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potential of each weapon and each launching system. Resulting from increasing dependence upon technological superiority to redress numerical imbalance, this preoccupation probably accounted for early failure to assess properly those operational characteristics which are sensitive to combat degradation through countermeasures or suppression. The Soviets took a different view, measuring effectiveness in terms of the role of the ATGM on the rate of advance and time required to achieve combat objectives. This aggregated view permits consideration of less finite factors such as disruption and suppression and their effect upon force mobility.

- It appears that the introduction of ATGMs had profound implications in the doctrine and materiel channels with relatively minor implications in organizational channels of both countries. Although possessing superiority in numbers of tanks, the Soviets are fielding ATGMs in vehicles that have specific tank destroyer roles. This may suggest a forthcoming change in Soviet organization and an additional step in ATGM development, again well ahead of U.S. development.
- As to battle management automation, technological application by the two countries has been quite different. The United States had a significant lead in computer technology over the Soviets but for a variety of reasons did not apply this technology to combat operations except in analytical modelling. As the United States was striving at various echelons to determine what it wanted computers to do, the Soviets were following their top-down approach by formulating at a high level their automation needs along with accompanying doctrine and training programs. [redacted]

[redacted]

A Soviet artillery fire control system similar to TACFIRE has been developed and tested successfully, and may be

fielded before the comparable U.S. system. Somewhere in the developmental process, the Soviets have overcome the U.S. lead in the battlefield application of computer technology.

III. NATIONAL GOALS, MILITARY POWER, AND TECHNOLOGY IN RECENT HISTORY

PERCEPTIONS OF CONFLICT

(U) Jervis has noted[1] that a country is most affected in its views of conflict and, for that matter, in its relationship to potential adversaries, by its experience in its *last* major war. This effect is not surprising; it has often been noted that the military seems to be preparing to fight the last war again. This factor does introduce the undesirable effect of inhibiting the ability of a country to adjust its perceptions based on changing circumstances and differing power relationships.* Further, it inhibits the ability to recognize the impact of changing technology. A noteworthy example is the fact that the United States has had air superiority in recent wars, with the result that such superiority continues to be assumed for ground combat forces and key rear area facilities. In contrast, the Soviets, who experienced severe losses from German air attacks on their ground forces in World War II, have configured an air defense system to preclude such circumstances in the future. Their emphasis on air defenses is strengthened by the fact that Soviet military leadership since World War II has been dominated by ground force officers, many of whom experienced firsthand the effects of German air attacks. Jervis emphasizes that firsthand personal experience has a profound effect on the perspectives of individuals--a key point in examining the factors that affect the process of developing and incorporating new technology. This firsthand experience, whether by individuals or by nations, will dominate the lessons that might be learned from the experience of other countries in other wars,** and

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*(U) We attribute perceptions to nations, although, of course, only people have perceptions. The collective perceptions of a group of individuals often form the basis for the direction and actions of a nation for a period of time, but other individuals or groups will continue to have differing perceptions that may temporarily be less influential. For convenience here, we adopt in this exposition Jervis' formulation of a collective perception, giving a country the ability to perceive.

**(U) There is, however, some transfer from another nation's war experience. The United States has learned from the 1973 Middle East War and has put greater emphasis on numbers of ATGMs and the mobility and protection of ATGM operators. On the other hand, the United States has moved slowly to shore up its lagging ground based air defense, suggesting that such transfer may be selective in application.

even of a nation's previous wars, which become increasingly distant in time and experience.*

A key question posed by Jervis is why the last war of a nation should be expected to be a valid model from which that nation forms its images of war. As an example, countries can reject pursuit of a technology because their initial experiences with it in war was unsatisfactory. The Germans and French were inhibited from taking advantage of machine-gun technology in the late 19th century by its apparent ineffectiveness when used by the French, in the Franco-Prussian War, as an artillery-type weapon. The British, on the other hand, suffered no such inhibition, since they had not been a participant in the war, and could see beyond this initial, poor application of the technology.**

The Soviet Experience in World War II

The influence of past wars on the present is very well embodied in the Soviet propensity to apply their experience in World War II to the present in a continuing flow of exhortations, anecdotes, and analyses of their experience against the Germans.***

The profundity of the experience can be gauged by the loss of about 25 million Soviets in that war, including 13.7 million dead or missing military personnel and 11 million dead civilians, the destruction or capture of almost incomprehensible quantities of equipment, and the ravaging of the Western USSR by the Germans.(13) The United States must go back to the Civil War of over a century ago to find a national wartime experience that even remotely resembles that of the Soviets. A brief review**** of some Soviet experiences will

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*It should be cautioned, however, that a nation's experience in earlier wars probably has a sufficient effect on its perceptions as to affect its conduct of the next war, so that in fact all of a nation's wars exert an influence on the present through such mechanisms.

**From a discussion in Ref. 1, based on *Machine Guns*, G. S. Hutchinson, Macmillan and Co., London, 1938.

***The Soviets have also been able to develop military doctrine in areas not specifically covered by past experience. Note, for example, their doctrine for the use of nuclear weapons in a theater offensive. (See, Douglass, Ref. 12.)

****This review draws heavily on Ref. 13.

aid in identifying some factors that affect the Soviet perceptions of the nature of conflict.

The most striking characteristics of the war were the magnitude of the forces engaged in conflict and the unparalleled destructiveness. Russia's original tank and aircraft inventory, the largest in the world, was essentially destroyed in the first year. This was not so bad as might appear, since the equipment was largely obsolete and technically inferior to that of the Germans. Heroic efforts in the Soviet production of military equipment, including about 100,000 tanks(14) in the course of the war, were instrumental in keeping the Soviet going. The vastness of the USSR and the endurance of the Soviets in the face of such losses made a deep impression on the Germans and eventually weakened their will. The Germans suffered such high losses that eventually they were unable to compete with the Soviets because of their inability to replenish losses as rapidly as the Soviets. As the war continued the Soviets gained increasingly greater advantages in force ratios. This was particularly true with artillery, which was used in vast quantities to blast open the German defenses. The Soviets quickly improved their technical capability and produced large numbers of reasonably capable weapons.

The Germans were successful when they fought a mobile battle; in 1941 when they mounted a rapid offensive, their success was astonishing. The Soviets, who had not planned for defensive operations, were in disarray with disruption of control and inability to react and regroup. But the Soviets were able to buy valuable time: in late 1941 German mobility was frustrated by the poor Soviet road network and the severe mud and winter conditions--an experience paralleled by that of Napoleon over a hundred years earlier. Time gave the Soviets the opportunity to change their strategy and their military leadership, while enabling replenishment of losses through recruitment and training of personnel and production of new equipment. After the 1943 Battle of Kursk, the Soviets acquired the initiative and began a series of offensives that by 1945 became increasingly more rapid in execution.

The enormous turnover of men and equipment during combat caused the adoption of the Soviet system of replacing entire units as they

become ineffective. The lack of education and mechanical and technical skills by soldiers necessitated maintaining a simplicity in operational factors for equipment and a rigidity in patterns of operation. Soldiers were responsible for only one or two types of infantry weapons; artillery fire control procedures were simplified, using point and shoot direct fire for division artillery. Soviet soldiers exhibited seemingly contradictory qualities of courage and cowardice, tenacity and indifference. Reliability and initiative of soliders and officers have been historic concerns throughout the history of Russian military operations, and World War II was no exception.

> In large part because of the recent purges, corps and division commanders lacked initiative, experience, and training. Newly promoted officers attempted to compensate for their lack of experience with blind obedience to orders from above. This, combined with Stalin's executions of unfortunate commanders early in the war, reduced flexibility and initiative at all levels, resulting in dogmatism and preference for fixed formulae even when they were contradicted by reason or experience. Conformity was a prerequisite for survival.(13)

The World War II experiences continue to exert a strong influence on Soviet individual and collective perceptions of future conflict. They seem to accept as a fact of life that war is incredibly destructive; despite which they have demonstrated that Soviet survival and victory are possible, a view required by Marxist-Leninist doctrine. The realities of warfare dictate that victory will not come easily, that combat is an ordeal for which intense preparation and training are required--only hardened soldiers will be able to endure. The speed of operations is of paramount importance in keeping the enemy off balance and unable to react. Equipment that is complex in operation or fragile in design will be of little use under the intensely stressful conditions of modern warfare. Large numbers of weapons, technologically comparable to those of the enemy in attributes that matter in warfare, are required since large numbers will be lost in battle. Such Soviet images of future warfare differ in many ways from U.S. perceptions.*

*The tremendously high rates of consumption and destruction witnessed in the 1973 Middle East War apparently came as much less of a surprise to the Soviets than to the United States observers.

The United States Legacy

Although the United States suffered the effects of a highly destructive war over a hundred years ago in the Civil War, its conflicts since then have largely been overseas, with the homeland remaining safe. This geographical isolation from the theater of conflict has been a powerful factor in U.S. policy considerations. In a more extreme form, it was manifested during the Vietnam War in the objective of attempting to isolate the United States from experiencing any major economic impact as well.

During World War II the United States produced 80,000 tanks,(14) although in 1939 it had a negligible tank inventory and no plans for such production. The war was destructive of personnel and equipment, although not in the quantities that the Soviets experienced. The United States succeeded not because its equipment was superior but rather because its resources were so great compared to the Japanese and to the Germans. Despite the World War II experience confirming that destruction of both personnel and equipment is a reality of war, the United States has adopted the option of attempting to develop a capability for warfare in which friendly casualties are reduced through the expanded and more efficient use of materiel. Conservation of manpower and low personnel casualty rates are important considerations for U.S. officers. The use of firepower to reduce friendly casualties was carried to great lengths in Vietnam, where commanders habitually substituted artillery fire and air strikes for small unit maneuver, this in response to political pressures from home and the propensity to measure U.S. success in terms of the ratio of enemy body count to friendly (particularly American) losses.

Since World War II, it has been an American article of faith that the United States should be able to develop a conventional military capability with sufficient technological superiority to make it unnecessary to match Soviet equipment and personnel strengths. Until recently, this feeling of technical superiority was reinforced by the tendency to portray only a notional enemy in Europe, without examining Soviet doctrine or capabilities in a meaningful way. Thus, the development of U.S. military forces proceeded with insufficient regard

of what a wartime environment might actually be like, and, as will be shown later, led to neglect of reality in such developments as anti-tank missiles. Developments in military forces proceeded in ways suggecting that peacetime considerations dominated concerns for employment in combat.

Following World War II the United States (and NATO) moved toward a defensive strategy in Europe, posturing its forces to respond to ground attack by the larger forces of the Soviet Union and its allies. Defensive tactical doctrine was based on an area or position defense, suitable more for the United States view of World War II than the war in which the Soviets and Germans fought.(15) This posture persisted until a reexamination of the U.S. position in Central Europe occurred at about the same time that the 1973 Middle East War reemphasized the speed and lethality of armored conflict. The reexamination has led to the formulation of new tactics, with an attempt to configure forces to deal specifically with current Soviet armored capabilities. This change has caused an increase in attention to how the Soviets might fight, which may lead to a more sober appraisal of what war might be like. Furthermore, significant changes in weapon systems and force structure are occurring, although budgetary implications of these changes and increasing the emphasis on ground forces have yet to become public issues. In particular,(15) training costs will increase in the future. To the extent that warfare is perceived to be more like the Soviets portray it, the military burden would increase as demands on personnel and equipment (including quantity) are increased.

It is particularly interesting to note the image of the electronic battlefield that has emerged in the United States in the past decade. This image of war has been fostered by extreme claims for the effectiveness of precision weapons and sensors by developers of such technology and by those how desire a battlefield where friendly lives are rarely at risk. Although it is likely that such technology will play a crucial role on the battlefield, these portrayals suggest that such a battlefield exists today,* or that an automated battlefield is imminent.

*It is often the case that once the technology for future military equipment is described, the time delay until its introduction is ignored, and its existence on the present battlefield is assumed.

Moreover, the implications of enemy actions that might interfere with the technically complex operations of such an array of equipment are greatly underestimated in the zeal to extol its virtues.

THE MILITARY BURDEN

The dilemma that the United States has gotten into in its land warfare force posture is portrayed by Burke.

> That the United States cannot hope to match the Soviets' quantitative advantage in military power is a basic precept of U.S. defense planning. The numerical imbalance being an unalterable reality, we look to technology for salvation, reasoning that qualitatively superior combat systems, the product of an advanced industrial base, and sophisticated management techniques will at least fill the gap. (16)

It has become axiomatic that for ground forces the United States will not attempt to match Soviet strength, in either numbers of personnel or equipment, and likewise that NATO will not undertake to match the Warsaw Pact, although the Western powers have a greater combined population and a greater productive capacity. The numerical imbalance thus represents a deliberate choice as to how great a military burden, and in what form, each side is willing to assume.*

Quality Versus Quantity

Following World War II, technological superiority for the United States was represented by its nuclear weapon monopoly. A choice was made to allocate resources more to domestic needs and less to active military manpower and conventional weapon development and production. This posture was justified by the long-standing assumption that the Soviets (and the Chinese), although quantitatively superior, were technologically backward. The position has been supported over the years by additional judgments or assumptions. Originally, a clear superiority in nuclear weapons was viewed as a compensating factor,

*The effect on the perception of the military burden caused by the social changes in the United States in the 1960s and 1970s has probably been considerable, but is not discussed here.

preventing overt Soviet aggression in Europe. Later, as nuclear superiority became less apparent, the possibility of an escalation from conventional to unlimited nuclear war was viewed as something the Soviets would dare not risk. Furthermore, conventional wisdom held that strength in Europe could be built up in time of crisis through reinforcement by additional U.S. active forces and, with sufficient warning time or for a long enough war, from reserve forces. Appeal has been made to the ability that the United States demonstrated in World War II to produce vast quantities of war materiels, although such a rapid conversion to military production is no longer feasible. In fact, one of the major differences in how the United States and the Soviet Union develop new military equipment is the major role played by producibility in quantity in Soviet design.

For the Soviets in World War II, high production, external aid, and greater sources of military manpower defeated an enemy who was technologically (and initially militarily) superior. Numerical superiority was important but was clearly not enough. Thus, the postwar goal was set of achieving technological comparability, employing lessons learned from successes in World War II. Such lessons suggested development of simple weapon systems, producible in large numbers and capable of being operated by relatively unskilled personnel. Emphasis was indicated on key features, such as weapon lethality in the case of tanks, and performance characteristics that are satisfactory when large numbers of systems are operated in stressful, degraded battlefield conditions. The Soviet approach requires both quantitative superiority and technological comparability, neither of which is particularly risky or uncertain, but both of which require a sustained national effort. In contrast, the American approach (accepting quantitative inferiority but redressing the imbalance with superior technical performance) places greater demands on high performance and entails greater uncertainties and risks, both in the development of equipment and in its employment. This apparently lightens the military burden.

The sustained Soviet efforts have, in fact, resulted in technological comparability for its ground forces relative to those of the United States and NATO. This has not resulted so much from spectacular

technological innovation as from a deliberate, long-term effort. Soviet ground forces in the last 15 years have received a priority among the services second only to the Strategic Rocket Forces in the resources allocated to R&D and procurement. Such a priority can be laid to several factors, among which is the predominance of ground force officers in the military hierarchy. Also, the Soviet Union as a continental power has required little from its naval forces until recently. 1.825 million of the 3.675 million Soviet armed forces personnel are in the ground forces.(17)

The roughly equal division of resources among the three U.S. services seems to be an institutional necessity rather than the result of analyses of national needs. For the Army, with its greater manpower, this results in far less available for the development of new equipment. Consequently, programs competing for scarce resources must appear to offer spectacular improvements in capabilities. Such improvements come largely through advanced technology and are difficult to achieve; a pattern of disappointment emerges from consequent failures, delays, and performance that is lower than expected. Advanced technology becomes both the salvation and the culprit. Morse has noted that "any suggestion for significant changes in military systems or thought always raises a host of questions and leads inevitably to a series of investigations whose effect is often to study new proposals to death, thus preventing or interminably delaying their adoption."(18)

In Burke's view(16) a serious logical dilemma for the ground forces is posed by national attitudes toward resources for ground forces and the need for technological superiority:

(a) the technology, whether or not possible, has not yet been proved;

(b) such costs in present programs, as well as the momentum of on-going developments, are so great that new programs are infeasible; and

(c) that in any event it is unrealistic to expect quantum change, except possibly over a period of several decades . . ..

Although the United States has great economic resources and an advanced technical base, it has to focus on extraordinary jumps in capability through the incorporation of new technology. This results from an historical national distast for the costs imposed by the military burden and the lack of a long-term military technology development strategy.

At this point, despite a host of possible technological improvements for U.S. conventional ground forces, it is questionable whether continued confidence in the counterbalance derived from American technological superiority is warranted. Jervis[1] has pointed out how, once an image is established by policymakers, image stability persists despite evidence to the contrary, and basic assumptions that are the foundation of such an image are not questioned. Only reluctantly do individuals reexamine their perceptions, and then only when discrepant information becomes impossible to explain away or fresh outlooks are brought in by outsiders or new faces. It seems quite appropriate to apply these notions to the basic assumptions being discussed. That is, *the United States may not really be capable of matching Soviet quantitative superiority with its technology*. Furthermore, the Soviets are not nearly so backward in technology (particularly for land warfare). Finally, the precept that the United States cannot match the Soviets quantitatively could be reexamined.

As an example, much of the concern about the imbalance of forces in Central Europe is portrayed by the citation of the imbalance in the number of tanks. A great deal of effort and resources have been devoted to the development of antiarmor equipment and forces that are the hope for alleviating this problem. Throughout this effort the focus was on the achievement of superior technology, rather than the quantity of equipment to be fielded. Until a year ago the Army procurement plans for the XM1 tank, as stated to the Congress, called for a total of about 3300 tanks. The total number was so low because the cost of higher number might have jeopardixed the program. It is quite conceivable that 10,000 to 20,000 such tanks could match the Soviets both qualitatively in the NATO-Warsaw Pact tank balance, alleviating anxiety over force imbalances, yet the military burden imposed by the procurement

and operation of such forces is judged by U.S. standards to be unacceptable.*

Differing Views of the Burden

It is difficult to identify the underlying aspects of the national character of the two countries that leads to such different national outlooks toward the military burden. One factor, as suggested earlier, is the difference in national suffering from the effects of war. The Soviet leaders are clearly determined to assure themselves that their national territory will never again be a battleground. Lambeth has suggested that ". . . Soviet military men are not fundamentally different from most other professional soldiers the world over: knowing more intimately than anyone else what the real rigors and agonies of combat are like, they are the last to seek a fight, the least convinced things will go easily, and the most acutely sensitive to the fact that one can never be sufficiently prepared."(19)

Soviet doctrine requires that their ground forces must be continually capable of preventing foreign invasion along the historic routes from the West and the East. Even though their strategic force cannot prevent catastrophic damage from intercontinental nuclear war, it nevertheless remains a national goal to continue to strive for a combination of offensive and defensive capabilities that would permit such security. The Soviets apparently do not view such defense matters in terms of maintaining a level of adequacy or sufficiency that entails an acceptable level of risk, but rather to justify greater efforts as offering additional security. More is better, or, as Lambeth has suggested, "Too much is not enough."(19)

Jervis has suggested several features of the American cultural and historical experience to which national aversion for assuming the military burden could be attributed.

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*It should be noted that emphasis on tank imbalance is a simple portrayal of the deeper concern about the imbalance of the forces as a whole; the simple measures used to portray these imbalances are inadequate.

> First, economic plenty has encouraged the belief that choices can be avoided by expanding the pie. Second, liberalism with its emphasis on harmony of interests is not conducive to the examination of trade-offs among important values. Thus, many aspects of American culture share an optimistic outlook. . . . A third strand has been provided by America's international experiences. . . . America's advantageous geographical position has permitted her great freedom of choice. Enjoying a large element of 'free security,' the United States has not had to make the same hard choices that others have faced. American statesmen have been slower to perceive trade-offs because in their benign environment they have had to make fewer sacrifices.(1)

Since the beginnings of the modern Soviet state in 1917 there have been two competing viewpoints in the United States regarding relations between the two countries. The conciliatory view emphasizes the reduction of tension through cooperation, with at least a tentative willingness to trust in the good will of the Soviets and their sharing of mutual interests in the world order. The hostile view emphasizes the aggressiveness of the Soviets and depicts the relationships in terms of adversaries and competitors. Jervis has described these viewpoints as spiral and deterrence theories. In terms of military competition, spiral theorists tend to see conflict, or an arms race, emerging because one side unnecessarily threatens the other through an improvement in its military posture, while deterrence theorists see conflict emerging from one side signalling its lack of will or its weakness to its aggressive competitor. The causes of World War I appeal to the spiral theorists, while deterrence theorists concentrate on the origins of World War II. One or the other (or both) of these viewpoints has held sway in the United States over the years in its attitude toward the Soviet Union. Much of the current debate in the United States over its military posture emanates from differing viewpoints of the long-term nature of the U.S.-Soviet relationship.

Jervis has suggested that the adherents of both of these viewpoints are overly zealous. The world is more complex than those with either of these views can readily admit. There is an American propensity to avoid long-term struggles and adopt a strategy that offers security without anguish. The Soviets in many aspects have a hostile view toward their competitors and view themselves as part of a long-term

struggle in which military power plays a key role. Yet, they can drive improvements in military power through incremental changes that accrue dividends over a long period of time. Advantage is only emphemeral, and the struggle to remain successfully competitive must be constant.

TECHNOLOGICAL CHANGE

Although at any given time it may appear that change and modernization in military forces are agonizingly slow, observations made every ten years would reveal rather startling differences in many military systems, while some would look nearly the same. Sometimes the changes appear naturally and are welcome, while other changes appear to some to add unnecessary complexity and are resisted.

Patterns of Change

Although obviously both Soviet and American land warfare forces are undergoing considerably change, there are some important differences in both the type and rate of change and the inclinations of all interested parties to accept change.

One useful characterization is that the Soviets tend to see technological change in military systems as a natural process that can be fostered by developing and maintaining a continuous stream of technological developments in all the areas that can contribute to the continued improvement and modernization of military systems. New systems can be viewed as natural products in a stream of development, and as contributing to a military function that requires the concurrent development of other elements as well. Although American military systems also derive from a continuously evolving technological base, new military systems that are developed and produced are treated more as discrete products, both in terms of their function and in relation to their predecessors and their eventual replacements.

Another way of portraying this difference is in terms of how the problem of technological obsolescence is dealt with. The problem can be characterized by two dilemmas: (1) modern military systems typically have operational system lifetimes that are considerably longer than the natural time between successive generations (i.e., they live too long),

and (2) in many cases the rate of improvement of key subsystems technology is so rapid that, as a result of lengthy development time, new systems appear obsolescent while in development and obsolete shortly after they are fielded.

This spiral of change may cause less anxiety for the Soviets than for the United States. Such change is entirely compatible with basic Marxist-Leninst dialectic principles. For example, the dialectic view suggests that any particular weapon system not only can be improved over time, but must be improved because increasingly successful counters to it will naturally be developed. In their view the socialist system is more naturally receptive to change, while change is increasingly resisted by the capitalist system; the forces of change favor the socialist camp. The Soviet development system appears to be successful when it results in a stream of technology leading to overlapping development cycles for new military systems. In its ideal state, at the same time that one new system (e.g., an ICBM) is being produced and deployed, a modernized version or a replacement system is being developed and tested, while another new system, more advanced still, is in the early stages of development. These different generation systems will typically have many common components but differ in some key subsystems that are evolving particularly rapidly or are especially important in the performance of the system's mission. ICBM systems are a notable example of overlapped development; ATGM systems also appear to have reached this position.

Continuous change would appear naturally compatible with American development styles as well. Modern American society, after all, appears to be undergoing rapid change. However, as suggested earlier, there are aspects of American attitudes toward the military burden that promote the need for large increases in the technical performance of systems while simultaneously imposing barriers to such change.

Concerns for the military burden and belief in the virtues of American technology have, in the case of land warfare, led increasingly to dependence on smaller numbers of fielded systems exhibiting outstanding performance characteristics. A budgetary mind set in the political process has resulted in a focus on discrete military

equipment items as budgetary line items rather than as part of a military function. The antiarmor function, for example, is much less conspicuous as the subject of Congressional debate or deliberation in the public media or journals of military affairs than the features and capabilities of individual new antiarmor systems, such as the XM1 tank, armed helicopters, or the Copperhead guided artillery round.

The focus on discrete weapon systems is epitomized in the Army's program manager system. The goal of the program is to field a particular new equipment item, and the performance of everyone associated with it is judged by how successful they are in furthering this objective. Such a system is not in harmony with the overlapping cycle system described for the Soviets. The urge to sell the new system (selling is an appropriate appellation for the advocacy of a new system in the continual budgetary reviews it undergoes), both by the Army's program management and the industrial contractors and military laboratories, leads to an emphasis on the dramatic leaps in performance that the new system must inevitably demonstrate in comparison to its predecessor. Large numbers of entirely new subsystems and components are typically required to achieve these performance objectives, in contrast to the much smaller number that more modest performance improvements might require. Indeed, new Soviet systems typically have far fewer new elements than their American counterparts.(20)

The positive image sought for a new system because of its major performance improvements is not easily reconciled with the potential for performance degradations. Precision-guided weapons would be far less likely to survive scrutiny during their development process if it were suggested that countermeasures such as smoke could render them ineffective at times, or if evaluations conducted in operational conditions were to infer that soldiers employing them under the stress of combat might succeed in killing targets with them less than 10 percent of the time, rather than more than 50 percent of the time (although even 10 percent might be a dramatic improvement over the past).

The discrete weapon system focus in the U.S. military development process today does not foster modest improvements unless they appear

very cheap. It does not easily accommodate the dilemmas posed by technological obsolescence, it inhibits attentiveness to operational countermeasures, and it delays the development of follow-on systems. The latter, rather than being the result of the natural, inevitable process of technological change, is rather a threat to a system in development. Follow-on systems, rather than being the welcome next generation of design, suggest that the system in development is inadequate and obsolescent, and could lead to program cancellation. In the eyes of Congress and the public media, such suggestions of inadequacy contradict the promoted image and connote poor judgment or insincerity on the part of the system developers and managers. Moreover, unless there is also some delay in *beginning* the development of a follow-on system even after the new system has cleared the last hurdle and is being developed, a bad image might also be formed. The delays in the development of follow-on ATGM systems, such as HELLFIRE, while TOW and Dragon were in development and being deployed, are illustrative of how such a process operates.

Management Styles in Contrast

Although much of what has been noted thus far is pervasive and underlies the process of the development of new technology, the discussion has been oriented, particularly in the Soviet case, toward the process of absorbing new technology once such a technology has become familiar. That is, the focus has been on technological evolution, and not revolution. Alexander has observed that, for the Soviets,

> given the many incentives toward technological conservatism, major, nonincremental change must often come from high-level political intervention in the R&D process. Examples of this are numerous, especially in the World War II memoir literature and personal histories of the Stalinist era, but the practice appears to continue. It has been argued that intervention may now be declining because of the greater complexity of modern military weapons decisions and the increasingly diffuse structure of priorities in the Soviet Union. The High Command have attacked the arbitrary and personal decisionmaking of Stalin and Khrushchev and have pressed for increased military influence. These very arguments by the military, however, would seem to confirm the wholesale involvement of political leadership in the weapons development process. (14)

Nowhere has Soviet high-level leadership been more in evidence than in promoting the third military revolution: information. As was discussed earlier, high-level Soviet leadership has carefully guided the development of battlefield automation from the beginning. It has been presented as an historical inevitability that is irresistible, and in the process of implementing it, the leadership will not condone opposition. Marshal Batitskiy, Chief of the National Air Defense Forces, for example, in stressing the need for automation in 1974, stated that ". . . in the future it will become increasingly difficult or simply impossible for those who fear or underrate new equipment (and methods) to exercise control. Sooner or later these individuals must be eliminated."(21)

Although some of the earlier exaggerated expectations have been toned down, as the realities of operational experience with development systems have become apparent, the leadership continues to attach great importance to this technology. Details of its implementation are the continuing focus of concern of the Minister of Defense, Chief of the General Staff, and high-level military leaders throughout the system.

The high-level involvement appears to be necessary for the Soviets, for a mechanism for developing an entirely new type of technology cuts across existing institutions and cannot be derived naturally. If such an innovation were left to the existing technological institutions, negative influences on the measures of success normally in operation would tend to impede its progress. Developments which require a large number of entirely new components or subsystems would conflict with the emphasis on producibility in large numbers that favors few new components. Entirely new technologies, such as automation, require a revamping of institutions and facilities that undoubtedly has adverse effects on other ongoing activities whose results or products are closer to fruition.

Examples of high-level management of "revolutionary" technologies in the United States are also prominent. The Manhattan Project and the Apollo Project are notable examples. In other cases, however, such as battlefield automation, such high-level involvement has been lacking.

On the other hand, high level advocacy and management of discrete military functions, while leading to their efficiency, may detract severely from overall force balance. Strategic Air Command and the nuclear submarine programs are cited as examples of this phenomenon. Such influences may account for United States reluctance to centralize control of battlefield automation. The role of industry in technological innovation in the United States has always been considered a natural strength of American society. New technological possibilities suggested by representatives from industry often provide the original motivation for, and often continue to dominate, the development of new items of equipment for the military. While the benefits of such a mechanism are potentially favorable in cases where the new developments fit reasonably well into existing military organizations and concepts for system employment, problems are likely to emerge when the fit is not so smooth.

The *weapon system* orientation that exists today in land warfare inhibits the adoption of new technologies that are not explicitly for weapons. The weapon system orientation has emerged in part because, with the fragmentation of decisionmaking that exists for the development of military systems, the role of weapons, their characteristics, and their effects are understandable to a wide range of audiences and can be portrayed quantitatively and visually. It is much harder to portray the more subtle aspects of the value of non-weapon equipment; such items fare less well in budgetary deliberations, and military personnel associated with non-weapon functions are less visible and receive less reward in the system.

In the example of battlefield automation, as described earlier, the absence of any high-level advocacy and the fluctuations in system management and development have greatly impeded its introduction into the Army. The promotion of battlefield automation technology by contractors, without concurrent consciousness-raising in the Army as to how such technology can be employed, has resulted thus far in a poor fit. There appears to be an awesome gap between the manual operations in existence and automated battlefield operations. Some of the reasons for this poor fit are discussed in the next chapter, and the nature of the battlefield automation revolution will be explored in greater depth later as well.

HISTORY AND CHANGE: AN OVERVIEW

Soviet experience from World War II, with massive devastation to the homeland and high casualty levels, provides a vivid and enduring view of warfare--many senior Soviet officials fought in responsible positions in World War II. Defense of the homeland, tradeoffs in strengths (sophistication versus numbers), replacement by unit, operational simplicity, individual toughness, speed of operations, these and similar factors from that experience base condition modern Soviet military thought.

In contrast, few U.S. officers with World War II combat experience remain on active duty.* The U.S. homeland was spared devastation or even the threat thereof. The production base remained intact and was expanded without interruption by enemy action; what came from it was an increasing stream of war materiel so that the U.S. succeeded not because its equipment was superior but rather because its resources were so great in comparison to its adversaries. Subsequent experience from the conflicts in Korea and Vietnam was basically the same.

Oversimplified, this brief comparison serves to suggest some of the underlying differences driving U.S. and Soviet technological strategies. Since World War II, the United States has believed that it could develop sufficient technological superiority to compensate for Soviet numerical superiority of armed forces. This was carried through intervening crises with considerable lack of clarity as to whether technological superiority or continued application of greater resources actually influenced the outcome. In the United States, pressures from competitive industry and military service advocates favored technological advance.

Differing perceptions of the national burden reinforce these notions. The Soviets continue to stress numerical strength while striving for technological comparability, neither of which require acceptance of great risk or uncertainty. In contrast, the American approach accepts quantitative inferiority while demanding superior technical performance, accepting the inherent uncertainties and risks in order to lighten the apparent military burden.

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*Current U.S. Army Chief of Staff graduated from USMA in 1951.

One result of this U.S. approach is a focus on achieving extraordinary jumps in system capability. Although the United States may await realization of the technical capability for such jumps, it may not really be capable of matching Soviet quantitative superiority solely through the application of advanced technology. Complicating the issue is increasing Western awareness that the Soviets are not backward in all types of technology, and they possess the capability and resources to field several new generations of equipment for each major advance by the United States.

The Soviets apparently do not view defense matters in terms of maintaining a level of adequacy or sufficiency that provides what they perceive as an acceptable degree of risk. The struggle is not a trade-off between the extent of the national burden for defense versus the risk of military conflict; the struggle is to develop whatever level of military might seems necessary to protect the homeland, even to the extreme of preparing for offensive action to preempt a real or imagined threat. An important part of the struggle is the presence of the struggle itself. The burden becomes a social one rather than a military one that detracts from social programs, somewhat the reverse of the situation in the United States.

As to technological change, the Soviets see system evolution as a continuous stream in which new subsystems can be mated to proved components in an endless chain of materiel updating. Thus a wide variety of modifications of a single major weapons system may be in the field simultaneously. The United States tends more to develop replacement items as discrete products, budgeted and justified on the basis that their predecessors are on the verge of obsolescence. The Soviet dialectic view of system evolution conflicts with this U.S. notion that to be good, the proposed replacement must be essentially new, must apply some advanced technology, and must do some task measurably better than its predecessor. Additionally, it must not overlap another developmental or operational system in mode or capability unless a competitive shoot-out has been specifically authorized.

The Soviet top-down developmental philosophy is very obvious in the battlefield automation area. High-level involvement appears

essential in order to achieve institutional acceptance of a new technology. Here we see major improvements (rather than component improvements) being forces into the system through emphasis from the top echelons. In the United States, on the other hand, lack of high-level advocacy have slowed its introduction into field units.

Despite these enumerated differences, the Soviet and the United States systems tend to produce basically similar* end products and military hardware items although they were designed in response to different drives under quite different views of the conduct of combat. A lesson here may be that there is considerable significance in the timing and volume of development and production, at least in the recent past. This suggests a rather balanced historical cycle between the adversaries in which each initiative, whether gradual or major step, is soon met by a counter. There is evidence, however, to suggest that the Soviets may be becoming more aggressive in development, fielding equipments which are in themselves major innovations rather than component innovations on otherwise proved systems. And the pace of introduction seems to be accelerating, as in the case of the main battle tanks which have appeared in the past few years.

One must be alert to the possibility that past parallel results by the differing Soviet and U.S. systems need not provide basis for linear projection into the future.

Hardware similarities and system differences aside, the real difference lies in how the end products are used on the field of battle.

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*If one is willing to call a 60-ton tank and a 35-ton tank "similar."

(U) IV. ASSESSMENTS OF BATTLEFIELD EFFECTIVENESS

(U) THE 1973 MIDDLE EAST WAR

(U) The 1973 Middle East War has served as a model for American ground forces for the high intensity and destructiveness of operations on the modern armored battlefield.

(U) "The war in the Middle East in 1973 might well portend the nature of modern battle. Arabs and Israelis were armed with the latest weapons, and the conflict approached a destructiveness once attributed only to nuclear arms. . . . In clashes of massed armor such as the world had not witnessed for 30 years, both sides sustained devastating losses, approaching 50 percent in less than two weeks of combat."(22) It is important to note that this observation came as a great surprise to the United States, but apparently not to the Soviets.

(S) During this war, which lasted 19 days, a large percentage of the armored vehicles and aircraft of both sides was lost (25 percent of the Israeli tanks, one-third of the Arab tanks, 30 percent of the initial Israeli fighter inventory, about 70 percent of the initial Arab fighter inventory).* The Israeli losses were particularly severe in the first several days, as defending tanks and aircraft were forced to endure high losses in order to contain the offensives until Israeli mobilization produced a larger force and a more balanced defense. Tank units in this period were forced to fight continuously, often with little ammunition remaining, and with unit losses quickly exceeding 50 percent. Israeli air losses were as high as 5 percent attrition per sortie on the second day of the war. Israeli close air support strikes, although carried out in excellent visibility conditions, were largely ineffective in operations against vehicle targets because of the severe air defense environment, difficulties in identifying targets, and Arab jamming of voice communications.

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*(U) The insights and data on the 1973 Middle East War derive from an analysis of References 5, 23, 24, 25, 26, and 27.

(S) Severe local shortages in ammunition or fuel were experienced by both sides. The Syrians at one point abandoned *400 operable tanks (20 percent of their tank force)*, most of which were out of ammunition. Unexpected high demands on Israeli artillery, to make up for support that the Air Force could not supply, caused shortages and required resupply from the United States. Especially high demands were made on Israeli artillery to deliver suppressive fire. [redacted]

[redacted]

(S) Despite the heavy use of Sagger ATGMs by Arab forces, tank losses in the war were largely the result of enemy tank fire. An estimated 70 to 90 percent of the Israeli tank losses and over 90 percent of the Arab tank losses were due to tank gun (and antitank gun) fire. Sagger missiles were fired in large numbers (6000 to 8000), with multiple firings at the same tank; the analyses of damage and destruction of Israeli vehicles suggest that the effective kill probability of Sagger against tanks was in the range of 2 to 5 percent, *an order of magnitude less* than the nominal 60 percent figure ascribed to the weapon under test conditions and in FM 100-5. Nevertheless, Sagger launches in such large numbers caused serious Israeli losses at first and continued to inhibit the movement of Israeli armor in the counteroffensive phase, because of the need to take evasive measures and lay down suppressive fire at suspected or located ATGM positions.

(S) Israeli air-delivered PGMs, launched carefully, without pilot distraction, one at a time against lightly defended targets in an ideal environment, achieved successes comparable to their effectiveness in test conditions. In a less benign environment, however, they might have been considerably less effective.

(S) In the report of the results of the war, the intensity and lethality of combat are highlighted. A significant aspect of the war that received scant attention was the fact that Israeli tanks were out of commission as much for equipment failure as for combat damage. In the intensity of battle heroic Israeli repair efforts were

successful in returning tanks quickly to battle. An average of seven percent of the total tank force was repaired and returned to battle each day.

(U) The Middle East War is held to be a possible model for ground combat between modern forces such as NATO and the Warsaw Pact. This review touches on some key aspects of such combat, including the pace, intensity, and lethality of battlefield operations, the ability to deal with unforeseen occurrences, and the degradations of effectiveness experienced under realistic battlefield conditions.

(U) THE BATTLEFIELD ENVIRONMENT

(U) It is unlikely that anyone would disagree in principle with the goal of being prepared to fight under the battlefield conditions that one is likely to face. It is difficult (or nearly impossible), however, to simulate the conditions of actual war in the training environment. Moreover, it is not so easy to come to grips with what war is like at the level of those who are in the midst of it. Keegan, in his book, *The Face of Battle*,[28] has examined the writings of the history of Western warfare and discovered that until the 19th century no account of war had been given from the viewpoint of the common man. Typically, Western military history has been the study of weapons, leaders, strategy, and doctrine. He characterizes the instruction of future military leaders at Sandhurst and other institutions as offering a desensitized treatment of war. Officer training attempts to make actions that are naturally chaotic and instinctive appear to be orderly and rational. However, in reality, most men are afraid on the battlefield. They are, after all, products of a culture where there is fear of personal aggression and a prohibition on taking the life of another. Keegan claims that in World War II no more than one-fourth of all American fighting soldiers actually used their weapons when in combat with the enemy, even in highly motivated units, even when hard pressed. His analyses of historical battles from the viewpoint of the common soldier demonstrate their personal fear in many ways, among which is the strong urge to flee that historically was suppressed by forces in the rear whose duty it was to send fleeing soldiers back

into the melee. The stress on individuals imposed by noise, smoke, the dead and wounded around them, fatigue, hunger, cold or heat, water, and mud stands in grim contrast to the more typically rational, technical descriptions of war. The intensity and lethality of war is nowhere more vivid than that in the trenches of World War I, including the wholesale slaughter of General Haig's troops in their attempts to take German positions in the Somme offensive.

Keegan suggests, in extrapolating from these views of the past, that lethality of weapon systems has become so great that ordinary humans may be unable to tolerate the stress and may not even be needed for most operations. The need for sharpshooting infantrymen in modern combat situations has been obviated by the introduction of automatic weapons with such high rates of fire and great lethality that volume of fire overcomes the need for accuracy.

It is a thesis of this report that the Soviets today are more cognizant of the realities of war and the nature of the battlefield environment, in the terms that have been described above, than Americans are. While Soviet experiences in World War II are a dominant source of their impressions, Russian experience in conflict throughout this century has undoubtedly left its mark on their fears and concerns. In the Russo-Japanese War, the lack of military discipline, the untrustworthiness of officers, and the use of outmoded tactics and equipment were evident. In World War I, although as usual they greatly outnumbered their German enemy, there was no comparison in the quality of the two forces and the abilities of commanders. Following an initially successful Russian attack, the armies were soundly defeated because their supply system broke down and their command system proved ignorant of the German movement and even of the activities and objectives of the other Russian armies whose support was necessary.(29)

The catastrophic effects from the lack of requisite information are well illustrated to the Soviets in the failure of General Tukhachevski in the 1920 campaign against the Poles. Again, an initially successful Russian attack occurred, with poorly equipped peasant hordes routing the outnumbered Poles, creating panic with an impression of an irresistible force. Mobility and surprise, which had seemingly been

lost elements of warfare just two years earlier, had returned. However, as had been the case in the past, transport shortages occurred, the offensive bogged down, and the Poles mounted a successful surprise counteroffensive that routed the Soviet forces, who were handicapped by the lack of information on enemy and friendly force situations and the inability to replan.

The lack of trust by high authorities in the loyalty and competence of the Soviet officer corps was exemplified by the attachment by Trotsky of political commissars to run the units. This distrust of officers persisted into World War II, and it is still the subject of great concern.

In Liddell Hart's interviews of German generals they expressed admiration for the ability of Soviet soldiers to endure conditions that they considered intolerable, with clearly inadequate supplies. Simple rigid plans and operations were enforced by the composition of the Soviet Army--an illiterate peasant horde, largely Asiatic, without modern skills--following the debacle of 1941 in which large numbers of Russians were killed or captured (1.5 million captured between June and September). The Russians have continually experienced having their vast numerically superior forces lose control and collapse under pressure because of lack of discipline and motivation, an inadequate officer corps, an inferior practice of military tactics, and an inability to acquire and distribute essential information. These historic failings were eventually countered in World War II. Political action succeeded in motivating the troops to defend their homeland rather than the Soviet government, and to steel the troops to perform under stressful conditions that demoralized the opposition. As will be amplified later, the natural (in the Soviet view) centrifugal tendencies of soldiers to lose control and do the wrong things, as manifested in the hsitorical collapses of Russian armies, has become a central concern of the military leadership, and military developments, training and doctrine are permeated with the effects of this historic fear. In a sense the Soviets could be said to have objectives in ground warfare whose success flows from success in maintaining control over the natural tendencies of their officers and soldiers to fail to perform.

The scenarios for conflict in Central Europe that the United States and the Soviet Union have envisioned for many years have many common attributes. The Soviet offensive doctrine and U.S. defensive doctrine for this environment are important factors in explaining differences in the battlefield employment of new technology. Although the Soviets may emphasize that their offensive has a strategic defensive basis, taking place after they initially halt a NATO offensive, both sides primarily focus tactically on the ability of NATO to defend against a Pact offensive. Soviet land warfare doctrine is offensive in nature, emphasizing the rapid movement of large numbers of forces against very capable defenders who must be overwhelmed by shock. U.S. doctrine for warfare in Europe took a decidedly defensive turn in recent years, with the doctrine articulated in FM 100-5 concentrating on the basic problem of how to defend in Europe while outnumbered.(22) Emphasis on high individual performance requirements appears quite naturally in this situation.

Although the Soviet offensive campaign against the Germans, and the lessons the Soviets learned from the German blitzkrieg tactics, are thought by many to be the source of their belief in the superiority of the offensive, the offensive emphasis goes back much further. The classical model for success in the offensive is General Suvorov who, during the era of Catherine the Great, won over 60 engagements without a loss while employing blitzkrieg-style shock tactics. Swiftness and surprise were more important than numerical superiority. In the modern era the Soviet campaign against the Japanese in Manchuria in 1945 has received much analysis in the Soviet literature because of the rapid advances they made.(30)

The Soviets have focused on the centrality of maintaining a high rate of advance among the decisive factors for success in offensive operations. Effectiveness of weapon systems (both accuracy and volume of suppressive fire) is very important and their weapon systems need to be comparable to those of the defenders in quality, but movement is the key. In contrast, the defensive orientation of U.S. doctrine puts high emphasis on the effectiveness of weapon systems and firepower comparisons figure prominently in evaluations of the ability of defenders

to halt the Soviet offensive. Defensive maneuver is for the purpose of concentrating U.S. weapons where the Soviet forces are most numerous and exacting high loss exchange ratios. High attrition of enemy forces is considered the key to impeding their advance.

MEASURES OF EFFECTIVENESS ON THE BATTLEFIELD

Nancy Nimitz has suggested* that the Soviets place less direct emphasis on military capability than does the United States in considering the relative balance of power in its most aggregated form. The ranking she suggests is:

	U.S.	USSR
Military capability	1	3
External political trends	2	2
Political will	3	1

For the united States military capability is a comfortable point of emphasis, as it is the most tangible and is conveniently associated with technology, which is thought of as a comparative U.S. strength. Nimitz illustrates the Soviet emphasis on the morale of troops with remarks paraphrased from a Soviet textbook on the military technological revolution:(31)

- The high costs of western weapons are sometimes inversely proportional to their worth.
- The initiative and ingenuity of politically motivated armies can frequently offset an inferiority in equipment.
- The lack of motivation of western troops reduces the combat effectiveness of their equipment and weapons, no matter how highly automated the control of such equipment may be.
- The emphasis placed by western governments on superior equipment reflects their political vulnerability--that is, their need to minimize human losses that might evoke domestic unrest.

*Nancy Nimitz, The Rand Corporation, unpublished notes on Soviet perceptions of the military balance.

Although in the United States we would recognize that employment factors and the motivation of troops are also important, we would not accord such a preponderant role for such factors in comparison with the quality of equipment.

Lesser Soviet emphasis on technology in no sense reduces their concern for achieving technological comparability, and they are highly respectful of the potential effectiveness of U.S. advanced technology for warfare. Nevertheless, it is also apparent that, from such a perspective, U.S. emphasis on technology to alleviate the military burden would be viewed as a clear sign of weakness and as confirmation that the factors that the Soviets deem the most significant are working in their favor.

The means by which each side evaluates its position in the Central European arena could be reasonably characterized as Nimitz has done. Similarly, in looking at evaluation of proficiency in a Central European conflict, the Soviets attach a much greater weight to indirect and intangible factors such as troop control and the will of opposing soldiers that do not figure heavily in U.S. analyses. The central measures of effectiveness (MOE) that each side tends to employ in evaluating its performance in land warfare engagements are shown in Table 8. The Soviets emphasize an aggregated measure, unit rate of advance, that is more closely related to overall campaign objectives than the less aggrefated U.S. measure of armored vehicle kills.*

The Soviet measure is related to analyses of their successful offensives in World War II, in which increasingly higher rates of advance were achieved as the war progressed. The rates of advance are supported by massive firepower, but the lethality of firepower is considered for its effect of temporarily paralyzing the enemy and preventing adequate defensive response, this to a much greater extent than does U.S. doctrine. The Soviets focus on effects dependent on time, in which victory

*The U.S. measure is the analog for a European war of the use of body count as the MOE for ground combat in the Vietnam War.

Table 8

MEASURES OF EFFECTIVENESS IN ENGAGEMENT

	U.S.	USSR
Primary	Ability to destroy armored vehicles	Rate of advance of units
Quantified Parameters	Armored vehicles killed	Time to achieve specified objective
Secondary	(Delay, disruption)	Suppression of antiarmor
Means	High accuracy, lethality of weapons	Activeness, mobility, surprise, mass, paralysis of enemy action and will
	High individual kill rates Long-range engagement Prepared defenses High-quality, timely information	Volume of fire Short-range engagement Meeting engagement Psychological factors
Payoffs	Clear result, common measure of balance, independent of enemy	All desirable effects follow: loss ratios, lower consumption
Greatest sensitivity	Individual man, machine performance degradations	Delay, indecision, loss of control

can be reversed if the momentum decreases, whereas the United States focuses on vehicle kills, a more permanent effect independent of the details of the engagement, and a measure compatible with a defensive posture. U.S. emphasis is based on the somewhat tenuous assumption that if a large number of vehicles can be killed, the offensive will fail. If there had been a great deal of data accumulated and analyzed to measure the relationship, the emphasis might seem more justified. However, factors employed in analyses for the degree of attrition necessary to destroy a unit's effectiveness are based on very uncertain data and on military judgment that, among other things, do not reflect Soviet criteria for assessing the effectiveness of forces. U.S. analyses of Soviet engagements in World War II are not performed, so that U.S. model calculations of enemy unit operations and effectiveness are really based on a notional enemy, rather than the Soviet Army.

The Soviet approach is to operate against the weakness of the enemy, while avoiding the strength. Frunze in the past emphasized the value of mobility and maneuver as a balance against a technologically superior enemy.(32) Those units which succeed in rapidly penetrating the defenses are supported, not those which are bottled up in static, destructive combat. Units with high rates of advance are expected to overwhelm the opposition, not engage and destroy large numbers of defenders. Firepower is employed for the suppression of antiarmor forces more than for destruction as such, so that discrete targeting is not so important as firing at suspected target areas with large numbers of weapons, using calculations of units of fire necessary to accomplish a task as a guide to how much firepower to employ.(33) Targets are not necessarily hit or destroyed with the first round, but rather require repeated attacks. Shock and paralysis of the enemy stem from this massive application of firepower in conjunction with rapid operations. Large numbers of enemy forces can be captured or destroyed later as a result. Tactics are favored in which the defenders are off balance, unable to plan and manuever, and are surprised by encountering the offense in meeting engagements rather than being given the time to prepare defensive positions. The U.S. dependence on high performance of men and equipment stands in contrast to intensive Soviet efforts to degrade and deny high performance.

In contrast, the U.S. focus on vehicle kills confronts the Soviet strength of large numbers, seeking to match firepower with firepower, while not taking advantage of the potential high sensitivity of the Soviet offensive to upsets in timing and control. The Soviets plan their offensive, *expecting high losses*, but depending on continuity and rapid movement of masses of forces. Inflicting high losses on them when they already expect them may not be enough to assure success. More recent U.S. attention to exploiting Soviet weaknesses and emphasizing factors imposing delay (counter-C^3, use of mines) still seems low in priority compared to the traditional weapon lethality factors. As suggested earlier, such lethality factors are more easily understood by the U.S. audience that participates in the continuing debate over military budgets, but this simplicity does not guarantee that the emphasis is necessarily also the most advantageous.

Soviet Focus on Time and Rate of Advance

Nathan Leites has examined Soviet military writings on the subject of land warfare in order to illuminate differences in U.S. and Soviet doctrine.* Although these writings are often treated as mere rhetoric, in fact they are significant in revealing high-level fears and concerns over various aspects of military performance and are helpful in putting military concern into the context of long-term Soviet (Russian) tendencies and ideological views.

The writings reveal a deep-seated pessimistic view of human nature, often expressed in terms of the bad behaviorial patterns that are likely to occur when men are put into adverse circumstances such as war, unless suitable precautions are taken in advance to overcome such tendencies. The height of the Soviet concern over the morale, behavior, and performance of Russian (later Soviet) troops in wars in this century. Since in the Soviet view such problems must be actively worked upon and cannot be ignored, there is constant attention to political indoctrination in troop training and a devotion to reducing the effects of wayward tendencies through a variety of means. These tendencies are all the more of concern because of the Soviet appreciation of the battlefield environment. Bad tendencies come to the fore when people are under stress, and the battlefield for which the Soviets prepare is very stressful. To the extent that they can get their troops to muddle through in this environment, because of attention to indoctrination and training factors, they can expect certain standards or norms of performance for units. Although these standards are far short of ideal, they do not depend on high levels of performance by individual soldiers and they are likely to be met even when the individuals are under stress. Although the Soviets continue to concentrate on hardening the individual to be able to perform well under wartime stress, they attempt to configure operations so as not to be unduly dependent on it.

Perhaps the most important factors on the modern battlefield in the Soviet view are speed and time. Victory on the battlefield would go to the force that is the master of time. One cannot exaggerate the

*The discussion that follows makes extensive use of the material in Reference 34.

overwhelming importance of time on today's battlefield, and it has had a prominent role in earlier thinking as well. Modern Soviet writers refer to the model for offensive doctrine: "Let us remember the precepts of A. V. Suvorov: 'Procrastination is like death.' 'An instant gives victory. One minute decides the outcome of a battle, one hour the success of a campaign.'" Attentiveness to time and the consequences of ignoring it permeate Soviet thinking. "The importance of time is emphasized in all areas of Soviet life and was given particular stress in a directive of the Twenty-fourth Party Congress concerning the 'productive utilization of every minute of working time.' The insistence that 'each hour should be strictly accounted for' is tempting because it seems to permit increased productivity without an increased use of other resources."(35)

To the maximum extent possible, standards for performance in the military are established that involve time norms for the achievement of specific objectives. Political work is seen as inspiring soldiers to shorten the time it takes for them to fulfill missions. Modern military technology can be viewed as contributing to higher speed in combat and shorter time to perform necessary tasks.* The time for making decisions--a particularly great concern--can be shortened through the use of automated aids. Incessant training to perform particular tasks reflects the goal of shortening the time and achieving automatic responses on the part of the soldier. Goldhamer(35) refers to the stopwatch that frequently is present during Soviet troop training. "Combat readiness also involves precise computation of time, a feature that helps explain why the stopwatch is an ubiquitous instrument in Soviet military training." Unit effectiveness in many instances will be measured by the ability of a unit to better the established time norm for a particular operation, thereby establishing a new norm as a competitive standard for other units to meet. "Socialist competition sometimes leads to departures from the proper operational sequence set down in training plans. Some commanders develop 'harebrained schemes . . . to make

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*The linkage between modern technology and time suggests that an important Soviet measure of technological advance is to be found in its time-related factors.

certain jobs go faster.' In many instances, a relaxation of requirements occurs involving the disregard of quality for the sake of speed, which happens to be much more readily measured in socialist competition."(35)

Because the Soviets view time factors as so critical, they are particularly concerned with the natural tendency of people, in the Bolshevik view, to "scorn time," to be sluggish, to delay, and to be late, for no particular reason. Political indoctrination in training aims at reducing such tendencies, at instilling in troops the proper attitude toward time and the ability to perform their tasks quickly, without delay.

The key benefit of achieving surprise in combat is time-related: it reduces the productivity of the enemy's surviving resources for a time, providing a temporary advantage that must be acted upon quickly. A second benefit, less stressed by the Soviets but more conducive to U.S. values, is the greater reduction of enemy forces relative to one's own as the result of surprise. The particular Soviet emphasis on the short-lived, temporary advantage reflects a fundamental Soviet view of the battlefield. A major Soviet goal on the battlefield is to create situations in which they achieve fleeting advantages over the enemy and to pursue such advantages to the fullest, as rapidly as possible, to create such chaos in enemy activity that eventually the enemy will lose control of the actions of his forces and become paralyzed in his ability to respond to the ever more rapid and massive Soviet offensive. The advantages are only fleeting, however, and the enemy is resilient enough to regroup if allowed the time. Offensives in the past bogged down, and factors conspired to force pauses in offensive operations. Concerns over pause were enunciated by Soviet writers as far back as the 1920s. Pause is now strongly associated with failure, and continuous combat without interruption is expected and demanded. Episodes in World War II of uninterupted actions are cited, with friendly forces attacking the enemy while under their own artillery fire. Taking advantage of suppressive fire without delay was a stated goal in their World War II Field Manual: "The delay in the transition to the attack

deprives the infantry of all advantages obtained by the suppression [by artillery] of the enemy."

(U) Uninterrupted actions deprive the enemy of the time and possibility for establishing order in his own troops; a pause, a gift of time for the enemy, allows him to reorganize and prepare counters to the impending attack. The solution is not to pause, not to stop for any reason, to ignore fatigue, enemy fire, and friendly fire. Physical limitations on continuous actions are ignored. Rest and consolidation, potential benefits of a pause, are assumed to work to the advantage of the enemy, not to the Soviets. As technology advances, the consequences of delay become even more costly.

(C) The rate of advance has been suggested earlier to be the primary measure of effectiveness used in evaluating offensive operations. The preeminence of this factor is illustrated by an author, writing in *Military Thought*, that "the competition in the attainment of high mobility between the armies of the various countries is, in essence, the struggle for superiority over the enemy." Another author: "The higher the speed of advance, the greater the possibilities for the disruption of the enemy's calculation, for the fragmentation of his units and their piecemeal distruction." "Mobility and high tempos of combat operations bring success in a battle or operation."(32)

(U) The rate of advance is related to the degree of success in achieving victory in battle, with analysis of engagements in World War II providing the data to support the claim. Savkin(32) refers to analyses of nine tank army operations in which high rate of advance reduces friendly losses, lowers the expenditure of supplies, and increases defender losses. In quantitative terms, operations with an advance rate of 20 to 50 km per day, compared with those where the rate was 4 to 10 km per day, demonstrated a reduction of friendly personnel losses by about a factor of three and tank losses by about 1.5. The consumption of ammunition was decreased by a factor of 6, and fuel, by 3. In another example, comparing rates of advance of 9 km per day with 0.5 km per day, personnel losses were reduced by a factor of 6, and tank losses, by 20. "As a rule, with high rates of advance there was an increase in the number of captured vehicles, artillery, and tanks."

In the Visla-Oder Operation a tank army "captured twice the number of soldiers and officers while advancing at a rate of 30 to 33 km per day than with a rate of advance of 10 to 13 km per day."

In a recent book on tank operations in World War II,[36] in which 40 tank army operations are analyzed, the front offensive operations were divided into the three periods of war as shown in Table 9.

As the war progressed, and the Soviets gained an ascendancy, the rate of advance and depth of operations increased greatly. For isolated parts of operations, rates of advance as high as 180 km per day were experienced in the Manchurian campaign.

"It is also important to point out that throughout the war the average daily rates of advance continuously increased; this was mainly a consequence of the increased striking power of large front strategic formations, the acquisition of combat experience, improvement in the art of preparing and conducting operations, the heroism and courage of Soviet soldiers, improved combat equipment, and also a number of other reasons." Tank armies in these operations often conducted operations continuously for up to 20 days, with strength

Table 9

SCOPE OF FRONT OFFENSIVE OPERATIONS DURING THE GREAT PATRIOTIC WAR

	1st Period	2d Period	3d Period
Offensive width, km	300-400, to 600	75-250	200-250
Depth of operation, km	70-80	100-200	200-300 and more
Average rate of advance, km/day	4-5	10-20	20-30
Duration, days	14-20	10-20	12-20

SOURCE: Ref. 36.

falling as low as 30 percent, while remaining an effective force and being readily reconstitutable. Combat effectiveness remained possible with even greater losses, but reconstitution was a much greater problem.

(U) In a sense, the "proof" that the high rate of advance is the key factor for victory is somewhat tautological, since the high rate of advance is facilitated by high enemy losses, low friendly losses, etc. The point is, however, that the Soviets see the rate of advance as more important per se than achieving high rates of kill and inflicting high casualties from a more static posture. With a push to achieve a high rate of advance, temporarily high friendly losses or passed-up opportunities to slow down and inflict greater losses are subsumed by considerations on a larger scale, a campaign scale, in which maximizing the rate of advance for the campaign will lead to achieving all desirable effects, such as lower friendly losses, from the perspective of the campaign as a whole. The rate of advance focus sweeps in a great many contributing factors, all of which are important. Those factors that contribute to increasing the rate of advance are particularly important, and attention is devoted particularly to improvements of factors that impede the rate of advance.

(U) A key factor for achieving a high rate of advance is the compresssion of force in time and space to overwhelm the enemy psychologically. This involves increasing the density of armor and artillery per km of front and striking rapidly. Simultaneity favors victory, while successive application of force protracts the operation and favors the enemy. The compression of force is viewed, not for its ability to achieve high enemy losses, but rather for its suppressive, psychological effect.

(C) According to one Soviet writer, "The effectiveness with which personnel is suppressed depends not only on the quantity of ammunition launched against it, but also on the duration during which the ammunition is expended. . . . Losses inflicted within a very short time exercise a substantially greater moral impact on personnel than losses occurring during a more protracted period." The effect is a temporary paralysis of the enemy's ability to respond, to resist, and to plan.

Leites relates that several Soviet authors in the 1930s emphasized the psychological effect of forces compressed in time. "The same degree of losses can either ruin a unit if it is inflicted in the course of a short . . . assault, or it can be endured almost without any notice if members of the unit are eliminated from battle in the course of a long time." . ."Even losses of a mere 10 percent, inflicted within minutes, demoralize a unit to such an extent that it may remain incapable of combat for a long time." In comparing the artillery preparation operations at Verdun in World War I with those of the Weichsel-Oder operation in January 1945, Sidorenko attributes the failure of the former and the success of the latter to the fact that the former operation took 7 days while the latter, although using less ammunition, compressed the operation to 25 minutes.

(U) Savkin relates the now classic examples of increasing concentration of force on narrowing axes of attack in World War II, as the result of high production of equipment throughout the war and increasing skill by commanders in controlling and operating their forces. Lenin himself emphasized the importance of force concentration, seeing it as having even broader applicability: "to achieve victory it is necessary 'to have an overwhelming preponderance of forces at the decisive moment at the decisive point. This law of military successes is also a law of political success, especially in that fierce, seething war of classes which is called revolution."(32)

(U) Savkin, in reviewing wars of the past, notes that quantitative superiority usually means victory, but that weaker forces can win with superior quality. One senses a real ambivalence, as Leites has noted, between the Soviet urge for large numbers, the vulnerability of large forces to nuclear weapons, and the fear that enemy qualitative superiority could be more important.

> Qualitative superiority has acquired great importance. It has become easier to make up for a lack of numbers of troops with nuclear weapons, especially if troops possess high morale. But in this case, too, on the axis of main attack it is necessary to ensure, if not the decisive, then a sufficiently favorable correlation with the enemy in personnel as well, although the "mania of numbers" which infected many generals in the past has no scientific basis in our era.

The Soviets, based on their previous wartime experiences, realize that numbers alone do not guarantee success, and the qualitative factors have become increasingly important. Nevertheless, the "mania of numbers" legacy from the past really is endemic, and the Soviets continue to emphasize that large numbers are necessary, although not sufficient.

> . . . The degree of influence of new means of warfare on methods of conduct of combat operations is directly related to the number and quality of these means. New forms of weapons and military technology employed in small numbers cannot have a substantial influence on the character of combat operations. The revolution in military affairs caused by the employment of powder did not take place immediately, but took at least three centuries.. . . It was only . . . when the opportunity arose to produce and employ firearms in mass numbers, that there ocurred fundamental changes in methods of conducting troop combat operations. (32)

These factors--large numbers, high mobility, rapid rates of advance--all are treated in a highly *aggregated* manner. Operations are discussed from a campaign perspective, not from that of individual small units or individual weapon effectiveness. Although a great deal of training effort obviously goes into increasing the proficiency of individuals, the purpose is more to guarantee the cohesion of operations than to achieve high performance levels in actual combat. The high level of destructiveness expected in modern warfare preclude depending on individual high performance standards for men and equipment, for degradation of performance is natural and unavoidable. Rather, cohesiveness of operations in this environment and making sure that units execute simple operations reliably and *on time* are key. The Soviets' deep pessimism that everyone will fail to perform adequately if left to their own devices is reflected in their anxiety over the fragmentation of their forces. Time-coordinated attacks depend on units arriving at their planned destination on time, not on their engaging enemy forces along the way and inflicting high losses.

The Soviets for a long time have relied on large numbers to alleviate the need for individual high performance, and have sought to employ

strategies that relax high performance demands. Tukhachevskii in 1920 suggested that "strategy must furnish tactics with tasks easy to accomplish." Redundancy is built into operations and tactics wherever possible. Accuracy of single aimed shots is not relied on, although it is desired; rather, a tank platoon of three will all fire at the same target. Antitank missiles are fired in salvos at individual targets. SAMs are fired in salvos rather than individually. Ten weapons, each with a 0.1 kill probability, for example, can achieve a higher probability of killing a target than one with a 0.5 kill probability. Also, larger numbers of weapons firing have a greater psychological, suppressive effect, and the distribution of capability reduces vulnerability. It is desirable to employ several different means to achieve an objective than to rely on a single means. Several different air defense weapon types have overlapping areas of responsibility, assuring greater confidence that the objective is attainable.

U.S. Focus on Vehicle Kills

The emphasis on firepower in U.S. doctrine for armored land warfare is unmistakable. The U.S. image of the modern battlefield is dominated by large numbers of Soviet armored vehicles (usually depicted as tanks) invading NATO. Success on the battlefield is viewed as being achieved by killing armored vehicles, one at a time, in sufficient numbers and at a sufficient rate to add up to overall success.

There has been a fascination with PGMs as offering a relatively inexpensive counter to the Soviet tank threat. Missiles such as TOW are widely advertised as having hit probabilities of better than 90 percent against tanks at 3000 meters, and the missiles cost only a few thousand dollars each. The Copperhead missile is held to offer the possibility of killing tanks using existing artillery launchers, again for only a few thousand dollars each. The potential can even be put in such terms as being able to kill vehicles worth hundreds of thousands of dollars with such missiles, for cost exchange advantages of a factor of 100. In FM 100-5, medium tanks of the