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Soviet Science and Technology Policy: An Emerging Leadership Strategy

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A Research Paper

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Soviet Science and Technology Policy: An Emerging Leadership Strategy [redacted]

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A Research Paper

This paper was prepared by [redacted] Office of Soviet Analysis, with contributions from [redacted] Office of Central Reference, and [redacted] Office of Scientific and Weapons Research. Comments and queries are welcome and may be directed to the Chief, National Issues Group [redacted]

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Soviet Science and Technology Policy: An Emerging Leadership Strategy [redacted]

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Summary

Information available as of 15 June 1985 was used in this report.

International and domestic pressures are forcing the Soviet Union to concentrate on accelerating technological change. The leadership recognizes that the USSR is increasingly lagging the West in meeting the challenge of the new industrial revolution—known in some Moscow circles as bionics, microcomputers, and robotics—and is concerned that the inability to move emerging critical technologies quickly into production is a major brake on development in both the defense and civilian industries. As a result, the future economic base of Soviet military power is weakened. The Soviets are also apprehensive about possible US technological breakthroughs that could upset the strategic military balance. No less important, Moscow is worried that technological dependence on the West not only makes the USSR and the Soviet Bloc vulnerable to Western political pressures and economic sanctions but also retards, in important respects, the development of indigenous capabilities in science and innovation. [redacted]

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In response, the leadership is moving to make science and technology (S&T) policy the linchpin of its economic strategy. The Politburo apparently believes that more rapid advance and diffusion of S&T is the key to modernizing the economy, raising productivity, and accelerating economic growth. Development of S&T, in the leadership's view, would thus make more fundamental economic reforms, such as greater use of market forces, unnecessary. While this effort began under Brezhnev, Gorbachev has given it new impetus, using a special Central Committee conference in June to focus national attention on problems of accelerating S&T progress. [redacted]

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The leadership's model for speeding technological advance is not the capitalist or the socialist market economy but rather its own military economy in which centralized program planning, organization, and management, as well as strong party direction, are the norms. Measures the leadership is taking to apply this model to the civilian economy include:

- Improving the effectiveness of bureaucratic levers—the party's sponsorship and oversight of new technology development, and strong centralized management—that have been generally weak in the civilian sphere but are crucial to military technology and defense modernization.

- Creating big, goal-oriented projects to accelerate the development of key technologies (lasers, robotics, biotechnology). In January 1984, for example, the President of the USSR Academy of Sciences called for a comprehensive program to advance development and use of computers in

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industry, science, and education, and he cited the USSR's nuclear and missile programs as models for such a national effort. In early January 1985, the Politburo approved such a computerization program extending to the year 2000.

- Placing people with experience in managing high technology in key positions in the party apparatus by promoting industrial technocrats, such as party secretary and Politburo member Nikolay Ryzhkov, and by transferring top defense industrial executives to critical civilian jobs. 25X1

Some of the tactics involved in this approach, like closer central party supervision and goal-oriented programs, probably are also viewed by the Soviets as capitalizing on the intrinsic advantages of a centrally planned economy. 25X1

In addition to making better use of techniques applied in the defense sector, the leadership has directed that:

- The development of a 20-Year Comprehensive Program for S&T Progress be updated every five years to help guide the setting of national priorities and drive the system of annual and five-year plans toward solving major, long-term economic and social problems.

- The focus and organization of the State Planning Committee (Gosplan), the State Committee for Science and Technology (GKNT), and the USSR Academy of Sciences be changed to improve S&T policy planning and coordination and to promote the application of research to critical national needs.

- The system of management incentives and sanctions be changed to spur development and use of new technology and to phase out obsolete technology in both the civilian and military sectors of the economy. 25X1

These measures, which have evolved particularly over the last five years, suggest a strong commitment to technological modernization of the economy that could, if implemented, rank in scope with the reorganization of defense industries in the early 1960s and possibly even with the industrialization campaign of the 1930s. Indeed, Mikhail Gorbachev, at an ideology conference in December 1984, emphasized that this task "must be made truly national in nature and given the same political ring as industrialization of the country had in its time." 25X1

The multiple paths that the Soviets are pursuing to hasten S&T advancement in the civilian sector have evolved gradually. Increasingly, these efforts have gained momentum and taken on the characteristics of a long-range and broad-gauged strategy for overcoming the USSR's technological backwardness. Gorbachev, also in his December speech, used the term "strategy of S&T progress" to describe Moscow's evolving economic policy moves. So far, however, the regime has taken only the first steps toward implementing its declared policy. We expect more vigorous implementation of most of these measures in the civil sector in the 1986-90 plan period, and it will stretch into the mid-1990s. Whether the leadership can muster—and sustain—the investment and political clout that are really needed to ensure implementation is uncertain, however. [redacted] 25X1

The increased domestic development of S&T is designed in part to lessen the Soviets' dependence on the West for high technology. At the same time, however, their efforts to buy, borrow, and steal Western technology are being intensified and are likely to continue at least through the 1990s. Even beyond the year 2000, Moscow will probably want Western technology to save time in development, avoid research and development (R&D) costs, and hedge against failure. Nonetheless, economic realities—hard currency constraints and problems in assimilating foreign technology—will constrain any steep rise in trade and the acquisition of foreign technology to boost Moscow's modernization program over the next several years. [redacted] 25X1

If the party's new S&T policy is to succeed, strong leadership from the top, increased party involvement, better use of both administrative measures and monetary incentives, and, above all, a substantial increase in resources and investment will be required. Real progress will hinge particularly on several key issues:

- Gorbachev's success in consolidating his position—and his willingness to use his power to overcome entrenched institutional opposition to new ways of economic management and new priorities.

- Implementation of changes in planning, organization, management, and incentives that would give innovation in the civilian sector the high priority that it already enjoys in the defense industries. Without reform of the basic workings of the civilian production sector, ongoing leadership efforts to reorganize S&T policy agencies and R&D institutions will be insufficient to meet the new S&T goals.

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- Reorienting resource allocation policy in the 1986-90 Five-Year Plan to secure sufficient investment to follow through on the stated goal of modernizing and retooling the economy.

- Acceleration of personnel turnover, begun in 1983 under Andropov (but slowed under Chernenko), and personnel assignments based on technocratic expertise, rather than political credentials. The promotion of more competent managers and technocrats to leadership positions at all levels is essential to ensure implementation of current S&T policy initiatives. Gorbachev will probably look in particular to party organizations in 22 cities where 80 percent of S&T is concentrated as areas in which to make new appointments as well as from which to recruit personnel for Moscow.

- Refashioning of the party apparatus—its organizational structure, personnel expertise, and attitudes—making it a force for technological change, rather than an obstacle. Implementation of such institutional changes could be pushed through only by a General Secretary who is firmly committed both to faster technological progress and to an expanded role for the party in modernizing the economy.

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Gorbachev's initial moves suggest that some of these "necessary" conditions for implementing an ambitious S&T policy probably will be met. He has moved rapidly to consolidate his position and has shown that personnel policy is a top priority item. His verbal commitment to S&T modernization and convening of a conference on this subject have probably sent strong signals throughout the political system that he intends to move forcefully on this issue and that opposition would not be wise. Nonetheless, formidable obstacles exist that will block easy or rapid technological change.

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Altering resource allocation policy to support faster S&T progress will be difficult. A major drive to modernize the economy's antiquated stock of plant and machinery would require increased investment at a time when the squeeze on resources is particularly tight. During the 1986-90 period, the Soviet leadership will face a far more delicate balancing act in resource allocation than before because:

- Pressure will come from all three resource claimants—defense, investment, and consumption—for increased allocations, but, unlike recent plan periods, the demands of one or another claimant probably cannot be safely deferred.
- Soviet economic growth will probably continue at a rate of 1.5 to 2.5 percent per year through the end of the decade.

A substantial increase in investment at the expense of defense or consumption, and possibly both, is unlikely.

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It is also unlikely that the Politburo's attempt to engineer a nationwide high-tech revolution and industrial revitalization by decree will achieve its objectives. In the past, the leadership's direct intervention has been an important spur to technological innovation and development, especially in the defense sector. But today's economy is much more complex, and the leadership's political capacity to intervene directly to solve problems is necessarily limited. [redacted] 25X1

More specifically, priorities by definition must be limited. Increasing the number of civilian priority programs, for example, might undermine the effectiveness of the USSR's military programs by diverting resources and personnel. The planning and management approach of the defense sector, moreover, cannot be transplanted easily to the civilian side, and it will not work there with equal success. The institutional environments are different, and formal application of military R&D techniques is not likely to be sufficient. To assure that decisions prevail and programs are implemented, civilian managers must institutionalize defense industry methods in their attitudes and working relationships. Some of these measures to accelerate progress in S&T constitute a challenge to long-established attitudes and institutional interests, will tax the capabilities of key elite groups, have already sparked political controversy, and could lead to a revision or reversal of the present course. [redacted] 25X1

Even with Gorbachev's complete support, and assuming that initial bureaucratic and institutional barriers can be overcome, the ultimate success of this approach to modernization is not assured. Its key aspects reflect the political and ideological biases in the existing economic system, and its momentum stems partly from the establishment's desire to avoid the fundamental systemic changes that may be required for the S&T policy to succeed. Ironically, however, the objectives of this effort and many of the measures adopted actually may increase pressure for a more radical economic reform, such as freeing prices and basing incentives on profits, that have been considered anathema by the party's moguls. It is too early to know whether Gorbachev, during his probably long tenure in office, will address these even more controversial issues. His speeches to date, nonetheless, indicate that he puts a high priority on the S&T policy's stated objective of accelerating economic growth and that he intends to push hard in this area—factors that may lead him to adopt bolder measures if he becomes convinced that a less radical approach will not get the job done. [redacted] 25X1

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Introduction

Moscow's hopes for spurring economic growth hinge critically on the ability to switch to a new development strategy. A change from *extensive growth*, which is based largely on massive injections of labor and capital, to *intensive growth*, which is achieved primarily through increased productivity, has been the declared but elusive objective since the mid-1970s. While some steps have been taken toward this goal, Soviet leaders acknowledge that improvements in total factor productivity are not adequate. The leadership's ability to achieve an effective breakthrough in increasing overall productivity of labor, plant, and equipment is uncertain. Some of the obstacles appear endemic to an economic system that has fostered long-established work habits of casual discipline, slack effort, shoddy workmanship, and waste. Among managers there is a deeply ingrained drive to meet quantitative output goals—regardless of cost, quality, and other efficiency criteria—and an unwillingness to innovate or take risks because of a perverse system of incentives that discriminates against change.

The Soviets have tried to improve productivity mostly through improvements to the existing economic system and management structure—improvements that follow a well-worn and narrow path of reform. Despite a veritable treadmill of reform decrees, continuing debates, and more experiments, however, the leadership's efforts have not markedly reversed the downward drift in productivity and growth. The leadership has been unwilling to bring about a major modification of the traditional command economy and take significant steps toward a socialist market economy, given the challenge to political control and vast uncertainties that would inevitably flow from such a revolutionary move. In the face of the enormous political, ideological, and economic constraints against even partial marketization, this conservative approach to economic reform seems unlikely to lead to a substantial change in how the economy operates.

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An additional constraint is the economy's antiquated stock—buildings, machinery, and equipment—which provides a weak foundation for boosting productivity growth and the spread of new technology. Since the mid-1970s, the Soviet leadership has tried to redirect investment policy away from new construction to stress renovation and modernization of existing industrial facilities. These efforts have not been successful, however. The overall rate of retiring old and obsolete capital stock—always low compared with that of Western countries—has steadily slowed. According to Soviet data, 30 to 40 percent of all equipment now in operation in the USSR has been in use for 15 to 20 years or more, and fewer new machines have been introduced in the 1981-85 period than during 1976-80.

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A major effort now to increase investment in machine building would run head-on into the conflicting demands of other resource claimants. During the 1986-90 period, the Soviet leadership will face pressure from all three major claimants—defense, investment, and consumption—for increased allocations. Moreover, prospects for a continuing slow rate of economic growth during the remainder of the decade—1.5 to 2.5 percent per year—will further constrain resource allocations.

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At the same time, the Soviets have taken other initiatives that focus on integrating policies on science and technology (S&T) with economic policy. These initiatives, heavily dependent on centrally imposed changes, constitute an alternative approach to economic decentralization and modernization. Central to this course of action is Moscow's belief that faster technical progress is the key to achieving growth through a major improvement in the productivity of the economy. The Soviets did not initially view these measures as a coherent program or strategy, nor have

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they generally labeled them as such. But they have increasingly taken on the character of a long-term, encompassing strategy that appears to be gaining momentum and commitment from the leadership for the 1986-90 Five-Year Plan.

Soviet leaders began to lay the groundwork for this course in the early and mid-1970s—particularly in the defense industries. By the late 1970s, several signs appeared that indicated not only increasing priority for applied science but also the growing involvement of the defense sector in development of civilian technology. The leadership showed its heightened concern by instituting:

- *New S&T commissions.* In March 1979, standing commissions on science and technology were created in both chambers of the USSR Supreme Soviet. Prominent academicians, weapon designers, and military leaders, including the Chief of the Strategic Rocket Forces, serve as commission members. Since 1984 the head of the party's Department for Defense Industries also has been a member.

- *Establishment of Science Day.* In April 1979, Soviet leaders proclaimed, for the first time, an official day devoted to science. The celebration of Science Day is another acknowledgment of official efforts to mobilize the scientific and engineering community, and also public opinion, behind national objectives.

- *New S&T prizes.* A new set of S&T prizes, awarded annually on Science Day, was instituted in August 1980 for the development of new technology of direct benefit to the economy, and particularly for work performed under national S&T programs. Defense scientists, engineers, and industrial managers have figured among the public nominees and winners of these prizes.

Undergirding Moscow's intensified S&T efforts is "innovation by order," the leadership's direct intervention to spur technological change. This approach had focused primarily on the defense sector. Now efforts are being made to apply planning and management features of the military-industrial complex, which were used to advance weapons and space technology, to the more backward civilian economy. These include:

- High priority for and political sponsorship introducing new technology.
- Strong centralized management of development programs.
- Close Communist Party oversight of the research and development (R&D) and production process.

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More specifically, the Soviets are adopting the following S&T policy directions to address the central issues of economic growth:

- Improving long-range planning of science, technology, and the economy with greater emphasis on the use of R&D results in production and in modernization of both civilian and defense industries.[1]

- Fashioning major development programs for priority S&T problems and integrating them into economic plans.

- Reorganizing the State Planning Committee (Gosplan), the State Committee for Science and Technology (GKNT), and the Academy of Sciences and strengthening their roles in S&T policy planning and coordination.

- Restructuring the network of R&D institutions to improve the experimental base of science, the coupling of research with production, and the interaction between civilian and defense sectors in key areas of applied science and engineering.

- Strengthening both the incentives for innovation and the penalties for failure to innovate among scientists, engineers, and managers.

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[1] Central to the campaign for modernization is the faster retirement of obsolete plant and equipment and its replacement with more efficient production facilities embodying advanced technology. Emphasis on retooling and reequipping industry will result in a large share of total investment being dedicated to machinery and equipment.

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- Expanding the party's involvement in directing S&T efforts, accelerating innovation and modernizing the economy, and monitoring priority S&T programs.

- Revising personnel policy to promote to key government and party positions people who have technical expertise and managerial experience with a strong track record of innovation.

These policy directions cut across various sectors and institutions; focus on political, economic, social, scientific, and technical factors; and affect domestic and foreign policies alike. Recent efforts to implement most of them are a continuation or intensification of earlier policy, which has often only partially and haltingly been carried out. For the most part, they seem to be still largely "posturing" and "pre-positioning" steps, which have had only limited results to date. If they continue to gain momentum, however, these policy initiatives—as well as other actions the leadership might take to orchestrate S&T development—could have an impact on the basic workings of the economy, institutional relations, and shape of the future ruling elite.

Increasing Emphasis on Long-Term Planning

The Soviet leadership has for some time recognized that a long-range S&T program could serve as a powerful lever for modernizing the economy. Soviet leaders have pressed development of a long-term program to overcome deficiencies in planning that have long hampered their efforts to address effectively the country's economic and social ills. General Secretary Brezhnev first called for the Comprehensive Program for S&T Progress and a matching economic plan at the 1971 CPSU congress. Again, at the 1976 congress, he emphasized that without such a program it was impossible to manage the economy successfully.[2]

[2] For some time, long-range S&T forecasting and planning have been important management tools in the Soviet military-industrial complex. In contrast with the civilian economy, however, the defense industry has the advantage of a well-defined customer/consumer and a framework of desired capabilities and requirements in which to evaluate the merits of alternative lines of S&T development.

It is also evident from leadership statements that the Politburo hopes the Comprehensive Program for S&T Progress overcomes the traditional preoccupation in Soviet economic management with short-term planning, which tends to drive out long-range plans, and the traditionally conservative bias toward current production, which discriminates against new technology and favors established products and processes. Specifically, the Program is a vehicle to orient, integrate, and drive the annual and five-year plans more effectively toward providing a strong impetus for accelerating economic growth. At the 1976 party congress, Brezhnev acknowledged that the Program's guidelines "certainly cannot and should not be as binding and as detailed as five-year plans." He explained further:

> *Their purpose is different, namely, to determine ahead of time the nature and scale of the tasks confronting us and to concentrate our forces on solving them, to see more clearly formulation and implementation of programs and projects extending beyond a five-year period.*

Former Politburo member and Senior Economic Secretary Andrey Kirilenko gave a similar description in an August 1981 *Kommunist* article on Soviet S&T policy:

> *It is the task of the Comprehensive Program to identify trends in economic and social development, the origin of new requirements, and the capabilities of science and technology in solving new problems, as well as to coordinate the efforts of all links of science and production in implementing fixed goals.*

Initial efforts to prepare the Comprehensive Program for S&T Progress for the 1976-90 period, nevertheless, became bogged down in bureaucratic politics,

particularly bickering between the Academy of Sciences and Gosplan over methodology. Moreover, although the Academy and GKNT had by the summer of 1978 jointly drawn up an initial draft of the Comprehensive Program, Gosplan still had not produced its promised matching but separate 15-year economic plan.

Planning Decrees

Gosplan's failure to develop its own long-range plan held up completion of the Comprehensive Program for S&T Progress drafted by the scientists and reportedly angered Brezhnev. More important, that failure seems to have been a key factor behind his renewed drive to reorganize Gosplan, and it may have triggered the Politburo's August 1978 special decree on "strengthening" Gosplan, which Brezhnev mentioned at the November 1978 Central Committee plenum.

During conversations with Gosplan officials in December 1978, US economists detected increased Soviet interest in "scientific forecasting" and "technology assessment." Beginning in February 1979, according to Soviet published sources, Gosplan departments, even without a draft of its own long-range plan, began to participate actively, for the first time, with various Academy and GKNT scientific panels in shaping the Comprehensive Program whose time frame was also extended to the year 2000. The Program, finally completed in about 20 volumes by fall 1979 but not yet released publicly, was the centerpiece of the Academy's general meeting in December 1979. This meeting was attended—also for the first time—by Baybakov.

The July 1979 party-government decree on improving planning sought to formalize the place of the 20-year Comprehensive Program for S&T Progress in the planning system. The decree mandated that such a program, adjusted and updated every five years, be the first stage of the planning cycle and serve as a general frame of reference for drafting the 10-year basic guidelines for economic and social development and the five-year economic plan. In accord with this procedure, the 1981-85 plan was shaped, in part, on the basis of the Comprehensive Program for S&T Progress to the year 2000.

Gosplan Drags Heels

Gosplan's failure to produce its own 15-year plan probably reflected its own lack of training for the effort. 25X1

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the long-range economic plan "was a waste of time for anyone to read." 25X1 (k)(4)

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Subsequently, the leadership has taken additional measures to broaden participation in the Program and to strengthen its role as a driving force behind Moscow's economic planning for the 1986-90 period and beyond: 25X1

- Comprehensive programs are being elaborated in all the union republics as integral parts of the national Comprehensive Program.

- A 20-year Comprehensive Program for S&T Progress also is being jointly drafted for CEMA. Following much public Soviet prodding, the June 1984 CEMA summit meeting formally approved the idea. Shortly thereafter, party secretary Nikolay Ryzhkov observed in *Pravda* that such a program "will enable CEMA countries to pursue a more coordinated S&T policy and will undoubtedly be an important new instrument for socialist integration." 25X1 25X1

Debate Over S&T Progress Program Update

Current efforts to update the Comprehensive Program to the year 2005, however, have again brought long-range S&T policy and development strategies to the forefront of Soviet debate on the economy. This revision has generated pressure for improved policy 25X1

analysis and technology assessment along with disagreement over directions and priorities:

- In March 1982, Academician Nikolay Fedorenko, head of the Academy's Economics Department, emphasized in the Soviet press the need for better grounded forecasts and recommendations in preparing the updated Program. He was also apprehensive about the adequacy of the existing science and technology base—R&D facilities and staffs—to meet mounting expectations for faster advances in S&T.

- In June 1982, the late Academician Nikolay Inozemtsev, Director of the World Economics and International Relations Institute (IMEMO), observed in the Academy's journal that the preliminary broad outlines of the revised Program raised "definite doubts and dangers." He implicitly criticized its drafters for being too conservative and for relying on yesterday's technology to solve tomorrow's problems and strongly suggested that the emerging shape of the updated Comprehensive Program was insufficient to narrow the USSR's technology lag.[3]

More recently, Soviet political leaders have become increasingly critical of the Comprehensive Program, especially with reference to its adequacy as a blueprint for technological change:

- Politburo member Grigoriy Romanov, at a Leningrad oblast party committee (*obkom*) meeting in March 1983, drew attention to the conservative thrust of the evolving 20-year regional program, and he castigated both party and economic officials for failing to grasp the significance of long-range development questions.

- Lev Zaykov, Romanov's successor as Leningrad party chief, took another swipe at the 20-year regional program at a plenum of the oblast party committee in October 1983. He called for "fundamental revisions" to permit faster economic modernization and the introduction of modern automation and computer technology to improve productivity and conserve scarce labor and material resources.

- Kyamran Bagirov, who replaced Politburo member Geydar Aliyev as Azerbaijan First Secretary, singled out "major shortcomings and omissions" in his republic's Comprehensive Program at a special party plenum in December 1983 and remanded it back to planning authorities for reworking.

- Politburo candidate member and Georgian party leader Eduard Shevardnadze, at a republic plenum in February 1984, called planning for the 21st century "today's most acute problem." It is "especially urgent," he stressed, "because we are still reaping the consequences of not having been sufficiently farsighted and able to forecast properly."

How this political criticism translates into an improved long-range strategy and policy planning in the near term, however, remains to be seen.

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At the March 1985 general meeting of the USSR Academy of Sciences, the Academy's Chief Scientific Secretary reported that Gosplan had examined and approved the updated Comprehensive Program for S&T Progress (1986-2005). He also added, "Extensive use is being made of its materials in drawing up the basic guidelines for the country's economic and social development up to the year 2000 and the 1986-90 Five-Year Plan."

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In April 1984, General Secretary Konstantin Chernenko added new political significance to the updated Comprehensive Program by linking it with ongoing leadership efforts to prepare a new edition of the CPSU Program to be approved at the next party

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[3] IMEMO has primary responsibility for monitoring international economic trends and policies and has reportedly been heavily involved in work on the Comprehensive Program. a new subdepartment was formed at the Institute in early 1982 to study and forecast S&T developments in developed Western countries and to suggest methods of raising the effectiveness of Soviet S&T policy. defense industry representatives—particularly from the Ministries of Shipbuilding, the Radio Industry, and Aviation Industry—initiated through IMEMO a close monitoring of S&T developments in the "capitalist" countries.

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congress, to be held in February 1986.[4] In an April 1984 speech to a special Politburo commission charged with revising the CPSU Program, he emphasized that better use should be made of the forecasts and assessments of the Comprehensive Program to substantiate the provisions and goals included in the new CPSU Program.

Priority Programs

The Comprehensive Program for S&T Progress also has become a driving force for setting national priorities. Kirilenko in the August 1981 *Kommunist* article, for example, stressed that the Program:

> *Should include those key national economic and social problems on which the efforts of scientists along with resources and funds should above all be concentrated, and it should serve as the basis for forming large-scale target* [goal-oriented] *programs.*

In line with this approach, the 1981-85 Five-Year Plan included, according to published sources, a list of 15 special problems for which economic target programs were being drafted. Eleven of the 15 programs reportedly were included at the time of adoption of the plan in late 1981 (see insets). These programs, effectively subprograms of the long-term Comprehensive Program, are intended to hasten modernization of critical economic sectors. They have been described by Soviet sources as the "main links" and "backbone" of the 1981-85 plan and economic strategy for future five-year plans. Despite their stated importance, however, most of these programs have not yet been implemented, and those that have—the Food and Energy Programs—have not progressed at the pace originally intended.

National Economic and Social Target Programs for the 1980s [a]

Economywide

Expansion of quantity and quality of food
Increased production of new types of consumer goods and better services
Reduction in the use of manual labor
Conservation of raw materials and energy
Use of chemicals as substitutes and supplements
Improved use and processing of minerals
Expanded production of extremely scarce materials that are largely imported

Specific sectors

Machine building
Energy
Transportation
Metallurgy

Regional

Development of the West Siberian oil and gas complex
Construction of the Baikal-Amur Mainline (BAM)
Railroad and economic development of the BAM zone
Agricultural redevelopment of northern European Russia's industrial zone
Development of the Angara-Yenesey region in East Siberia

[a] *We have identified these programs from various Soviet open-source materials. Four are major regional development programs that focus largely on the establishment of new resource (particularly energy) bases and major industrial centers.*

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Raising Priority for S&T Programs

The leadership recognizes that achievement of the objectives of the Comprehensive Program for S&T Progress and its subsidiary 15 priority programs requires better linkage to Soviet scientific and technological developments. Since the mid-1960s the GKNT has been responsible for identifying and commissioning work on key science and technology problems, and a list of priority S&T programs has been included in the plans. This effort in the past, however, had no bureaucratic clout and was not well integrated into

[4] The CPSU Program is supposed to set the general party line for an extended period and to serve as a guide for domestic and foreign policies of the USSR. The program now under revision dates from the Khrushchev era (1961). The 1961 Program set detailed but unrealistic and even utopian goals, "including overtaking the US economy" by 1970 and entering the era of full Communism and material abundance by 1980.

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National Priority Programs

Since 1982 the leadership has paid more attention to implementing these target programs. Although several appear to be still in draft and bogged down in negotiation, some—because of strong prodding by the leadership—have been steered through the bureaucracy and approved at the highest levels:

- *The* Food Program, *extending to 1990, was approved at the May 1982 Central Committee plenum and remains a major agenda item at Politburo meetings. A special Land Reclamation Program to the year 2000—possibly a major component of or addition to the Food Program—was approved at the October 1984 Plenum.*
- *A 20-year* Energy Program, *reviewed in draft by the Politburo in April 1983, was approved by the June 1983 Central Committee plenum.*
- *Development of a* Consumer Goods and Services Program *for the period 1986 to 2000 was approved by the Politburo in September 1983 and endorsed by the Central Committee plenum in December. In his February 1985 election speech to the Russian Republic Supreme Soviet, Gorbachev affirmed that work on this program was "being completed." According to US Embassy sources, however, so far a commitment has not been made to provide enough resources to make it viable.*
- *A* Transportation Program *through the year 2000 also has been drafted, according to Soviet officials.*

With the exception of the Food Program, only broad generalities have been published concerning these programs. [redacted]

economic planning or development. These projects lacked the strong goal orientation, high priority, close producer-consumer relations, and strong centralized management so characteristic of Soviet weapons programs and did not provide a vehicle for promoting technology transfer between the military and civilian sectors. As a result, most of these civilian S&T programs rarely went beyond the research phase—ending in development of a prototype that, in GKNT Chairman Marchuk's words, "hangs in midair" for years before being put into production and use. [redacted] 25X1

In an attempt to overcome these problems, the Soviet leadership has adopted new measures to develop specific large-scale S&T programs that cut across bureaucratic lines and promote technology transfer between defense industries and the civilian economy. The 1981-85 Five-Year Plan defined S&T priorities more sharply than previous plans, emphasized S&T programs to address major problems of the economy, and allocated substantial resources to implement them. These programs also have broad economic application to both the defense and civilian sectors. More specifically:

- The list of national priority S&T programs was trimmed from about 200 in the 1976-80 plan to 170.
- According to GKNT First Deputy Chairman Dmitriy Zhimerin in a June 1983 *Planovoye khozyaystvo* article, 37 billion rubles were to be spent on the domestically generated aspects in the 1981-85 plan. This sum represented about 30 percent of total USSR science outlays, which were likely to approach 130 billion rubles in this five-year plan period, according to Soviet measures.[5]
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  equivalent to 30 billion rubles has been set aside for foreign technology acquisition in support of the 170 programs.

[5] Zhimerin breaks down the 37 billion rubles on the domestic or indigenous aspects of the 170 S&T programs as follows: 14 billion rubles for scientific research, development, testing, and evaluation and 23 billion rubles for development of production capacity for the manufacture of new products. Before the current S&T priorities list was final and the 1981-85 plan was formally adopted, a high-ranking Gosplan official cited, in an earlier issue of the same journal, a planned figure of 39 billion rubles for 168 S&T programs. This sum included 11.5 billion rubles for R&D, 5.3 billion rubles for testing and evaluation, and 22.2 billion rubles for development of productive capacity. See Ya. Ryabov, "Questions of Working Out Comprehensive Target Programs," *Planovoye khozyaystvo*, No. 10 (1981), p. 5. [redacted] 25X1 25X1

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- Among the 170 programs, the plan designates for the first time 41 special "target programs" (for a partial list of S&T target programs, see appendix A), which include series production of new equipment and aim at speeding up the introduction of several critical technologies—including lasers, fiber optics, industrial robots, powder metallurgy, and microelectronics—into the economy.

Many of the 170 S&T programs (see table) were set up to support and complement the 15 national economic and social target programs. The highly sketchy published versions of the Food and Energy Programs, for example, contain sections on science and technology that include projects associated with individual S&T priority programs:

- Various development programs support the *Energy Program*—fast breeder reactors; long-distance power transmission lines of 1,500 kilovolt (kV) dc and 1,150 kV ac; special large-diameter, laminated, high-pressure gas pipelines; enhanced oil recovery techniques; synthetic liquid fuels; and better equipment and technology for both underground and open-pit mining.

- To support the *Food Program* nearly 20 S&T programs provide for the development of more than 300 new kinds of agricultural machines, new types of mineral fertilizers and pesticides, stronger varieties of grain and other crops, as well as the introduction of modern food-processing technologies.

- Some S&T programs may well undergird the forthcoming *Consumer Goods and Services Program:* developing new drugs, medicines, and modern diagnostic equipment; new kinds of industrial safety equipment; a range of more sophisticated consumer durables including electronic household appliances; and retooling light industry.

Indeed, if the output targets of these and other major programs are to be met without greatly exceeding planned costs, more rapid progress in meeting S&T program goals would appear to be a vital precondition for their successful implementation.

During the current 1981-85 plan period, Moscow also has intensified efforts to mobilize the Soviet S&T community and enlist East European support for these priority S&T programs:

- The USSR Academy of Sciences is participating in 112, or two-thirds, of the programs (including 32 target programs), up 15 percent from the previous plan, according to Soviet published sources.

National Priority S&T Programs in the 1981-85 Five-Year Plan

General Focus of Programs	Total Number of Programs	Target Programs [a]
Total	**170**	**41**
Power engineering, electrical engineering	10	4
Fuel, energy, and geology	13	6
Chemistry and petrochemistry	16	7
Metallurgy	13	2
Machine building and metalworking	22	2
Timber, wood processing, and paper and woodpulp	4	1
Light and food industry, consumer durables	8	1
Computer technology and communications	15	4
Agriculture (including land reclamation)	18	7
Transportation	8	1
Construction	10	1
Environmental protection	7	0
"Scientific" organization of labor	1	0
Other	25	5

[a] Target programs—in contrast to other S&T programs—include the stage of series production of new equipment and aim at accelerating the broad-scale introduction of key technologies and innovations into the economy, generally within the current plan period. Nontarget programs are geared more toward long-term research in the most promising areas of S&T or toward the development of technology to be put into use generally during the following five-year plan.

Source: Ya. Ryabov, "Management of Scientific and Technical Progress and Growth of Production Efficiency," *Planovoye khozyaystvo*, 10 (October 1982).

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- The number of Soviet higher educational establishments taking part in these programs has more than doubled, according to Soviet open sources. They now participate in 140 of the 170 programs.

- CEMA participation in Soviet S&T programs also is on the rise. By mid-1982, Bloc countries were involved in 12 programs on a multilateral basis and in 40 programs on a bilateral basis, according to the Soviet press. Since 1983, new CEMA cooperative agreements have been signed in the areas of microprocessors, microelectronics, and robotics, while existing agreements have been amended or expanded in food processing, energy, machine building, and consumer goods.

Military Involvement

Although none of the publicly identified S&T programs under the general responsibility of the GKNT are weapons development programs, many (particularly the target programs) focus on the development of new technology, materials, and manufacturing processes that can be used to help design and produce sophisticated weapons. There is growing evidence, moreover, that Soviet military R&D and production organizations are now participating in several civilian S&T programs as both developers and end users of new technology. These programs appear to be an important mechanism for technology transfer between military and civilian sectors; they are being used both to modernize the civil machine-building base and to retool defense industry with critical high technologies:

- Several organizations involved in the Industrial Robots Program, identified in the Soviet open press, are major R&D centers of defense industrial ministries. They include these science and production associations—*Pozitron* (Defense Industry), *Ritm* (Shipbuilding), *Svetlana* (Electronics Industry), and the Leningrad Optical-Mechanical Association (LOMO) (Defense Industry).

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- The Ministries of the Defense Industry, Aviation Industry, and the Radio Industry are in the Powder Metallurgy Program.

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- The Ministries of the Radio Industry, Communications Equipment Industry, and Electronics Industry, according to Soviet press reports, are major participants in about a dozen programs in computer technology, microprocessors, and microelectronics.

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- Various elements of the Ministry of Defense Industry (MOP) are probably taking part in the Industrial Lasers Program The Soviet press also reports that, under this program, laser technology is being introduced at the Baltic Shipyard. The Academy of Sciences' Center for Industrial Lasers in Troitsk, established in 1980 and identified by Soviet open sources as a major participant, draws heavily from military-oriented laser facilities and personnel.

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The full extent of defense industry involvement in and commitment to these programs, however, is not yet clear.

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The August 1983 Decree on S&T

Portions of the special decree "On Measures To Accelerate S&T Progress in the National Economy," adopted 28 August 1983 by the CPSU Central Committee and USSR Council of Ministers, supplement

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earlier measures by calling for expanded use of goal-oriented program-planning techniques at all levels of the economy. Beginning with the 1986-90 plan, large-scale S&T programs are to be drafted not only for the 170 national programs but also to address major S&T problems specific to individual union republics, branch ministries, large economic regions, and territorial-production complexes. Some of these listed programs have been launched since adoption of the decree.

New items also are being added to the list of national S&T priorities. Zhimerin hinted at this in his June 1983 article when he noted that "more than 170 programs" were in development:

- The August S&T decree authorized a new target program for flexible manufacturing systems (FMS) and advanced automation technologies.

- A program to accelerate the USSR's development of high-speed computers—which Academy Vice President Yevgeniy Velikhov, in December 1983, had recently been appointed to head—may also have been put on the priorities list.

- The Politburo at its 6 September 1984 meeting, according to the Soviet media, issued directives for developing what appears to be a target S&T program for introducing automatic rotary and rotary-conveyor production lines in the economy.

Local party leaders have begun to press the pace of S&T development in their bailiwicks. For example, in Leningrad, where authorities were granted greater autonomy to conduct comprehensive regional planning by a special decision of the Politburo in September 1983, the party organization in December 1983 decided "to considerably expand" the S&T programs section of the 1984 draft economic plan. At its April 1984 plenum, the *obkom* set up a special council headed by First Secretary Zaykov to coordinate an accelerated computerization program for the Leningrad region through 1990. Politburo member Vladimir Shcherbitskiy at the 30 March 1984 general meeting of the Ukrainian Academy of Sciences called for the inclusion of republic target programs on biotechnology, robotics, and flexible automated production in the 1986-90 plan.

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In accordance with the instructions of the party-government August decree on S&T, several ministries have now begun to draft their own branchwide programs to spur technological modernization that presumably build on national programs already approved. For example, the Ministry of the Food Industry, according to a December 1983 article in the ministry's official journal, has been ordered to develop a program to introduce low-waste and waste-free food production equipment for better processing of agricultural raw materials. Also in 1983, the newspaper of the Ministry of the Meat and Dairy Industry reported that a target program was being drawn up to automate production and management throughout the industry. The Soviet press reported that the Ministry of Railways at an expanded collegium meeting—which had been called to discuss the August S&T decree—decided to draw up target programs to raise the technological level of this troubled transportation sector.

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the August decree may have prompted an intensification of the effort that began in the early 1970s to speed up innovation in the defense industries.

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Despite these measures to raise the priority of S&T programs and improve their management, Soviet press commentary indicates that this effort has not been entirely successful. Several S&T programs, including target programs, are running behind schedule. Both civilian and defense industrial ministries participating in these programs have been criticized for failure to devote adequate funds, personnel, and management attention to them. While this criticism indicates continuing leadership pressure on the bureaucracy, it is also apparent that bureaucratic resistance and technological conservatism have been difficult to overcome.[redacted]

Reorganizing the S&T Policy Establishment

Calls for improvement of long-range planning and bureaucratic resistance to it led the leadership to reorganize the S&T establishment to make it more responsive to its demands and more able to conduct comprehensive, integrated policies. These efforts, begun under Brezhnev, include important personnel and organizational changes in the three national agencies that coordinate the development of science and technology: Gosplan, the GKNT, and the USSR Academy of Sciences (see inset "S&T Policy Actors"). In each, individuals—who have strong backgrounds in applied S&T, close ties with military R&D organizations or defense industry, and apparently keen interest in accelerating S&T advances—have been put into key leadership positions.[redacted]

More broadly, the reorganization aims at improving S&T interaction between the military and civilian sectors of the economy to the mutual benefit of both. Increased interaction is a two-way—not a one-way—street. On the one hand, the defense establishment is being called upon to assist civilian industries in application of technology. On the other hand, the scientific community (especially the Academy of Sciences) is being driven to enhance military-related R&D, while key civilian ministries (especially those related to defense) are under pressure to help modernize the defense industries as well as their own plant and equipment to better support weapons production.[redacted]

Gosplan

Gosplan has been undergoing significant reorganization since 1979. These changes—probably stemming from a never-published 1978 Politburo decision to strengthen Gosplan—are designed to overcome the traditional "production bias" and the "branch organization bias" of the planning apparatus, to strengthen its role in supervising the economic bureaucracy and promoting technological modernization, and to improve its ability to integrate S&T into economic policy and plans.[redacted]

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First, oversight for S&T matters was made the special responsibility of a first deputy chairman of Gosplan. A new S&T portfolio apparently was created with the appointment in February 1979 of Yakov Ryabov as a fifth First Deputy Chairman. (Previously, Gosplan had four first deputies, who were responsible for defense, heavy industry, agriculture, and construction.) Ryabov had been CPSU Secretary for Defense Industry since 1976. From the time of his arrival until his departure from Gosplan in May 1983 when he was named head of the State Committee for Foreign Economic Relations, Ryabov was clearly the chief spokesman and prime mover for S&T policy within the planning hierarchy.[6][redacted]

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[6] A designer-engineer turned party secretary and a longtime critic of Gosplan, Yakov Ryabov was a protege of Politburo member Andrey Kirilenko. He served as Sverdlovsk party chief from 1971 to 1976 when he was elected to the central party Secretariat. Although the reasons for his removal from that post still are not clear to us, Ryabov seems to have been put into Gosplan to press for reforms from within and particularly to raise the importance of S&T issues in economic planning and policy deliberations. The decree appointing Ryabov is unusual in that it states that the appointment is made "in connection with the need to strengthen further the USSR Gosplan." Within a month of Ryabov's arrival, moreover, Gosplan began to participate for the first time in a major way with the Academy of Sciences and GKNT in work on the Comprehensive Program for S&T Progress, according to Soviet published sources. During his stay at Gosplan, he wrote and spoke extensively on the role of priority S&T programs. In September 1984, Ryabov was again reassigned and appointed a deputy premier of the USSR Council of Ministers.[redacted]

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S&T Policy Actors

A large and complex network of special government agencies is involved in the formulation and conduct of Soviet S&T policy. These agencies, which have overlapping responsibilities and shared powers, plan and manage the broad policies and priorities decided by higher CPSU organs and approved and budgeted by the USSR Council of Ministers. However, this web-like structure impedes the development and implementation of comprehensive S&T policy.

The GKNT is the principal organization charged with maintaining a unified national S&T policy and ensuring that research results are utilized and applied effectively. It has overall responsibility for S&T planning, specifically for applied civilian research and development. It coordinates scientific and technical activities, especially in priority areas; together with Gosplan, plans capital investments for science; approves organizational changes, including the creation and closing of research facilities; manages the dissemination of S&T information; and monitors the funds allocated to science. With only a few exceptions, however, the GKNT does not have its own research institutes.

The GKNT has primary responsibility for coordinating and monitoring the priority S&T programs included in the five-year national economic plan. These projects—numbering 170 in the 1981-85 plan—are usually multidisciplinary in scope and involve the combined efforts of economic ministries, state committees, and the USSR Academy of Sciences.

In addition, the GKNT plays an important role in coordinating efforts to acquire foreign technology to fulfill the needs of the military and the defense industries as well as those of the civilian sectors of the economy. It supports both legal and illegal acquisition. The GKNT also collects S&T information through a vast, complex network of cooperative agreements with other countries and private firms. The GKNT's collection effort is closely coordinated with that of the Soviet intelligence services.

Gosplan is responsible for overall planning of the Soviet economy and the introduction of new technology into the production process. Gosplan works with the GKNT in overseeing large interministerial R&D projects, especially priority S&T programs involving series production of targeted new technologies; considers the overall magnitude of capital investment for R&D; and consults with the Ministry of Finance and GKNT to determine the levels of funding for projects. Gosplan also works with the State Committee for Material and Technical Supplies and the GKNT on planning and distribution of equipment and supplies for R&D organizations; and it participates in developing plans for training scientific manpower and for improving wages and working conditions for S&T personnel. In contrast to the GKNT, which emphasizes development of scientific and technological capabilities and coordination of the R&D enterprise, Gosplan strives to achieve economic growth through more efficient industrial production, based—among other factors—on improving R&D performance and utilization.

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The Military-Industrial Commission (VPK) of the Presidium of the Council of Ministers is the principal coordinating agency for military R&D and monitors major weapons development programs. The VPK also has the dominant coordinating and decisionmaking role in the Soviet foreign technology acquisition program, setting national priorities, and monitoring program fulfillment.

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Other organizations are involved in developing plans, setting policy, and monitoring performance in the S&T system, but they have a much narrower focus and mandate. They include the State Committees on Standards, Inventions and Discoveries, Material and Technical Supply, and Construction Affairs; the Ministry of Finance; the Higher Certification Commission; and Agencies of Hydrometeorology and on Utilization of Atomic Energy.

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The day-to-day administration and actual conduct of R&D is performed within three institutional subsystems, each concentrating on specific stages of the R&D process:

- *The Academies of Sciences (both all union and republic) specialize in fundamental research. The USSR Academy conducts its own fundamental (and some applied) research, but it also is in charge of drawing up national plans for fundamental research in the natural and social sciences in the USSR and oversees most basic research in other institutions. The USSR Academy also develops with GKNT the 20-Year Comprehensive Program for S&T Progress before each successive five-year plan and participates in more than two-thirds of the national priority S&T programs monitored by the GKNT.*
- *The Industrial Branch Ministries conduct most applied research and virtually all design, development, engineering, and production. The branch institutes attached to individual ministries perform the major portion of Soviet research focusing on the application of scientific findings to production.*
- *The Ministry of Higher and Specialized Secondary Education (MinVUZ) undertakes some basic research, but its facilities concentrate more on applied R&D, funded under contract by the defense and civilian industries. In terms of overall Soviet R&D, the share of research in higher educational establishments is quite small (about 5 percent). The main function of the MinVUZ is teaching, especially the training of scientists and engineers for industry, and not research.* [redacted]

Figure 1. *Yakov Ryabov* [redacted] 25X1

Yuriy Maslyukov, a former deputy minister in the Ministry of the Defense Industry, may have taken over Ryabov's S&T duties at Gosplan.[7] Maslyukov was identified as a Gosplan first deputy chairman [redacted] 25X1
[redacted] by *Pravda* in 25X1
a list of deputies elected to the USSR Supreme Soviet in March 1984. From 1972 to 1975, Maslyukov seems to have headed the Chief Technical Directorate of the MOP, which oversees development of scientific research, experimental design and testing, and the implementation of new technology within the MOP.
[redacted] 25X1

Second, the Gosplan Science and Technology Department, which handles questions of innovation and monitors national S&T programs, has been reorganized and given new leadership. At the October 1980 party plenum, Brezhnev called upon the military R&D establishment to share its talents with the

[7] The division of responsibilities within the leadership core of Gosplan remains unclear to us. A source at Gosplan told US Embassy officials in June 1983 that Maslyukov had recently been brought in to assume the duties of Lev Voronin, a former first deputy minister of the MOP who had been the first deputy chairman of Gosplan in charge of defense industry since October 1980. Voronin, according to this same source, in turn, has taken over the former general economic planning and heavy industry responsibilities of Nikolay Ryzhkov, who in November 1982 transferred from Gosplan to the CPSU Secretariat. However assignments of these various leadership responsibilities have occurred, Gosplan, for the time being at least, has *two* first deputy chairmen who come from both the production planning (Voronin) and the new technology (Maslyukov) sides of the defense industrial sector. [redacted] 25X1 25X1

Figure 2. Yuriy Maslyukov 25X1

Figure 3. Aleksey Chubarenko 25X1
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civilian sector. Shortly afterward, Aleksey Chubarenko, an experienced defense manager, was brought into Gosplan to head the expanded S&T office and has been since at least 1982 a member of the Gosplan Collegium.[8] Chubarenko had previously been a deputy chairman of the Directorate of Experimental Work and of the Scientific-Technical Council of the MOP since at least 1968. The latter body is concerned with S&T development in the MOP and is responsible for improving the organization and effectiveness of the ministry's institutes and design bureaus.

Third, and more general, a new statute on Gosplan, approved by the Council of Ministers in June 1982, mandated structural changes intended to broaden the perspective and expertise within Gosplan, so it could better tackle problems of economic modernization:

- The membership of Gosplan was expanded to include representatives of other state committees and institutions. The heads of several state committees (including the GKNT), the Minister of Finance, the Chief of the Central Statistical Administration, and a vice president of the Academy of Sciences now are all ex officio members of Gosplan.

- A group of senior economic and scientific advisers was formed to work directly under the Chairman of Gosplan.

- Special territorial plenipotentiaries with small staff offices are being established in Sverdlovsk, Novosibirsk, Irkutsk, and Khabarovsk. 25X1
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they will serve as the "eyes and ears" of Gosplan in the Urals, West Siberia, East Siberia, and the Far East, respectively, where they will supervise major regional economic and S&T development programs. 25X1
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In addition, the new statute authorized a reorganization of Gosplan's departmental structure to provide an organizational framework for more effective program planning and better interministerial coordination. All substantive departments have been made part of a three-tier structure—administrations covering large complexes of economic activity, "summary" departments, and "ordinary" departments. The S&T Department has been elevated to the status of an administration. Furthermore, appointment of the most important department and administration heads, evidently like Chubarenko, will now be approved by the Council of Ministers for the express purpose of raising their stature and bureaucratic clout in dealing with the ministries. 25X1
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[8] This unit was previously named the Department of Summary Planning for the Introduction of Scientific and Technical Achievements into the National Economy. It had been headed since at least 1967 by Konstantin Yefimov, who seems to have had no defense industry background.

GKNT

The leadership began efforts to improve performance in the GKNT, the balance wheel in civilian S&T policy, in 1979. At the November Central Committee plenum, Brezhnev criticized the GKNT for not being more "energetic" in pressing both the acquisition and the application of emerging technologies. [redacted] 25X1

New Chief. In January 1980, Guriy Marchuk replaced Vladimir Kirillin, who had headed the GKNT since 1965. Marchuk was a logical choice to succeed Kirillin. He is a strong proponent of applied research and, [redacted] 25X1 more tough minded than Kirillin. As Chairman of the Academy of Sciences' Siberian Department since 1975, Marchuk had actively promoted close ties between science and industry. In March 1979, he became chairman of one of the newly created Science and Technology Commissions in the USSR Supreme Soviet. Marchuk evidently impressed the Soviet leadership with the importance of developing domestic capabilities for innovation and reducing, over the long run, technological dependence on the West. At the same time, however, he almost certainly recognizes the USSR's continued need for foreign technology and equipment. Under his leadership, the GKNT has conducted an aggressive program to acquire foreign S&T. [redacted] 25X1

[redacted]

Figure 4. Guriy Marchuk [redacted] 25X1

Since becoming GKNT chief, Marchuk, in his public speeches and articles, has actively pressed for faster economic modernization at home and within the Soviet Bloc. He has also begun to reshape the GKNT leadership by replacing Kirillin's people with a younger generation of leaders who have strong technical backgrounds and experience in managing research and/or technological application. Under Marchuk, four deputy chairmen of the GKNT—three of whom were over 70—were retired, while six new deputies—all between 45 and 55—have been appointed. These staff and organizational changes have also reportedly eroded the status and responsibilities of Dzhermen Gvishiani, the only GKNT Deputy Chairman surviving from the 1960s and son-in-law of the late Premier Aleksey Kosygin (see inset). [redacted] 25X1 25X1

Reorganization. The GKNT has undergone internal restructuring that reflects new or expanded activity in several priority areas. A series on national S&T programs, which appeared weekly throughout 1983 in the *Ekonomicheskaya gazeta,* revealed that the following new departments were formed:

- Interbranch Technologies and Construction Materials.
- Mechanization and Automation of Production.
- Problems of the Atmosphere and World Oceans.
- Oil and Gas.
- Medicine, Health, and Medical Industry. [redacted] 25X1

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Figure 5. Dzhermen Gvishiani

According to the Soviet press, some GKNT departments have also been enlarged and upgraded to the status of administrations, evidently so they can handle increased policy planning and program monitoring. They are the Departments of Machine Building, Agriculture, and Science Organization. Still other departments have been renamed to reflect a change of focus or added responsibilities. The former Environmental Protection Department, for example, is now called the Low-Waste Technologies and Environmental Protection Department.

Increased KGB Role. Marchuk has made some changes within the GKNT organizational structure that handles foreign S&T contacts. These changes appear to signal an increased role for Soviet intelligence services in the GKNT's activities and in technology acquisition as a whole. In particular, the Main Administration for Scientific and Industrial Cooperation, which oversees these matters and has long been a KGB stronghold in the GKNT, has begun to assume a more visible, prominent role:

- Its new head, Aleksey Voskoboy, a KGB lieutenant general and former deputy head of the First (foreign operations) Chief Directorate of the KGB, has not kept a low profile at the GKNT. Unlike Fedor Martin, whom he apparently replaced in late 1982, Voskoboy has actively participated in attending technology exhibits and meetings with Western businessmen, including those sponsored by the US-USSR Trade and Economic Council.

Gvishiani in Eclipse?

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During Kirillin's 15 years at the helm of the GKNT, Dzhermen Gvishiani generally supervised its foreign S&T relations. Under Marchuk, however, Gvishiani has fallen into disfavor and been criticized for being "pro-American" and for rendering international S&T ties too impractical, 25X1 *Gvishiani is said to be responsible now primarily for international scientific cooperation, while Vladimir Kudinov, the former party secretary of the Paton Electric Welding Institute and GKNT deputy chairman since 1981, has become the "curator" or monitor for international technology exchange and most matters of industrial cooperation. Kudinov reportedly oversees the GKNT's Main Administration for Scientific and Industrial Cooperation, including its two subordinate administrations that handle S&T cooperation with capitalist and socialist countries—GKNT organizational components that used to fall under Gvishiani's jurisdiction. Although seemingly in a weaker position in the GKNT, Gvishiani continues to write articles on economic reform issues for* Pravda *and* Kommunist. 25X1

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- Its other KGB officers, Voskoboy's subordinates, also have appeared openly in intelligence-gathering activities at international scientific symposiums, laboratory visits, and trade fairs.

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Figure 6. Aleksey Voskoboy [redacted]

[redacted]

These changes suggest that the KGB is following a more aggressive policy to exploit GKNT covers and both legal and illegal channels for acquisition in response to the West's tightened controls on high technology and curtailment of official scientific exchanges with the USSR. [redacted]

[redacted]

USSR Academy of Sciences 25X1

Party leaders have also pressed the Academy of Sciences—the USSR's foremost research complex—to give more attention to the potential economic and military applications of its huge research effort. In his public speeches, especially from the late 1970s on, Brezhnev hit the Academy hard with this theme of applying research more closely to national needs.[11] [redacted] 25X1

Under Brezhnev's prodding—continued by his successors—a group of leaders is now running the Academy who are more enthusiastically supporting the party's demands, are closely tied to the military-industrial complex, and have the experience to direct a more applications-oriented policy. Four Academy leaders appear to be the principal players managing institutional and policy change: President Anatoliy Aleksandrov and Vice Presidents Vladimir Kotel'nikov, Yevgeniy Velikhov, and Yuriy Ovchinnikov. Velikhov, who in November 1977 was promoted to a newly created vice-presidency for Science and Technology and is a leading candidate to succeed Aleksandrov, has been at the center of all recent policy initiatives. 25X1

[redacted]

As a result of increased party pressure, the Academy is becoming increasingly involved in applied science and development of new technologies. Development of complex technologies such as lasers and microelectronics—the general task of the R&D system of the economic ministries—has been retarded by a generally hostile and backward industrial environment and by a ministerial structure that is highly compartmented along narrow branch lines. The Academy is also being used more and more, it seems, as a vehicle to transfer technology from defense industries to the civilian economy. Furthermore, it continues to support critical military R&D efforts to design more sophisticated weapons and to help modernize the defense industries. [redacted] 25X1 25X1 25X1

[11] At the 1981 party congress, for example, Brezhnev emphasized, "The country has an acute need for the efforts of 'big science' [the Academy and defense R&D sector] to be concentrated on the solution of key economic problems and on discoveries capable of making genuinely revolutionary changes in production." And he added,"Without an acceleration of S&T progress now, in the more complex conditions of the 1980s, it will be impossible to develop the economy successfully or to accomplish major social tasks." [redacted] 25X1

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Anatoliy Aleksandrov

Vladimir Kotel'nikov

Yevgeniy Velikhov

Yuriy Ovchinnikov

***Figure 7.** Leaders of the USSR Academy of Sciences*

New Emphasis on Applied Research. Though discernible and a point of contention for some time, the Academy's changing emphasis from basic to applied research has intensified in the 1980s and is evident in the:

- Increased participation by the Academy system (including the republic and specialized branch academies) in national S&T priority programs and the appointment of prominent Academy scientists as national coordinators of key target programs.[12]

[12] For example, according to Soviet publications, Aleksandrov oversees the nuclear reactors program; Velikhov, the industrial lasers and "supercomputer" programs; Ovchinnikov, the biotechnology program; and Academician Nikolay Yenikolopov, the composite materials program.

- The establishment of new institutes and laboratories—especially since 1980—dedicated to applied research in substantive areas considered most important (such as energy, metallurgy, molecular biology, and genetic engineering) and in crucial industrial and defense technologies.

- Organizational reforms, reportedly completed by September 1983, that bring industry representatives into research teams of various Academy institutes to help speed up the transfer of R&D into production.

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The shift in orientation is also seen in the increasing numbers of applied researchers, industry-based engineers, and science administrators, particularly from the defense sector, in the Academy's membership. The December 1981 and December 1984 Academy elections reflected this trend. As a result of the 1981 elections, for example, the Mechanics and Control Processes Department—one of the departments most concerned with applied science and traditionally closely tied to military R&D—became the largest of the Academy's 16 substantive departments. At that time Oleg Antonov, the prominent aircraft designer, and Aleksandr Nadiradze, the chief designer of solid-propellent ballistic missiles, were elected directly to the status of full academicians in this Department, bypassing the stage of corresponding members. New academicians elected in 1984 are Vladimir Utkin and Mikhail Reshetnev. Utkin, chief designer at the Dnepropetrovsk Missile Development and Production Center, is the designer of the SS-17 and SS-18 ICBMs. Reshetnev, chief designer at the Krasnoyarsk Space Components Plant, has designed several series of Soviet satellites. This general trend in the composition of its membership is likely to become more pronounced as the emphasis within the Academy continues to shift toward more applied science and deeper involvement in the industrial process and weapons development.

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Expanded Role in Computer Technology. The Academy has begun to play an expanding role in the development of computer technology and advanced electronics. Both Aleksandrov and Velikhov in their speeches at the March 1984 general meeting of the USSR Academy underscored the high priority the party assigned to this task. They emphasized that the Academy is being called upon to help surmount the obstacles retarding development of the Soviet domestic computer industry—bureaucratic barriers within the ministries as well as US bans and tightened COCOM restrictions on the sale of advanced Western technology to the USSR.[13] [redacted]

The Academy's increased involvement has been especially evident during the past two years:

- At its general meeting in March 1983, the Academy created a Department of Information Science, Computer Technology, and Automation—the first new department in 15 years. At its next meeting a year later, Vice President Velikhov was named its head and organizer. In late 1983, Velikhov told a US official that he was also recently appointed to head a new national program to accelerate the USSR's development of ultra-high-speed "supercomputers."

- Several new computer technology institutes are being established under Velikhov's department to strengthen the Academy's scientific and experimental base, thus enabling it to play an enhanced coordination role. According to the Soviet press, they include the Problems of Information Science Institute, Problems of Cybernetics Institute, Problems of Technology of Microelectronics and Ultrapure Materials Institute, and Microelectronics Institute—all headed by prize-winning engineer-academicians with close ties to the defense-related ministries of the electronics and radio industries.

[13] Aleksandrov, in an *Izvestiya* article (19 January 1984) called for intensified computerization, noting, "The United States has imposed a very strict embargo on the export of electronic technology and electronic equipment to our country in the hope of slowing down or halting our progress in this exceptionally important sphere. In so doing, however, it has forgotten that our science and technology have independently resolved tasks of equal complexity such as the creation of nuclear and missile hardware without receiving anything from abroad and in a fairly short time. This task is not beyond our motherland or its science and technology and our duty is to resolve it." [redacted]

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The December 1984 Academy elections further indicated the enhanced priority assigned by the Soviet leadership to computer technology as well as the deepening involvement of the military R&D sector in Velikhov's new department. As a result of the elections, 14 full and 26 corresponding members were elected to this department. This number is nearly twice the number of listed vacancies announced in *Izvestiya* on 14 September 1984. Among them, moreover, are several scientists who work at defense-related establishments. Anatoliy Savin, chief of the Kometa Design Bureau, Lev Koshkin, chief of a design bureau in Klimovsk, and Germogen Pospelov, a Soviet general and automatic control specialist who formerly headed the Academy's Section of Applied Problems (the Academy's liaison point with the Soviet military-industrial complex)—all were elected academicians. New corresponding members who have defense ties and who are in Velikhov's department include such institute directors as Veniamin Yefremov (Scientific Research Institute No. 20—radar engineering) and Anatoliy Kalayev (Kalmykov Radio Engineering Institute in Leningrad). Other corresponding members with defense-related backgrounds are Pavel Agadzhanov (major general and first director of the Air Defense Systems Engineering Institute in Moscow), Anatoliy Basistov (an air defense radar specialist associated with the Vympel Design Bureau), and Dmitriy Kozlov (department head at the Moscow Central Design Bureau for Space and ICBMs at the Progress Aircraft Plant). [redacted]

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Making Computers a Tool of Science. Intensive efforts are under way to introduce computer technology and information techniques into science to improve its quality and productivity. A "blackboard mentality" and the lack of a strong base in technology have traditionally been weaknesses of Soviet science; Academy leaders view them as major brakes on the development of science.[14] Consequently, they are taking several steps to overcome them:

- One of the priority S&T target programs in the 1981-85 plan is devoted to the automation of research and to computerized design.

- A new Institute for Applied Automated Systems, formed in mid-1982 and directed by the son of Military-Industrial Commission (VPK) Chairman Smirnov, is developing a computerized data transmission system for the USSR and union republic academies of sciences. The first local computer networks of this system—called Akademset—are working in the cities of Moscow, Leningrad, Kiev, Novosibirsk, and Riga, according to the Soviet press. The entire system—scheduled to be operational by the end of 1985—is directed at overcoming the severe communications barriers within Soviet science that have impeded the dissemination and application of new S&T advances.

- Academy researchers also will have access to another computerized information system being established by the GKNT. This network, which began service in early 1983, will eventually connect the capitals of the union republics and 36 oblast centers. It will also give Soviet scientists real-time access to the GKNT's information on foreign scientific publications, patents, and licenses, as well as improved communication among users.

- The Soviets have also heightened efforts to access and exploit Western S&T data bases (including military topics). 25X1
Oleg Smirnov's new institute in 1983 was 25X1
designated the center for this activity 25X1
Smirnov also 25X1
hoped that expanded use of foreign data bases would greatly benefit Moscow's long-range efforts in computer-aided design. He called for an all-union conference in 1985 on the problems of working with foreign computer networks and information systems. 25X1

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The Active Role of Regional Science Centers. The Academy has also pressed its regional scientific centers to play a more active role in solving regional economic problems and in coordinating the research of industrial and educational establishments with that of academy institutes. Apparently, party leaders are trying, nationally and locally, to use the Academy to break down or circumvent ministerial barriers to technological change. 25X1

The Academy itself, backed by regional party leaders, has sought to strengthen its role in spearheading the advance of S&T in Leningrad, a major center of defense industry and high technology development. For example, a new scientific center of the Academy was created in Leningrad in March 1983, supplementing the three existing regional organizations—the Siberian Department, and the Urals and the Far Eastern Scientific Centers. The Leningrad Center, which coordinates research of the northwestern economic region, is headed by Academician Igor' Glebov, who works for the giant Electrosila Production Association of the Ministry of Power Machine Building. Glebov, who also chairs the S&T Commission at the USSR Supreme Soviet's Council of the Union, worked closely with Romanov when the latter was Leningrad party chief. 25X1

The Academy also promoted S&T in the Urals, one of the USSR's oldest industrial and most technologically backward areas. In October 1983, the CPSU Central Committee issued a special decree on the Academy's Urals Scientific Center aimed at improving its work. 25X1

[14] Aleksandrov in his January 1984 Izvestiya article emphasized that, without a massive educational effort to raise the computer literacy of the Soviet population, efforts to modernize the economy will "turn out to be only a large useless expenditure." He called for a national computerization program "comparable to the one we developed to eliminate [general] illiteracy after the October Revolution—a program that is probably no less important in today's world." Velikhov, whose son has an Apple computer, also strongly advocates more education in computers. Velikhov is working with the GKNT to learn about American computer-based educational systems. The widespread introduction of computers into Soviet schools is a major goal of a comprehensive education reform program, approved by the Central Committee and endorsed by the Supreme Soviet in April 1984.

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The decree called upon the Council of Ministers to increase the resources devoted to the center. [redacted]

Of the union republic academies, the Ukrainian Academy of Sciences has led in taking a more active role in advancing S&T. In December 1980, the Northwestern Scientific Center was organized to oversee the large R&D complex in Kiev. In January 1981 a republic party-government decree expanded the coordinating role of all six scientific centers of the Ukrainian Academy. The USSR Academy Presidium in 1980, moreover, approved the effort of the Ukraine's Western Scientific Center in Lvov to improve regional S&T coordination and recommended it as a model for its own scientific centers and affiliates as well as for those of other republic academies. Following Brezhnev's trip in March 1982 to Tashkent, local party officials set up a Tashkent Scientific Center within the Uzbek Academy. In 1983 the Kazakh Academy established a new scientific center in Karaganda. [redacted]

While supporting the increasingly applied orientation of the Academy, the trend toward regionalization also represents further encroachment by the party and industry on the Academy's institutional autonomy. According to the Soviet press, party officials are prominently involved in several regional scientific centers, especially in the Ukraine and parts of the RSFSR. In practice, these centers appear to function as coordinating arms of their respective party committees as much as of their republic academies; local party authorities are using them to propel S&T development in their areas. [redacted]

Combined Meetings or Science Summits

Besides internal reorganization of the three main planning bodies—Gosplan, GKNT, and the Academy—steps have been taken to strengthen their interaction with each other. These efforts have resulted in meetings of the Gosplan Collegium together with the GKNT Collegium and the Presidium of the USSR Academy of Sciences, where major issues in S&T policy and planning are addressed. According to a Soviet economics journal, there were seven such science summits between 1980 and 1982. At five conferences, participants heard proposals from the USSR Academy, the Siberian Department, the Urals and the Far Eastern Scientific Centers, and the Ukrainian Academy on which major scientific and technological accomplishments should be introduced into production. These meetings also helped define and amplify the priority S&T programs that were listed in the 1981-85 Economic Plan and that were, for the first time, formally approved by all three planning bodies. [redacted] 25X1

A new round of S&T meetings, aimed at listing the priorities for the 1986-90 plan, will probably be held in 1985. According to the Soviet press, the GKNT, Academy, and Gosplan already have given joint approval to some union republic 20-year programs for S&T progress—the first stage in setting priorities. [redacted] 25X1

These meetings of the planning bodies demonstrate the higher priority and visibility accorded S&T issues by the leadership. In addition, joint sittings seem to provide:

- A means by which a unified scientific front can be brought to bear on major S&T policy decisions. 25X1
- A major forum in which high party and government officials can participate and endorse policy decisions. For example, former Politburo member and party Secretary Kirilenko, Premier Nikolay Tikhonov, and party Secretary Vladimir Dolgikh, as well as five deputy chairmen of the USSR Council of Ministers, attended the 26 December 1980 science summit.
- A means of bringing S&T issues directly into Gosplan's highest councils and plan deliberations. 25X1
- A new and special channel whereby scientists can advise on the introduction and use of S&T advances. Such direct access to Gosplan officials and the

planning process "opens up the possibility for an outlet into the economy of the country as a whole," noted the head of the Academy's Siberian Department. Previously, Academy scientists have had to negotiate directly and separately with the ministries regarding the use of S&T results.

Leadership actions to reorganize the S&T policy establishment will help these organizations better address problems in technology development and application. At the same time, however, efforts to change the attitudes within these institutions and to restructure their external relations—developments critical to achieve the leadership's goal—will necessarily be a long-term and difficult process.

Restructuring the R&D Network

Reorganization of the S&T establishment alone will not make science and technology an integral and viable part of economic policy. Reorganization of the vast network of R&D units at the base of the S&T establishment is also required to put S&T applications to practical use. Brezhnev at the 1981 party congress called explicitly for "a certain regrouping of scientific forces," emphasizing that the USSR could no longer tolerate backward and inefficient research institutes and design bureaus. Since the congress, GKNT and Academy leaders have publicly urged—both in speeches and publications—the need for better organization and structural changes that would concentrate resources on key problems, strengthen the experimental production base of science, raise scientific productivity, improve the ties between science and industry, and speed technological innovation.

R&D reorganization, however, has been a slow, uphill battle against strong institutional resistance and severe resource constraints. Under Andropov, intensified pressure was put on the scientific and economic bureaucracies to move off dead center on this question.[15] Thus, Marchuk reported in the March 1983 *Kommunist* that the GKNT had completed its survey of the R&D structure of 42 ministries and agencies. The following August, the joint party-government decree on S&T reemphasized the need for new and improved R&D institutions. As media commentary indicates, however, the ministerial bureaucracy has continued for the most part to delay or avoid the GKNT's recommendations, organizational decisions, and other major changes.[16]

Despite the slow pace and limited scope of organizational reforms, recent press commentary and officials' statements hint at the broad outline of the regrouping of scientific forces under way. In general, reorganization entails:

- Expanding the number of science and production complexes, centers, and associations, within the economic branch ministries, which link institutional performers in the research-to-production process.
- Creating new structural frameworks to support the development of interbranch science and technology programs that require the cooperation of several ministries.
- Increasing *access to* and joint *use of* facilities and services across sectors on the basis of negotiated settlements and shared interests. Academy scientists, for example, are making greater use of the experimental and pilot production bases of ministries—including the defense industries—while the latter are tapping the basic and applied research capabilities of the Academy.

Economic Ministries

Within the ministries of various economic branches emphasis is shifting to the creation of powerful scientific and engineering centers that can ensure the rapid

[15] According to the Soviet press, the S&T Standing Commissions at the USSR Supreme Soviet addressed the issue of R&D reorganization in December of both 1982 and 1983; they strongly criticized the GKNT and the ministries for bureaucratic foot-dragging and for failing to implement the commissions' recommendations to accelerate the restructuring process.

[16] In October 1984, one of Marchuk's deputies, Mikhail Kruglov, reported in a Soviet newspaper that the GKNT had recently checked on progress toward R&D reorganization in 50 ministries and agencies. He noted that ministerial decisions had been taken to close down about 150 scientific organizations and to reorganize 60—still a very small part of the total ministerial S&T structure.

development and wide-scale introduction of modern resource-saving technologies. The formation of such centers was endorsed in principle at a May 1981 high-level meeting on machine building, held at the CPSU Central Committee and attended by several representatives from the defense industries, according to the Soviet press. The policy of developing centers has been one of Marchuk's favorite themes. In a September 1982 *Trud* article, he noted that the GKNT, jointly with the ministries, was "now organizing" large S&T centers in almost all branches of the economy.

Marchuk and other GKNT officials have been vague, however, about the specific details of such organizations, and implementation has been slow. They emphasize that the centers should be integrated design and development facilities, closely linked with production. Structurally, they should include, in addition to scientific research institutes and engineering design bureaus, experimental test bases and production plants capable of manufacturing unique equipment or standard items in small batches. The giant Elektrosila and Svetlana production complexes in the Ministry of the Electrical Equipment Industry have been cited by GKNT spokesmen as organizational models. The label of new S&T center may be extended to already existing organizations that have been variously called science-technical associations *(nauchno-tekhnicheskiye obedineniya* or NTOs) and production-technical associations *(proizvodstvenno-tekhnicheskiye obedineniya* or PTOs). PTOs focus primarily on innovation and the assimilation of prototypes and are frequently led by large design bureaus. NTOs have been particularly prominent in the aviation industry.

Efforts also are being made to expand the number and to improve the operation of science and production associations (*nauchno-proizvodstvennyye obedineniya* or NPOs). These large complexes also concentrate research, design engineering, and production subunits under a single roof and serve as special nurseries for innovation.[17] Most existing NPOs, however, lack the capability for series production, and many do not have even an experimental production facility within their structure. In an April 1983 *Izvestiya* interview, Marchuk noted that the regime saw an enlargement of the network of NPOs as "the main way" of enhancing the productivity of small, isolated institutes and design bureaus and of overcoming the weak experimental production base of most ministerial R&D organizations. The August 1983 S&T decree endorsed a policy of expanding NPOs and mandated measures to improve their planning and management.

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In line with these plans, more sectorial research institutes and design offices apparently will lose their independence and be incorporated into large S&T centers, NPOs, production associations, and plants—and tied more directly to the production process.[18] At the same time, some new institutes and design bureaus are being created by the ministries to tackle new problems. The August S&T decree further orders all major enterprises to add general designers to their staffs to manage new technology development.

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Academies of Sciences

Within the academy system, organizational efforts focus on strengthening the Academy's traditionally weak technology base, both to enhance academy capabilities to conduct applied R&D and to raise industry's interest and confidence in academy research results. In general, organizational policy stresses:

- Enlarging the Academy's own network of applied research institutes and experimental design facilities.

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- Establishing joint laboratories, financed by specific ministries but run by Academy authorities and located either directly at academy institutes or production enterprises.

[17] Though NPOs began to be created on a nationwide basis by a 1973 party-government order, some ministries a decade later still had not set them up or had done so only slowly and formally. The number of NPOs has been frozen at about 250 since 1977. The failure of ministries and central planning agencies to implement changes in planning, financing, and management so these organizations can indeed operate as integrated structures has limited the effectiveness of existing NPOs. Marchuk charged in *Kommunist* in March 1983 that such a formal approach threatened "to discredit the very idea of the NPO."

[18] The Minister of the Machine Tool and Tool Building Industry, for example, in January 1984, noted in a Soviet trade journal that in response to the August decree nine institutes had been transferred to all-union production associations; eight design organizations had been attached to plants; three new NPOs had been established; nine new special design bureaus at plants and seven design bureaus had been organized; and 25 existing organizations had their specializations redefined.

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- Utilizing production enterprises and experimental plants for industrial verification of academy research results and as pilot bases for introducing academy-developed technology into the economy. A laser laboratory at the giant Moscow Automotive Plant (ZIL), for example, functions as a base laboratory for the Academy's Industrial Lasers Center. Governmental authorities in the Ukraine and Belorussia have led in authorizing such facilities for their republic academies.

- Creating large scientific research and design engineering complexes at leading academy insitutes, consisting of an institute, a design bureau, and an experimental test shop. By 1982, according to Soviet open sources, the Ukrainian and Belorussian academies each had eight such complexes in operation. Similar complexes and centers also are being formed in the Latvian and Uzbek academies.

- Creating science and production associations within the framework of the academy system. Despite the lack of formal authorizing legislation, several republics already have begun voluntarily to form such associations linking academy organizations with industrial enterprises. According to the Soviet press, Academy NPOs have been set up for advanced electronics, computers, space technology, and powder metallurgy. Soviet open sources also report that defense industrial ministries have been key supporters of the formation of some associations.

- Returning to the USSR Academy of Sciences some of the applied institutes it lost in the 1960s. For example, the Institute of Electronic Control Machines, which was transferred to the Ministry of Instrument Making, Automation Equipment, and Control Systems in 1966, is being brought back into the Academy to help build up its new Computer Department. [redacted]

Interbranch Organizations

The establishment of special interbranch organizations that focus on S&T developments that cut across various branch ministries consitutes the third major regrouping effort. Marchuk, in a January 1983 *Ekonomicheskaya gazeta* article, labeled the absence of such bodies an"important "weakness" of the Soviet S&T system. The predominantly branch structure and management of Soviet S&T resources, prominent Soviet scientists and science administrators emphasize, no longer respond to the main problems of science, technology, and the economy, which increasingly transcend existing ministerial boundaries.[19] [redacted] 25X1

Organizational proposals and initiatives point largely toward the development of three types of structures:

- Scientific research institutes similar to the Paton Electric Welding Institute, which cut across ministerial lines and can conduct applied research, engineering, and technology design.

- Interbranch NPOs and similar S&T centers that promote collaboration of scientific, educational, and production establishments in the development and diffusion of key technologies.

- Temporary project teams, developed to solve long-term complex S&T problems or to design new equipment and technology. If successful, they may be changed into NPOs. The August decree explicitly calls for the creation of such ad hoc collectives, and the USSR Council of Ministers in January 1984 adopted a resolution regulating their formation and operation. [redacted] 25X1

Soviet open literature also indicates that considerable controversy still exists over questions of the institutional authority and bureaucratic subordination of these interbranch structures. The press and specialized journals have published various proposals that such organizations be created under the GKNT, under Gosplan, or even directly under the USSR Council of Ministers. For the moment, however, such organizations are largely experimental. Few, in fact, have been publicly identified. A science-production association on powder metallurgy, directly subordinate to the republic council of ministries, has been functioning since 1980 in Belorussia. A deputy premier has been appointed to oversee the organization of such interbranch S&T organizations. [redacted] 25X1 25X1

[19] On this general issue, see the articles by Professor G. Popov and Academician Gvishiani in the December 1983 and April 1984 issues of *Kommunist*, respectively. [redacted] 25X1

CEMA Organizations

The Soviets also are calling for S&T organizational changes among CEMA members to reduce dependence on Western technology and to obtain greater access to East European resources and capabilities. Moscow particularly wants intra-Bloc structures that will increase the level of collaboration and hasten technological development in priority areas—agreed to at the June 1984 CEMA Economic Summit—such as advanced electronics, computers, biotechnology, nuclear power engineering, and new materials technologies. [redacted]

The Soviets have begun to advocate the creation of powerful "international production and technological complexes" in CEMA countries similar to those being created in the USSR. [redacted]

[redacted] Academician Oleg Bogomolov, Director of IEMSS and reportedly a close adviser to former General Secretary Andropov, expressed similar views in a May 1983 *Kommunist* article on CEMA strategy for the 1980s. In the July 1984 *Kommunist,* Premier Tikhonov raised the idea of setting up an intra-Bloc center for robotics similar to the Joint Institute for Nuclear Research in Dubna. [redacted]

Moscow is also pressing to establish more "direct links" between Soviet factories and their Bloc counterparts. "Direct links" is a Soviet catchphrase for shortcutting the economy's bureaucratic maze. Traditionally, factories had contacts with each other only through the government ministries that ran them. Foreign transactions, moreover, had to be channeled through trade agencies. By letting plants work directly with technologically more advanced East European firms, the Soviets apparently hope to foster modernization, speed the infusion of new technology into the economy, and circumvent the Foreign Trade Ministry's monopolistic control. [redacted] 25X1

Some practical steps apparently have been taken to promote these policy directions:

- The Politburo at its 7 June 1984 meeting, according to *Pravda,* approved unspecified measures aimed at greater technology sharing and coproduction within CEMA. The Politburo reportedly again discussed closer Bloc S&T cooperation at its September 1984 session. 25X1
- A decree of the Council of Ministers, also adopted on 7 June and later made public, authorized new factory-to-factory contacts with CEMA members and Yugoslavia. 25X1
- Provisions for direct links have been included in the Soviets' long-term (to the year 2000) economic and S&T accords with Poland and the GDR. At the October 1984 Havana meeting of government heads of CEMA nations, Premier Tikhonov publicly confirmed that factory-to-factory dealings had already begun with Poland and the GDR. [redacted] 25X1

Strengthening Incentives and Sanctions for Innovation

The civilian research-to-production cycle lacks an effective incentive system. Limits on bonuses and compensation for innovations appear at almost every level for both individuals and organizations.[20] Failure

[20] For example, until recently, for any single invention the award cannot exceed 20,000 rubles. The limit on the bonus paid to any enterprise for any single production innovation is 200,000 rubles. The total amount any enterprise can earn in innovation bonuses in one year is limited to a certain percentage of its total wage bill. No individual can receive a bonus for innovation in excess of 25 to 50 percent of his base salary. An additional and more restrictive limit is that the sum of an individual's bonuses from the Innovation Fund may not exceed 1,200 rubles a year. Furthermore, the sum of all special bonuses a manager can receive may not exceed the equivalent of six months' salary per year. [redacted] 25X1 25X1

to innovate does not generate strong penalties: enterprises that do not innovate are not economically threatened nor do they become bankrupt. Just as a ceiling limits rewards for innovation, a floor cushions failure.

Following Brezhnev's death, Soviet leaders have taken greater interest in the creation of economic conditions and a psychological climate more conducive to innovation. Andropov made this a central issue on the economic agenda. At the November 1982 Central Committee plenum, he strongly criticized the lack of incentives for developing new technology and decried the system whereby managers, though accountable for the production plan, at worst are only scolded for not meeting new technology goals. At the June 1983 plenum, Andropov again spoke out in favor of the risk-taking innovative manager and against the conservative "who avoids innovation and loses nothing." He reemphasized the need to devise a system of incentives and sanctions that would turn managers and workers, as well as scientists and designers, to new technology and, at the same time, make "work in the old way unprofitable." He made clear, moreover, that failure to innovate should have "a direct and inescapable impact" on the pay, job status, and reputation of workers and executives.

As a result of Andropov's pressure, some partial and cautious first steps have been taken to alter the balance of risks and rewards that works against innovation. In particular, the August 1983 S&T decree mandates the expanded use of monetary rewards to stimulate new technology and financial penalties to root out old technology. The decree also orders changes in pricing policy and in the system of quality certification and technical standards to undergird the new incentives and sanctions.

Better Rewards for New Technology

To better reward those who discover and/or introduce new technology, the August 1983 decree authorizes:

- Payment of bonuses over and above the fixed maximum to managers, engineers, and other specialists for developing and/or introducing new equipment, processes, and materials that meet or exceed current standards; and for increasing the share of new items in the total product mix.
- Incentive price markups—up to 30 percent of wholesale prices—for high-quality, new technology products. Though not new, this measure has not been extensively or effectively applied.
- Introduction, beginning in 1985, of lump-sum bonuses ranging from 3,000 to 40,000 rubles each, to enterprises and individuals for creating and introducing new technology.

In addition, various experimental programs that offer differentiated wages and special bonuses to boost productivity and innovation are being tested. The Council of Ministers in March 1983, for example, approved an experiment to improve the pay structure of designers and technologists in five Leningrad-based production associations. This program seeks to heighten cost consciousness and use of resource-saving designs and computerized design systems. Basically, it seeks to apply the "Shchekino model" to R&D by encouraging managers to reduce staffs and use the surplus wage funds to raise salaries and reward good work among the remaining personnel. According to the Soviet press, the enterprises taking part in this experiment by late 1984 were reporting manpower cuts of from 7 to 15 percent with wages going up by 8 to 10 percent.[21]

The Academy of Sciences is offering material incentives to scientists who conduct more applied research and improve productivity (see inset). At engineering laboratories attached to selected Academy institutes, for example, personnel can now earn extra pay—up to 30 percent of their wages—for meeting project goals and doing applied research. the

[21] The Shchekino chemical plant in 1967 first experimented with meeting production plans with fewer workers. Since then, this approach has been adopted in some 2,000 enterprises. Under the Shchekino plan, enterprise managers are allowed to keep for incentive purposes (for bonuses up to 50 percent of regular wages) the wage fund savings obtained through meeting output plans with unchanged or reduced labor force. For a number of technical reasons (for example, frequent change in plans, experimenters hindered by supply failures, conflicts with other in-force rules), the Shchekino method has spread slowly and has had limited success.

Poor Morale in the Scientific Community

These limited experiments with new incentive schemes only underscore the more general problem of low salaries and morale among the members of the S&T community. The Soviet press has carried several articles that note the comparative decline in scientists' salaries since the mid-1960s, the increasing difficulty of attracting youth to science, falling enrollment rates in engineering schools, and a shortage of designers. [redacted] *Soviet scientists in Moscow were openly complaining in February 1983 about their low salaries and professional restrictions on moonlighting to supplement them. They frankly contrasted their incomes to those of food store clerks or truckdrivers who, because they can make extra money through black-marketeering and other illicit activities, allegedly "earn more than all but the upper ranks of scientists."* [redacted]

Issues of wages and productivity of scientists, in turn, have sparked a broad debate in the Soviet press on the system of remuneration in science. The ongoing discussions make clear that much controversy and confusion exists over what a scientist should be paid for, how he should be paid, and how much he should be paid. Still other Soviets stress that scientists are not moved by economic incentives alone. Given the complexity of the problems and the potential for exacerbating social tensions and political conflict, Soviet leaders are likely to proceed cautiously on these issues. [redacted]

Soviet press identify Velikhov as the major promoter of this experimental program. [redacted]

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Meanwhile, the Soviet leadership reportedly is preparing additional measures to encourage innovation. [redacted] 25X1
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February 1985 the Central Committee was considering changes that would allow plant managers who introduce new production lines to drop older ones and to have their initial output goals lowered to compensate for the downtime necessary to install and learn to use new equipment. The inflexibility of production targets is the main reason Soviet industry has traditionally resisted technological change. The need for such incentives was probably addressed at the recent June CPSU conference on S&T policy. [redacted] 25X1 25X1

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Stiffer Penalties for Obsolete Technology

Alongside better rewards for successful innovation, harsher penalties are being prepared against managers who fail to innovate. Underlying these measures is increased public emphasis in Soviet journals that incentives alone are inadequate to solve all the problems of technological modernization, that the introduction of major scientific advances "has never been and cannot be a pleasure" for enterprises, and that policy without effective liabilities and sanctions is, to cite Lenin, "a rattling of the air with empty sound." [redacted] 25X1

Stiffer sanctions are particularly needed to accelerate the *diffusion* of new technology rather than *innovation* per se. In the Soviet system, new products simply do not drive out old products the way they do in a market economy. According to *Pravda* (16 July 1984), 85 percent of new inventions in the USSR are implemented in only one or two plants, while little more than 2 percent end up in more than five enterprises. In the effort to broaden diffusion, the central planning agencies are being strengthened to define and enforce a stronger policy on obsolete production and technology. The August 1983 S&T decree, for example, 25X1 25X1 25X1

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emphasizes stronger and broader application of measures that, although adopted some years ago, have remained largely on paper:

- Price markdowns—up to 30 percent of wholesale prices—for outdated industrial goods subject to removal from production. Such discounting will now result in a reduction of enterprise incentive funds.

- Tighter quality control to root out obsolete products. Certification of industrial output will now be made according to two categories of quality—superior and first—rather than three as before. Articles not certified in either category are now subject to removal from production.

Among new measures, the decree authorizes:

- *All* product grading to be done by state certification commissions. Previously, they had awarded only the highest category of quality—the state Seal of Quality—while the ministries themselves had classified output as first and second categories.

- Managerial and enterprise bonuses for meeting current production goals to be reduced by no less than 25 percent for failure to fulfill S&T plan targets.

These measures are not likely to sit well with the Soviet managerial elite, who fear that the safety net protecting them in the past from punishment for noninnovative behavior could be threatened. Yet, the new sanctions appear to have support in high places, especially from Nikolay Ryzhkov, a former Gosplan official whom Andropov brought into the Party Secretariat in November 1982 reportedly to develop economic reform options and to oversee strategic planning. Before his election as a CPSU Secretary, Ryzhkov wrote articles highly critical of lagging innovation, especially in the machine-building sector, and accented the need for faster technological rearmament along with tighter quality controls.[23]

[23] In an October 1981 *Trud* article, Ryzhkov noted that a joint Gosplan-GKNT survey of 20,000 models of machinery found that 29 percent were obsolete. Over the period from 1970 to the end of 1980 the share of new machinery produced in the base and terminal year fell from 4.3 to 2.5 percent, while the share of production of 10-year-old technology rose from 20 to 28 percent. Ryzhkov reiterated the need for better standards and more independent nondepartmental certification of product quality in an August 1982 *Planovoye khozyaystvo* article.

Leadership efforts to speed the removal of old technology, especially through greater centralization and coercion, however, are bound to encounter major obstacles apart from ministerial resistance. Just as they have trouble with the term "new technology," central planners face difficulties in defining "obsolete products" and "outmoded technology." The dropping of old products and processes must also be closely coordinated with their replacement by new models and methods. Otherwise, bad technology could give way to no technology and create even more bottlenecks and gaps. To date, the Soviets have demonstrated no better grasp in dealing with technological obsolescence than they have with technological innovation. Equally as important, the new incentives have yet to remove the manager from responsibility for meeting current production plans. This remains his number-one success/failure criterion and is the basis for determining bonuses. This performance standard necessarily would make plant managers reluctant to take production lines down to modernize and reequip their factories.

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Greater Managerial Autonomy

The economic managers' decisions to innovate are strongly influenced by not only their *interest* in new technology but also their *capacity* to innovate. Traditionally, economic managers—at the lower levels in particular—have lacked adequate economic incentives, appropriate machinery, and sufficient managerial autonomy to make innovation successful and profitable.

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Recently, several Soviet S&T figures have publicly voiced the need for greater economic decentralization to promote innovation. Academician V. Trapeznikov, Director of the Moscow Control Problems Institute and a former GKNT deputy chairman, raised this issue in a May 1982 *Pravda* article. In a December 1982 *Trud* article, Abel Aganbegyan, the reformist economist, also called managerial autonomy the "basic question" of incentives. He said that enterprise managers have the incentive to produce good results—including innovation—only when the results depend essentially on their own actions and cannot be changed by "a simple telephone call" from Moscow or by "an adjusted plan" handed down by a ministry.

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Three months later in the same newspaper, Oleg Antonov, the noted aircraft designer, similarly called for decentralizing measures to unleash the initiative of lower level managers. Antonov urged changes in planning "so that if the enterprise director wanted to and could, he would—not reluctantly but joyfully—introduce new technology without detriment to the production process, the collective, and to himself personally." [redacted]

Subsequent to these calls for some economic decentralization—voiced by Andropov himself at the November 1982 plenum—the Politburo in July 1983 approved an experimental program purportedly giving enterprises in five industrial ministries more latitude in using investment and wage funds, largely to spur technological innovation. In September 1984 the Politburo decided to expand the program—further emphasizing the acceleration of retooling and modernization in key sectors. An additional five union ministries—all machine-building ministries—and 15 republic ministries (mostly in light industry and consumer services) joined the experiment on 1 January 1985. The Leningrad experience with new wage and bonus systems for designers and engineers has achieved some positive results and has become part of the national experimental program (see "Better Rewards for New Technology" section). [redacted]

So far, however, this experiment in enterprise autonomy has had mixed results (or, as Gorbachev said at the plenum, the results were "not at all bad but they cannot provide complete satisfaction"). The Soviet media has reported that some participating enterprises have indeed achieved some success in raising labor productivity and in conserving material resources. Yet public statements by local managers and continuing Politburo criticism of the experiment's shortcomings—also published in the press—generate skepticism that it will produce significant economic improvements or large-scale modernization. [redacted]

The problems of the experiment are twofold. First, it faces the difficulties of previous piecemeal reforms that are launched in selected areas or sectors before general application throughout the country. Such an approach has generally not been effective in accomplishing major structural change. On the contrary, experiments tend to be absorbed by the system and have little impact. Second, it simply does not address directly serious problems endemic to the economic system that result in inadequate incentives for managers to undertake the risk of adopting innovations or new technology. Essentially, these consist of taut planning, mandatory requirements to meet output targets, and inflexibility in supply arrangements. These and other rigidities cannot be viewed separately from the system of centralized planning and control that has spawned them. The experiment's limited nature does not come to grips with central problems, such as the role of the ministries vis-a-vis enterprises and central planners or the reallocation of resources within ministries to deal with weak and backward enterprises. The experiment makes rather significant demands on almost all the resources at an enterprise manager's disposal without ensuring him the essential external support necessary to enable him to meet his own requirements. In short, this experiment, like those that preceded, has failed to provide a combination of carrot ("moral" or "material" incentives) and stick ("disciplinary" or "sanctions") measures to encourage successful decentralized decisionmaking. [redacted] 25X1

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Expanding the Party's Role

Despite the emphasis on improved long-range planning, organizational restructuring, and better use of incentives, the leadership also is relying on more traditional methods of administration to elicit desired behavior. Soviet leaders recognize that greater party involvement is required to speed up the notoriously slow and disjointed civilian innovation process and to overcome the economy's technological backwardness. The party apparatus is the traditional integrator of activities that cut across organizational lines and is now being called upon to push innovation and retooling, mobilize resources, monitor priority programs, break down ministerial barriers to technological modernization, and to secure better coordination among research and production organizations involved in the innovation process. [redacted]

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While this involvement will help overcome secrecy barriers, a capability that could facilitate the spillover of technology from the defense sector into civilian industries, it probably reflects the usual inclination to maintain control as well as perhaps cynical recognition that S&T progress does not "happen by itself" but must be consciously pushed, directed, and controlled. In this process, party organizations must lead—not lag.

The party has always had these responsibilities in the defense industry. Generally, a Central Committee Secretary presides over the party's efforts.[24] The Central Committee's Defense Industry Department provides direct oversight of the weapons acquisition process and of all nine defense industrial ministries. Chiefly through this department, the party supervises a network of regional party defense industry departments that monitor and expedite defense industrial activities throughout the USSR.

The Communist Party hierarchy, however, has not been well suited to exercise a strong modernizing role in nondefense industry. Typically, civilian S&T lacks the sponsorship of the top party leadership and the close party oversight, which are characteristics of military R&D. Party oversight of the civilian innovation process, moreover, is divided among several economic and functional departments in the Central Committee apparatus. The various economic branch departments have generally been more interested in current production than in new technology, while the Science and Educational Institutions Department has been more concerned with ideological conformity among scientists than with practical results.

Organizational Changes

The perceived need for greater party involvement in civilian S&T is forcing the party apparatus to make organizational changes. Special coordinating councils on S&T progress are being created directly under various regional party committees and some union republic party central committees. These councils, generally headed by a party secretary, serve as a major channel through which the party's authority is brought to bear on the scientific establishment and managerial bureaucracy.

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Central Party Apparatus. No major restructuring of the CPSU Central Committee apparatus has been undertaken—though Andropov reportedly considered such sweeping organizational changes.

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Republic Party Organizations. New party S&T coordinating councils have recently been created in some union republics. In May 1982 a Coordinating Council was created under the Georgian Central Committee. Georgian party chief and Politburo candidate member Eduard Shevardnadze [25] heads the council, while other party secretaries and Central Committee department chiefs or their deputies lead most of its sections and working groups. The head of the Defense Industry Department, for example, chairs the council's working group on machine building; the head of the Organizational Party Work Department directs the working group on regional S&T organization. As

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[24] The late Defense Minister Dimitriy Ustinov formally held this party secretarial post from 1965 until 1976; during that time, he presided over a massive Soviet military buildup and rapid modernization of the defense industries. Former Leningrad party chief Grigoriy Romanov has had responsibility for oversight of the defense industry since his move to the Secretariat in 1983.

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[25] Shevardnadze has particularly pressed for an expanded party S&T role. He told the May 1982 Georgian party plenum, "The time has now come when the party organization and all Communists must make a decisive 180-degree turn toward the problems of science and S&T progress." Later, in July 1983, speaking about the significance of the May special plenum on science, Shevardnadze told a republic science gathering, "The matters dealt with were not ordinary, and the decisions taken were not routine."

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indicated by Georgian press reports, almost all Central Committee departments are being drawn into the workings of the Coordinating Council. [redacted]

In October 1983, a Coordinating Council to oversee S&T progress was set up under the Ukrainian Central Committee with party chief and Politburo member Vladimir Shcherbitskiy at its head.[26] According to the Soviet press, the task of the Coordinating Council is to intensify party influence from top to bottom on the implementation of S&T policy throughout the republic. In discharging this task, the Council will supervise and coordinate the work of the S&T councils under all regional party committees. [redacted]

In April 1984, the Leningrad Regional Party Committee, which along with the Moscow City Party Committee enjoys "union republic" status, altered the structure of its Council for Economic and Social Development. The *obkom* also added the phrase the "Acceleration of S&T Progress" to the council's name. Lev Zaykov, the party first secretary, was named chairman of the new Council.[27] In mid-April this *obkom* council established a special subcouncil—also headed by Zaykov—to oversee a massive computerization program for the Leningrad region in the next five-year plan. The CPSU Central Committee in August 1984 endorsed the initiatives of the Leningrad party organization for accelerating economic modernization and called for a national seminar to popularize the Leningrad experience to be held sometime in early 1985, according to the Soviet press. [redacted]

[26] Shcherbitskiy has been a consistent advocate of a strong party S&T role. In his 1983 book, *Scientific and Technical Progress: A Party Concern,* he speaks out against "falling into a sort of euphoria by placing one's trust in some kind of automatic mechanism for introducing innovation" and for "engaging fully all the levers of party-political influence to speed up technological change." [redacted]

[27] Zaykov first called for these organizational changes in October 1983 at a special *obkom* plenum that met to discuss the significance and implications of the joint party-government August S&T decree. He explicitly tied these changes to the need to increase party control, noting that "to strengthen further the party's influence on the implementation of a unified S&T policy in the Leningrad area and to improve coordination of the work among party committees, the role of the *Obkom* Council for Economic and Social Development should be augmented; the functions of the bureau for S&T progress should be expanded; and its structure should be changed." [redacted]

Regional Party Committees. Increased party involvement with science and technology has been most evident at the intermediate levels of the organizational hierarchy—in major oblast centers and republic capitals. Here distinct government agencies with responsibility for coordinating S&T activities generally do not exist. Thus, party committees have become the driving force in recent years behind efforts to spur innovation and secure more coordinated S&T strategies within a given region. According to Soviet open sources, the Leningrad, Novosibirsk, Irkutsk, and Donetsk *obkoms* and Krasnoyarsk *kraykom* have led in promoting development of long-range regional S&T plans. The Moscow, Leningrad, Tomsk, L'vov, Kiev, and Sverdlovsk *obkoms* have actively promoted the use and closely monitor the course of provincial or citywide target programs. [redacted] 25X1 25X1 25X1

The use of coordinating councils or special commissions to advise and assist party leaders on S&T matters is also most widespread on the regional level. Some party committees like the Novosibirsk and Tomsk *obkoms* have reportedly utilized such bodies for a decade or more, while other provincial party authorities have only recently adopted this innovation. In some large "science capitals," like Kiev or Novosibirsk, the councils on S&T progress enlist several hundred scientific experts and have various sections and working groups that tackle specific problems and oversee individual projects. [redacted] 25X1

These regional activities acquire national importance, however, because of the heavy geographical concentration of S&T resources and the key role of regional centers in overall development strategy. These factors also largely determine why and where party authorities are expanding their involvement. Scientific research and development in the USSR remain highly concentrated in a few large industrial centers. Moscow, Leningrad, and Kiev alone account for about 25 percent of all scientific organizations and about 40 percent of all expenditures on science in the USSR, 25X1 25X1

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according to open Soviet sources. Over 40 percent of the nation's scientific organizations and 55 percent of scientific expenditures are located in just 11 cities.[28] If we add to this group another 11 cities, then we account for approximately 80 percent of the USSR's S&T potential. Indeed, it is largely in these 22 key science cities that party intervention and control appear to have increased most markedly since the end of the 1970s.[29]

Building a Cadres Policy To Support Technological Advances

Since Brezhnev's death, the Politburo has taken significant moves to reorient cadre policy to support more rapid S&T advance. In his maiden speech as party leader to the Central Committee plenum on 22 November 1982, Andropov stressed the importance of putting more competent and dynamic people in pivotal jobs. Again, before a 15 August 1983 gathering of party veterans, he emphasized that the party leadership must prepare to transfer power to a younger generation, telling his audience of septuagenarians that "each new generation is in some way stronger than the previous one, knows more, and sees farther." Though Andropov had neither time nor muscle to implement widesweeping personnel changes, he did initiate the long-delayed process of cadre renewal and succeeded in promoting talented party technocrats as well as successful industrial managers and defense industry specialists to some key party and government positions (see insets: "Party Technocrats," "Industrial Managers," and "Defense Industrial Managers").

General Secretary Gorbachev has been particularly involved with this effort. During Andropov's tenure, he took charge of the cadres portfolio in the Secretariat. He continued to oversee personnel matters after Chernenko became party chief. In his speeches and articles, Gorbachev has consistently stressed the importance of professional ability and the need to support cadres skilled in achieving desired economic

Party Technocrats

Yegor Kuz'mich Ligachev
Age 64 . . . recently elected full Politburo member . . . played major role in party personnel changes while head of CPSU Organizational Party work department . . . was deputy chairman of S&T commission of the Council of the Union of the USSR Supreme Soviet (1979-84) . . . longtime party manager—headed Tomsk Obkom from 1965-83—and probably client of former party secretary Kirilenko . . . has technical engineering degree . . . in critical position to make S&T a priority in party's personnel and organizational policy.

Vadim Andreyevich Medvedev
Age 60 . . . has been chief of the Science and Educational Institutions Department since August 1983 . . . was a deputy chief of the CPSU's Propaganda Department from 1971 to 1978 and then rector of the party's Academy of Social Sciences until 1983 . . . worked with Politburo member Romanov in Leningrad party apparatus in the late 1960's . . . trained as an economist . . . likely to bring dynamic and pragmatic approach to economic and societal issues.

Arkadiy Ivanovich Vol'skiy
Age 52 . . . came to General Secretary's personal staff under Andropov . . . had been deputy chief of the Machine-Building Department for 14 years . . . awarded a prize in 1971 for helping to automate production . . . trained as an engineer . . . appointed by Gorbachev in April 1985 to head CPSU Machine-Building Department.

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[28] These are Moscow, Leningrad, Kiev, Kharkov, Novosibirsk, Sverdlovsk, Minsk, Tashkent, Alma Ata, Tbilisi, and Baku. (U)
[29] The additional 11 cities are Donetsk, Gorki, Riga, Perm', Kazan, Dnepropetrovsk, Rostov, Chelyabinsk, Krasnoyarsk, Irkutsk, and Vladivostok. See Yu. Kanygin and B. Botvin, "Razmeshcheniye issledovatel'skogo potentsiala," *Voprosy ekonomiki,* 5 (1979), pp. 43-44.

Soviet science is concentrated in fewer cities than is the defense industry. Nearly two-thirds of more than 300 major defense plants and shipyards are located in 25 of the largest industrial cities; more than 100 are located in the 10 largest industrial cities. Not surprisingly, there is considerable overlap in geographical concentration: 13 of the top science cities also are among the 20 most important defense industry cities.

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Industrial Managers

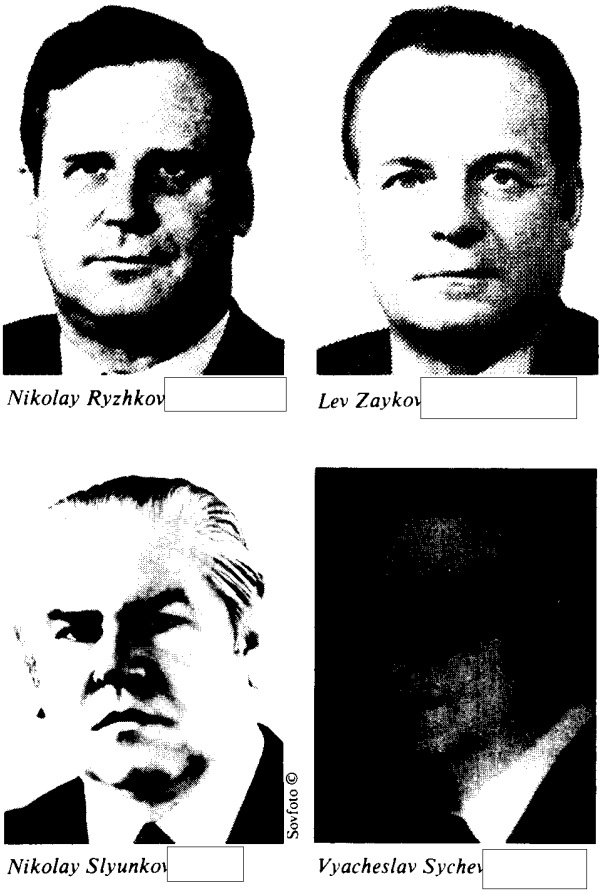
Nikolay Ivanovich Ryzhkov
Age 55 . . . CPSU secretary and chief of Central Committee Economics Department since November 1982 . . . recently elected to full Politburo status . . . spent 25 years at the Urals Heavy Machine-Building works in Sverdlovsk, serving as general director from 1971 to 1975 . . . former party secretary Kirilenko sponsored his move to Moscow . . . was First Deputy Minister of Heavy and Transport Machine Building (1975-79) when he became First Deputy Chairman of Gosplan in charge of heavy industry . . . brought into Secretariat by Andropov to help initiate economic reform . . . engineer by training . . . believed to be well suited for work under Gorbachev.

Nikolay Nikitovich Slyun'kov
Age 56 . . . became First Secretary of Belorussia in January 1983, at behest of Andropov . . . had worked in the Minsk Tractor Plant for 22 years including seven years (1965-72) as director . . . served two years as First Secretary of the Minsk City Party Committee before becoming Gosplan deputy chairman responsible for the machine-building industry in 1974 . . . trained as an engineer . . . recognized as a promoter of automation and computer technology.

Lev Nikolayevich Zaykov
Age 62 . . . succeeded Romanov in June 1983 as Leningrad party chief after having been mayor of Leningrad since 1976 . . . until his appointment as mayor, he served in various capacities within the defense industry including a stint as a general director of an unspecified science and production association . . . during this period was also the head of various secret facilities engaged in military-related work . . . is an electronics and computer specialist . . . also has a strong record of managerial performance.

Vyacheslav Vladimirovich Sychev
Age 51 . . . became CEMA's Secretary General in October 1983 . . . previously supervised GKNT's Department for S&T Cooperation with Socialist Countries . . . logical position for him because of increased policy emphasis on S&T development in Bloc economies.

[redacted]



Nikolay Ryzhkov [redacted] *Lev Zaykov* [redacted] 225X1

Nikolay Slyunkov [redacted] *Vyacheslav Sychev* [redacted] 25X1

Figure 8. *Industrial Managers* [redacted] 25X1

results. Having now assumed the top party post himself, he is moving quickly on the cadre front, advancing officials such as Ligachev and Ryzkhov, who were brought in under Andropov, and stepping up cadre turnover at lower levels. [redacted] 25X1

Implications for the Soviet System

The drive to spur S&T progress to achieve "intensive growth" is a major effort that is gaining a long-term commitment from the Politburo and bureaucratic momentum. In the leadership's perception, the task of technological modernization of the economy ranks in

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Defense Industrial Managers

Sergey Sergeyevich Afanas'yev
Age 66 . . . assigned to be Minister of Heavy and Transport Machine Building in April 1983 after having been Minister of General Machine Building . . . an engineer by training and a protege of Ustinov . . . the personnel shift, which is the first of its kind in 26 years, is designed to reinvigorate this industry . . . ministry is vital to both civilian and defense sectors and is one of leading ministries in experiment begun under Andropov.

Georgiy Dmitriyevich Kolmogorov
Age 55 . . . appointed Chairman of the USSR State Committee for Standards in January 1984 . . . climbed managerial ladder to become First Deputy Minister of the Communications Equipment Industry in 1975 . . . semiconductors specialist who won a state prize in 1973 for developing new transistors . . . a Doctor of Technical Sciences, he brings considerable technical and administrative experience to an organization that has been targeted to improve product quality as well as technical standards throughout the economy.

Genrikh Borisovich Stroganov
Age 53 . . . named USSR Gosplan Deputy Chairman in May 1984 . . . previously a Deputy Minister of the Aviation Industry in charge of scientific research . . . probably oversees machine building.

Boris Vladimirovich Bal'mont
Age 57 . . . became Minister of the Machine Tool and Tool Building Industry in February 1981 . . . was First Deputy Minister of General Machine Building . . . an engineer . . . worked in defense industries for almost 30 years before ministerial reassignment.

Anatoliy Antonovich Reut
Age 56 . . . appointed Chairman of the Belorussian Gosplan in February 1983 . . . was the First Deputy Minister of the Radio Industry and had been director of a computer plant in Minsk.

Lev Alekseyevich Voronin
Age 57 . . . Gosplan first deputy chairman since 1980 . . . now in charge of the expanding experiment in enterprise autonomy . . . previously spent many years in defense industries . . . served as First Deputy Minister of Defense Industry before coming to Gosplan.

Aleksey Ivanovich Chubarenko
Age (unknown) . . . became head of Gosplan's S&T department after having served in the Ministry of the Defense Industry.

Yuriy Dmitriyevich Maslyukov
Age 47 . . . Gosplan first deputy chairman who was Deputy Minister of the Defense Industry.

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scope and importance with the industrialization of the 1930s. As Gorbachev emphasized in a 10 December 1984 speech to an ideology conference, "The process of economic intensification must be made truly national in nature and given the same political ring as industrialization of the country had in its time." [30]

Moscow's approach, however, is far from being a coherent strategy and so far lacks the commitment of resources and investment needed to carry it out.

While various initiatives are under way, implementation is planned largely for the next five-year-plan period. Even so, these initiatives constitute a challenge to long-established attitudes, institutional relationships, and expectations. Formidable political and bureaucratic obstacles remain that could lead to a revision or reversal of the present course. Indeed, if the effort to use S&T to modernize the economy and to generate strong resource efficiency gains is to succeed, strong leadership from the top, increased party involvement, and even greater use of administrative measures will probably be required.

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[30] Former Politburo member Kirilenko in his August 1981 *Kommunist* article on party S&T policy similarly insisted,"In terms of its historical dimensions, significance, and consequences, the switch to intensive development rightly ranks with the transformation of socialist industrialization."

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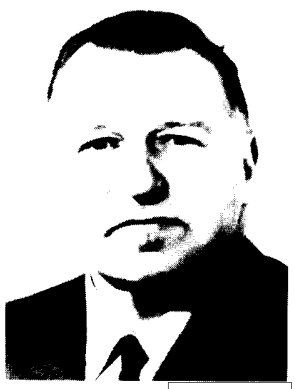
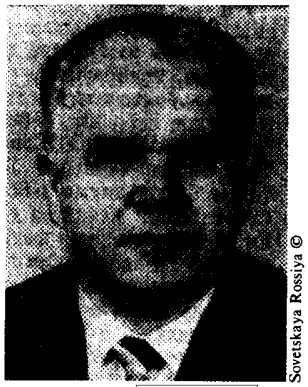


Sergey Afanas'yev

G. D. Kolmogorov



Boris Bal'mont

Anatoliy Reut

Sovetskaya Rossiya ©

Genrikh Stroganov

***Figure 9.** Senior Defense Managers Reassigned to Key Civilian Economic Posts*

This effort to hasten the advance of S&T extends well beyond R&D organizations and raises broad questions of political, economic, and social change in the USSR. Actions that the leadership has taken directly affect the interests and tax the capabilities of key elite groups and institutions. Moscow's intensified S&T policy has implications for the internal evolution of the Soviet system more generally, especially in:

- Leadership politics.
- Resource allocation.
- Economic reform.
- Interaction between the military and civilian industrial sectors.
- Personnel policy.
- The role and restructuring of the CPSU.
- The role and acquisition of Western technology.
- Pressures and prospects for change.

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Leadership Politics

Initially, Brezhnev—probably with help from Ustinov and Kirilenko—began the drive for S&T modernization in the late 1970s. His published speeches sketch its general outlines, and he appears to have been taken with the idea of curing the ills of the civilian economy by patterning it on the defense sector.[31] Andropov gave further impetus to this approach, which also coincided with his efforts to bring younger people into the aging elite. He may have used the constituencies of Ustinov and Kirilenko to help consolidate his power. During his tenure, their proteges were primary beneficiaries of the cadre changes and policy moves. Moreover, the three newcomers promoted to the party Secretariat under Andropov—Ryzhkov, Romanov, and Ligachev—had backgrounds in S&T matters and were strong advocates of economic modernization.

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These efforts slowed under the more conservative Chernenko but began to pick up new momentum during his last months. At a Politburo meeting on 15 November 1984—attended by several regional party leaders—Chernenko announced:

> *If we look at the problems of development of science and technology from broader positions, the*

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[31] In a part of his memoirs devoted to Sputnik, written just before his death and published in the January 1983 issue of *Novyy Mir*, Brezhnev described the Soviet space program as an "organizational prototype" for broader civilian application, and he lamented that the leadership had not been demanding enough of civilian industrial leaders.

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Figure 10. *Grigoriy Romanov*

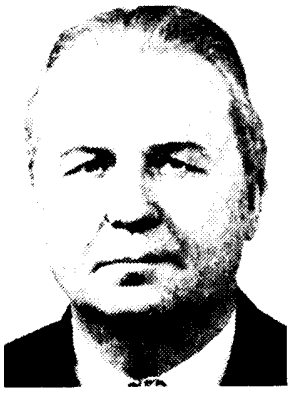

Figure 11. *Yegor Ligachev*

state of affairs in this sphere arouses some concern. Therefore, the Politburo deems it necessary to discuss at a forthcoming plenum of the Central Committee questions of speeding up S&T progress and of improving its management in all links of the economy. This plenum should be prepared in such a way as to ensure that its decisions provide for a radical change in this vitally important direction of our development.

It is not certain what role the ailing Chernenko was playing by this time in S&T policy.

The continuing leadership emphasis given to improving productivity of labor and plant and equipment, despite the destabilizing impact of three successions in less than three years, suggests that a consensus exists within the Politburo on at least the broad contours of how to make better use of science and technology in improving the economy. This emphasis coincides with the rise of modernizers apparently bent on overcoming the USSR's technological backwardness and its lagging economy. They seem to represent a coalition for change that includes managers and technocrats from the defense sector as well as from the machine-building and heavy-industry lobbies of the civilian sector. Although differences of views and interests undoubtedly exist, the coalition is apparently held together by the shared recognition that Soviet military power rests ultimately on the general health of the economy and that the future of both turn increasingly on more rapid progress in achieving large productivity gains.

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Further progress in modernization will require firm leadership and political will to overcome entrenched institutional resistance. Far less grandiose economic and management reform efforts under Brezhnev failed, in part, because they were only partially executed and the leadership lacked the resolve to battle the bureaucracy and push them through. After the two decades of the Brezhnev era, moreover, bureaucratic obstacles are now more entrenched than ever. Implementation of S&T modernization measures, which will not really begin in full until the 1986-90 period, will require a leader who is both politically and physically much stronger than either Andropov or Chernenko. Whether Gorbachev is up to this task—and leadership test—remains to be seen, although the early signals suggest he will push hard in this area.

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Thus, the execution of a visible S&T policy could become a key issue in the consolidation of Gorbachev's power. It may become even more important if the broad consensus that now exists on the importance of S&T progress for economic growth breaks down and disputes arise over how fast to push technological change, at what cost, and by what methods.[32] Even

[32] Grigoriy Romanov, Gorbachev's rival in the recent succession, has particularly insisted on more rapid advance. In public statements, he has emphasized that the present revolution in S&T "is fundamentally changing our ideas about the tempo of production retooling. What used to take decades to accomplish must now be done in years." Though he may have different views from Romanov over tactics, Gorbachev, too, has taken a firm stand on the urgency of accelerating S&T progress. In his discussion of S&T problems last December, Gorbachev emphasized that "all of them must be solved and solved without delay." Again, in his February 1985 election speech to the Russian Republic Supreme Soviet, he noted that adopting a "wait and see" stance on this vital issue "means losing time, and time is everything."

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Gorbachev's Views on S&T Policy and Progress (Excerpts From Speeches)

Paramount importance now attaches to the acceleration of S&T progress and the fundamental improvement of the quality and reliability of machines, equipment, and all other items that are produced. Without this, it is impossible to resolve the tasks of raising labor productivity at the rates we need and of scaling greater heights in the country's economic and social progress.

27 June 1984 Speech in Smolensk

The policy of intensification is dictated by objective conditions and the entire course of the country's development. There are no alternatives to this. . . .The process of economic intensification must be made truly national in nature and given the same political ring as industrialization of the country had in its time.

Questions of accelerating S&T progress, as you know, will be discussed at the next CPSU Central Committee plenum. The strategy of scientific and technical progress itself is of top importance. . . . It is clear that priority must be given to fundamentally new, truly revolutionary decisions that can improve labor productivity many times over. In other words, a profound breakthrough is necessary in the many directions of S&T progress and in increasing the efficiency of the economy.

A substantial change in investment policy is required. Today capital investment resources are most often distributed to branches and regions, as they say, "from the achieved base." As a result, the existing industrial structure is retained for many years and qualitative advances in its S&T level are held back. This situation must be changed and changed decisively. Preference must be given to highly effective S&T programs and to the development and introduction of fundamentally new systems of machines and technologies.

It is necessary to improve organizational forms of integrating science with production and to create more effective economic incentives for the application of scientific achievements and technological innovations. Here we can rely on the positive experience of the work of science and production associations and complexes and the development and implementation of goal-oriented S&T programs. The spirit of competition in S&T creativity should be better used. Why, for example, should we not use widely a competitive system for the development of new products and new types of equipment and technology?

All this calls for a major restructuring of the cadre training system. . . . The country has begun to implement a reform of general education and professional schools. . . . During the course of this reform it is necessary to take into account fully the needs of S&T progress and in particular to ensure that young people are computer literate. . . . The engineer is the central figure of the S&T revolution. Today it is especially important to improve substantially the qualitative preparation of technical specialists and ensure their correct utilization.

10 December 1984 Report to Ideology Conference in Moscow

To increase the pace of S&T progress is an imperative command of the times. This is a matter for all the people. This task faces us in its full magnitude, and it must be resolved everywhere, at all levels. . . . Adopting a "wait and see" stance means losing time, and time is everything.

20 February 1985 Election Speech to the RSFSR Supreme Soviet

We are faced with striving to achieve a decisive turning point in switching the national economy onto a path of intensive development. We must; we are committed to move to the most advanced S&T positions in a short span of time and to a supreme world level in productivity of social labor.

11 March 1985 Acceptance Speech as CPSU General Secretary

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though Gorbachev is moving fast to consolidate his control over people and policy—the promotions of Ligachev and Ryzkhov have significantly strengthened his position in the leadership—longstanding systemic obstacles to domestic innovation and to major change in the economic system as well as political and economic constraints on shifting substantial resources toward investment will block rapid or easy implementation of the modernization program.

The outcomes of leadership transition not only in the Politburo but also in other parts of the Soviet power structure will also affect the direction of S&T policy. Much will depend on who succeeds Tikhonov as prime minister, Aleksandrov in the Academy, Baybakov in Gosplan, and other organizational leaders—all who would be key bureaucratic players in accelerating S&T advance. How willing and able the successors are to assume the burdens of restructuring their organizations and eliminating parochial institutional thinking will help determine how successful leadership efforts as a whole are likely to be. At the same time, the choice of successors will also suggest Politburo commitment to policy directions.

Resource Allocation

The scale of Moscow's S&T drive, to judge from leadership rhetoric and the proliferating number of S&T programs, will require substantial investment—much more than the leadership has thus far committed or is probably willing and able to deliver over the next several years.

It is possible that the leadership may already have recognized that the historically low rate of capital investment—originally set at less than 2 percent per year—in the 1981-85 plan is inadequate to meet rising needs for modernization. In fact, actual total investment has increased by about 4 percent per year on average during the 1981-84 period. If this pace continues in 1985, then investment growth in the first half of the decade would increase by 18 to 19 percent compared with that of 1976-80, almost double the originally planned growth of 10.5 percent. Nonetheless, even this growth has not brought either the expected gains in productivity or renovation of existing capital stock. At the same time, the share of the science budget allocated to priority S&T programs seems to have grown only slightly, from 25 to perhaps 30 percent.

Given the necessarily long leadtimes involved, the leaders will have to commit appropriate resources in the 1986-90 plan if they want to have any reasonable chance of achieving positive results in S&T modernization in the 1990s. Members of the leadership have repeatedly called for an acceleration of S&T progress, which has direct implications for investment growth. Gorbachev, in fact, made a strong pitch at the December 1984 ideology conference—omitted from the *Pravda* version of his speech—for a "substantial change" in investment policy to hasten broader modernization.

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More specifically, leadership statements suggest that the Politburo has apparently reached a consensus to support the investment demands of the Food and Energy Programs (which will take, according to Soviet data, about one-third and one-fifth, respectively, of total investment in the 1986-90 plan) and to increase investment in the machine-building and metalworking (MBMW) sector—so critical to raising the technological level of the economy as a whole. A summary of the proceedings of a July 1984 Central Committee conference on the five-year plan noted that the "faster growth" of machine building was being given "great attention." Gorbachev, in major speeches both before and after becoming General Secretary, indicated that investment in MBMW must be given preferential treatment. He told the April 1985 party plenum that it was necessary "to speed up by one and a half to two times" the rates of growth in this sector during 1986-90. He noted that the problem of retooling was particularly acute because of the "considerable age" of the country's productive apparatus and stressed that "the prime concern" in the 12th Five-Year Plan must be a substantial rise in the rate of replacing obsolete equipment.

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Gorbachev's ability to achieve such accelerated growth—amounting to a 7.5- to 10-percent increase per year—in machine building is doubtful in face of the severe resource constraints confronting him. He has given no hints as to where the resources will come from. It also is uncertain that the increase in producer durables that embody truly new productivity-enhancing technology will be sufficient to halt the

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decline in capital productivity and revitalize the increasingly obsolete industrial base. Stepping up production of producer durables will leave less machine-building capacity to produce military hardware and consumer durables. A major shift to increase investment at the expense of defense or consumption, and possibly both, is unlikely. [redacted]

A leadership decision to boost investment, moreover, would have some impact on GNP growth during 1986-90, but its principal effects would fall in the 1990s. New fixed investment is converted into capital stock with a substantial lag, and the existing capital stock is so large that increments in investment would have to be huge to significantly boost its growth. Thus, the leadership's possible hope for securing major gains in capital and labor productivity through the introduction of new technology will probably not materialize until at least the 1990s, if then. [redacted]

Economic Reform

Many Western specialists on the Soviet economy and some Soviets believe that the present system's inflexibility and centralized nature are major stumbling-blocks to innovation and its implementation in production. They contend that what is needed is greater decentralization, private entrepreneurship, and the injection of competitive market forces—the key triggers to innovation in Western market economies. Yet these alternatives are rarely emphasized by Soviet political leaders, S&T experts, and economists, and there are good reasons why the new Soviet leadership is not yet ready to try more radical change (see inset). Proposals now under consideration to streamline the ministerial apparatus and to improve incentives would not alter the basic structure of the Soviet command economy. [redacted]

The ministerial system—restored in 1965 and basically unchanged since then—may soon undergo major alterations, including the formation of superministries to oversee related branches or groups of ministries. Central authorities would concentrate on the big issues or strategic decisions (such as investment and pricing), and enterprise managers and regional authorities would make operational, daily decisions. [redacted]

Soviet commentators emphasize that S&T development is largely in the realm of strategic decisions and requires S&T planning and management to be more, not less, centralized. They criticize the ministries for failing to carry out Moscow's S&T policies in the past and stress that the plethora of new priority programs to modernize the economy requires strong coordination and control by top officials in the ministries, Council of Ministers, and Central Committee. [redacted] 25X1

While a coherent and strong S&T strategy would certainly need some central direction, a system of introducing new technology on the basis of centralized control is likely to yield only limited dividends. Central direction can facilitate achievement of selected technological improvements, but it cannot foster a pervasive innovative spirit or comprehensive modernization. [redacted] 25X1

Improved incentives at the managerial and worker levels to spur the introduction of new technologies are also being discussed. [redacted] 25X1

in late January 1985, additional incentives to accelerate the introduction of new technology were on the

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Gorbachev's Approach to Reform

Unlike Chernenko, who supported economic orthodoxy, Gorbachev has publicly assailed economists for clinging to "dogmatic ideas" and has called for more innovative thinking. He has criticized the timid approach taken in addressing critical problems in the past, and he has argued that "profound changes" in the entire economy require changes in the organization of labor and production, planning, and incentives. [redacted] 25X1 25X1

Although it is likely that Gorbachev will attempt to encourage a fresh and flexible approach to economic problem solving, he probably will not in the near term be willing or able to seek radical restructuring of the Soviet economic mechanism. He may first want to wait and see if his more modest initiatives will significantly improve the economy. In this regard, Andropov's discipline campaign resulted in a discernible boost in growth in 1983. More important, Gorbachev probably realizes that he must get his own political house in order before addressing such controversial issues as basic structural change. [redacted] 25X1 25X1

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work agenda for the conference on S&T. They include incentives for enterprise managers to recruit younger engineers and designers who have had the benefit of recent academic training in the relevant disciplines. Another measure aims at encouraging innovation by alleviating the pressure on managers who introduce new technology to fulfill previously established output goals. This relief is to be achieved through more flexible planning that can take into account the considerable downtime of equipment and staff involved in the development and installation of new technology.

Such policies, however, probably will not be any more effective than past tinkering with indicators designed to induce managers to modernize and reequip their shops. The chief yardstick for measuring managerial and worker performance is still success in meeting production targets. Moreover, even if it changed managerial behavior, manipulation of success indicators could lead to behavior contrary to Moscow's goals and might have the unwanted result of too much emphasis on promoting development of new technology. Innovation for its own sake is no more sensible than production for its own sake.

Military and Civilian Industrial Interaction

Rather than copy the capitalist or socialist market economy as their model for technological advance, the Soviets have apparently decided to use their own military economy in which centralized program planning, organization and management, as well as strong party direction are the norms. Their approach to S&T is to build priority programs along with special management/monitoring mechanisms to protect and implement them much as has been done in the defense sector (see appendix B).

It seems likely that the Soviets will be frustrated in this effort; they will be unable to successfully transfer the higher quality performance of the military to civilian objectives. The major obstacle is that the priority status now accorded the military sector—whether it be the lavish use of materials, the assignment of competent, experienced managers, or the attentive supervision of high-level government and party officials—cannot realistically be extended to the whole economy.

The leadership is trying to enlarge the list of national priorities, traditionally made up mainly of major defense programs, to accommodate major civilian programs. These—for example, the long-term food and energy programs—are designed to solve key economic and social problems that have been deliberately neglected by past leaderships, largely due to the cost of the large defense burden. Not everything, however, can be made a priority. To command the necessary resources and high-level attention, the number of programs must be strictly limited; otherwise, uncontrolled proliferation of programs, each with high supply priority and explicit backing from political leaders, would seriously distort over the long run the whole structure of the economy. More important, greater priority for civilian programs—even those which may have some long-range benefit to weapon system development—increases the competition for scarce resources, potentially squeezing military industry programs and threatening low-priority civilian programs.

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In any case, major shifts in resource allocation policy are unlikely. Significant and fundamental changes would pose a challenge to the entrenched power of the Ministry of Defense and the defense industries. These institutions are in a strong position to protect their interests. The Soviet policy planning process is resistant to major alterations in priorities, and existing military programs have strong inertial momentum. Lower priority civilian programs, thus, will probably pay the price.

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Beyond the issue of resource allocation, promoting the defense industry model is also not likely to bring to the economy large gains in productivity, efficiency, or innovation—key goals of economic modernization. Although military output has been high in numbers of new weapon systems, improved effectiveness, and increased capabilities, on balance, productivity in both civilian and military R&D has been notably poor. The defense sector's reputation for quality and efficiency, has been achieved at a substantial resource cost.

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The defense industry sector, moreover, has not been that successful at technological innovation. Defense scientists and engineers have shown themselves to be innovative in using available technology to design effective weapons, but not as innovative as their Western counterparts in making technological breakthroughs. While the military R&D system is well adapted for managing high-priority weapon programs, it is not well adapted for encouraging and exploiting small-scale, incremental technological advances that collectively and cumulatively can have a major impact on low-priority weapon programs. In addition, Soviet defense industry continues to have serious deficiencies in such key areas of military technology as the design, manufacture, and quality control of microelectronics and computer technology. [redacted]

Despite these limitations, the defense industries are better manned than the civilian industries, and the transfer of some officials to the civilian economy probably will have a public impact. At the same time, this transfer will probably not have a significant adverse impact on military R&D programs or defense industry activities. Indeed, the reassignment of these experienced executives suggests that the Soviet leadership is confident that suitable replacements can be found from among their subordinates without any detriment to the military-industrial complex, and that its managerial wealth can be used to shore up lagging sectors of the national economy. [redacted]

Greater defense industry and civilian economy interaction, moreover, could help weapon system development. To be sure, current efforts to accelerate introduction of the latest manufacturing technologies, materials, and processes in civilian ministries involved in defense production could have a disrupting effect on production operations in the near term. Intensified RDT&E under way in the defense industries since the mid-1970s appears to have been a factor behind the slowdown in military hardware procurement after 1976. These short-term disruptions, however, are probably viewed by Moscow as more than offset by the hoped-for, long-term improvements in capabilities to design, fabricate, and manufacture more sophisticated weapon systems in the 1990s and even possibly in the second half of the 1980s that will result from increased priority for civilian S&T programs. [redacted]

Remaking the Government and Party Elites

After nearly 20 years of unprecedented stability, the Soviet bureaucratic elite is undergoing significant change. Andropov initiated the belated process of rejuvenation of both the party and government bureaucracies. At the top of both hierarchies, men in their fifties and early sixties have begun to replace those in their seventies. Many of these new men are better educated and more familiar with high-technology requirements and options than their predecessors, have been strong public advocates of improved industrial efficiency through the use of advanced management techniques and automation technologies, and appear to be resourceful, pragmatic, and confident leaders. [redacted] 25X1

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More extensive personnel changes are needed, however, before an appreciable impact is made on the actual workings of the administrative machinery. Andropov's changes were due to deaths, "honorable retirements," and internal transfers. Only a few dismissals were due to corruption or ineffectiveness. This generally perfunctory handling of cadre changes, however, is probably insufficient and too slow to dislodge the bureaucratic deadwood and recalcitrant elements opposing technological change. [redacted] 25X1

Bringing better trained managers and technocrats into leadership positions at all levels is essential to ensure implementation of current S&T policy initiatives. In the end, the success of these initiatives hinges substantially on the speed and extent to which Gorbachev and other party leaders can overhaul the bureaucracies. Rejuvenation of the elite, in turn, will almost certainly become closely entangled with the course of Gorbachev's consolidation of his authority and power. All previous party leaders have solidified their positions and gained control of institutional power bases by expanding their influence in selection of cadres. Controversy over cadre selection is built into Soviet politics, and its possible link to an ambitious S&T policy as the impetus for modernization of the civilian economy will make it even more controversial. The issue of technocratic expertise versus political, or ideological, control—the longstanding issue of the Reds versus the Experts—will probably be especially contentious as will debate over the pace and methods of personnel changes. [redacted] 25X1

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The leadership will find the policy of advancing technocrats difficult. Some Soviets have reported rumors of considerable bureaucratic and popular resistance to reforms that would base personnel selection on merit. In February 1983, a party insider told US Embassy officials in Moscow that Chernenko's warning in a fall 1981 *Kommunist* article that the party's failure to consider the interests of all social groups could lead to political, social, and economic crisis was aimed at Kirilenko's advocacy of appointment of industrial technocrats to high party posts—the approach subsequently taken by Andropov.

Despite opposition to strengthening technocratic and managerial influences in the Soviet governing elites, Gorbachev is likely to overcome this resistance. The pace of personnel change has been stepped up. He appears intent on bringing in a more modern technocratic elite into management positions. Competence and performance now are likely to be more important in personnel turnovers and career advancement. Old-style managers are not likely to fare well in this environment and will probably be quickly pushed aside.

The Party's Role in Managing the Economy

Moscow's intensified S&T policy course has led to increased party involvement in management of the economy. This development—the traditional way for promoting technological innovation—has been prompted by the party's need to maintain its leading role in society and to strengthen control over science and technology.

The party fills a functional and institutional void created by the leadership's failure to build effective coordinating mechanisms and incentives in the governmental and R&D structures to facilitate innovation. The party is the "disinterested" adjudicator of bureaucratic conflict in the ministerial hierarchy, and it also best reflects central objectives. Sporadic intervention by political leaders continues to be vital to the promotion of technological change, as it has been in the past.

The issue of the party's role in the economy is being debated within the Soviet leadership. Before Brezhnev's death, Chernenko and Kirilenko publicly disagreed on this issue. In an August 1981 *Kommunist* article entitled "The Party's Unified S&T Policy," Kirilenko stressed the need for the party to play an active role in S&T, while Chernenko in the following issue pressed for reduced party involvement in the daily operation of the economic bureaucracy. Chernenko, in his maiden speech as General Secretary to the February 1984 Central Committee plenum and in a speech to a meeting of party apparatus workers at the Central Committee in March, emphasized these points. Growing party involvement in economic management and displacement of economic officials by party functionaries, he said, diverts the latter from attending to other important party tasks, such as social policy and ideological indoctrination, and also subverts responsibility of economic managers and government administrators, who frequently pass the burdens of their official duties to party committees.

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Resolution of this debate has practical implications for internal party reform. An expanded party role in spearheading technological change would probably require some restructuring of party organization, changing work methods, and upgrading of cadre skills. Major segments of the party bureaucracy probably oppose such changes, including the added responsibilities of an enhanced S&T role. Most of the regional party apparatus (almost 85 percent) have little experience in S&T, would be largely cut out of it, and probably would lose influence. Only the party organizations in those 22 cities that oversee 80 percent of the USSR's R&D resources (some 13 percent of the regional apparatus) would probably gain influence.

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A suggested restructuring of the Central Committee, reportedly aimed at making it "an engine change," apparently met strong resistance from central party workers in the early months of Andropov's leadership. Internal party changes as a result have been largely ad hoc arrangements and half measures. The S&T coordinating councils and commissions that have

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sprouted up under many party committees still appear to be weak tools for overcoming impediments to technological change. Any major reorganization of the party directed at making it a force for technological change, rather than an obstacle, could be pushed through only by a general secretary who is firmly committed both to faster technological progress and to an expanded role for the party in modernizing the economy.

Any attempt to involve the party apparatus more fully in a more rapid modernization of the economy, moreover, would have a significant impact on other parts of the institutional power structure. Power relations between the party and governmental bureaucracies have been essentially frozen for the last 20 years, following the period of Khrushchev's continual reorganizations of party and government and the party's more direct management of the economy. Any expansion in the party's role in S&T policy, therefore, will probably involve—indeed require—some shift in the bureaucratic balance, greater power for the party apparatus than that of the governmental machine, and, consequently, reconfiguration of the political leadership.

Gorbachev has not addressed these issues directly. He is, nonetheless, a champion of more rapid technological progress and the thrust of his personnel policies reflects a definite bias for technocratic expertise. These factors strongly suggest that he will increase party involvement in S&T and consider changes in the party's traditional management approach to such problems.

Foreign Trade and Technology Transfer

Moscow could stimulate its modernization program by stepping up imports of foreign technology. The USSR has imported Western plant and equipment to help ease bottlenecks, raise efficiency, and modernize its economy. Machinery imported from both Communist and non-Communist countries is a substantial part of the equipment portion of total Soviet investment—about one-third. As noted earlier, the 1981-85 Five-Year Plan also allocated almost as much (30 billion rubles) for foreign technology to support the 170 national S&T programs as was spent (37 billion rubles) on the programs' domestic RDT&E and construction costs.

However, economic realities as well as basic changes in Soviet economic perceptions and attitudes will probably constrain any steep rise in trade and acquisition of foreign technology:

- The USSR's hard currency import capacity will be limited by declining oil exports and lower world oil prices. Unless its cautious borrowing policy is revised, constraints on hard currency could well force the USSR to reduce imports of advanced machinery and equipment from the West at least through 1990. In fact, the Soviets have been scaling down their orders for Western technology since 1980.

- Since the mid-1970s, the Soviets' disappointment with the contribution of Western technology to the growth of industrial productivity has cooled their enthusiasm for increased trade and technology transfer. The expected growth did not materialize, partly because use of legally acquired Western technology in the civilian economy has been notably inefficient. Moreover, imported technology sometimes falls prey to the same obstacles and long leadtimes as indigenous technology.

- The Soviets have become concerned about the cost of technological dependence on the West. Western trade sanctions and technology bans, imposed after the Soviets' invasion of Afghanistan, exposed the USSR's vulnerability to such pressure. Soviet political and scientific leaders recognize that excessive reliance on Western technology retards domestic technological progress. It diverts resources that could be channeled into indigenous innovation capabilities and reinforces the USSR's technological inferiority to and dependence on the West.[33]

[33] The Soviets' enhanced concern about technological dependence, as well as a desire for greater self-sufficiency and parity, extends to key strategic areas, such as computer technology.

Partly in response to Western sanctions and changes in Soviet perceptions of the costs and benefits of Western technology, Moscow is trying to get more and better technology from its East European allies. Given their strained economic situation, however, it is unlikely that they could significantly boost their technology sales to the USSR soon. East European exports in 1983 already accounted for roughly one-fourth of total Soviet investment in machinery and equipment. Besides, much of this equipment is an inferior substitute for that produced in the West.

More generally, too, the Soviets are pressuring the East European countries to boost technological modernization and to broaden exchange of S&T, especially in the strategically important fields of electronics, energy, biotechnology, and machine building. The Soviets believe faster technological progress is vital to the future development of CEMA economies; this is the motivation for their renewed efforts to strengthen the Bloc's economic integration and political cohesion. However, longstanding and major political, economic, and technological impediments will constrain the pace and scope of these Bloc-wide efforts.

Pressures and Prospects for Change

For the most part, recent S&T policy measures are neither new nor radical but represent a continuation or intensification of earlier efforts. They have evolved gradually and essentially maintain both the existing party power structure and the overall centralization of the Soviet system. This evolution seems to make an S&T-intensive economic strategy politically and ideologically acceptable to the ruling Soviet elite and probably accounts for the momentum that is building behind it.

This mounting momentum, however, may also increase pressure for further changes in direction that the leadership would probably want to avoid. To be effective, evolving S&T initiatives seem to require more extensive changes in the structure and staff of the party apparatus, in general party membership and recruitment policy, in the distribution of influence and power within the party, and in the party's external relations with other parts of the power structure. S&T policy also requires movement toward reducing plan directives for production units, freeing prices, basing incentives on profits, and changes in the organization and operation of the economic ministries—steps the Soviet leadership has so far been unwilling to make.

The obstacles blocking rapid or easy advance are formidable. Not only must the latest science and technology be mastered, but also long-lived cultural conditioning, attitudes, and relationships must be changed. Even more important, the rigidities inherent in the present economic system will provide formidable barriers to any initiatives to accelerate progress in either diffusion of new technology or in encouraging innovation. Nonetheless, if the commitment can be sustained and the will acquired to implement the new S&T policy, the incremental progress of the past in furthering economic growth and military prowess will probably be sustained.

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Appendix A

Science and Technology Target Programs in the 1981-85 Five-Year Plan [a]

Power Engineering and Electrical Engineering

1. Development of the unified electric power system.
2. New types of equipment for producing electric and thermal power (500,000- and 800,000-kW units for thermal power plants, 150,000- to 200,000-kW gas turbines and 250,000-kW gas plants, 500,000-kW magnetohydrodynamic [MHD] gas power units and work on solid fuel, 1-million-kW MHD power unit).
3. Development of long-distance, high-power transmission lines (1,500 kV dc and 1,150 kV ac lines).
4. Fast breeder reactors and thermal neutron reactors for both heating and power.

Energy and Geology

5. Synthetic liquid fuels from coal.
6. Gas pipelines with pressures of 100 to 120 atmospheres and multilayer pipe of 1.42 millimeters in diameter.
7. New geophysical and geothermal means for searching and surveying deep-lying mineral deposits.
8. New oil recovery techniques to increase yields of strata by 55 percent to 60 percent.
9. Open-pit coal mining to exploit Kansk-Achinsk Coal Basin.
10. Development of oil and gas deposits of the continental shelf.

Chemistry and Petrochemistry

11. Biotechnology and genetic engineering.
12. New synthetic materials based on new methods of processing flexible chain polymers.
13. New processes for producing low-tonnage chemical products.
14. Highly filled polymers and composites.
15. Low-temperature catalysts.
16. Anticorrosion protection program (new lacquers, coverings, and new methods of electrochemical protection).

Metallurgy

17. Powder metallurgy.

Machine Building and Metalworking

18. Robotics.
19. Industrial lasers.

Timber, Wood-Processing, and Paper and Woodpulp Industry

20. Mechanization of labor processes in timber cutting and wood processing (fiberboard and wood chip technology).

Computer Technology and Communications

21. Computerized management information systems.
22. Automation of scientific research and computerized design.
23. Microelectronics and microprocessors.
24. Fiber optics.

Agriculture and Land Reclamation

25. Sugar beet technology.
26. New pesticides.
27. Production processes for high-quality food products.
28. Modern means of livestock raising.
29. New varieties of grain.
30. New kinds of rice.

31. Modern irrigation systems.

Transportation

32. New forms of transport (containerized transport, pneumatic pipelines, and so forth).

Construction

33. Progressive technology and industrial methods for new construction materials.

Miscellaneous

34. Plasma technology.

35. Special machinery for harsh northern conditions.

36. Modern materials-handling technology.

37. Three-dimensional seismic surveying for detecting and forecasting earthquakes.

[a] This list includes 37 of the 41 S&T target programs in the plan. It has been compiled on the basis of individual programs identified from open Soviet sources.

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Appendix B

The Soviet Defense Industrial Sector: Keys to Its Technological Success

Specific features of the Soviet military-industrial complex help overcome obstacles to innovation that are endemic to the economy and contribute to its demonstrated technological success. On balance, these features have been most effective for managing high-priority weapons development programs, but they often hinder performance in other areas. [redacted] 25X1

High Priority

The military R&D establishment has profited greatly from the high priority Kremlin leaders have always placed on defense and their conviction that technology must be harnessed to build Soviet military power. As a result of this priority, defense R&D facilities can attract the most qualified technical and managerial talent, are assigned the best equipment and high-quality components, and are assured of continuing financial and material support. About one-half of all Soviet R&D expenditures and about one-fourth of Soviet defense expenditures—since 1960 the fastest growing category of defense spending—go for military R&D. Moreover, this priority system is supported by an institutional structure and decisionmaking process that both facilitate the imposition of military priorities and obstruct external encroachment by nonmilitary groups in the policy process and competition for resources. [redacted] 25X1

Strong Centralized Management

Military R&D programs are expedited by high-level monitoring and strong central management. At the top of this oversight structure are special institutions with no civil economic counterparts—the Defense Council and the Military-Industrial Commission (VPK). While Communist Party leadership elements, headed by the Politburo, actually authorize the key military R&D and weapon programs, it is in the Defense Council (composed of the top party, military, and government officials with national security responsibilities) that many of the most important decisions on major programs and policy directions are made. [redacted] 25X1

The VPK of the Presidium of the Council of Ministers consists of the top executives of the Soviet defense industries and a supporting staff. The VPK coordinates the work of the nine defense industrial ministries (Aviation, General Machine Building, Defense, Shipbuilding, Radio, Medium Machine Building, Machine Building, Electronics, and Communications Equipment) and also closely monitors weapon programs, enforces schedules, and ensures that technical and performance specifications are met. Both in its planning activities and its day-to-day functions, the VPK serves to eliminate or circumvent the inefficiencies characteristic of the Soviet economy. [redacted] 25X1

Communist Party Oversight and Sponsorship

The entire weapons acquisition process is also subject to direct oversight by the party leadership. The Politburo is the ultimate authority for national security decisions and final arbiter of all policy issues. The party general secretary chairs the Defense Council. The Central Committee's Secretariat provides party oversight of the weapons acquisition process. This responsibility, which includes overseeing the work of the VPK, has usually been exercised by a Central Committee secretary for defense affairs—the post held by Brezhnev in the late 1950s and early 1960s and by Ustinov from 1965 to 1976. The Defense Industry Department, which performs as a staff organ of the Central Committee, participates in party oversight of military R&D. The department supervises a network of regional party defense industry departments that monitor and expedite defense industrial activities throughout the USSR. [redacted] 25X1

The Soviets, through this oversight structure, attempt to make the weapons acquisition process responsive to high-level policymakers. Party leaders sometimes directly intervene to overcome bureaucratic obstacles

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and technological conservatism in the armed forces and the defense industries. They have been willing and able, at times, to use their power to impose innovation priorities, to marshal resources, and to get things done. In this way, they can serve as major forces for change.

The Military as a Powerful Customer

The Ministry of Defense, the primary customer of defense industry, is involved in all stages of the arms acquisition process, from requirements generation to overseeing the manufacture and certification of new weapons. Through its General Staff, the deputy minister of defense for armaments, and the technical directorates of the services—which have on-site military inspectors at weapons design and production facilities—the Ministry of Defense wields a vigorous consumer-monitoring apparatus. The direct association of consumer with industry provides a quality control and feedback mechanism lacking in the civilian economy and is a principal factor in the better performance of Soviet defense industry.

The opportunities for military leadership review—like those for party oversight—of military R&D programs occur at several key points in the research-to-production cycle. This review process allows the Ministry of Defense consumer—like top party leaders—to shape the output of the weapons acquisition process. Both military and party leaders press and make demands on the defense industries, and together they exert a strong force for innovation.

Foreign Technology Acquisition

Military competition with the West also puts pressure on the Soviet armed forces, and, through them, on the defense industries to produce advanced weapons and equipment. The Soviets often use Western counterparts as points of reference for their systems and technologies. They give the highest priority to obtaining and exploiting those Western technologies with military applications. The acquisitions are used in the development of new weapon systems and in improving existing military capabilities. The aggressive acquisition and use of Western technology is one of the most important reasons why technological progress is more rapid in the defense industries than in civilian industry.

Secrecy

Secrecy is inherent in the operation of Soviet military R&D. Extreme secrecy exacts a price; it inhibits the flow of needed information and ideas among people and organizations, thereby impairing program efficiency and stifling initiative. However, secrecy helps to buttress the priority of military R&D by preventing criticism of defense industry efficiency and by fending off claims of civilian industry for scarce resources. Thus, secrecy reinforces the highly centralized and relatively closed system of military decision making.

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Appendix C

Excerpts From General Secretary Gorbachev's Report to the June 1985 CPSU Conference on S&T Progress

A conference on "Questions of Accelerating Scientific-Technical Progress" was held at the CPSU Central Committee on 11-12 June 1985. (General Secretary Gorbachev had announced the leadership's plans for such a conference at the April party plenum.) In his report to the conference, entitled "The Fundamental Issue of the Party's Economic Policy," Gorbachev touched on practically all the major themes dominating recent Soviet S&T policy discussions and directions. In general, he criticized the slow pace of implementation of leadership decisions in this sphere, sought to give new impetus to the S&T drive, and emphasized the necessity and urgency of action. Below are excerpts from his conference report.

Importance of S&T Progress

The party views the acceleration of S&T progress as the main direction of its economic strategy, as the main lever for the intensification of the national economy and for raising its efficiency, and hence for the solution of all other economic and social issues.

The Politburo decision to hold the present conference on the threshold of the 27th CPSU Congress was brought about precisely by this task. Problems of accelerating S&T progress must be placed at the center of the pre-Congress election campaign, of the whole of the party's political, organizational, and educational work. The attention . . . of the whole people must be fixed on this.

The Shift to Intensive Economic Growth

For many years there has been talk of shifting the center of gravity to intensive factors of economic growth, but the measures adopted were half measures, inconsistent measures, and not fully implemented. And, thanks to inertia, the economy continued to develop mostly on an extensive basis.

Figuratively speaking, we, too, must harness S&T progress. There is simply no other way. . . . We have fundamentally exhausted extensive methods of development.

The 12th (1986-90) Five-Year Plan

First and foremost, the guidelines for the economic and social development of the country in the 12th Five-Year Plan and up to the year 2000 must contain fresh approaches that provide a sharp turn toward intensification and the energetic pursuit of S&T progress.

The Politburo recently discussed the draft guidelines . . . serious criticisms were expressed that require revision of the draft. It has not yet been possible to include in it measures providing for the transfer to a course of chiefly intensive growth for a number of industries, to deepen the structural rebuilding of the economy, to attain the necessary concentration of capital investments in the priority areas. . . .

Retooling the Economy

Before us lies the implementation of the new technological reconstruction of the national economy. . . . The resolution of this problem is an urgent matter, an all-party and nationwide matter, and this must be done in a very brief period of history.

For a long time, many enterprises were not refitted with technical equipment and were not modernized. All that happened was that everything possible was squeezed out of them, as they say.

The capital repair sector has become inordinately swollen as a result of the aging of production equipment. Last year 35 billion rubles was spent for this. A quarter of the country's pool of machine tools and 6 million workers are employed in repair workshops. . . . All this costs society too much.

A long-term program for the technical reconstruction of every enterprise and industry must be outlined.

In the immediate future, the share of withdrawal of fixed capital . . . must be doubled. . . . This will make it possible by the end of the 12th plan to renovate our manufacturing equipment by more than one-third, and have up to 50 percent new equipment in use.

Increased Investment in Machine Building

Comrades, in retooling the national economy and in carrying out the S&T revolution, the commanding, key role belongs to machine building. We are faced with changing radically attitudes toward the machine-building complex. . . . In the 11th Five-Year Plan period, only about 5 percent of all capital investment in production was directed toward civilian machine building. . . . In the years 1986-90, capital investment for the civilian machine-building ministries should be increased by 1.8 to 2.0 times. . . . This would correspond to the interests of the technical reequiping of our economy.

Basically, we must . . . move the center of gravity from new construction to the technical renovation of enterprises. . . . The proportion of funds earmarked for reconstruction in the overall volume of production and capital investment must be increased in the years immediately ahead from one-third to at least 50 percent.

First and foremost, machine building itself must be reconstructed. . . . A serious base is being put down for a mighty upsurge in Soviet machine building as the foundation for the technical retooling of the national economy. This is the main direction of our development, and it must be firmly adhered to, both now and in the future.

Emulating the Defense Industries

Clearly, it is essential, following the example of the defense industries, for the output of special equipment for their own needs to be developed on a wide scale within each machine-building ministry. And, in general, the experience of the defense industries must be used to full extent. We have begun this work. It has to be continued actively. . . . Use of automated planning systems in the design bureaus of the aircraft industry has made it possible to raise labor productivity by three times and to reduce the time taken in planning manufactures by 2.5 years. This is truly new technology, which is bringing with it revolutionary changes in production.

The Role of Science and the Academy of Sciences

The frontline of the struggle to accelerate S&T progress in the national economy advances through science. . . . We can and must obtain incomparably greater returns from science. We should take a new look at the tasks of science based on the requirements of our time, requirements that science be turned decisively toward the needs of production and that production turn all its attention and efforts to science.

Institutes of the Academy of Sciences must be turned around sharply to face the direction of expanding research, which is technological in its thrust, and their role and responsibility for creating the theoretical foundations for fundamentally new types of equipment and technology must be enhanced.

It would not be amiss to examine the possibility of setting up a Department for Engineering Problems in the Academy.

The organization within the framework of the USSR Academy of Sciences of integrated, interindustry S&T centers . . . is highly effective. Such centers are capable of being pilot organizations, coordinating basic research and the entire work along the most important, interindustrial S&T directions. It is evidently fitting for such centers to have design organizations and experimental enterprises.

The Industrial Science Sector

Particularly severe demands must be made on industrial science. . . . More than half of the nation's scientists are concentrated here, and about 90 percent of all allocations for R&D are directed here. Hundreds of research establishments, planning, technological, and design organizations come under the authority of individual ministries alone. The final results of the activity of many of them . . . are very low.

Paradoxical as it may seem, the main weakness of industrial science lies in its isolation from production. In order to overcome this, many industrial institutes and design bureaus should—right now—amalgamate with production associations and enterprises.

Reorganizing the R&D Network

We need to establish in general the extent to which the existing network of industrial scientific establishments corresponds to modern times. In the current five-year-plan period, the State Committee for Science and Technology undertook such an attempt, but the work was not carried through. It is very important to give new impetus to all work on developing the network of science-production associations, which should become the real outposts of S&T progress.

Raising the effectiveness of science to a great extent depends on the state of the experimental testing and design base, which—it must be said frankly—because of our errors in reckoning has greatly lagged behind in its development and hampers the introduction of scientific achievements. The problems of building up the testing base and of supplying scientific equipment and instruments must be solved as quickly as possible.

Proposals to create management consulting firms, organizations specializing in introducing innovations, engineering firms, and so on also merit careful study.

Gosplan

The extremely important tasks connected with the S&T revolution demand a substantial improvement in planning and a radical strengthening of the role and responsibility of the USSR Gosplan. . . . We must implement in practice Lenin's stipulation about transforming Gosplan into the country's leading economic science agency, gathering together major scientists and leading specialists. This must be done so that, as Lenin put it, we have broad plans backed up by technology and trained science.

State Committee for Science and Technology

The question also arises of the place and role of the GKNT. The CPSU Central Committee receives many critical observations about this organization. The Council of Ministers must determine precisely the competence of the committee. Clearly, responsibility must be placed on the GKNT for the exercise of control over the S&T level of the ministries. . . . Without substituting for either the planning organs or the ministries, the GKNT must concentrate attention on forecasting, on choosing and justifying the priority directions for the development of science and technology . . . and this must be served by a comprehensive program of S&T progress.

Improving Innovation Incentives

We need a mechanism that really ensures advantages to labor collectives that successfully speed up S&T progress. We need a mechanism that makes the output of obsolete and inefficient goods unprofitable and economically punishes both management and the labor collective, and, in the final analysis, leads to a deterioration in the indicators of an enterprise's performance. . . . Our system of incentives is extremely confused, cumbersome, and inefficient.

Management Restructuring

Comrades, the acceleration of S&T progress insistently demands a profound reorganization of the system of planning and management. . . . Without this, everything that we are talking about today may remain but a fond hope. We have been going round these problems for many years now and sizing up how best to solve them. But there is little real progress. . . . We are becoming ever more convinced that inertia and merely going through the motions in this work are no longer tolerable.

The Economic Experiment in Enterprise Autonomy

More and more industries are joining in the large-scale economic experiment. But . . . we must move on from the experiment to the establishment of an integrated system of management and administration. . . . The drawing up of such a system must be completed in a short space of time. . . . We must start from the top echelons.

The ministries, in their present form, in the way they function . . . have no interest in the economic experiment, and particularly they have no interest in the introduction

of those principles upon which we are carrying out the experiment. . . . The ministry . . . has vast experience and the ability to keep a tight rein on everybody and interpret the decisions of the Central Committee and the government in such a way that, after the application and all the recommendations, nothing is left of these principles.

S&T progress requires more freedom and flexibility in adopting decisions at the level of the association and the enterprise, for the introduction of advanced technology is organically linked with the selection of options, quick reaction to new things, and an interest in the final result. . . . Their opportunities have been expanded somewhat. But to a significant extent they still have not been able to implement their ideas because central planning and finance bodies, the ministries, and all-union production associations have . . . basically nullified the rights of enterprises.

Strengthening the Party's Role

We need to strengthen party influence on the whole course of S&T progress, fortify the party stratum in its key sectors. . . .

Experience shows that a successful form of party guidance is the councils for S&T progress attached to the central committees of union republic Communist parties, *kraykoms, obkoms,* and *gorkoms.*

The party committees of ministries . . . are obliged to stir themselves up sharply . . . to come to grips with the cardinal issues of the development of various industries.

I would like to stress yet again: times have changed. They are making new demands on party activity, its style and methods, and hence on cadres.

Reorienting Cadre Policy

The whole experience of the party says that there is little that can be changed in the economy, in management, or in education if the psychological adjustment is not made, if the desire and the ability to think and to work in a new way are not produced. A simple truth, it would appear. But it is one that our cadres are recognizing still only with difficulty and with caution.

Systematic work in retraining management and scientific and engineering cadres acquires particular urgency.

Implementation and Urgency of Action

We cannot postpone the implementation of this work, since we realize that, unless we create new economic and organizational conditions, there cannot be a real acceleration in S&T progress.

It has to be said, comrades, that we are talking about a long-term political line. And not one of the problems that we are obliged to solve today can be put off until tomorrow. One cannot linger. One cannot wait, for there is no time left for getting going. It has all been exhausted in the past. Movement must be ahead only, and must build up speed.

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