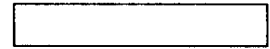




Director of  
Central  
Intelligence

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# East European Contributions to Soviet Technology Development



Interagency Intelligence Memorandum

Approved for Release by CIA  
Date 2/19/2010

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NI IIM 88-10003/I  
March 1988

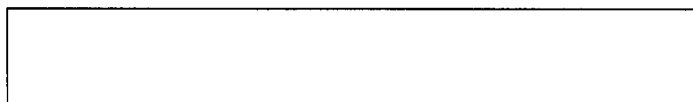
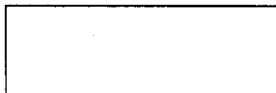
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NI IIM 88-10003/1

EAST EUROPEAN CONTRIBUTIONS TO  
SOVIET TECHNOLOGY DEVELOPMENT

Information available as of 1 January 1988 was used in the preparation of this Memorandum, approved for publication on 17 March 1988 by the Acting Chairman of the National Intelligence Council.

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CONTENTS

|   | <i>Page</i> |
|---|-------------|
| SCOPE NOTE.....                               | 1           |
| KEY JUDGMENTS.....                            | 3           |
| DISCUSSION.....                               | 5           |
| Soviet Motivations.....                       | 5           |
| Seeking Greater East European Assistance..... | 5           |
| East European Technical Capabilities.....     | 7           |
| Role of Western Technology.....               | 12          |
| Prospects.....                                | 14          |

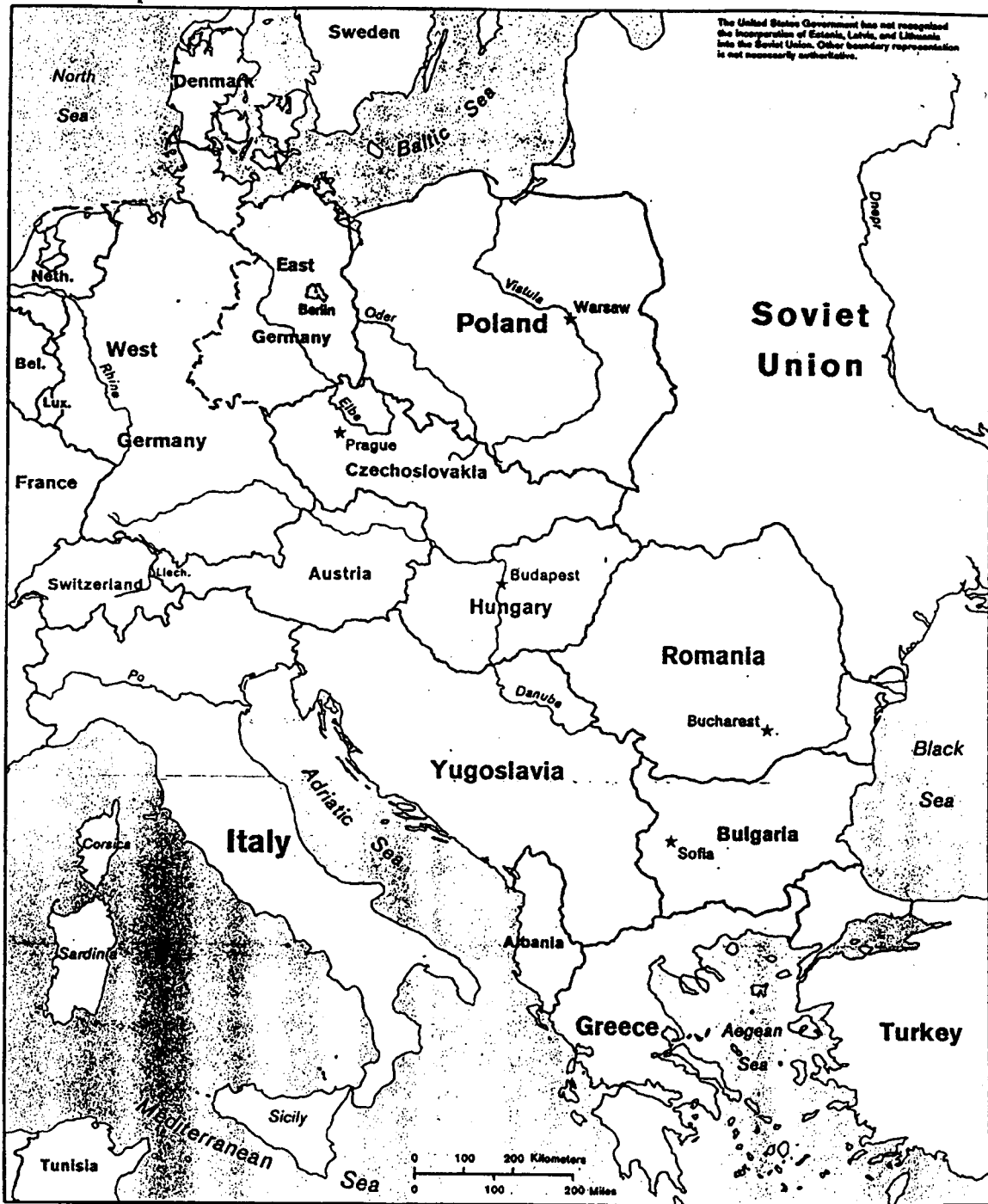
SCOPE NOTE

This Interagency Intelligence Memorandum is the first National Intelligence Council-sponsored assessment of current and future capabilities of the East European countries to contribute to the high-technology objectives that the Soviets have identified as key elements in upgrading the Bloc's economic and military potential.<sup>1</sup> To a lesser extent we also assess the will and the ability of the countries of Eastern Europe—each with its own agenda and interests—to engage in a program of cooperative technology development and sharing in areas vital to economic development in the region. In reviewing how Eastern Europe might contribute to Soviet needs, this Memorandum focuses on seven technology development areas identified by the Council for Mutual Economic Assistance (CEMA) in its Comprehensive Program for Scientific and Technical Progress to the Year 2000. These seven areas are: computers and software, microelectronics, telecommunications, factory automation, advanced materials, nuclear energy, and biotechnology.

Because the Soviets will seek major contributions from technology leaders in each area, overall assessments of East European technological capabilities are based on the best available rather than an average technology level in the region. In some technology areas—biotechnology, for example—our ability to assess and forecast East European technology levels is limited by gaps in our information. Overall, the Intelligence Community has directed limited resources to East European technology, choosing instead to concentrate on Soviet developments.

<sup>1</sup> For purposes of this IIM, Eastern Europe refers to Bulgaria, Czechoslovakia, East Germany, Hungary, Poland, and Romania—the East European members of CEMA.

Figure 1  
Eastern Europe



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KEY JUDGMENTS

Eastern Europe will continue to support—but will not be a full partner in—Soviet technology development. Nearly all East European contributions to the Soviet effort are non-leading-edge technologies that the Soviets themselves could produce, like computer peripherals and traditional machine tools. Indeed, Eastern Europe has supplanted the West as the USSR's major supplier of machine tools. There are, however, pockets of expertise where the East European contribution is more significant, such as East Germany's electron beam furnaces and advanced integrated circuits.

The Soviets are taking three approaches to promoting technology: (a) better coordination among countries of the Council for Mutual Economic Assistance (CEMA), (b) acquiring more technology from the West, and (c) hoping that general economic reform will spur technology development.

The "CEMA 2000" program is the Soviets' main effort to improve Eastern Europe's technological contribution, but we do not believe it will help very much. Aiming to raise the level of indigenous Bloc technology to world standards by the year 2000, Moscow is promoting new forms of cooperation that emphasize direct enterprise-to-enterprise links:

- We believe that the East European countries will find it very difficult to raise significantly the quality and volume of machinery and equipment exports to the USSR over the next three years. Moscow has had only limited success in compelling its allies—or even its own managers—to follow the less bureaucratically centralized procedures for joint ventures it has promoted.
- Although Gorbachev's personal commitment to the success of the CEMA 2000 program implies that the technological contributions of Eastern Europe will increase in time, these contributions in themselves will not enable the Soviets to make significant inroads on the West's technological lead.

Another of Moscow's goals for the CEMA 2000 program is for the Bloc to acquire more Western technology—both by legal and illegal means:

- We expect all East European countries to step up their efforts to *illegally* acquire COCOM-controlled Western technology, with

[REDACTED]

Hungary and Bulgaria being the most active. We believe that East European countries retain for their own use most COCOM-controlled equipment thus obtained.

- With respect to *legal* acquisition, several East European countries have eased restrictions on joint ventures with Western firms, but progress has been slow. Some of the technology so acquired would surely be passed to the USSR. [REDACTED]

Moscow is also encouraging the East Europeans to follow its own partial economic and trade reforms, set in place to spur technology development. However, although the climate for reform is much improved under Gorbachev, the full-fledged, market-oriented changes that are really needed to close the technology gap with the West are clearly a long way off. [REDACTED]



## DISCUSSION

### Soviet Motivations

1. Gorbachev has made increased cooperation with Eastern Europe one of the primary features of his industrial modernization program—a key element of his strategy to revitalize the Soviet economy. The program he has outlined aims at bringing the quality of Soviet products and the efficiency of Soviet industry up to world standards by the year 2000. This is to be achieved through accelerated technological development, innovation, and renovation of industrial capital. If successful, the modernization program would strengthen the industrial base and thus better enable the USSR to compete economically and militarily with the West and promote the image of vitality and strength that Soviet global prestige demands. Gorbachev has increased the pressure on the East Europeans to export more and better quality goods to the USSR. Existing trade protocols for 1986-90 probably call for the East Europeans to increase exports to run trade surpluses and pay back outstanding debts owed Moscow.

2. Unlike the West, where industrial modernization is driven by both supply and demand factors—with interaction between the two stimulating economic growth—Gorbachev's modernization program has concentrated primarily on increasing the supply of more technologically advanced equipment. Since assuming leadership, Gorbachev has consistently exhorted the scientific and industrial establishments to expand the supply of key technologies and to move these new technologies more rapidly into industry. His program emphasizes development of the high-technology sectors of the economy that provide the advanced equipment and processes needed for industrial and military modernization, especially microelectronics and instrumentation; computer equipment and software; telecommunications; new materials; and machine tools, flexible manufacturing systems, and robotics. To get the modernization program off to a good start, the current Five-Year Plan (1986-90) calls for ambitious production targets:

- Production of computer equipment is slated to grow by 18 percent annually through 1990. By that time, the Soviets plan to produce a total of

1.1 million personal computers, compared with almost none until the mid-1980s.

- Output of the main producer of instrumentation equipment and process control computers is slated to grow by 11 percent per year in the 1986-90 period, up from 6 percent in the previous five-year period.
- Production of robots during this period is to increase annually by 17 percent, numerically controlled machine tools by 14 percent, and machining centers by 34 percent compared with 1981-85 production.

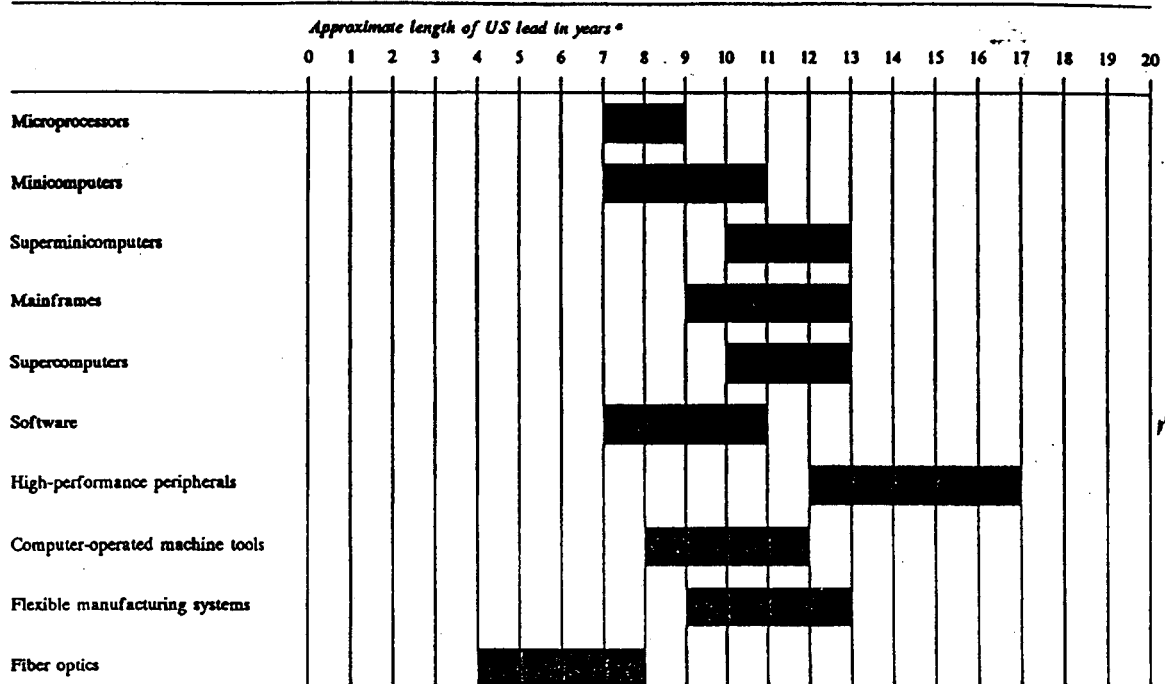
3. While the Soviets probably will not meet most of these targets, they have already taken a number of steps to provide more and better machinery in each of these areas. Most significantly, investment in the civilian machine-building ministries is to increase by a massive 80 percent during 1986-90 compared with the 1981-85 period. Meanwhile, funding for "science"—a rough indicator of the resources committed to R&D—is also to increase sharply. But the USSR remains far behind the West in the production and application of key technologies that drive industrial modernization (see figure 2), and, despite higher investment to support these production goals, the backward state of domestic technology will force the USSR to look to Eastern Europe and the West for help.

### Seeking Greater East European Assistance

4. S&T cooperation figured prominently in Gorbachev's speeches to both the East German party congress in April 1986 and the Polish party congress in June 1986. The sole focus of the October 1987 CEMA session in Moscow was to "elaborate a mechanism of economic cooperation that would make the maximum contribution to implementing the strategy of deepening and intensifying [CEMA] integration processes."

5. The organizational thrust of Moscow's S&T cooperation policy reflects both the Soviets' concern for raising the overall technological level and economic performance of the Bloc and Moscow's drive for

**Figure 2**  
**Selected Advanced Manufacturing Technologies:**  
**The United States Versus the USSR**



\*US lead based on estimates of time needed for USSR to reach series production of technology levels similar to those in production today in the US.

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increased leverage over East European S&T programs. For example:

- The December 1985 CEMA summit designated 11 of the 16 new Soviet interbranch S&T complexes (MNTKs)<sup>2</sup> as CEMA "head organizations" for Bloc-wide S&T programs. Other Soviet bodies were placed in charge of the remainder of the 93 projects of the CEMA 2000<sup>3</sup> program.

<sup>2</sup> The MNTKs are national Soviet organizations, consisting of scientific research institutes, engineering and design facilities, and pilot production plants. The majority of the large scientific and technical complexes were set up by a Politburo decree of December 1985 to solve S&T tasks that extended beyond any one ministry's area of responsibility. □

<sup>3</sup> The CEMA 2000 program, or the Comprehensive Program for Scientific and Technical Progress to the Year 2000, focuses on seven technology areas: computers and software, microelectronics, telecommunications, factory automation, biotechnology, advanced materials, and nuclear energy. □

- Soviet specialists have been put in charge of the five CEMA working groups charged with developing concrete targets for the CEMA 2000 priority areas.
- At a 1986 meeting on CEMA cooperation, the Soviets reportedly threatened to levy unspecified fines on the East Europeans if they did not successfully discharge their CEMA 2000 responsibilities in their national S&T programs. In addition, tough Soviet negotiating tactics over Czechoslovakia's R&D obligations "shocked" Prague officials, who were threatened with reductions of raw materials shipments if they refused Soviet demands. □

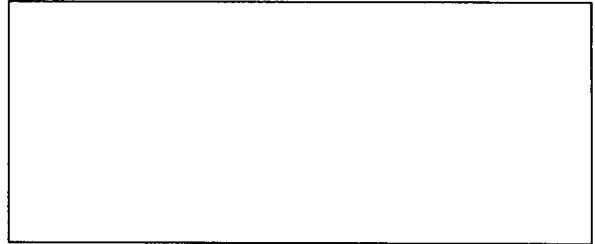
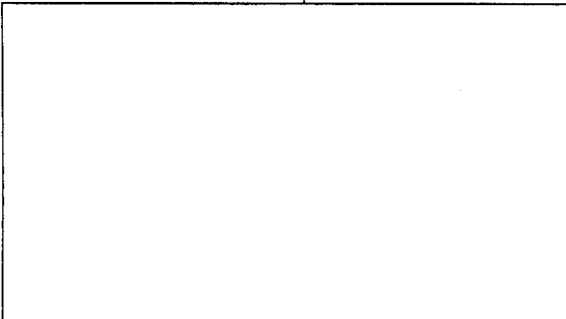
6. The East European response to the Soviet push for greater S&T cooperation has been mixed. The

Poles and the Bulgarians have been openly enthusiastic from the outset, probably because they anticipate better access to the extensive Soviet and regional R&D network and resource base. In contrast, the East Germans—the most technologically advanced member of the Bloc—have been cool to participating in the program. The Hungarians have indicated that they feel they have much more to gain from scientific cooperation with the West than from the USSR and that S&T cooperation with the Soviets will be a one-way street.

7. Increasing the level of S&T cooperation with Eastern Europe could afford the Soviets several economic and political benefits. It has the potential to:

- Foster greater political and economic interdependency among the CEMA countries, conserving scarce hard currency supplies and, eventually, lessening their reliance on Western technology, while remaining under Soviet control.
- Allow the Soviets to tap into the pockets of technological expertise that exist in Eastern Europe.
- Shift some of the research, development, and production burden to the USSR's East European allies.
- Allow the Soviets to concentrate on more advanced technology development programs, especially those with military applications.
- Reduce the wasteful duplication of effort and the production of incompatible products in the region as a whole.
- Enhance Soviet ability to manage programs for the acquisition of Western technology.

8. The Soviets apparently believe that increased S&T cooperation would serve their security as well as their economic objectives.



### East European Technical Capabilities

9. Although its products are usually inferior to those manufactured in the West, Eastern Europe as a region is ahead of the USSR in several key technology products, due largely to the region's more developed contacts with Western technology producers (see figure 3). In the past, East European products and expertise have contributed to Soviet requirements in the areas of machine tools, computer equipment, microelectronics, robotics, and telecommunications. Moreover, the East European countries have enhanced Soviet access to Western technology by serving as additional collectors of foreign equipment and know-how under Soviet-managed acquisition programs. (See table 1 for an overview of East European national economic and technological performance and cooperation with the USSR.)

#### Computers

10. The most important East European contributions to the USSR probably will continue to be peripheral devices—such as disk drives, video displays, communications terminals, and electromechanical input-output devices—and systems and applications software. Although the Soviets can produce these devices indigenously, East European equipment is superior to generally available Soviet equipment, although less advanced than Western products. Eastern Europe has provided the USSR with some good quality, general purpose central processors, but these have been of relatively minor importance in the total Soviet computer inventory.

11. Collectively, the East European countries have made and will continue to make contributions to the USSR's ability to meet its general purpose computing needs. These contributions, primarily in the civil area,



**Table 1**  
**The East European Countries:**  
**Key Economic and Technological Characteristics**

|                | Technical Strengths  | Level of Cooperation With the USSR  | Status of Economic Reforms   |
|----------------|--|---|--|
| Bulgaria       | Leading producer and supplier of magnetic disk drives in CEMA. These drives are generally considered to be superior to Soviet models.  | Bulgaria has established joint enterprises with the Soviets in the production of machine tools and robot controllers. Also works closely with Soviets in the area of computer production and software development.  | General Secretary Zhivkov has slowed the pace of the ambitious changes he announced in July 1987. Bureaucratic and personnel changes have blurred the lines of authority within the party and the government and created confusion among those responsible for executing his wishes. Apparently at Soviet urging, Zhivkov has opted to take more time in working out details.  |
| Czechoslovakia | Eastern Europe's leading producer of nuclear reactors and related equipment that is qualitatively on a par with Soviet equipment (although based on Soviet designs). Czechoslovakia is not allowed, however, to produce control rods or carry out any enrichment or reprocessing of nuclear material.<br><br>Although not as advanced as East Germany, Czechoslovakia has a long history of machine tool manufacture, and it can produce a wide range of conventional and advanced machine tools and flexible manufacturing systems. | Czechoslovakia, the USSR's second-largest trading partner, has historically followed Moscow's lead closely and has been one of the most vocal among the East European countries in calling for closer trade ties and economic integration.<br><br>A joint Czechoslovak-Soviet robot development center was established in Presov, Czechoslovakia, in 1985.    | The Czechoslovaks are engaged in debate over the extent and pace of economic restructuring. As a result of their disagreements, publication of a timetable has been postponed. In his first speech as party General Secretary, Milas Jakes took the middle ground between reformist and conservative elements in the party and signaled more than anything else a policy of continuity with the gradual pace of change adopted by former party boss Husak. |
| East Germany   | Leading East European producer of microelectronics and computer equipment, most of which is reportedly more reliable than Soviet counterparts.<br><br>Strong, competent machine tool industry and the region's leading producer of numerical control modules.<br><br>The Carl Zeiss Jena firm, one of the world's leading optics producers, is also the Bloc's leading producer of semiconductor manufacturing equipment.  | The Soviet Union's leading trading partner. Also the leading East European supplier to the USSR of machine tools, computers, integrated circuits, and other high-technology products.<br><br>East Germany is resisting, however, Soviet pressure to establish joint ventures at the enterprise level, viewing such links to Soviet firms as a one-way street. | East German leader Honecker continues to defend the correctness of East Berlin's economic policies based on centralized structures and planning, with little room for private initiative or local control. Although some middle-level party functionaries believe that changes are needed, most concur that they will come only when Honecker leaves the scene.  |

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Table 1 (continued)  
 The East European Countries:  
 Key Economic and Technological Characteristics

|         | Technological Strengths   | Level of Cooperation With the USSR  | Status of Economic Reforms   |
|---------|---|---|--|
| Hungary | <p>Its computer industry, although small, maintains close cooperation with Western firms and produces nearly a full line of reliable computer equipment through domestic programs or under foreign license.</p> <p>Hungary is also the most advanced producer of applications software in Eastern Europe, some of which is marketed and sold in the West.</p> <p>Hungary is reportedly a leading supplier of advanced instrumentation to the Soviet space program.</p> <p>Serious economic problems have limited the amount of resources available for industrial investment.</p> | <p>Soviet-Hungarian S&amp;T cooperation has become more advanced in recent years and has among its principal objectives the development of 26 new technological processes for the production of chemical reagents and fabrication of large-scale integrated circuits.</p> <p>Hungary established two joint ventures with the Soviets during 1987: a joint firm to produce integrated circuits was created in May, and a firm to jointly produce advanced medical instrumentation was formed in April.</p> | <p>The Hungarians, following General Secretary Kadar's cautious and indecisive lead, are proceeding in piecemeal fashion. The overall pace of reform is insufficient to overcome the country's serious problems. Projected austerity measures, including an important package of tax reforms that went into effect in January 1988, will noticeably reduce the standard of living.</p> |
| Poland  | <p>One of the leading producers of computer printers in CEMA, generally on a par with Soviet and East German models.</p> <p>Technology role limited by the virtual collapse of the Polish economy in 1981.</p>  | <p>Poland supplies the Soviet Union with computer equipment, such as printers, floppy disk drives, and minicomputers.</p> <p>The immediate prospects for direct ties to Soviet enterprises are limited by the generally neglected state of Poland's high-technology industries.</p>   | <p>Poland is trying to put the best gloss possible on the November 1987 defeat of the referendum it hoped to use to justify draconian price hikes. The regime still announced a 40-percent price hike for 1988 and intends to proceed with restructuring of the government and some decentralization of economic decision making.</p>  |
| Romania | <p>In Romania, already the most technologically backward nation in Eastern Europe, worker productivity and welfare have worsened during the 1980s as food and fuel shortages have intensified. Moreover, President Ceausescu has squeezed the domestic economy to boost export earnings and to pay off foreign creditors as quickly as possible to prevent their interference in domestic policies.</p> <p>Cutbacks on imports of spare parts and of investment goods needed to modernize the industrial base are undermining the potential for future growth.</p>                | <p>Romania has not been a major participant in CEMA S&amp;T programs and has not supplied the USSR with significant quantities of high-technology products.</p>   | <p>In Romania, pressure to abandon Secretary General Ceausescu's ill-considered economic policies has risen in the wake of the riots in Brasov, but the Romanian leader continues to resist any changes, most recently at a special party conference in December 1987.</p>   |

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**Figure 3  
East European Demonstrated Capability to Produce  
High-Technology Products \***

| Legend                    | ▶ Improving  | ● Maintaining | ◀ Declining |     |  |
|---------------------------|--------------|---------------|-------------|-----|--|
| Product                   | Lag<br>Clear |               |             |     | East European<br>Leader                                |
| <b>Computers</b>          |              |               |             |     |  |
| Mainframes                |              |               |             | ▶▶▶ | German Democratic Republic                             |
| Peripherals               |              |               |             | ▶▶▶ | Bulgaria<br>German Democratic Republic                 |
| Personal computers        |              |               |             | ▶▶▶ | Bulgaria<br>German Democratic Republic                 |
| <b>Microelectronics</b>   |              |               |             |     |  |
| Integrated circuits       |              |               | ▶▶          |     | German Democratic Republic<br>Czechoslovakia           |
| Fabrication equipment     |              |               | ▶▶          |     | German Democratic Republic                             |
| <b>Telecommunications</b> |              |               |             |     |  |
| Transmission              |              |               | ●           |     | German Democratic Republic<br>Czechoslovakia           |
| Switching                 |              | ●             |             |     |  |
| Terminals                 |              |               |             | ●   | Hungary  |
| <b>Factory automation</b> |              |               |             |     |  |
| Machine tools             |              |               |             | ●   | German Democratic Republic<br>Czechoslovakia           |
| Controllers               |              |               |             | ▶   | German Democratic Republic,<br>Czechoslovakia, Hungary |
| Robotics                  |              | ●             |             |     | Bulgaria<br>German Democratic Republic                 |
| <b>Advanced materials</b> |              |               |             |     |  |
| Ceramics                  | ◀            |               |             |     |  |
| Composites                | ◀            |               |             |     |  |
| Metals                    | ◀            |               |             |     |  |
| <b>Nuclear power</b>      | ▶            |               |             |     | Czechoslovakia   |
| <b>Biotechnology</b>      |              |               | ●           |     | Hungary  |

\* Based on the capabilities of the leading country in each technology area.

serve as supplementary sources of hardware and software products, technical know-how, and services. Data on actual flows of East European computer equipment to the USSR are scarce and uneven. For some of the key contributions (based mainly on East European open sources), see table 2.

**Table 2**  
Current Deliveries to the USSR  
of Selected East European  
Computer Equipment

|              | Equipment Type     | Approximate Annual Quantity |
|--------------|--------------------|-----------------------------|
| East Germany | Ryad mainframes    | 125                         |
| Hungary      | Ryad minicomputers | 100                         |
|              | Computer terminals | 4,000 to 5,000              |

This table is ~~Secret~~

#### Microelectronics

12. Although the increasing flow of microelectronic devices from Eastern Europe to the Soviet Union fills an important niche in providing circuits that go primarily into civilian applications, the total quantities involved do not represent a large proportion of total Soviet IC consumption. East Germany, the leading country in the region in microelectronics development, is the primary supplier of ICs and related equipment to the Soviets. We believe that the majority of the most advanced East German ICs are exported to the USSR. In addition, the East German production combine Carl Zeiss Jena is CEMA's leading producer of semiconductor production equipment, much of which is shipped to the Soviets (see inset).

#### Telecommunications

13. The East European countries export medium-technology telecommunications equipment to the USSR. East Germany supplies two types of automatic telephone exchanges, having shipped 250,000 lines in 1984. Czechoslovakia has been a longstanding supplier to the USSR of radio and television transmitters, and Hungary has been an active contributor in the field of computer networks.

#### Factory Automation

14. As a region, Eastern Europe rivals the USSR in the overall value of its machine tool output, although national capabilities vary widely. The leader, East

#### Carl Zeiss Jena: A Model Combine

East German leaders tend to single out the Kombinat VEB Carl Zeiss Jena (CZJ) as the model industrial combine. Looted and completely destroyed by the Red Army immediately after World War II, CZJ reassembled those employees who did not flee to the West and became one of the GDR's most technologically advanced combines. It is widely regarded as a world leader in some technologies, particularly optics. The combine sells extensively in the West and acquires Western technology. CZJ also assists the USSR in a variety of areas, including supplying photoreconnaissance technology and military optics such as night vision devices and laser rangefinders. In recent years, CZJ has become more active in the microelectronics field, and, sometime before the end of the century, the company hopes to produce 4-megabit dynamic RAM memory devices—a level of technology currently at the prototype stage in the West. The combine is also the Bloc's leading producer of semiconductor production equipment—most notably electron beam photo lithography machines—with a large percentage going to the USSR.

CZJ has 24 subordinate enterprises and 69,000 employees, making it one of the largest enterprises in the country. It produces more than \$2 billion worth of electronics and optics equipment annually and sends more than 60 percent of its total output to other Eastern Bloc countries, including 30 percent to the Soviet Union. CZJ in early 1986 had two research organizations with 7,500 employees, a close working relationship with the Friederich Schiller University of Jena, and a wholly subordinated foreign trade enterprise (with a branch office in New York City). The combine is one of only a handful authorized its own hard currency account—a reward for its superior export performance.

CZJ displays many of the characteristics the party leadership is trying to instill throughout the economy, and it often is used as a standard of comparison. In January 1986 the combine received lengthy, front-page praise in the Communist party newspaper *Neues Deutschland*. Party leader Honecker had glowing words during a visit to one of its plants in May of that same year. Praise typically centers on CZJ's:

- Technologically advanced, high-quality output.
- Success at exporting to the West and to socialist countries.
- Steady growth and rapid increases in productivity.
- Close working ties between researchers and the factory floor.

Germany, currently supplies over one-fourth of the total value of Soviet machine tool imports. Relatively advanced computer-numerically-controlled (CNC) tools account for more than 40 percent of the GDR's annual machine tool output, a share three times larger than that achieved by Soviet producers but still small compared with the shares held by advanced CNC machine tools in Western product lines. East Germany, Czechoslovakia, Bulgaria, and Hungary are key suppliers of forges and presses, advanced numerically-controlled and computer-numerically-controlled tools, and flexible manufacturing system (FMS) components to the Soviets.

15. In response to Soviet pressure, the East European machine tool industries intend to increase exports to the USSR for 1986-90 and expand R&D and production links to the Soviets. Analysis of available East European national export plan targets indicates that the value of machine tools going to the USSR is slated to grow by more than one-third during 1986-90 over the previous five-year period. The largest supplier, East Germany, is committed to raise exports by 33 percent, and second-place Czechoslovakia promises a 40-percent increase.

16. Nearly all of this growth in the value of machine tool exports will stem from the higher quality mix of machine tools scheduled to come from Eastern Europe—absolute numbers of tools exported will grow only slightly. The draft "Program on Multilateral Specialization and Coproduction" recently published by the CEMA Committee for Cooperation cited some 80 agreements that call for production of 179 FMSs, 86 types of industrial robots, and 210 models of new metal-cutting machine tools. Plans also call for the development and production of advanced instrumentation and control components for transfer lines and FMSs.

#### Advanced Materials

17. The level of development in Eastern Europe in advanced materials varies widely from country to country, and it is not clear how much the region contributes to Soviet developments. For the most part, East European expertise is concentrated in particular, narrow technical areas rather than being broad based. Individual East European scientists are brought to the USSR to participate in R&D projects. East European contacts are more important to the USSR as a source of the machinery and equipment (for example, East German electron beam guns) needed to process advanced materials than for the advanced materials themselves. As a result, several countries in the region

have one or two world-class R&D areas: East Germany, for example, in electron beam furnace technology and Czechoslovakia in electroslag remelting and electroslag welding technology.

#### Nuclear Energy

18. With the exception of computer technology, CEMA cooperation in the nuclear energy field is probably more developed than in any other technology area. Czechoslovakia is the clear leader in Eastern Europe in the production of equipment for nuclear reactors and is capable of manufacturing more than 80 percent of all the operating equipment required for medium-sized (440-megawatt) reactors. This production, however, is derived from Soviet designs and almost exclusively supplies East European nuclear plants. In addition, the Soviets do not allow any East European country to produce the nuclear fuel bundles that go into their reactors. Each of the other East European countries produces equipment under a CEMA agreement (signed in 1979 and covering the period 1981-90) on specialization, coproduction, and reciprocal deliveries of equipment for nuclear power plants.

#### Biotechnology

19. Cooperation in biotechnology appears to be the least developed of the key technology fields. Each East European CEMA country except Romania has identified biotechnology as a priority area of development, and Hungary and Czechoslovakia are the Bloc leaders in pharmaceutical and agricultural biotechnology applications. The region as a whole is placing a heavy emphasis in this area and has aggressively pursued Western technological assistance to help meet its goals.

#### Role of Western Technology

20. Eastern Europe has used several methods to transfer advanced Western technology to the Soviet Union: export of indigenously manufactured products incorporating Western components or technology; legal purchases of products and licenses to Western technology; and clandestine acquisition of militarily significant Western technology, equipment, and know-how. However, no Warsaw Pact military equipment incorporates Western components.

#### Export of Embedded Western Technology

21. We believe that the most frequent transfer mechanism used by Eastern Europe is the export to



the USSR of indigenously manufactured products containing Western technology or components, acquired both legally and illegally. East European computer equipment, machine tools, robots, and other microelectronics-based products imported by the Soviets contain various amounts of Western integrated circuits and technology. Hungary and Bulgaria, the most active collectors of dual-use Western technology, still rely almost exclusively on Western chips and other technology in the production of this equipment. [redacted]

#### Licenses

22. The Soviets also benefit indirectly from East European purchases of licenses to Western technology not only by importing the equipment produced under these arrangements, but also through the know-how and service arrangements that sometimes are included as part of the deal. Thus, by purchasing licenses from Western firms, the East Europeans are able to provide the Soviets with a more reliable product and, in some cases, can even funnel Western systems engineering and servicing know-how to the Soviets as part of CEMA cooperative arrangements. [redacted]

#### Clandestine Acquisitions

23. The third major way in which the Soviets receive advanced Western technology from Eastern Europe is through East European acquisitions of Western know-how and equipment in support of Soviet technology acquisition efforts. The Soviets have two programs to coordinate their acquisitions of Western technology: one administered by the Soviet Military Industrial Commission (VPK) and one managed by the Soviet Ministry of Foreign Trade.<sup>5</sup> [redacted]

24. The VPK program targets military and some dual-use Western technology to raise the technical levels of weapons and military equipment and to improve defense manufacturing processes through the exploitation of designs. This program is designed to acquire one-of-a-kind samples and documentation. [redacted]

25. During the late 1970s and early 1980s, various East European intelligence services provided the Soviet VPK program with significant amounts of open-source, classified, and corporate proprietary information as well as samples acquired in the West. Much of this information was applied directly in Soviet defense industrial ministries. The intelligence services

<sup>5</sup> In January 1988 the Ministry of Foreign Trade was merged with the State Committee on Foreign Economic Relations to form a new Ministry of Foreign Economic Relations. [redacted]

reportedly contributed about 30 percent of the items collected by the KGB in accordance with VPK requirements. During that same period, the KGB contributed about one-third of the total information and samples collected in efforts to satisfy VPK requirements. Thus, we estimate that the East European contribution was about 10 percent of the VPK requirements that were satisfied during this period. [redacted]

26. In addition to the VPK program, the former Soviet Ministry of Foreign Trade administered an illegal trade or diversion program to acquire relatively large numbers of dual-use (civilian and military) manufacturing and test equipment for direct use in production lines. (There is no indication that its successor, the Ministry of Foreign Economic Relations, will operate differently.) This program seeks export-controlled microelectronics, computer, communications, machining, robotics, diagnostic, and other equipment to increase the throughput of weapons-producing industries. [redacted]

[redacted] We believe that most COCOM-controlled equipment obtained by the East Europeans is retained for domestic use. An analysis of fragmentary data on individual cases of proven and alleged diversions to the USSR suggests that less than 10 percent transited or were orchestrated by one of Moscow's East European allies. [redacted]

27. There are some indications that the Soviets are making a greater effort to coordinate CEMA imports of Western high technology, be they legal purchases of equipment or licenses, or illegal acquisitions of COCOM-controlled technology and equipment. [redacted]

Prospects

28. Rapidly escalating Soviet demand and lagging domestic production of high-technology products ensure that the import of these products from Eastern Europe will remain supportive to Soviet industrial modernization goals over the next decade. The need for additional support from Eastern Europe is made even greater by hard currency shortages and restrictive Western export control policies that will continue to frustrate Soviet efforts to obtain advanced technology from the West. [ ]

29. The East European countries will be hard pressed, however, to significantly increase the quantity of machinery and equipment deliveries to the USSR over the near term. We believe that the Soviets will continue to press the region to modernize its industrial base in key technology sectors and to raise the quality of its production. Trade plans for Czechoslovakia for 1986-90, for example, include a list of 110 categories of machinery and equipment exported to the USSR that are to achieve a "higher technological standard." Hungary's trade plans with the USSR also include an agreement that almost one-third of Hungarian exports will be replaced by more modern products over the period. [ ]

30. We believe that the Soviets are pursuing a strategy within CEMA to increase the quantity of high-quality equipment and machinery imports from Eastern Europe and to raise the level of technology within the Bloc to achieve "world standards" by the year 2000. In addition to attempts to increase imports of industrial machinery and equipment from individual countries, they are trying to establish new forms of cooperation that place a greater emphasis on direct enterprise-to-enterprise links to better tap technology developments in Eastern Europe. Also, the Soviets are pushing the East European countries to acquire—legally and illegally—advanced, dual-use production technology both to pass on to the Soviets and to help with East European modernization efforts. These efforts, combined with a number of domestic measures designed to increase the output of advanced technology, will result in higher production volumes of more modern equipment. [ ]

31. In contrast to the measures to increase supply, the Soviets and their East European allies have put far fewer mechanisms into place on the demand side to promote the innovation and diffusion of the appropriate technologies into machine building and the rest of the economy. They have yet to change the system of

plan targets and incentives sufficiently to make it generally advantageous for managers to favor innovation over maintaining the status quo. Reforms designed to increase enterprise autonomy will not have much effect if managers are still penalized for stopping production to accommodate modernization or cannot induce machinery suppliers to produce the right equipment and provide reliable installation and maintenance support. These are still common obstacles confronting plant managers in the CEMA countries. [ ]

32. Ultimately, Communist authorities will have to streamline and decentralize economic decision making. The centrally planned economic system, with its rigidities, its propensity to centralize development as well as decisionmaking, its stultification of competitive research, and its tradition of ignoring the needs of the user, is ill suited to the demands of automation and technology development. East European officials, especially in Poland and Hungary, have been pressing CEMA to accept fundamental reforms in the means and structure of trade among Bloc countries. Progress has been and is likely to continue to be slow in the introduction of these measures. [ ]

33. Increased investment levels in machine building and tighter cooperation within CEMA will most likely result in greater quantities of key technology products in the Soviet Union and Eastern Europe. The prospects for significantly raising the quality of high-technology development within CEMA, however, remain bleak in the absence of more far-reaching reforms that would decentralize the central planning apparatus and capital allocation procedures enabling managers to demand, and ultimately receive, the technology needed to modernize production. [ ]

34. Although the CEMA 2000 program represents a new form of cooperation, it may not be adequate to master the problems associated with the development, assimilation, and effective use of advanced technologies. If the region is going to become truly competitive in world markets in these technologies, we believe the Soviet leadership will have to push for real changes both in the domestic economic policies of the Bloc and in the CEMA system within which they operate. Although the sheer determination of Gorbachev's early efforts to push the program will probably lead to some progress within CEMA in the development and application of these technologies, the gap with the West will continue to grow. [ ]