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Soviet Military R&D: Resource Implications of Increased Weapon and Space Systems for the 1980s

An Intelligence Assessment

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SOV 83-10064
April 1983

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An Intelligence Assessment

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[redacted]

Soviet Military R&D: Resource Implications of Increased Weapon and Space Systems for the 1980s

Key Judgments

Information available as of 15 February 1983 was used in this report.

Key indicators emerging from Soviet weapon and military space development programs point to an increasing commitment of resources to military research, development, testing, and evaluation during the 1980s. Unless significant changes in the political or economic climate reverse present trends, the Soviets will:

- Introduce a greater number of new or substantially modified weapon and military space systems than during each of the last two decades. We believe that they will develop and deploy as many as 165 systems in the 1980s, compared with about 140 during each of the previous two decades.
- Develop more costly weapon systems than in the past. The higher costs for many of the systems stem in part from the incorporation of considerably more high technology than has been typical for new Soviet weapon systems.
- Continue the growth in floorspace at their primary R&D facilities at least through 1985 at about the annual level prevalent since the mid-1960s. Much of this expansion will be for new weapon development programs that will appear later in this decade.

Although the Soviets are in a period of economic difficulty, their current resource commitments to weapon development programs suggest continued growth in expenditures for military R&D. The costs resulting from the large number of systems under development, the advanced technology in many of these systems, and the expansion of the R&D facilities will continue to drive up Soviet R&D outlays. As a result, however, Soviet leaders are expected to have available an unprecedented number of weapon systems that can be deployed with military forces through the early 1990s.

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Introduction

For more than two decades, the Soviets have been engaged in a broad-scale buildup of their military forces. An important ingredient in the buildup is the heavy Soviet commitment to develop new and better weapon systems. During each of the past two decades, about 140 new or substantially modified weapon and military space systems were developed and deployed.[1] We estimate that resources going to military R&D increased from the equivalent of $7 billion in 1960 to $35 billion in 1980, and we project a further increase to about $50 billion by 1986.[2] (Comparable US expenditures in 1980 were about $17 billion.) Floorspace devoted to R&D at key facilities more than doubled from 1960 to 1980.

The expansion of military forces, however, has been at considerable cost to the Soviet economy. Since the mid-1960s, defense programs (including R&D) have accounted for about 15 percent of industrial production and over 30 percent of machinery output.[3] Moreover, the defense sector generally receives priority claim on high-quality manpower and material resources when in competition with civilian-sector needs. Competition for resources between the defense and civilian sectors has become more intense as Soviet economic growth has slackened

To assess the level and trend of Soviet commitments to military R&D, we have examined the number of weapon systems under development that are expected to reach initial operating capability (IOC) during 1981-90[4] and have compared them with systems introduced over the past two decades. We have also [redacted] recent expansion at the most important R&D facilities, much of which will support weapon development programs that we have not yet identified.[5]

This study examines only new systems and major modifications—development efforts that require relatively substantial resource commitments.[6] A new system is developed primarily from the ground up rather than reconfiguring an existing system and usually involves a new design of the primary weapon as well as other key elements of the system. A modified system is one that uses an existing design but is reconfigured somewhat to alter or increase its capability—usually involving the design of some new components but not major changes in configuration or missions. Only those past, current, and future modifications that we judged to require roughly half of the R&D resources expended on the original system—referred to as major modifications—have been included in this analysis. Modifications that cost comparatively less than major modifications have been excluded from this paper.[7]

[1] Hereinafter the term "weapon systems" is used to denote both weapon and military space systems. . . .

[2] Data are in 1981 dollars and represent what it would cost if the Soviet defense R&D effort were undertaken in the United States.

[3] This sector also produces consumer and producer durables as well as military hardware . .

[4] We define "weapon systems" to include aircraft, missiles, naval ships (surface combatant, mine warfare, amphibious, and major auxiliary), submarines, military space systems, major munitions, and principal land arms (tanks, armored vehicles, artillery, and antiaircraft weapons). For this paper we have selected the 10-year timespans as 1961-70, 1971-80, and 1981-90 because they embrace a long enough time period (two five-year plans) to avoid aberrations caused by "bunching" of new R&D programs

[5] For details on the data base used for weapon systems and floorspace expansion, see appendix /.

[6] Our designation of a new system or a modified system does not necessarily correspond to Soviet classifications for these systems. For those systems already deployed, we use the Intelligence Community's designation for new and modified systems. For those systems under development, our classification is based on our estimate of the resources the Soviets are expending on their development. There generally has been a close correlation between what the Community has designated new and modified and our estimated R&D costs. These costs therefore provide a fairly reliable basis for estimating whether systems currently under development will be designated as a new system or a modification when they reach IOC. Using these classifications, Soviet development efforts for the 1980s can then be categorized and compared with historical trends. For more detail on how R&D costs are derived for these systems, see appendix B. . . .

[7] For example, the IL-76 Candid was a newly designed transport aircraft that reached IOC in the mid-1970s. The IL-76 Tanker, which will probably reach IOC by the mid-1980s, is considered to be a major modification to the original Candid. It has a modified fuel and redistribution system, a fuselage appendage, and wing pods, and it probably will be used as an airborne refueling system. We have considered the IL-76 Candid B, however, which was introduced a year after the original Candid, to be a minor modification. A new tail gun system was about the only item that distinguished this aircraft from the original, and therefore we have excluded it and other such systems from this analysis.

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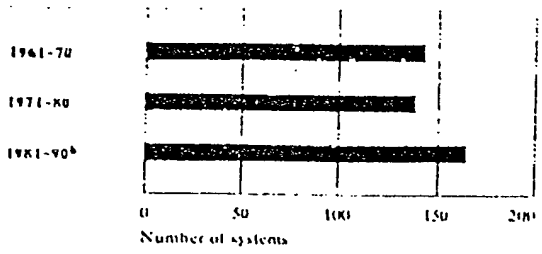
Figure 1
Number of Major Soviet Weapon Systems Introduced, by Decade, 1961-90[a]



[a] New or major modified weapon systems reaching initial operating capability.
[b] Projected.

Table 1
Soviet Weapon Systems Under Development and Expected To Reach Initial Operating Capability, 1981-90 [a]

	Number of Systems
Total	165
Reached IOC during 1981-82	40
Under development (known and projected)	160
Expected to be canceled	−15
May not reach IOC until after the 1980s because of development problems	−20

[a] Includes new and substantially modified weapon systems. There is a broader definition of development programs that includes civil space systems and major subsystems of weapon programs such as an ASW system for a ship. Using this definition, the Soviets have conducted more than several hundred programs each decade.

Number of Weapon Development Programs

The Soviets are expected to introduce considerably more new or substantially modified weapon systems this decade than during each of the past two decades. In the 1960s and 1970s approximately 140 different weapon systems completed their development cycles in each decade, reached IOC, and were deployed (see figure 1). During the 1980s, of the some 200 major weapon systems we believe will be under development, we expect as many as 165 systems to reach IOC (see table 1):

- About 40 of these began the testing stage in the 1970s and reached IOC during 1981 and 1982.
- Firm evidence exists that another 95 systems are currently still either in testing or some earlier stage of development.
- Another 65 systems are projected by some components of the Intelligence Community to be developed and introduced by 1990. This estimate is based on perceived force requirements and technological availability. The number of systems in this projection also was affected by references in intelligence sources on additional weapon systems under development—over 30—that we know very little about (and which have been excluded from our list of 95 firmly identified programs currently under development). The projection of another 65 systems, however, has been made without regard to economic constraints.
- Our data base indicates that about 10 percent of the identified programs under development in the 1960s and 1970s were canceled. We therefore estimate that about 15 programs of the 160 identified and projected systems under development in the 1983-90 period will be canceled.
- On the basis of past Soviet performance, and given the greater technological complexity of these systems, we believe that as many as 20 will experience substantial delays and probably will not be deployed until after 1990

The number of systems in this decade already identified as deployed or under development (135) almost matches the number that reached IOC in each of the two previous decades. It also represents a substantial portion of the 165 systems we project will reach IOC this decade.

Table 2
Soviet Weapon Systems Reaching IOC
by Five-Year Period, 1961-90

	1961-65	1966-70	1971-75	1976-80	1981-85	1986-90
Total	63	79	60	77	108 *	27 *
New	31	49	27	26	61	20
Major modifications	32	30	33	51	47	7

* Includes the 40 systems that reached IOC in 1981-82. It also includes the 95 systems firmly identified under development as of the end of 1982 for which we have estimated IOC dates. It excludes, however, the additional 30 systems we expect to reach IOC this decade, because we have no evidence at this time to determine whether they will be new or major modifications.

We almost certainly have not yet identified all the weapon systems under development [redacted]

[redacted] Additionally, Soviet practice suggests that many of the systems that recently reached IOC will undergo major modification or redesign in this decade to improve mission capabilities or to incorporate better subsystems. For example, many of the aircraft that either have reached IOC in the last several years or will soon reach IOC probably will be modified substantially before the end of the decade. Finally, much of the floorspace completed at key weapon design bureaus over the past several years probably will support programs not yet identified

Development of New Systems

The mix of systems introduced by the Soviets since 1960 indicates that the number of new versus modified systems is cyclical and that we are in the midst of a shift favoring the development of new-design systems. As a result, the Soviets are developing both in absolute and in percentage terms more new systems for the 1980s instead of relying heavily on—as they did in the 1970s—modifying existing designs to achieve a desired capability. In many cases, technological advances in weapon systems are made because of improvements to subsystems and components. As the Soviets continue to integrate these advances into their weapons, they often design new systems for them. The SA-14 shoulder-fired surface-to-air missile system, for example, was designed to replace the SA-7 system. The SA-14 was developed so that it could accommodate a newer and more advanced seeker, seeker electronics and cooling system, and propulsion system

On the basis of Intelligence Community classification of these systems, about 55 percent of those introduced during 1961-70 were new designs. During the 1970s, however, this portion dropped substantially, possibly because the Soviets wanted to exploit fully the advances in technology achieved during the 1960s. By the early 1980s, this trend had reversed again and, as reflected in table 2, new systems as a portion of the total number deployed began to increase

Our current data, as reflected in table 3, indicate that most new-design systems will be in strategic and tactical missiles (about one-third combined) and aircraft (about one-fifth). Another one-sixth of these will be in space systems. The remainder (roughly one-third) will be spread fairly evenly over the other five weapon categories. Missiles and land arms represent

Table 3
Firmly Identified Soviet Weapon Development Programs Expected To Reach IOC, 1981-90 [a]

Systems	Number of New Programs	Number of Major Modifications
Total	81	54
Principal land arms	11	16
Missiles		
Air-to-air and air-to-surface	7	1
Cruise missiles	4	2
SAM/ABM	5	5
ICBM/SLBM/IRBM	5	11
Short-range/naval	3	1
Ships	6	0
Submarines	4	5
Space	13	8
Aircraft/helicopters	18	5
Laser	2	0
Other weapons	3	0

the largest share of modified systems—about two-thirds combined. The remaining one-third of the modified weapons will be for space systems, aircraft, and submarines.

Unusually Costly Development Programs. Of the new systems being developed, a greater number than in the past require substantially more resources to develop. The higher cost for many of these systems stems in part from the incorporation of considerably more high technology than is considered typical for a new Soviet weapon system. As such, these systems may well incorporate major development and resource risks because the Soviets have yet to apply a new technology to a specific weapon design.[a] During each of the past two decades, about 10 of these unusually costly programs were developed. We believe that more than 20 of these systems are now being developed and are intended to reach IOC during 1981-90. These projects cover a broad range of military missions with apparent emphasis on space systems. (See table 4 for a listing of such systems reaching or expected to reach IOC in each decade.)

Willingness by the Soviets to undertake the development of these relatively expensive programs may represent some change in their approach to undertaking design efforts incorporating more innovative approaches. Generally, the Soviets have been reluctant or unable to incorporate major innovations in their systems. In the past they have preferred instead to develop new weapon systems by relying on a series of incremental steps. The weapons R&D establishment strove to minimize uncertainty to meet prescribed output norms upon which careers and bonuses are dependent. Their preferred evolutionary approach enabled the Soviets to keep acquisition periods from lengthening dramatically and, to some extent, to control costs through design inheritance—using common design features and off-the-shelf components from program to program. We calculate, for example, that the use of standard designs and components rather than the development of new ones reduced the overall R&D cost of the SA-5 system by approximately 17 percent. We estimate, however, that costs for the SA-10 were reduced by only 5 percent. These estimates are based on [redacted] analysis of the technical characteristics of the SA-5 and SA-10. The practice of introducing technology incrementally, however, reduced the Soviet chances of

[a] The AN-400 transport, a C-5A-type aircraft, is an example of an advanced system. It represents the first Soviet aircraft embodying wide-body and related technologies. Future large aircraft using this technology will not be considered advanced and will not cost as much because the development and manufacturing technology will already have been mastered

Table 4
Unusually Costly Soviet Weapon Development Programs, 1961-90 [a]

Reaching or Expected To Reach IOC During:		
1961-70	1971-80	1981-90 (Projected IOCs)
Moskva helicopter carrier [b]	Saturn-V–class space launcher [c]	Medium-size solid-propellant ICBM
Photoreconnaissance satellite (high resolution)	A-class attack submarine [b]	Large aircraft carrier [b]
Photoreconnaissance satellite (low resolution)	Kiev VTOL carrier [b]	Permanent manned space station
Freehand tactical fighter [c]	Salyut space station	Space plane
MIG-25 Foxbat interceptor/fighter	Dual spacecraft [c]	Space transportation (shuttle) system
TU-128 Fiddler fighter	SA-10 surface-to-air missile system	Electro-optical photosatellite
P-class submarine [b]	Photoreconnaissance satellite (high resolution, second generation)	Typhoon ballistic missile nuclear submarine [b]
ABM-1A antiballistic missile system	Launch detection satellite	AA-9 air-to-air missile
RORSAT Ocean reconnaissance satellite	ASAT interceptor	Short-range ground-based laser [d]
SS-7 ICBM	SU-24 fighter-bomber	Strategic ground-based laser [d]
AA-6 air-to-air missile		AN-400 wide-body transport aircraft
		Kirov cruiser [b]
		ABM-X-3 antiballistic missile system
		SA-X-12/ATBM (surface-to-air/antitactical ballistic missile system)
		Advanced RORSAT ocean-reconnaissance satellite
		Synchronous meteorological satellite
		Cosmos 929 for modular station w/Salyut
		SS-NX-20 SLBM
		New SLBM
		New Saturn-V–class space launcher
		Blackjack B-1–type bomber

[a] The higher cost for many of these systems probably stems from the incorporation of considerably more high technology than is typical for a new Soviet weapon system. (See appendix B for derivation of "unusually costly" criteria.)
[b] Costs for ships and submarines are based on the cost of the lead unit produced, which incorporates a large proportion of the R&D resources going to a program.
[c] These systems were in full development during 1961-80 but never reached IOC. Similarly, a few of the systems under development in the 1981-90 period probably will not reach IOC.
[d] Not based on detailed dollar costing. Their anticipated costs are based on the enormous capital investment already committed to the development of laser weapons.

realizing major gains in individual weapon capabilities.

Generally, the initial development of systems based on advanced technologies innovation is riskier since there is no similar system on which to pattern the development programs. There is, therefore, a greater likelihood that false starts and development problems will occur, usually resulting in a much longer-than-normal development cycle. Such long programs tie down design personnel and other assets, which drives up R&D costs. For example, the A-class submarine (a high-speed, deep-diving antisubmarine warfare submarine with a titanium hull) was under development for more than two decades before the first unit became fully operational, primarily because the technology needed for its development had not been established. In contrast, less technologically risky submarine programs that began at about the same time—the C-, V-, and Y-classes—required only eight to 10 years to become operational.

To some extent, the Soviets were probably less innovative in the 1960s because their R&D establishment was considerably smaller than it is today. The Soviets allocated their R&D resources more sparingly during this period and could afford to take on only a few risky programs requiring very large resource allocations. As their R&D resource base gradually grew over the years with the acquisition of new facilities and manpower, they could afford to undertake more higher risk development efforts. The evolutionary approach to weapons development probably has given Soviet design bureaus the confidence and ability to incorporate newer and more advanced technologies into their weapon systems. Also, the acquisition of Western military technology has probably enhanced the Soviets' ability to integrate this know-how into their own military systems and reduce associated risks. Nevertheless, we believe that the normal evolutionary design approach will still persist as the primary Soviet method of introducing new technologies in future systems.

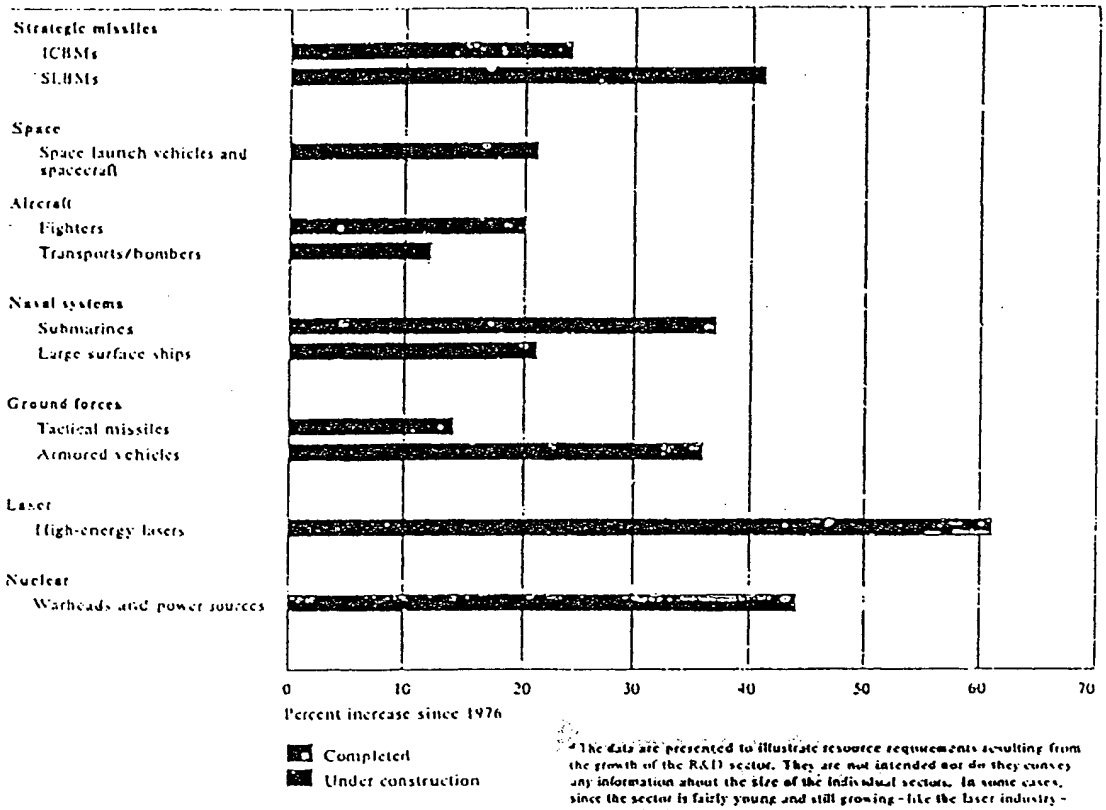
Expansion of R&D Facilities

In addition to the large number of systems under development, continuing construction at a broad range of military R&D facilities provides further indication of the Soviet commitment to military R&D programs during this decade.

bout one-half of the most important facilities are being expanded. The annual addition to floorspace through the mid-1980s will roughly equal that added annually since the mid-1960s

Missiles. The commitment to develop additional ICBMs and SLBMs remains strong. Since 1976, floorspace at the primary ICBM design bureaus has increased by roughly 70,000 square meters (or about 13 percent), and there are another 70,000 square meters under construction.[9] The facility for overall design of all SLBMs has grown by 50,000 square meters since 1976 (about one-third); an additional 10,000 square meters of floorspace is under construction. These investments appear to be consistent with a general movement toward the development and deployment of a larger number of solid-propellant missiles. They have also necessitated the establishment of a much larger development base for solid propellants. Floorspace for the nine primary solid-propellant R&D

Figure 2
Floorspace Expansion for Selected Categories of Soviet Military R&D*



* The data are presented to illustrate resource requirements resulting from the growth of the R&D sector. They are not intended nor do they convey any information about the size of the individual sectors. In some cases, since the sector is fairly young and still growing—like the laser industry—moderate absolute increases in floorspace will appear as relatively large percentage increases.

organizations grew steadily—over 5 percent annually—during the 1970s. Since the late 1970s they have continued to increase floorspace at about the same rate, adding over 80,000 square meters of floorspace, with 15,000 square meters more under construction. (S NF)

Space. The USSR is also preparing for a substantial buildup of its space program. Since the mid-1970s, the primary space development facilities have expanded by about 13 percent (220,000 square meters). Roughly an additional 100,000 square meters are currently being added. We have already identified [redacted]

new or modified space programs still under development and expected to reach IOC in the 1980s. [ ]known mission requirements indicate that a majority of these are newly designed systems that will be equipped with advanced attitude control and onboard processing capabilities. Among the numerous space development programs expected during this decade are a new modular space station, better intelligence and command and control satellites, a space shuttle, and new and larger space launchers capable of placing larger payloads into orbit."

Aircraft. The Soviets are continuing to expand their key aircraft design facilities across the board. Floorspace at fighter design bureaus is up by about 15 percent (roughly 30,000 square meters) since 1976, and approximately 10,000 square meters are still to be completed. Transport/bomber development facilities have been increased in size by about 10 percent since 1976 (40,000 square meters), and facilities encompassing roughly 10,000 square meters are under construction. We have already identified four new and two substantially modified fighter systems, three new and one modified transport aircraft, and one new bomber still under development—all are expected to reach IOC later this decade. These numbers will probably increase during this decade, since the Soviets historically have modified newly designed aircraft. Construction now under way also may support additional programs.

Naval Forces. Facilities that design submarines and large warships expanded faster during 1979 than during any other year since the mid-1960s. Floorspace for facilities responsible for submarine design have increased by over one-third since 1976, and design bureaus dedicated to large surface ships have increased by about 20 percent during the same period. We have identified several projects for Soviet naval forces expected to reach IOC later this decade. They include two new and possibly four modified submarines as well as a new large aircraft carrier and a guided-missile cruiser. Because the Soviets introduced over 25 different classes of surface ships during each of the past two decades, we expect to discover more than the two identified so far, especially since recent expansion of facilities is comparable with that of the past.

Ground Forces. The Soviets are continuing to expand the facilities that develop land arms. Those developing missiles for use by the Ground Forces—surface to air, antitank, and short-range ballistic—have added about 10 percent more floorspace since 1976. Those developing armored vehicles grew by over 30 percent during the same period. We have already identified 11 new and 16 modified land arms that will be introduced during the 1980s. Land systems frequently are not discovered until very late in development or, in some cases, after deployment. Because facility expansion has not slackened, we anticipate that more systems will appear later this decade

Lasers. The resource commitment to R&D on lasers and related technologies is one of the strongest of any research area in the USSR. By the mid-1970s, about 350 facilities had been identified as being involved in some type of laser research. Floorspace at 15 of the largest and most important high-energy laser facilities known to be involved in weapons research expanded by more than one-half (over 200,000 square meters) since 1976, with another 40,000 square meters under construction.

The Soviets appear to be moving closer to developing a deployable laser weapon and by the decade's end probably will field several full-scale laser weapons. [ ]

[ ] In addition to large-scale laser weapons, the Soviets are developing more systems that incorporate laser technologies, such as laser-guided weapons.

Nuclear. Resources allocated to develop new and improved nuclear explosives since 1978 have been growing as fast as during any other four-year period

since 1963. The two main nuclear warhead R&D facilities have added about 100,000 square meters of floorspace during this time—an increase of about one-third—and currently have another 40,000 square meters under construction. These increments probably are largely in support of new developments in fission and thermonuclear explosives, although some of it may be for nuclear power sources. Some of this investment probably also is for the development of enhanced-radiation weapons and smaller, more efficient fission weapons to be used on delivery vehicles such as cruise missiles.

Facilities engaged in R&D of nuclear power sources and known to be working on military projects have been expanding faster than any other type of R&D facility in the Soviet Union [redacted] The types of activities these facilities are engaged in include R&D on accelerators and magneto-hydrodynamic generators that could be used to power laser weapons, submarines, and large surface ships, and nuclear power in general for a variety of applications, including nuclear energy for civilian use

Implications for Future Investment Decisions

Although the USSR is experiencing economic difficulties, top-level planners appear to be following a planned course of steady improvements to defense through increasing allocations of resources to their military R&D programs. This is apparent not only in the number and quality of the weapon systems under development but also in the expansion of R&D floorspace. Expansion since the mid-1970s has not slowed and has increased in some weapon areas.

If, as we believe, the growth of the Soviet economy continues to decline, or even stabilizes at the recent low rates of growth, growing outlays connected with the development, production, and maintenance of complex and costly weapon systems will further aggravate competition among claimants for increasingly scarce investment resources. If the Soviets, however, are successful in relieving bottlenecks that have plagued the Soviet economy, some improvements in labor productivity and overall economic growth could be achieved.

Over the past several years, the leadership has indicated that it expects the defense industries to assist in the R&D and production of higher quality products in the civilian machine-building sector. For example, the Soviet Government recently instructed the defense industrial ministries to help produce turbines for their gas pipeline program. Such a step probably was required because of the technological backwardness of the civilian turbine industry which, according to a recent [redacted] lags behind technology for aircraft engine turbines by about eight years.

Other evidence suggests that some key military R&D facilities have been ordered to assign some of their scientific and technical personnel to civilian R&D efforts [redacted] that the institute was to receive a 6-percent increase in its 1982 budget but that 3 percent of its scientists were to be transferred to the civilian sector to help productivity there.

There is plenty of room in the defense R&D community to accommodate other types of contributions to the economy. The Soviets continue to use their R&D manpower inefficiently despite repeated attempts by planners to rectify this problem. For example [redacted] indicate that full-employment policies at some weapon design bureaus result in large portions of the engineer force working primarily on "nonproductive" tasks when the design bureau is between development programs (see inset). During such "down periods"—which sometimes can last over a year—these military R&D resources could be used to develop civilian goods, particularly for bottleneck areas. For example, the design teams that develop turbine engines for aircraft could just as well help to design badly needed and more powerful stationary turbine engines for the gas pipeline project.

Inefficient Resource Utilization in Soviet R&D: The Case of the Ilyushin Aircraft Design Bureau

The Soviets continue to use their R&D manpower and facilities in a relatively inefficient manner. Soviet full-employment policies stipulate that no reductions in the work force take place during transitions from one development program to the next or when complications are encountered in development programs. In such cases, large amounts of capital and labor lie idle or are not used productively.

For example, in 1965 the Ilyushin Design Bureau (KB), which designs military and civilian transport aircraft, had completed development of the IL-62 but had not yet completed preliminary design—the design stage before full-scale development—of the IL-76. Consequently, most of the design bureau and its experimental production plant were left without work. A [redacted] who worked as [redacted] at the Ilyushin KB during this period claimed that this idle period lasted from mid-1966 to mid-1967 and estimated that several thousand employees were affected, including at least 1,000 engineers. None of the workers were laid off. Instead, the engineers were given busy work such as accumulating data on the performance and reliability of aircraft in service or reviewing detailed scale drawings for almost every aircraft designed by the Ilyushin KB, even for aircraft that had long been retired from service.

We have analyzed the employment level and the aircraft programs developed by the Ilyushin KB since 1960 (see figure 3). Manpower allocations for individual programs—shown by the individual trapezoids—were estimated on the basis of development milestones, the degree of technological innovation, and the level of employment at the KB. The large dip in utilized manpower during the mid-1960s represents the idle period caused by the delayed transition from the IL-62 to the IL-76 program.

[redacted] claim that similar idle periods occur when development difficulties delay weapon programs. Taken in the aggregate, these employment policies along with the lack of project diversification at R&D facilities can result in a substantial pool of R&D resources being paid for but providing little or no return. If Soviet KBs were charged to take on civilian projects during the "down" periods, they could be used to advance selected areas of civilian industry.

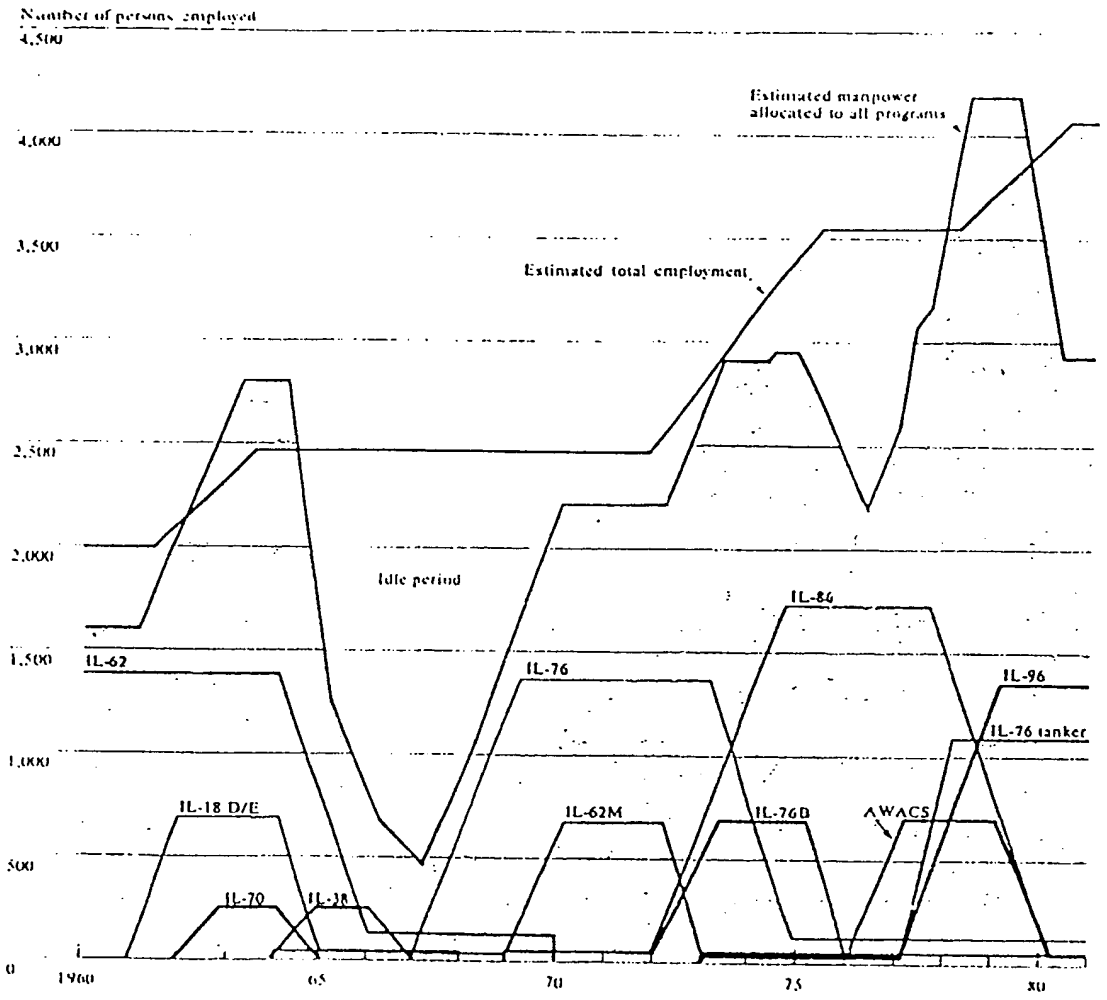
Outlook

If the Soviet Union follows present trends, it is likely that they will develop a greater number of systems during this decade than in the 1960s and 1970s and that a larger proportion of those developed in the 1980s will be more costly and technologically advanced. A speech by the late President Brezhnev in October 1982 underscored the Soviets' intention to integrate the "latest achievements of science" into the armed forces and claimed that any technological lag by the military "is inadmissible." This speech is in line with a series of statements made by top Soviet leaders in recent years that have specifically singled out military R&D as one of the areas in which they plan to forge ahead and to do "everything possible" to stay abreast of Western military developments.

If Soviet leaders decide, however, that increased transfers of R&D resources from the military to the civilian sector are militarily prudent and economically necessary, they could exercise several options that would minimize, to varying degrees, the military costs associated with these cutbacks. Three of these options are discussed below.

Cancel or Cut Back Programs. Substantial savings could be obtained if the Soviets reduced the number of programs in train by canceling systems in development and entering into production only those systems that they perceive to be crucial to military missions. Given the high number of systems available, they

Figure 3
Manpower Allocation at the Ilyushin Design Bureau, 1960-81



could choose to produce fewer systems and yet improve their overall capabilities by selecting the best of the many that will be available during this decade. The Soviets might also moderate the growth of R&D allocations by deferring or curtailing less crucial programs. This would free some R&D expertise that could be used to work on key civilian projects, especially if weapon design bureaus diversified their product lines.

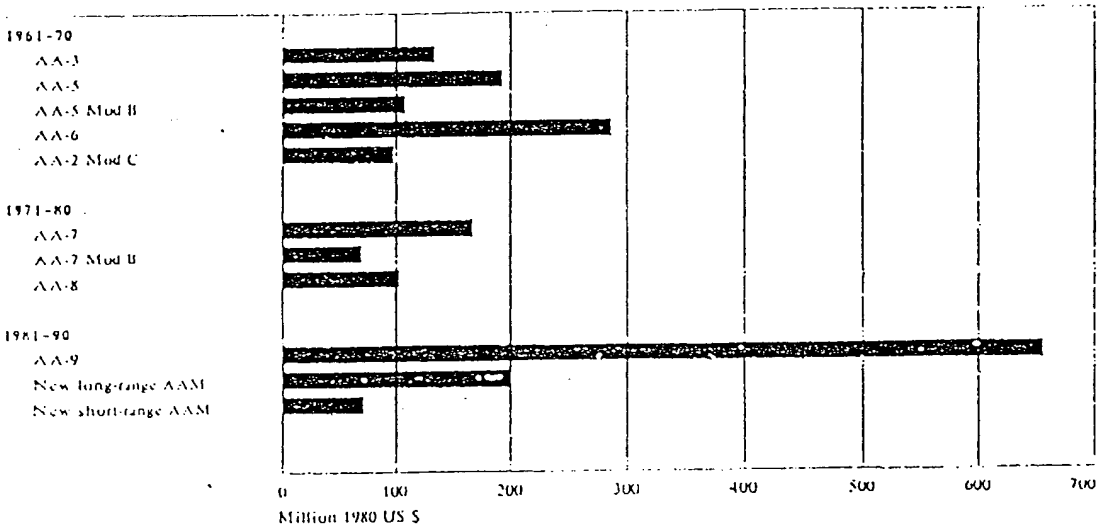
Develop Fewer Modified Systems. The Soviets could save resources by developing far fewer modified systems and concentrating on development of new systems that provide substantial—rather than incremental—increases in capability. If the resources were reallocated to develop more new systems, the Soviets might be able to introduce more quickly newer technologies and capabilities. Even though new systems generally cost more than modified systems, by using this approach and canceling enough modification programs they could save the considerable R&D resources expended annually to upgrade existing systems. The Soviets then could deviate from their strategy of procuring a large number of modified systems (at great expense) that increase capabilities only slightly. This probably would entail some refocusing of their current penchant for developing single-mission weapons to developing more multipurpose systems, similar to the US strategy for weapon acquisition. We already have some limited evidence—from aircraft development programs—that they may be moving in this direction

Exploit Arms Agreements. By taking advantage of the current interest in arms agreements relating to strategic and general purpose forces, the Soviets probably could tailor the agreements to suit both military and economic needs. By dampening the arms race, specific cuts in military R&D programs could result in diversion to the civilian sector—especially bottleneck areas—the skilled labor, high-quality plant and equipment, raw materials, and energy currently used to develop weapon systems. For example, limitations on future development could be used to buy time to develop new systems to meet specific needs rather than perpetually improving capabilities across the board

If the Soviets find it necessary to limit R&D resources going to military programs, our judgment is that they probably would choose an acceptable combination of each of these options. At a minimum, the Soviets are likely to intensify their efforts to improve the efficiency of the defense industries and to transfer technological know-how to civilian projects. If transfers of resources from the military to the civilian sector were deemed necessary, the Soviets could in a relatively short period turn over defense resources in some areas such as transportation, where armored vehicle engineering talent and facilities, for example, could be employed to develop more capable tractors, trucks, and locomotives. Massive outright transfers of resources from military efforts to civilian projects are unlikely in the near term, especially in those areas such as guidance and control for ballistic missiles, where technological know-how is not easily applied to civilian products. In the longer term, however, pressures for transfer of military R&D resources to civilian use may become more intense if shortfalls in industrial productivity continue to exacerbate economic difficulties

Appendix A

Figure 4
Estimated R&D Costs for Soviet Air-to-Air Missiles*



Appendix B

Estimating Soviet Weapon System R&D Costs

Detailed estimates of Soviet R&D costs in dollar terms for individual weapon systems were made by [redacted]. The estimated costs basically reflect what it would cost in the United States to replicate Soviet R&D of a weapon system. These estimates take into account the known Soviet design features of each system and known or estimated program milestones. The costs include estimated expenditures for setup and tooling, materials, engineering, prototype fabrication, and test and evaluation. They do not include predevelopment costs, such as basic research and concept design

The estimated R&D costs are an economic reflection of weapon system characteristics and technology and generally correlate with the designations of "new" or "modified" as used in this paper. New weapon systems incorporate innovative designs that embody little design inheritance from previous systems and are relatively more costly. Conversely, modified systems incorporate evolutionary designs or redesigns of existing systems and in general cost less.

After all systems have been costed within a weapon category—such as ICBMs or air-to-air missiles—they are compared within each decade to determine which are unusually costly development programs. Figure 4 portrays an example of this analysis for air-to-air missiles. Two missiles—the AA-6 and the AA-9—were considerably more costly as compared with comparable systems developed in the same decade. On this basis these and other such systems were included in table 4. Not surprisingly, these two missiles embodied considerably more advanced technology than other such systems developed during the decade

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Appendix C

Identified Soviet Weapon Development Programs
Expected To Reach IOC During 1981-90 •