, his main problems are the size and weight of electronics components and sensors. Every extra unit of weight imposes an ultimate penalty of five times that amount in take-off weight, driving up the size and cost of the aircraft. The equipment, however, meets the functional performance requirements set for it by the Soviet Air Force.

This sanguine opinion, however, is not shared by the defense minister. In the course of an extended indictment of defense science and R&D, he complained that "scientific developments proceeded along a well-trodden path and amounted, in essence, to duplicating what had already been created; . . . new and nontraditional solutions in the development of armaments and military hardware were not sought."²⁸ He further alleged that the results of research were introduced too slowly. He attributed these problems to "formal bureaucratic methods of leadership, leveling [of wages], a lack of personal responsibility, parasitical tendencies, a loss of initiative by some cadres at scientific establishments, and a loss of desire to achieve real results."²⁹ A mediocrity of cadres was encouraged by a "formal bureaucratic approach to their selection, deployment, and training" in which favoritism and untalented people penetrated the military R&D world.

General Yazov's proposed solution to his enumerated list of deficiencies, however, has little operational content and indulges more in the recitation of political slogans than in changes in incentives. "The prime conditions for improving the qualitative indicators of military science are to purge it of all accretions, to restructure internal relations within it, to create an atmosphere of glasnost, openness, and freedom of creativity and debate, and of businesslike criticism and self-criticism."³⁰

General Shabanov, though, is wary of organizational responses. "You may think that we can drastically improve inventiveness if we strengthen an already developed structure. But this will bring about just the opposite results, as it will only produce more methodological recommendations, instructions, directives."³¹ His solution, although not spelled out in detail, has a radical ring to it. "What we need is for this job not to be rest-

²⁷John Fricker, "Russian Round-up," *Air International*, September 1989, p. 131.

²⁸"Increasing the Return from Military Science," *Krasnaya Zvezda*, August 14, 1988, p. 1 (JPRS-SOV-88-158, August 16, 1988, p. 65).

²⁹*Ibid.*

³⁰*Ibid.*

³¹Shabanov, "The Horizons of Technical Creativity," *Krasnaya Zvezda*, November 15, 1988, p. 1 (JPRS-UMA-88-001, January 11, 1989, p. 74).

ful, but to be a volcano. You cannot make inventiveness in a bureaucracy."³²

The statements of Generals Yazov and Shabanov point up a new perception of Soviet research and science. Both Soviet and non-Soviet analysts proclaimed for many years that the main problem with Soviet technology lay in the *introduction* of scientific results into useful applications; the source of the problem was the weak incentives to incorporate new technologies into product designs and production. Potentially important research results were placed on the shelf and remained there. Many science leaders are now saying that the shelf itself is bare. Even in the past, there was general acknowledgment of weakness in many areas of Soviet science, but strengths could also be pointed to, especially in theoretical subjects and in fields related to military applications. The strong points today are becoming harder to find. These views are being expressed by individual scientists, by the science leadership, and by the political leadership; as a user of science results, the military leadership has also joined the ranks of science critics.

Academician Sagdeev, for example, bemoans the situation in Soviet science, asserting that there is *no* area in which the Soviet Union now leads the world.

We in the Soviet Union have been castigating ourselves for our failure to apply fundamental research findings to improve industrial productivity. We have revised policies to strengthen the connection between science and practice; but although such reforms may be necessary, we have not faced up to the real problem: Soviet fundamental science is too weak to contribute much to practical applications.³³

The president of the Academy of Sciences, Guri Marchuk, states: "We have come to a dividing line when backwardness could acquire a qualitatively irreversible character. The leaders of the nation must be informed that our situation in science contrasts sharply not only with the developed nations, but at times even with the developing countries."³⁴ Politburo member Yakovlev complained that because of the strong bureaucracy in the Academy, the level of scientific research in the USSR had drastically deteriorated in the past decade. "One group of people works, and another puts obstacles in the way of their activities."³⁵ In the majority of academic institutes, he said, no more than half the employees do any useful work, and in the worst cases, it would be hard to find anyone doing fruitful research.

³²Ibid.

³³Ronald Z. Sagdeev, "Science and Perestroika: A Long Way to Go," *Issues in Science and Technology*, Summer 1988, p. 1.

³⁴Guri Marchuk, "What Is to Become of Science?" *Pravda*, July 1988, No. 12, p. 1.

³⁵*Sovetskaya Litva*, August 14, 1988; quoted by Vera Toiz, *Radio Liberty Report*, August 25, 1988.

X. SOVIET WEAPONS ACQUISITION UNDER POLITICAL REFORM AND TECHNOLOGICAL REVOLUTION

Since the 1930s, one thing that the Soviet Union did well was to design and produce weapons. The country's leadership developed and maintained a scientific, design, and production infrastructure to support its political-military goals; the political leaders supported this technical edifice with a planning and implementation framework that guaranteed that the resources allocated to defense would be put to good and effective use. Much of this Stalinist structure is now beginning to crack. It has not crumbled, and for the present it is even far from collapsing, but it is beset by political changes that reduce its capabilities and by changes in the nature of defense technology that place a premium on the very economic characteristics in which the Soviet Union is weakest.

RESOURCE ALLOCATION

One source of Soviet defense industry effectiveness has been the willingness of the Soviet political leaders to devote substantial portions of the nation's economic strength to defense and to the support of defense industry. That support is now being reduced. The planned growth of defense expenditures has been converted to planned reductions. Procurement is falling by a projected 20 percent, and some Soviet political leaders claim this cutback is only the first step of an ongoing process. With this cutback, military and industry spokesmen have emphasized the importance of maintaining the R&D base: The reduced number of deployed weapons must be compensated for, they say, by higher quality weapons with increased performance and the ability to conduct a broader range of missions. This will require even more R&D than in the past.

VPK chairman Belousov told the Supreme Soviet that the first question to be solved arising out of defense cutbacks was the need to support science and the experimental base, including "real support for revolutionary new solutions in equipment."¹ This view is supported by defense industry managers who fear the decline in their technology

¹Remarks by Igor Belousov, June 28, 1989, Moscow Radio Service (FBIS-SOV-89-124, June 29, 1989, p. 36).

base. A "worst case scenario and a major concern" to the deputy minister for R&D in the aviation production ministry is that the defense reductions will encompass research and design work.² The Sukhoi deputy chief designer claimed that such a scenario "would threaten the next generation of Soviet fighters."³

Defense Minister Yazov rhetorically voiced his apprehension over the disappearance of the military's—and the nation's—science base: "By reducing military expenditures are we not submerging the final islet of our scientific-technical and intellectual potential, which is at the present time concentrated in the institutes and enterprises engaged in filling military orders?"⁴

Despite these anxieties, though, the Supreme Soviet reduced the defense R&D allocation in the 1990 budget by 14 percent, or R2.2 billion. Marshal Akhromeyev grudgingly accepted these cuts: "Along with the general reduction in defense spending, appropriations for scientific research and experimental design work in the military spheres are also being reduced. Life necessitates this reduction. But, to be frank, this is undesirable."⁵

Since 1988, we have witnessed a diversion of defense industry capacity, investment, manpower, and R&D resources to civilian output. In 1989, this initial transfer was compounded by explicit defense reductions, the sharp cutback in production programs, and a more-than-proportional reduction in defense R&D. To these reductions have been added explicit aggregate and program budget reviews by nonmilitary bodies with appropriations authority. At the same time, a form of profit-oriented accounting and incentives was initiated for defense enterprises, thereby creating new pressures for the prices of military products to cover their costs—out of the military budget rather than from unbudgeted bank loans. General Shabanov complained in October 1989 that the plight of the armed forces resulting from a smaller budget was made worse by price increases over the past year. "Unfortunately, comrades, the situation is aggravated by the fact that the cost of work and equipment has increased. There are quite a few examples of R&D costs increased by 1.5 and even 3 times originally

²Alan Postlethwaite, "Soviets Show New Types as Spending Cuts Loom," *Flight International*, September 2, 1989, p. 8.

³*Ibid.*

⁴Moscow Domestic Radio Service, July 3, 1989 (FBIS-SOV-89-127, July 5, 1989, p. 43).

⁵"Soviet Military Expenditures in 1990," *Krasnaya Zvezda*, October 6, 1989, p. 1 (FBIS-SOV-89-202, October 20, 1989, p. 88).

adopted cost guidelines."⁶ Among the reasons given for these increases were "imperfect norms" used to determine costs under *khozraschet*.

While the adequacy of the defense R&D establishment is being called into question, the military is wrestling with a new political-military "defensive" doctrine of "reasonable sufficiency." A smaller force structure with reduced quantities of equipment, but of higher performance, appears to be on the horizon. These developments point to military demands that place less emphasis on the mass-production base but perhaps even more on the advanced industrial capabilities and R&D resources of defense industry. The demands for higher performance, increased reliability, lower costs, new and nontraditional solutions to military tasks, and greater speed of introduction of new technologies will require a reorientation of Soviet defense R&D away from its Stalinist heritage that will conflict with the demands on these same resources coming from the conversion to civilian production.

The resource base of Soviet weapon acquisition is being assaulted in a way that will affect both the quantity of production and the R&D support. The cost-based "end results at any cost" approach will come under severe pressure. The Soviet military-industrial complex will be forced to confront the issue of efficiency, in addition to effectiveness, with implications for force-posture choices, resource allocations, and management incentives. However, Soviet bureaucracy and the weak incentive structures could very well absorb these pressures so that the future Soviet military will be neither leaner nor meaner, just smaller.

IMPLEMENTATION PRIORITY

Allocations and plans do not guarantee that the thousands and tens of thousands of products going into complex equipment will be produced and delivered at the right time, in the right quantities, and at the appropriate quality levels. In fact, the Soviet planning system guarantees that this will not happen. Plans are inconsistent in that they do not balance in detail; the planning job is just too large and complex to produce perfectly articulated plans for all products and producers. But, more important, planners deliberately call for more output than can be produced as the government attempts to squeeze more output out of the system by maintaining pressure on producers. The result is "taut" plans; some targets will not be met, and some planned supplies are never produced. Taut plans create supply uncertainty and a seller's market.

⁶V. M. Shabanov, "Guaranteeing Peaceful Labor," *Krasnaya Zvezda*, November 2, 1969, p. 1 (FBIS-SOV-69-212, November 3, 1969, p. 63).

Fragmentation of the science-industrial structure into industrial ministries (with their research institutes, design bureaus, and production plants) and a separate research establishment in the Academy of Sciences also create supply problems as well as difficulties in coordinating programs.

Defense industry has overcome these problems of uncertain supplies and coordination difficulties through *implementation priority*, exercised primarily by the Communist Party and the Military Industrial Commission (VPK). These two organizations have now been saddled with a new task—conversion—that is diluting their ability to maintain their customary focus on defense output.

An important symbolic and functional indicator of the dilution of defense priority was the appointment of Lev Zaikov as deputy chairman of the Defense Council, the highest defense policymaking body in the USSR. Zaikov's party responsibilities appear to include all defense and security-related activities, including defense industry; in his multiple positions as Politburo member, deputy chairman of the Defense Council, and Secretary of the Communist Party he would be senior to, and supervise, the Party secretary responsible for defense industry. The Politburo has assigned to Zaikov personal responsibility for conversion matters. A government and Party consolidation of supervision in a single person has raised the importance of the issue in political, Party, and government circles.

Such pressures for defense industry to develop and produce civilian output must impose additional demands on party and VPK officials. The energies and attention of defense managers also would necessarily be redirected toward initiating the output of new items in unfamiliar areas.

Although the formal system of supply priority for defense appears to have remained in place, the actual implementors of the priority system have these additional, important tasks. Although defense output is still given nominal dominance in the official and rhetorical system of priorities, complaints from military, political, and government leaders imply that the old system is beginning to break down. New political winds are shaking some of the oldest implementation realities as defense output no longer carries the sole priority of management attention, but must share it with civilian production.

BUYER'S MARKET

The provision of ample resources and the implementation priority to direct them to their planned uses would not deliver effective military

systems if the products did not match the military's needs. The military customer assures that the defense R&D and industrial complex delivers effective weapons through its capabilities as an informed, astute, and powerful buyer. These capabilities have been institutionalized in the organization of military representatives, in acceptance testing, and in the ability of the customer not to have to accept deficient products.

These capabilities, however, are being vitiated by the complexity of modern military systems that reduce the ability of military representatives to monitor and control enterprise activities and that prevent the full test of new systems prior to the accumulation of operational experience, and by the sheer inability of Soviet industry to perform as desired. These weaknesses in oversight and performance are compounded by the monopoly position of many suppliers. The sanctions that can be imposed on defense industry for failure to supply acceptable products are countered by an industry that knows there is often nowhere else to go.

In recent years, the actual application of sanctions to nonconforming enterprises appears to have declined. No one is forced out of business; managers are not sent to the camps; bonuses seem to get paid regardless of actual output; banks will lend to loss-making enterprises or ministries will redistribute profits; and floor space and investment are always increasing.

Increased technological complexity, reduced implementation feasibility, the monopoly position of suppliers, and the loss of sanctions have weakened the power of the buyer's market. The military is therefore more likely to find itself with lower quality, less effective weapons than in the past.

R&D STYLE

The Soviet style of R&D has much to commend it, but its ability to cope with the complexities of modern weapon systems design and development is being undercut by the organization and incentives of the Soviet economy. The coordination and management of complex programs are a challenge to even the best managed organizations in market economies, in which market forces richly provide coordination and incentives. In the Soviet economic environment, the proliferation of weapon technologies, the complexities of interfaces, the incorporation of subsystems from diverse sources into larger systems, and the fundamental importance of microelectronics and its supporting software all place a great burden on just those characteristics of the Soviet economy that are the weakest.

The level of complaints and the evidence from the hardware suggest that the effectiveness of the R&D establishment in delivering adequate models of new weapons is being compromised by technology, management, and the nature of the centrally planned and coordinated economy. Design bureaus and industry still seem to be quite competent at designing and producing the basic platforms⁷ (airplanes, tanks, etc.); the technical and industrial infrastructures—the pyramids—are well in hand for these. The design, production, and integration of the subsystems, not the platforms themselves, are at the core of the present predicament.

The Soviet R&D style depends on a capable industrial infrastructure and on complementary R&D organizations to supply mature components and technologies. Without these real capabilities, a particular style and approach offers little payoff. Indeed, it can be said that U.S. weapon acquisition has often succeeded despite its development style because of the strength of its technical and industrial support. Fixing the Soviet Union's weapon acquisition problems will require the creation of new R&D and industrial infrastructures, quite different from present organizations in form, incentives, and in management strategy.

CONCLUSIONS

Soviet strengths in weapon acquisition, and in the scientific and industrial infrastructure supporting it, are now being eroded by the complexities and characteristics of contemporary weapon technologies, by the endemic problems of the Soviet economy, and by the decline of Soviet research as the plague of bureaucratization and mediocrity invades the fortress of the scientific establishment. The problems are compounded by the reduction of defense budgets and the dilution of defense priority. The traditional strengths of Soviet weapon acquisition have not collapsed, but the slow and gradual encroachment of debilitating forces could produce a cumulative and important effect in the long run. A large part of the effectiveness of the Soviet military R&D style arises from the power of evolutionary change, which when pursued over long periods can yield dramatic, even revolutionary results. The same conclusions can be drawn for present circumstances, but with the direction of change reversed.

From the 1930s to the 1980s, Soviet military production and R&D developed along one dominant path, evolving and refining its practice.

⁷Design and performance of Soviet fighter aircraft at the 1989 Paris Air Show were described by the Western aviation press as "impressive" and "dumbfounding;" "Many veteran Western fighter pilots agreed the overall performance and handling qualities shown by the Su-27 put the aircraft ahead of existing Western fighters in close-in air combat capabilities." Robert Ropelowski, "Glasnost Gusto Invigorates Paris Air Show," *Armed Forces Journal International*, July 1989, p. 57.

and approaches into a clearly identifiable style and culture. This path was consistent with the requirements of political-military doctrine and with the economic base supporting it. Participants and foreign analysts alike grew comfortable with the operation and the understanding of this enterprise. Now, politics, doctrine, economics, and technology are changing. The Soviet defense production complex and the military are adapting to forces imposed by the leadership and by life itself. The fog and confusions of war are matched by the uncertainties of evolving Soviet politics and policies and their realization. However, some comfort is granted to the analyst, at least for the present, in that some things have not changed. The Soviet economic system remains essentially unreformed. Basic incentives, organizational arrangements, planning tautness, and bureaucracy are as before. But allocations are shifting; military demand is changing. And enough things have been set in motion that our comfort in relying on familiar landmarks may not be all that long-lasting.

Appendix

THE COST OF SOVIET WEAPONS

THE ANNOUNCEMENT OF SOVIET WEAPON PRICES

Since March 1989, Soviet sources have released information on the prices of several Soviet weapons, including tanks, ships, and aircraft. These prices are shown in Table A.1, where I have tried to include only those weapon prices reflected in internal Soviet transactions; the table does not cover export prices or vague statements about costs (e.g. "the Flanker [Su-27] is only 10 percent more expensive than the Fulcrum [MiG-29] in terms of man-hours; . . . the Su-27 is slightly cheaper than the F-15 in pure monetary terms."¹ However, a more complete analysis of such additional information would help to flesh out the price/cost picture. As is usual when new information that has been avidly awaited suddenly becomes available, these disclosures raise a host of questions that cloud interpretation. In this appendix, I will try to sort through some of these questions to discern what these figures may tell us about: (1) the basis for the seemingly small announced 1989 Soviet defense procurement expenditures of R32.6 billion; (2) the profits or losses to enterprises from defense production; (3) ruble-dollar ratios for military equipment.² A key issue behind these questions is whether published prices reflect resource costs. To even approach these issues, it is necessary to consider the validity and applicability of the announced figures.

All of the disclosures have been used to justify the surprisingly low aggregate defense expenditures figures announced by Gorbachev, and the equally small share of procurement. The figures could be pure fabrication; however, I suspect that they reflect the contractual prices that are credited to the production ministries' accounts when systems are delivered to the military. These would be the kinds of figures available to those charged with the task of compiling aggregate defense

¹Sergio Coniglio, "The Eastern Masterpiece: Sukhoi Su-27 Flanker," *Military Technology*, October 1989, pp. 100, 109.

²Estimates of ruble-dollar ratios are intended to show the ruble cost of producing an item in the Soviet Union relative to the dollar cost of producing the same item in the United States. They are not meant to be proxies for official, unofficial, or actual international exchange rates or foreign market prices. They should, however, reflect relative production efficiencies across different products.

Table A.1
ANNOUNCED COSTS OF SOVIET WEAPONS

Weapon System	Cost	Comments
T-90 tank ^a	\$500,000 (R315,000)	1/4 cost of Leopard @ \$2 million
Slava (?) class cruiser ^b	1/9 of U.S. Ticonderoga	"Similar Soviet cruiser" to U.S. Ticonderoga
Ka-25 (Hormone)(?) helicopter ^b	1/11 of U.S. SH-60	"Similar Soviet helicopter" to U.S. SH-60
Su-25 attack aircraft ^{c,d}	R5.8 million	Compared with F-16 cost of \$28 million
T-10 tank ^e	R87,000	Original cost in mid-1950s
T-10M ^e	R100,000	Original cost around 1960
T-64 tank ^e	R250,000	

^aMortimer B. Zuckerman and Jeff Trimble, "A Chat with Moscow's Defense Minister," *U.S. News & World Report*, March 13, 1989, p. 28. Since Soviet analyses of their defense expenditures have strictly adhered to the official exchange rate, I assume that the \$500,000 figure is a direct conversion of the ruble price at the official rate.

^bGeneral M. Moiseyev, "The USSR Defense Budget," *Pravda*, June 11, 1989, p. 5 (FBIS-SOV-89-111, June 12, 1989, p. 73).

^cEsther B. Fein, "U.S. Military Chief Sees Improved Soviet Ties," *New York Times*, June 22, 1989, p. A4.

^dV. Kocherov, "Mutual Understanding Through Dialogue: General Moiseyev and Admiral Crowe News Conference," *Krasnaya Zvezda*, June 23, 1989, p. 3 (FBIS-SOV-89-120, June 23, 1989, p. 8).

^e*Vremya*, Moscow Television, July 7, 1989 (FBIS-SOV-89-113, p. 88).

expenditures. Such accounts probably do not include all of the costs as seen by the producer, nor unplanned accounting profits or losses, nor the true economic resource cost, but only the contract prices that were used to establish the procurement accounts. These figures reflect the interplay of buyer-seller dominance in contract negotiations and the pressures on production enterprises to cover their costs and make a profit. These assumptions are partly based on an imperfect

understanding of Soviet defense contracting and accounting and on the statements of participants in the process.³ This interpretation is supported by additional statements of Soviet spokesmen rationalizing the announced cost. Thus, Defense Minister Yazov commented, "We have state-owned military enterprises; that is why we don't have to pay extra. If we come to the market system, we'll have the same approach as you."⁴ Yazov seems to be implying that market prices would have to cover all producer costs, profits, and some monopolist returns, whereas the Soviet military buyer can control how much it pays because the enterprises do not have to meet a market test. Similarly, General Staff Chief Moiseyev explained the order-of-magnitude difference in helicopter and cruiser costs by appeal to lower Soviet input factor costs and to the fact that "the level of profitability is regulated by the state."⁵ This level of profitability could even be negative; that is, defense enterprises may possibly operate at a loss, which would be picked up in production ministry accounts.

TANKS

For comparative purposes, we can contrast the Soviet T-62 with the U.S. M60. The M60 tank entered production in 1960, and the improved M60A1 model appeared in 1962. (See Table A.2 for basic U.S. and Soviet tank data and Table A.3 for costs.) The T-62, an evolutionary development of the T-54 and T-55, weighed 42 tons (empty weight) versus the 54 tons of the M60A1. Even though they were introduced at just about the same time, the T-62 was less complex in almost every subsystem than its American counterpart.⁶ It had a manual transmission, a manual, lateral lever type of steering mechanism, primitive clutch and brake, a 40-year-old engine, and little attention paid to crew comfort. The T-62 lacked a rangefinder and had only a fraction of the vision devices of the U.S. tank, which had automatic transmission, infinitely variable power steering, a rangefinder, greater interior room for crew comfort and ammunition storage, and generally

³It also seems reasonable to assume that the announced figures are the agreed factory price, without spares or the inclusion of R&D and other program costs; it may include all subsystems, but not expendable ordnance or the additional costs of modification and repair to bring the equipment to acceptable standards after delivery.

⁴*U.S. News and World Report*, March 13, 1969, p. 28.

⁵"The USSR State Budget," *Pravda*, June 11, 1969, p. 5 (FBIS-SOV-89-111, June 12, 1969, p. 73).

⁶This description is taken from Arthur J. Alexander, *Armor Development in the Soviet Union and the United States*, The RAND Corporation, R-1860-NA, September 1976, p. 121.

Table A.2
CHARACTERISTICS AND PRICES OF U.S. AND
SOVIET TANKS

Model	Year into Service	Weight Empty (tons)	Price (year of price)	Price, 1989 Value
U.S. Tanks				
M-60	1960	50	\$145,000 (1962)	\$514,000
M-60A1	1962	54	\$181,000 (1965)	\$628,000
M-60A3	1979	54	\$1,047,000 (1980)	\$1,424,000
M1	1960	53	\$2,047,000 (1984)	\$2,279,000
M1A1	1965	55	\$2,468,000 (1989)	\$2,468,000
Soviet Tanks				
T-10	1953	52	R87,000 (1965)	R140,000 ^a
T-10M	1967	54	R100,000 (1965)	R161,000 ^a
T-54	1949	38		
T-55	1958	37		
T-62	1961	42		
T-64	1968	43	R250,000 (1989)	R250,000
T-72	1973	42		
T-80	1984	43	R315,000 (1989)	R315,000

^aAssumes Soviet cost inflation rate of 2.0 percent per year from 1966 to 1989.

greater complexity in all subsystems. The T-10 and its successor the T-10M were heavy tanks of the same technological vintages as the medium T-55 and T-62.

In 1989 dollars, the production unit cost of the M60 was about \$514,000, and the M60A1, \$628,000. (The 1962 and 1965 costs of these models were \$145,000 and \$181,000.)⁷

U.S. manufacturing engineers examining the T-62 in the early 1970s judged that the cost of the T-62 should be roughly 20 percent less per ton than the M60A1. The same logic applied to the T-10M. (The T54/T55 and T-10 models should be somewhat less costly than the models that replaced them; the T-10M incorporated many of the same improvements to the T-10 that upgraded the T-55 to the T-62—primarily a two-dimensional gun stabilization system.) Taking the 1965 M60A1 cost of \$181,000 as a base, the T-62 cost estimate is about

⁷The Producer Price Index for "Machinery and equipment" was used to adjust U.S. costs for inflation.

Table A.3

ANNOUNCED AND ESTIMATED COSTS OF SOVIET TANKS

Model	Cost	Comment
M60A1	\$181,000 (1965)	U.S. production cost
T-62	\$113,000 (1965)	M60A1 analogy
T-10M	\$145,000 (1965)	M60A1 analogy
T-10	\$139,000	M60A1 analogy
T-10M	R100,000 (1965)	Soviet announced price
T-54/55	Z4,500,000 (early 1960s)	Polish production cost
T-54/55	\$102,000 (early 1960s)	Dollar value of Polish cost
T-55	R62,000 (mid-1960s)	Analogy to T-10M ruble cost
T-80	R186,000 (mid-1960s)	C.I.A. est. of 3 x T-55 cost @ R62,000.
T-80	R299,000 (1969)	R186,000 at 2.0% annual Soviet inflation
T-80	\$500,000 (1969)	Soviet announced price
T-80	R315,000 (1969)	Soviet announced price converted to rubles at official exchange rate.
T-80	\$1,062,000	3 x T-54/T-55 cost of \$102,000 at U.S. inflation rate.

\$113,000, the T-10M (at 54 tons) would have been about \$145,000, and the T-10 somewhat less. How close to Soviet costs are these estimates?⁸

In the mid-1970s, I interviewed a Polish army officer who had been associated in the early 1960s with the Polish T54/T55 production program. He claimed that the production cost of these vehicles in Poland was 4.5 million zlotys, which was cheaper than buying the tank from the Soviet Union at a price equivalent to 5.0 million domestic zlotys. The international commercial exchange rate in the early 1960s was 44.3 zloty/dollar. At that rate, the cost of the T-54/T-55 was about \$102,000, somewhat less than my estimate for the T-62, a difference of roughly the size and direction to be expected by the differences in sub-systems.

Interpreting these estimates at face value suggests that Soviet and Polish production efficiencies of fairly uncomplicated military equipment was at about the same level of efficiency as in the United States

⁸The cost calculation for the T-62 is: $(42/54) \times 0.8 \times \$181,000 = \$112,600$; for the T-10, $(52/54) \times 0.8 \times \$181,000 = \$139,400$.

in the mid-1960s. Applying the announced Soviet cost figure for the T-10M of R100,000 to my estimate of \$145,000 yields a mid-1960s ruble/dollar ratio of 0.69, which is slightly greater than the ratio calculated for the most complex Soviet machine tools.⁹

These mid-1960s quoted prices of Soviet tanks do not seem out of line with estimated resource costs, especially considering that the T-54, T-55, T-62, T-10, and T-10M were essentially evolutionary improvements of World War II vehicles that were being produced at rates of several thousand per year. Since the M60 was also an improved version of a late World War II design, the comparisons seem appropriate. The next generation of designs, however, moved away from the 1940s technology with the addition of computerized fire control systems; sensors; laser rangefinders; new engines, transmissions, and suspensions; and armor materials that departed from the simple homogeneous steel armor that had been used since the 1930s. The U.S. Army's first venture in this direction was the M60A2, which involved a new turret with a combination gun-missile launcher. The new stabilization and fire control systems, by themselves, drove the 1967 cost of the M60A2 to \$278,000 from the \$182,000 figure for the M60A1 in the same year.¹⁰ As shown in Table A.2, the cost of the M60A3 (which itself was improved incrementally over a decade) was twice as great as that of the M60A1, and the M1 was almost four times more costly.

The same process of technological change and increased complexity also took place in Soviet tanks. The CIA estimates that the T-80 cost about three times as much as the T-55.¹¹ We can work backward from the T-10 cost, adjusting on the basis of weight, to derive a mid-1960s ruble cost for the T-55 of R62,000.¹² The CIA estimated cost for the T-80 would then be R186,000 in mid-1960s rubles. Applying a Soviet inflation rate of 2.0 percent per year from 1965 to 1989 yields a 1989

⁹Estimates based on 1967 Soviet ruble prices and 1972 U.S. dollar prices showed that ruble-dollar price ratios increased with complexity, from about 0.20 for the simplest machine tools to 0.25-0.30 for moderate complexity, to 0.33-0.64 for the most complex machine tools. Tanks of 1960s vintage would rank with the most complex machine tools in terms of manufacturing complexity. James Grant, "Soviet Machine Tools: Lagging Technology and Rising Imports," Joint Economic Committee, U.S. Congress, *Soviet Economy in a Time of Change*, 99th Cong., 1st Sess., October 10, 1979, Vol. 1, p. 569.

¹⁰Alexander, *Armor Development in the Soviet Union and the United States*, The RAND Corporation, R-1860-NA, September 1976, p. 120. The M60A2 was a dead end and did not form the basis for the M60A3, which instead was an upgraded version of the earlier M60A1.

¹¹Central Intelligence Agency, *The Soviet Weapons Industry: An Overview*, DI 86-10016, September 1986, p. 27.

¹²The estimated ruble cost of the T-55 based on the T-10 is $(37/52) \times R87,000 = R61,900$.

ruble cost of R299,000.¹³ This estimate is quite close to the announced Soviet figure of \$500,000 (or R315,000). Alternatively, we can use the Polish T-54/T-55 cost of \$102,000, multiply by three, and apply a dollar price index to generate a 1989 dollar cost of \$1,062,000.

The ruble estimates suggest that the announced Soviet figures for the T-80 are not grossly different from actual resource costs. The announced figure for the T-64 of R250,000 falls into line as somewhat less costly than the more complex T-80 but considerably more so than the 1960s models. Using our estimated costs and the announced T-80 price of \$500,000 (or R315,000 at the 1989 official exchange rate) yields 1989 ruble-dollar ratios for tanks of 0.27-0.30,¹⁴ which is not out of line with estimates for basic manufactured products such as trucks, but is lower than the ruble-dollar ratios attributed to more complex equipment; these estimates imply either that the T-80 is considerably less complex than suggested by the manufacturing analyses of the CIA, or that substantial productivity growth has occurred in Soviet tank-building, or that the price paid by the military does not cover production costs.

Although any one of the above estimates has a solidity only somewhat greater than that of well-cooked oatmeal, they exhibit an internal consistency suggesting that the announced ruble costs of Soviet tanks are not grossly divergent from resource costs, with perhaps some squeezing of prices from the mid-1960s to the mid-1980s.

Su-25 ATTACK AIRCRAFT

The price announced by Soviet authorities for the Su-25 (Frogfoot) attack aircraft was R5.8 million. Comparison with the \$28 million price of the U.S. F-16 is inappropriate because of the very different missions of the two aircraft. A more appropriate comparison would be

¹³Inflation rates in Soviet machine building are a subject of intense study. However, a Soviet article has calculated input factor cost changes from 1966 to 1985, which we use to adjust Soviet ruble prices. The Soviet figures are simple arithmetic growth rates, which I have recalculated into compound growth rates. These estimates yield the following average compound annual input factor cost growth rates in Soviet machine building: 1966-70, 4.31 percent; 1971-75, 1.55 percent; 1976-80, 3.37 percent; 1981-85, 0.98 percent; 1966-85, 2.05 percent. (The 20-year rate, taken from the original Soviet figures, is not quite equal to the 20-year rate implied by the subperiod rates probably because of rounding errors.) Source: A. G. Gogoberidze and A. A. Deriabin, *Dinamika Tsen Na Produksiyu Mashinostroeniia, Finansi Statistika, Moscow, 1987*, pp. 14-15, cited in Vladimir Kontorovich, *Methodological Issues in Measurement of Real Growth of Investment*, Haverford College, March 1989, p. 3.

¹⁴The 1989 ruble-dollar rate for tanks is calculated as R299,000/\$1,062,000 = 0.27, and R315,000/\$1,062,000 = 0.297.

with the U.S. A-10; not only do they have similar missions, but the two aircraft share many features in their design. The Soviet aircraft, first flown in early 1975, is faster and about 15 percent lighter in weight than the A-10 (21,000 versus 25,000 lb empty weight) but has a shorter range.

One analysis of the Su-25 noted that it possesses many of the traditional characteristics of Soviet weapons: "The Su-25 can be summarized as a typical Soviet warplane: not one bit more sophisticated, capable, or expensive than it needs to be in order to fill a carefully delineated role. It does not represent the state of the art in warplane design."¹⁵ The chief designer of the aircraft said that a low-cost, simple airframe was one of the chief considerations in its design.¹⁶ The aircraft is powered by a derivative of the R-11 engine on the MiG-21, which has been assessed as costing about one-third as much as the comparable U.S. J-79 engine, if produced in the United States.¹⁷ In keeping with its low cost and simplified maintenance concepts, most of the Su-25's controls are manually operated.¹⁸

To estimate the cost per pound of the Su-25, we can use the above information, plus a U.S. cost analysis of the MiG-23 (Flogger), which was said to be about twice the cost of the Soviet MiG-21 and about the same as the U.S. F-16.¹⁹ Since the MiG-23 weight is about 50 percent greater than the F-16 and 75 percent greater than the MiG-21, the price per pound is about 15 percent more than the earlier Soviet aircraft and two-thirds that of the F-16. On this basis, I will use a range of relative complexities of 0.5 to 0.8 recognizing that this notion of cost complexity represents the efficiencies and resource costs of U.S. experience.

During the maximum production rate of the A-10 in 1979, its cost was approximately \$5.5 million, or (\$8.4 million in 1989 values). Adjusting for weight, and applying the complexity indices of 0.5 and 0.8, we can estimate a 1989 dollar cost of the Su-25 of \$3.5-\$5.6 million.²⁰ When these dollar estimates are combined with the R5.8 million figure, they imply 1989 ruble-dollar ratios of between 1.66 and 1.04. Note that these ratios are considerably greater than those estimated for tanks. These differences are not unexpected, since the

¹⁵Bill Sweetman, "Sukhoi Su-25 Frogfoot: STOL Striker for the Pact," *International Defense Review*, November 1985, p. 1762.

¹⁶Fricher, "Russian Round-up," *Air International*, September 1989, p. 133.

¹⁷CIA, *The Soviet Weapons Industry*, D1 88-10018, September 1988, p. 28.

¹⁸Fricher, "Russian Round-up," *Air International*, September 1989, p. 133.

¹⁹U.S. Department of Defense, *The FY 1981 Department of Defense Program for Research, Development, and Acquisition*, Washington, D.C., 1981, pp. 1-2.

²⁰Su-25 cost = (21,000 lb/25,000 lb) × 0.5 (or 0.8) × \$8.4 million = \$3.5 (\$5.6) million.

Soviet production capabilities have been noted as relatively less efficient than U.S. capabilities at higher complexity and more advanced technology levels, and attack aircraft use more complex technologies than do tanks. The announced price of the Su-25, therefore, does not appear to be grossly different from real resource costs. Finer distinctions are beyond the level of our capabilities.

GUIDED MISSILE CRUISER

Consideration of the prices of the Soviet cruiser and helicopter must be even more approximate than the above analyses. First, Soviet systems were not directly specified; the systems designated in Table A.1 were based on reasonable surmises. Second, neither a Soviet nor a U.S. price was announced, only multiplicative factors. However, some simple algebra permits the estimation of implied ruble-dollar ratios, which will enable us to assess the validity of the announced prices.

The U.S. Ticonderoga guided missile cruiser operates with a complement of SH-60 helicopters in an antisubmarine role. The Soviet Slava class cruiser is quite similar in size (about 10 percent larger), time period of construction, and missions; it operates with the Ka-25 (Hormone) helicopter.

I first assume that the stated comparative prices are in similar currencies, converted at the official exchange rate. (Later I amend this assumption.) If the dollar cost of the U.S. system is D , the ruble cost of the Soviet system is R , the official ruble-dollar exchange rate is X , and the factor by which the U.S. system is more expensive than the Soviet is F , then the cost in rubles in terms of the U.S. dollar price is $R = DX/F$; since $X = 0.6$ and $F = 9$, $R = 0.066D$. That is, if the U.S. ship were \$100, the Soviet ship ruble price would be about R7. However, as noted in the earlier examples, not all tanks, aircraft, and ships are alike. To estimate ruble-dollar ratios reflecting resource costs, adjustments must be made that take into account complexity and weight. Ten years of studies on Soviet ships by the U.S. Naval Sea Systems Command were summarized in a series of articles, where it was noted,

because of an estimated lower quality of construction and a lesser requirement for design and engineering services, it is estimated that these new Soviet ships less their weapons sensors [mainly radars and sonars] and other government furnished equipment [rockets, missiles,

and ammunition], should still be about 25% less costly than the same ship built to U.S. Navy standards.²¹

We should then adjust the U.S. cost by a complexity factor C, equal to 0.75, and perhaps a weight factor W (for ships with similar missions in the same size class, the Navy's complexity factor quoted above already includes a weight adjustment). The "Sovietized" U.S. ship cost in dollars would then be $D' = CWD$; and a resource-adjusted ruble-dollar ratio $r/\$ = (DX/F)/CWD = X/CWF$. In the cruiser case, $X = 0.6$, $C = 0.75$, $W = 1.0$, and $F = 9.0$; therefore $r/\$ = .09$. A ruble-dollar ratio under one-tenth is extraordinarily low. Perhaps, however, the figures that General Moiseyev referred to were not rubles converted to dollars, but direct comparisons of rubles versus dollars: $R = 9D$; in that case, the ruble-dollar ratio would still be an uncomfortably low 0.15 (i.e., $X = 1.0$ in the above calculation).

Considering the technological requirements of a guided-missile, antisubmarine cruiser, I would have expected a ratio of at least 1.0 or greater. How, then, do we interpret this cruiser price? First, ships take years to construct and require substantial investments in shipyards, buildings, and equipment; since interest rates are subsidized by the Soviet state and there is no land rent, these "missing costs" could contribute to the underpricing of Soviet ships. In general, the more capital- and land-intensive the means of production, the more these factors would operate. Another possible explanation is that the Soviets could have been comparing the bare ship cost, unoutfitted, as it was completed at the Nikolaev North shipyard, with a fully equipped Ticonderoga. Or the level of technology and complexity is considerably lower than estimated by U.S. naval ship designers. Or the efficiency of Soviet shipyards and equipment suppliers is many times greater than that of U.S. producers. Or the Soviet navy is stealing the cruiser from the shipyards. Only the first and last explanations are credible. Most likely the price to the shipyard does not cover its costs, and a substantial loss must be covered by the Ministry of Shipbuilding, by the state budget, or by bank loans.

ASW HELICOPTER

Comparison of the Soviet Ka-25 (Hormone B) shipboard helicopter with the U.S. SH-60 antisubmarine helicopter requires consideration of the different time periods of production: The Ka-25 was produced

²¹James W. Kehoe, Kenneth S. Brower, and Herbert A. Meier, "U.S. and Soviet Ship Design Practices, 1950-1980," *Proceedings/Naval Review*, May 1982, p. 131.

from 1966-75 and embodied early 1960s technology, whereas the Sikorsky SH-60 entered production in 1982. However, the Soviet announcement may also have referred to the follow-on model to the Ka-25, the Ka-27 (Helix A), which became operational in 1982.

Soviet authorities cited a cost factor of 11 for the helicopters. If we apply this figure to the Ka-25, it is necessary to add a Soviet cost inflation rate to bring the comparisons to a current basis. At an annual 2 percent cost increase from 1975 to 1989, this inflation adjustment, I , would be 1.32, and the ruble-dollar ratio equation would be $r/\$ = IX/CWF$; considering that the Ka-25 embodies technology at least 15 years older than the SH-60, and that Soviet aircraft have tended to be considerably simpler than U.S. aircraft, a complexity factor of 0.4 for the aircraft platform is used. With an empty weight of 10,500 lb, the Soviet helicopter is 23 percent lighter than the SH-60; the inflation factor I is 1.32 for a 1975 to 1989 adjustment, and the announced price factor difference is 11. The calculated ruble-dollar ratio is therefore 0.23. If, however, the comparison is with the newer Ka-27 (Helix A), the inflation factor would not apply, the weight ratio would be closer to 1.0, and the complexity factor would also rise as the new aircraft would be more complex and advanced. Assuming new values of $W = 0.85$, $I = 1.0$, and $C = 0.6$, the ruble-dollar ratio for the Ka-27 would be 0.11, which is similar to the value estimated for the cruiser. If the ruble costs of Soviet equipment were being compared by the Soviet analysts with the dollar costs of U.S. equipment, the ruble-dollar ratios for the Ka-25 and Ka-27 would be 0.39 and 0.18.

Only under the assumptions that the official Soviet comparison is in rubles versus dollars, for only the helicopter platform, for a 1960s technology design, and a mid-1970s price does the announced Soviet figure approach reasonableness as a true resource cost; and even then, the Soviet level of efficiency would have to be at least twice that estimated for production of the Su-25 attack aircraft, which was expressly designed for low cost. The other possibility, of course, is that the Ministry of Aviation Industry is in the same situation as the shipbuilding ministry—it is being ripped off by the Soviet navy. How likely is this possibility? At the Saratov aircraft factory, its main product line, the Yak-42 civil aircraft, is priced at a level that would either require a state subsidy for the enterprise to meet its cost, or the factory would approach bankruptcy. Even though the aircraft is highly profitable to Aeroflot, the factory must contemplate curtailing production under *khozraschet* with present prices, which cover only about one-third of production costs.²² The same

²²A. Isaev, "Reform and the Defense Branches," *Kommunist*, Vol. 5, March 1989, pp. 26-27.

situation seems to prevail with the Soviet navy's procurement of the guided-missile cruiser and its helicopter.

SUMMARY

In Table A.4, I summarize the ruble-dollar ratios calculated above. The T-10M tank of the 1960s and the Su-25 aircraft show the most reasonable and expected values, implying that the announced prices may reflect "true" resource costs. The T-80 value is low but within a range that can be rationalized by either high Soviet production efficiency or fairly uncomplicated technology; if neither of these conditions prevails, then the announced T-80 price is probably lower than production costs. The cruiser and helicopter are both too low to reflect resource costs and imply that the Soviet military has negotiated below-cost prices with the suppliers—a possibility that is consistent with statements by Soviet enterprise managers and with Soviet analysis of the monopsonist buying power of the military.

Table A.4

ESTIMATED RUBLE-DOLLAR RATIOS FOR
SOVIET WEAPONS BASED ON
ANNOUNCED PRICES

System	Estimated Ruble-Dollar Ratios, 1969
T-10M tank	0.69 (mid-1960s)
T-80 tank	0.27 - 0.30
Su-25 attack aircraft	1.04 - 1.66
Slava cruiser	0.09 - 0.39
Ka-25 helicopter ^a	0.23 - 0.39
Ka-27 helicopter ^a	0.11 - 0.18

^aIt is not clear from Soviet statements whether the helicopter referred to is the Ka-25 or Ka-27.