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STRATECH STUDIES

Technologies, Strategies and Policies

MASKIROVKA: SOVIET CAMOUFLAGE, CONCEALMENT AND DECEPTION

Roger Beaumont

**THE TEXAS ENGINEERING EXPERIMENT STATION
THE CENTER FOR STRATEGIC TECHNOLOGY
THE TEXAS A&M UNIVERSITY SYSTEM**

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AND DECEPTION

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Stratech Studies Series

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Foreword

The view that the Soviet Union is not a mirror image of the United States continues to spur a renaissance in Soviet studies. We see the Soviets in a new light, as if for the first time, and we accept the fact that they think differently than do we, especially regarding military affairs.

Because of these differences, comparative analyses have become more hazardous and demanding, particularly when the researcher follows the hallowed practice of isolating a digestable element of the complex being studied. Direct performance comparisons of weapons systems are presented as measures of combat potential when, in fact, those systems should be integrated into the respective nation's strategies, organizational structures, deployment patterns and battle tactics if they are to be properly evaluated.

From this study by Roger Beaumont it becomes clear that awareness of concealment, camouflage and deception is rather higher and more pervasive with Soviet military than in the U.S. defense system. Maskirovka appears as an integral part of the strategies and doctrines as well as the tactics of the USSR. They believe in it, they study and develop it and they use it, therefore, it is a subject of considerable importance to the Western world.

Richard E. Thomas
November, 1982

MASKIROVKA: SOVIET CAMOUFLAGE, CONCEALMENT
AND DECEPTION

Russia is a dumb question
mark on the Sphinx. The
Russians can keep their
mouth shut, and their
minds are closed to us--

Gunther Blumentritt

Their (The Soviets) feel-
ing was--and this might be
self-serving--that calls
for on-site verification
were being used to embar-
rass them because of their
well-known penchant for
secrecy... . They stated
it factually and coolly
.... They take this as a
national and cultural
characteristic and feel
that we should work with
that as a fact....--1

Thomas Powers

Since the early 1970s, some observers have noted a substantial increase of interest on the subject of maskirovka in Soviet military circles.² The term maskirovka, however is not new; it should be noted that it encompasses concealment and deception, and is not identical with the western concept term of camouflage.³ Camouflage, concealment and deception--C, C & D--is often used. Definitions abound, in any event and are fairly similar in essence, e.g., Shchedrov, stressing the active nature of maskirovka, noted that:

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VARIOUS METHODS OF TACTICAL MASKIROVKA



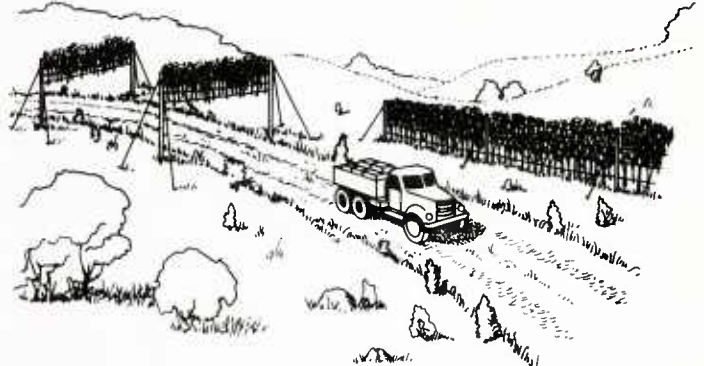
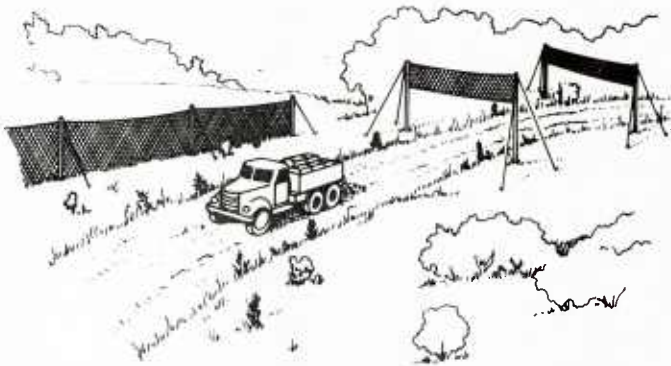
1.) Deformative masking (deformaruischaya)



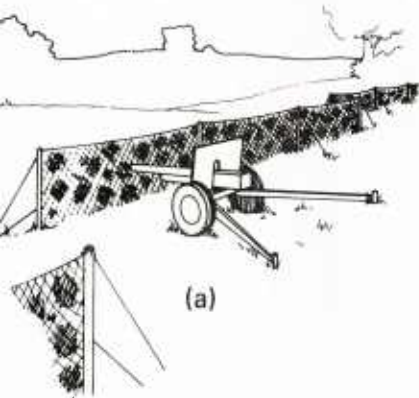
2.) Horizontal camouflage net



3.) Trees tied together



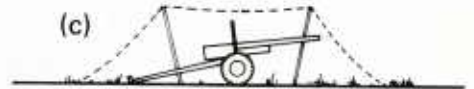
4.) Forms of road traffic masking using nets and frames with foliage.



(a)



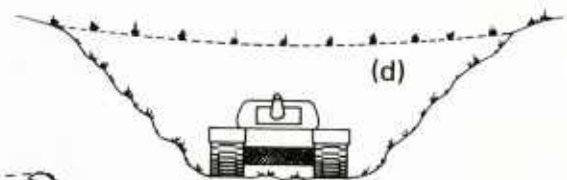
(b)



(c)



(e)

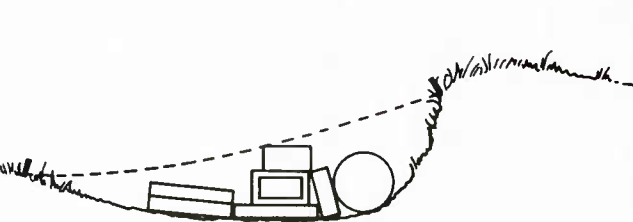


(d)

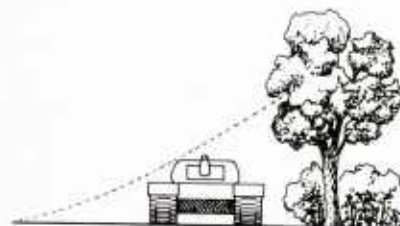


(f)

5.) Forms of net usage: a) vertical garnished mask b) net and standing foliage c) net and poles d) net and vehicle dug-in e) & f) net and raised standards



6.) Terrain blending with net



7.) Slanted net and standing foliage

...the main object is to convince the enemy of the presence of troops and objectives in places where in fact they are not...⁴

Soviet military psychologists view maskirovka in rather more abstract terms than do military analysts: "The essence of camouflaging is to eliminate the boundary between them (objects), and to blend in the objects against the background in terms of shape, illumination and color."⁵

At the outset, it is useful to consider two basic questions: is the increasing discussion of maskirovka--like dezinformatsiya, a term included as a sub-element of maskirovka in the formal definition--a case of old wine in new bottles, an element of Byzantine-Russian culture repackaged and enhanced to fit contemporary needs, and to accomodate technological and institutional change? Certainly the concern of Western analysts is not new. The possibility of Soviet strategic decoys has been noted since the 1950s⁶ when deterrence hinged on concerns about bomber attack. With modern sensing techniques well beyond the level of World War II, dummies have been designed to emanate "heat, light and electro-magnetic energy...and...heat emissions, a magnetic field...etc.,"⁷ light, in this case, including arrays of light clusters which simulate various industrial and military installations, as well as altering the light pattern of real activities. Another main question is: how pervasive is maskirovka as a component in Soviet fieldcraft and tactics, statecraft, economic maneuvering, propaganda, and intelligence--as well as an element in "war-fighting" doctrine?

The concept of maskirovka as defined by the Soviets encompasses a diverse spectrum of stratagems employed to warp the enemy's view of Soviet positions, designs and missions, and to alter the perceptions of their own side and their clients as well (see Table 1). They are aware that whatever is done must appear highly plausible to an enemy, and conform to both

Table 1*

TECHNIQUES	TYPES OF CAMOUFLAGE						
	Optical	Light	Sound	Radar	Heat	Infrared	Radio
Disruptive painting	X				X	X	
Nets	X	X		X	X		
Dummies	X			X	X		
Decoys and deceptions	X	X	X	X	X	X	X
Change in tell-tale indicators	X	X	X	X	X		
Feigned activities	X	X	X	X	X	X	X
Smoke	X	X					
Blackouts/dimouts	X	X		X	X		
Vegetation, incl. flooding	X			X	X	X	

*Derived from Adam and Gebel, op. cit., pp. 85-86.

Soviet doctrine and hostile reasonable expectation. A main operating principle is continuity of effort--aktivnost--in keeping with an admonition of Mikhail Frunze. Also recognized is the need for masking, beyond main objectives, second echelon elements, reserves and control points most likely to attract nuclear strikes and enemy air attacks.⁸ A Soviet treatise of the mid-1970s insisted that operational success hinges on the masking of both objectives and forces, and concluded that camouflage had become an art.⁹

The three types of maskirovka are tactical, operational, and strategic; in the case of the first, emphasis is on everyday, ongoing camouflage, denial and deception, in keeping with broad and cursory definition of camouflage as "one of the basic types of support activities for troops in operation and combat."¹⁰ The latter are carried out through large-scale deception "actions, regroupings, and concentration, concealing troops and installations, and misinforming the enemy,"¹¹ the difference between the two being one of scale rather than the Western nuclear-non-nuclear distinction implied in the use of the term strategic.

There are other qualifiers to this. As noted previously, in the Soviet Military Encyclopedia, disinformation is listed as a sub-technique.¹² Sluchainost--fortuitous or unexpected--is also a linked term;¹³ and a collapse of surprise, once major forces are committed, is assumed. This touches on the Soviet psychology of perception, to be examined further along.

Some Soviet discussions of maskirovka include a typology of both methods and types.¹⁴ Methods include the use of the following to deny observation or to confuse enemy observation:

- terrain features for masking or blending with camouflage
- prepared and issued camouflage material
- disguises
- coveralls
- use of deceptive clothing and uniforms
- sharpshooters to suppress direct observation
- vegetation as a screen
- flooding
- weather
- darkness
- paint--camouflage and radar-resistant
- constructed screens
- dummy equipment
- camouflage netting
- smoke¹⁵
- pyrotechnics
- altering shape (deformiruyushchaya)

It will be noted that Soviet organization of thought does not conform to the structure and categorization which stems from US and Allied technologies of perception and analysis.

Methods employed in respect to tactics and troop control are:

- altering of arrays
- timing of operations, including variance in tempo
- unexpected combinations or uses of weapons or equipment
- dummy installations
- unlikely axes of operations
- changes in routine
- feigned activity

Techniques include the control, suppression, reconfiguration or distortion of the following in the energy spectrum (including EMR and mechanical vibration):

- light
- heat
- sound (muffling, phasing, and simulation)
- radio and radar
- hydroacoustical
- radiation

Distinction has also been made between active and passive maskirovka, i.e., the former being methods of shielding and masking, the latter, the movement of forces and inobtrusive use of methods to deceive.¹⁶

A good deal of interest in research and in application is evident in Soviet literature in the area of radar deception under the category of maskirovka which, in the western typology, would fall closer to such activities and terms as electronic warfare, spoofing, decoying, beaconing, and the like.¹⁷ By the early 1980s, the means available to Soviet tactical ground forces to carry out maskirovka beyond field-expedient materials included:

- "Corner," "Pyramid" and pneumatic "Sphere PR" radar reflectors
- smoke
- aerosol
- radar-wave dispersing covers and screens¹⁹

An elaboration of categories is offered by Chuyev and Mikhaylov:

The purpose of tactical camouflage is to increase the level of uncertainty for the enemy by utilizing the time of day and geographical and meteorological conditions, by using different means and devices for camouflaging individual installations and subunits, and by simulation involving dummy installations and dummy tactical operations. The aims of operational camouflaging are achieved by maintaining the secrecy of preparations for an operation, by setting up dummy defensive installations, etc. It is not difficult to see that the effect of operational camouflaging can be achieved only if tactical camouflage discipline is observed, while failure to observe operational camouflage discipline considerably reduces the effect of tactical camouflaging. Strategic camouflaging is required to resolve similar problems, but at a higher level and on a larger scale. Thus, it is evident that there is a close relationship between all the available forms of camouflaging.

Matsulenko²⁰ offered the following definition of surprise which can be laid alongside the three main categories of maskirovka:

- strategic surprise is derived from concealing intent and time of onset.

- operational surprise is attained through concealing the time, strength, direction and mode of possible attacks.
- tactical surprise is based on unexpected use of weapons, techniques and skills

A PVO Strany general in analyzing maskirovka indicated that the goal of surprise was to break and disorganize, to force targeted commanders to conform to the attackers' wishes, and by forcing a rapid review of doctrine and policy under stress, to demoralize, with such effects to be obtained by:²¹

- lulling through low activity levels or inaction
- by confusing the enemy regarding actual intentions
- by a sudden onset of attack
- by acting in the least likely zone of activity
- by decisiveness of operations and artful maneuver

Theoretical discourses cite such cases throughout, indicating an extensive codification and analysis of a technique of warfare--and of statecraft and technique--in which the Russians and Soviets have shown prowess. The following cases suggest capacity and ability unique, and beyond Western military norms and style.

Soviet Camouflage in World War II

The Germans, while not impressed by many qualitative aspects of the Soviet military system, were most effusive in their praise for their foes' deception schemes, which they saw as well beyond the concealment and spoofing implicit in their own practice of camouflage. Sophisticated Soviet radio deception techniques were noted by the Germans from a very early point in the campaign in the East.

Such operations, while pervasive, were occasionally grandiose and complex. Operation Scherhorn was an elaborate Soviet spoof operation which

began in August 1944 and ran through April 1945. Using a captured German lieutenant-colonel, they managed to involve the German High Command--all the way up the chain of authority to Hitler--trying to aid a mythical 2500-man force trying to fight its way through the Soviet rear areas to the front. The Germans dropped supplies, agents and radio operators, all the while ignoring the fact that verification attempts always fell just short of certitude. Apparently, the Soviets used the operation to identify transmitters, and to "read out" the dynamics of the German command and intelligence system.²²

The Soviets also strove to array their forces to lull the Germans in the defense, and reconnaissance techniques were designed to avoid pointing to imminent operations. Night operations, dummy positions and the use of smoke were encountered regularly, in keeping with the Soviet doctrinal tenets of maskirovka--naturalness, variety and unceasingness--e.g. "in seemingly deserted fields, entire Soviet regiments, with their artillery mortars and tanks, were concealed."²³

German patrols were often allowed to penetrate Soviet lines and return with negative reports; air reconnaissance was of little value, and, in some instances, veteran vanguard elements passed through what seemed to be uninhabited regions, which then--sometimes only a few minutes later--revealed defenses of up to a regiment in strength to the following German main body.²⁴

The frequent citation of German surprise by Western and Soviet historians in the onslaught against Russia in 1941 tends to obscure the fact that the Soviets achieved strategic surprise as well. Maps of Russia obtained by German intelligence, i.e. those fed by Soviet intelligence,

misrepresented road conditions and other features; the extent of the Ural industrial complex was a mystery, as was tank production, leading to a substantial underestimation by the Germans of T-34 performance and numbers. In spite of the "special relationship" between the Red Army and the Reichswehr/Wehrmacht, 1925-1935, the Germans fell far short of developing a coherent picture of Soviet active strength or mobilization potential.²⁵

In reviewing the decade of liaison between the Reichswehr/Wehrmacht and the Red Army, a German historian of the experience noted that the Soviets displayed "suspicion, inferiority complexes, hallucinations of superiority, insincerity and deceitfulness;" the Soviet maneuvers that the Germans were allowed to see fell well short of realism.²⁶

A German veteran, describing a transition of battle morphology on the Eastern Front 1941-42 from linear episodic intensity to diffuse constant pressure, described how, in one instance:

...the woods seemed to be closing in on us, but we believed that our eyes were deceiving us. After a few days, this woods suddenly erupted with fire which engulfed our position. An entire Russian artillery battalion had...worked its way up to within close range...²⁷

In a similar instance in January 1944, when the 1st Tank Army, after its surprise attack near Zhmerinka, was repulsed by the Germans, it escaped from encirclement in deep snow and clear weather. In spite of determined German efforts to track the route, including two days of heavy aerial reconnaissance, the Soviets, moving only at night, escaped virtually unscathed.²⁸

A German senior commander noted that the Soviets infiltrated large units into camouflaged positions behind German lines "hundreds of times,"

despite the Germans being fully aware of the practice.²⁹ Such cases of "trickling forward" included the use of false graves as sniper posts, and the slow nudging of large rocks.³⁰

A historian of German air operations in the East generalized thus:³¹

Because of Soviet camouflage, deception and improvisation, the German Air Force was unable to stop instances of the steady flow of arms and equipment to the forces at the front, the infiltration of Russian troops into German-occupied areas and the menace of partisan activities

Another German veteran of the Eastern front observed:³²

Because he has an intimate understanding of nature, the Russian soldier easily constructs earthworks, digs trenches, improvises shelters and camouflages positions. He is able to move over the terrain more skillfully and orient himself than the soldier of the Western nations. He has unusual ability in detecting the presence of the enemy. When we were patrolling the lonely forests in operations against partisans, it was always the Russian volunteers accompanying us who detected the enemy first and opened fire...

Von Mellenthin also noted that:³³

The Russian soldier is a past master of camouflage, of digging and shoveling, and of building earthworks. In an incredibly short time, he literally disappears into the ground, digging himself in and making instinctive use of the terrain to such a degree that his positions are almost impossible to locate. The Russian soldier properly dug in, hugging Mother Earth, and well camouflaged, is an enemy doubly dangerous. Even after long and careful scanning, it is often impossible to detect his positions. One is well advised to exercise extreme caution, even when the terrain is reputedly free of the enemy.

At a higher level, an American correspondent noted the elaborate precautions taken to conceal the location of Soviet field headquarters from ground approach; even the highest levels of command found other major headquarters' location uncertain.³⁴

One well-known Soviet technique was the use of bridges which could be built and lowered beneath the level of the water or concealed beneath ice,

thus allowing flexibility and surprise when moving against German river-line defenses.³⁵

In moving naval vessels, merchant ships, and support craft on the Morskoi Channel during the seige of Leningrad, 1942-44, the Soviets utilized various techniques to keep the Germans off-balance, including white camouflage paint on ships, smoke-screens, dummy installations, camouflage netting, and the use of sporadic convoy departure times and fluctuating speeds.³⁶

Maskirovka in World War II, in Soviet military writing, is also often described in terms of the use of new weapons and methods, even such simple instances as a blizzard-shrouded advance in the Stalingrad attack.³⁷ Generally, however, blizzards hampered Soviet as well as German movement and visibility, and their use as cover was restricted to local operations.³⁸

Another frequently mentioned tactical case was the use of massed searchlights to dazzle and disorient German defenders of Berlin in 1945. (It was also a technique used by British forces crossing the Rhine in late March in 1945.) The first use of katyusha rockets is also pointed to frequently as a major case of tactical-strategic surprise in 1941-42, and several books have described the first instance of their introduction into battle as a kind of landmark in the history of maskirovka/vnezapnost.

Other cases of altering ordinary modes of weapons include the mounting of anti-aircraft guns on trains and barges for rapid redeployment and concentration, and the use of medium-caliber anti-aircraft guns in direct support of infantry during the Moscow and Stalingrad campaigns.³⁹ A dummy

forward line was constructed on the Terskiy Range in 1942 by the Transcaucasian Front, which absorbed considerable German attention and firepower.⁴⁰ Soviet agents reportedly donned German uniforms and visited headquarters to issue orders which generated chaos in early 1945.⁴¹

The evolution of Soviet field fortification techniques in the Great Patriotic War also reflected the logic of maskirovka:

Until the end of 1942...there were no connecting passages between log pill-boxes and so the units could not secretly manoeuvre with weapons during the course of battle. The trench system adopted by some of the fronts on their own initiative back in 1942 and by all fronts in 1943, following the instructions of the General Staff and the powerful obstacles imparted new qualities to our defences...(thus) creating conditions for unlimited secret manoeuvre... Heavy shelters...were erected mostly at the site of command posts...⁴²

In spite of such widespread efforts, the Soviets were not always successful. Massive camouflaging of bomb damage by altering building facades and route layout during the German assault on Moscow in 1941 was detected by the Germans since the basic layout of the city and the river could not be changed. The use of decoy fires, however, to simulate bombing, and of dummy aircraft, was more effective in blunting the effect of German night attacks.⁴³

Dashevsky described the administration procedures related to maskirovka command-and-control in Bagramyan's 1st Baltic Front in late 1944:⁴⁴

The maskirovka plan envisioned an array of defensive disinformation measures. All documents about questions of regroupings, and preparation for attack were prepared with only intentions indicated. Telephone conferences, even those encoded, were flatly forbidden. Special temporary controls established at all key telephone exchanges. All reconnaissance escorts, officers and generals were disguised in soldiers' uniforms, in small groups (5-6 men), at specified times and on separate sectors of Fronts, armies, corps and divisions. Absolutely forbidden was

the display of official vehicles to enemy observation. Local inhabitants, under regulations, were removed from populated areas where deployment of administrative organs was planned.⁴⁴

Maskirovka Since 1939: Finland and the Far East

The major Soviet offensive against Japan in August 1945 made good Stalin's promise to the western allies at Yalta in January 1945 that the USSR would attack Japan three months after Germany fell. The success of that campaign was a special triumph for Soviet military professionals, since apparently Stalin felt at first that surprise was impossible. The Russians, however, used a variety of deception techniques against the Japanese in Manchuria in 1939 to win an advantage by deploying numbers of forces well beyond what the Japanese believed possible in that particular situation.⁴⁵

A few months later, in the "Winter War," the Finns, no mean practitioners of camouflage and deception themselves, as the Russians grudgingly conceded, "grossly underestimated the strength which the Soviets could deploy in a region thought to be entirely dependent on the Murmansk-Leningrad railway"--the main supply artery which ran 50 to 150 miles from the main deployment areas all along the Russo-Finnish border and which was served by inferior roads.⁴⁶ Even though they had mobilized after the Soviet seizure of the Baltic states, before the Soviet demands that they cede border areas, the Finns had been lulled by an apparent ebbing of the crisis following the summons of their leaders to Moscow in early October.⁴⁷ Even when the Soviets fired seven shots into one of their own frontier towns and claimed the Finns had killed 13 of their soldiers, and began an actual attack in the North, the Finns believed these were just border incidents.⁴⁸

In any event, the deception plan for the Far East offensive in 1945 was both a fusion and refinement of many techniques evident in the "Hitler War." Deployment of units was carried out under the guise of routine training; meticulous camouflage plans were designed and their execution was supervised from the Front level; radio use was denied to units being moved into imminent contact; border troops were reinforced, and their stations were used as deployment and headquarters sites. Assumed names and ranks were used among forces which might be overrun by limited reconnaissance raids, or which might be observed by local resident agents. Most units moved by night. When the attack came, the first wave was broadly deployed reconnaissance-by-fire, to deny the enemy identification of the main forces, or thrust lines. Although the Japanese were aware of increased activities, they were shocked at the scale and speed of operations once they began.⁴⁹ Part of their bemusement sprang from the fact they had asked the Russians to serve as mediators in July, hoping to end the war with the Emperor's role preserved.⁵⁰

The next instance of a major Soviet-designed surprise attack came in June 1950, when North Korean forces, trained and equipped by the Russians, invaded South Korea, shattered the American-trained and advised South Korean constabulary, and threatened to overrun the country. Only a major intervention by the United States, aided by other nations under United Nations sponsorship, denied the North Koreans victory. The Soviet role throughout was real and apparent without being clearly defineable. Even though North Korean forces were obviously Soviet equipped and trained, and although opponents and neutral observers alike recognized the Soviets' vital role in the war from the outset, evidence of their involvement in the

substantive conduct of the war was scarce throughout. Albeit designed and controlled by Stalinist Russia, throughout the war, they appeared to stand virtually aloof.

It was suspected that Marshal Antonov planned the five-pronged initial attack.⁵¹ An American officer who escaped from North Korea in October, 1950, reported interrogation by senior Soviet officers, one of whom predicted Chinese intervention en masse if UN Forces crossed the 38th Parallel.⁵² No capture of or contact with Soviets in the ground war was reported. Khrushchev later indicated that Stalin was skeptical about North Korean leaders' optimism and ordered Soviet advisors out before the attack in June, 1950.⁵³ In the zone of air combat just south of the Yalu River in North Korea known as "Mig Alley," however, by 1952, the Soviets did commit their own and eastern European pilots to tours of 2 to 3 months for "bleeding" against the US Air Force. Combat was allowed under very close rules of engagement to assure that they not be identified, let alone fall into the hands of UN Forces.⁵⁴

Air combat operations during these engagements were run by a command-and-control hierarchy running from Mukden into North Korea. While the battle controllers were designated as Chinese and North Korea, Russian personnel were in the control room at all times.⁵⁵ Air combat with the Russians on at least one occasion was kept from public view by the UN High Command.⁵⁶ In speculating as to the Soviet role in Korea in respect to maskirovka, one may consider the U.S. Army official historian's explanation of the failure of MacArthurs's staff to anticipate the North Korean attack of June, 1950:

Signs which marked the prelude of the North Koreans attack had become accepted as Communist routine. The increased troop

movement and activity in North Korea in the spring of 1950 followed a pattern established by the Communists in 1947 when they initiated an annual rotation of completely equipped units from the parallel.⁵⁷

How much the infiltration of a 180,000 man Chinese army into North Korea on the eve of the major counter-offensive of November 1950 was specifically Chinese and/or Soviet in concept, style or execution, is not clear. A later episode certainly has the flavor of maskirovka a la Russe. In the spring of 1952, Chinese Communist artillery operations against United Nations' forces increased steadily in the face of UN air and artillery superiority. Techniques included firing guns alternately and from alternate positions--there were several per gun--and the use of roving guns. In the face of more numerous UN artillery, and more sophisticated control and counter-battery systems, the Chinese tripled the number of rounds fired per day, although the actual increase in guns--supplied by the Soviets--was less than a third.⁵⁸

In respect to the heavy emphasis on surprise, deception and camouflage, in Viet Minh/North Vietnamese operations in Indo-China, 1951-1975, one can only speculate regarding the point at which--or Chinese--Soviet C, C & D doctrine, visible enough in the realm of logistical flow, troop movement, and anti-aircraft and electronic tactics, can be teased out from the skills of their clients. Certainly the record in the Middle East, 1956-1973, is rather less dazzling, since Soviet advisors shaped force balance, deployment and tactics and positions which often failed, even in the hands of very closely supervised clients. In any event, far more systematic appraisal of Soviet military advising and support of such operations since 1945 is needed. Beyond that, in spite of imperfect knowledge, and the haunting fears of misinterpretation and dezinformatsiya, the

concept of maskirovka raises many questions worthy of analysis and speculation.

Analysis and Prognostication

The term creativity--tvorchestvo--is laced throughout Soviet military writing, and most especially in respect to surprise and deception, e.g.:

It is inconceivable to achieve surprise on the defensive without a creative approach to creating the groupings of forces and weapons and to organize the entire defense....and to avoid rectilinear configurations of the position and zones... .⁵⁹

In the same vein, Savkin suggests that "surprise is incompatible with stereotype."⁶⁰ It is, therefore, in view of the generally held perception of the Soviet system as monolithic, rigid and centralized, useful to consider how much a paradigm of creativity--creativity in the western sense--influences Soviet leaders/planners, their design and execution of complex operations. Is the constant reference to creativity merely an attempt to raise effort within the lock-step of Marxist-Leninist dogma?⁶¹ Or is it more of a cross-warp in the tapestry of the system, a potential source of the unexpected in statecraft and war, especially in the cohort of post-Revolutionary and post-Stalinist leadership?

As already noted, the Soviet spectrum of definitions of maskirovka ranges from the grand strategic to the immediate practical. The latter, in the West, is a matter usually left to the discretion of individual commanders and troops, sailors or airmen a bit closer to experience and artistry than to design and science. American military professionals readily admit the deficiency of their forces in this area--perhaps the evidence of urbanization, perhaps a by-product of fighting the last four major wars and many smaller campaigns with overweening air superiority. In

any case, the Soviet sub-concept of deforming and camouflage--deformiruish-chaya maska--touches especially close to the growing importance of rapid identification, i.e., virtually instantaneous "identification-friend or foe." While "first-shot kill probability" was already a major problem in World War II, it has intruded itself ever more dramatically into tactical analysis, weapons development and doctrine, since the 1973 Middle East War, and it is an area in which the categories of tactical and strategic often overlap. Given increasing sensitivity to such formulations of combat morphology as Lanchester's equation, and to the costs of error, that is certainly logical enough.

Critical response times in both tactics and in strategy have, moreover, been squeezed ever more closely together, and, in both dimensions, are measured out in micro-seconds. The many hours over which the floundering at Pearl Harbor and, then, in the Phillippines on December 7-8, 1941 took place now seems almost leisurely. Indeed, today even the differential in the speed of flight of anti-tank rockets versus tank guns is a vital part of the identification-fire-hit/miss-retarget-refire cycle. In terms of scale, the 30 to 45 minute warning time projected in case of strategic warfare is even tighter. In such a context, the use of techniques to deny weapons controllers even momentary positive identification of threats and targets puts a special premium on camouflage-deception techniques.

The rigorous conceptualization and unique achievement by the Soviets in this area suggests an attempt to accept and keep uncertainty at a higher level of consciousness has been the practice in the past. The history of arms control points to the probability of continuing refinement in the

strategic realm, and the Soviets have not yet allowed true random inspection. Yet, even if that avenue of verification was opened, Soviet military power would still have to be seen through the qualifying lenses of maskirovka-dezinformatsiya. To accept that fact is not to generate a high sense of anxiety, but prudence, and, above all, to sensitize policymakers, commanders, analysts and battle controllers to a broad and strange landscape of uncertainties. In a way of further investigation, then, one can suggest that the various disciplines tangential to maskirovka be plumbed:⁶²

- physiology
- ethology (in respect to natural mimicry and camouflage)
- human factors
- remote sensing (including optical)
- psychology of perception
- electronics and electrical engineering

The value of rigorous review of German experience in Russia in this area is obvious enough, but a consideration of the evolution of other camouflage systems--Chinese, French, British, Italian, and Japanese--is also in order. Beyond that, maskirovka is something akin to conceptual doughnut hole. Patterns may be a function of omission or commission, and both positive and negative images may define each other. As Burton Whaley has noted in respect to aerial photograph analysis, camouflage once identified, is not arrayed to determine patterns, but, rather, such data tends to be set aside as the search for actual material continues.⁶³

To consider a hypothetical case, the great emphasis on pipelines in fuel transport has been paralleled by many references to pipelines in support of military operations.⁶⁴ On the surface of it, the advantage in bulk transport by pipeline is offset by the fact that it offers an enemy a way to cut a vital artery at low risk. On the other hand, the sudden

installation of dummy pipelines in crisis or war could absorb enemy fire-power and concern, while other techniques--clandestine burial of pipelines, prepositioned stocks and other modes of unit resupply--could carry the main burden of fuel supply.

A main problem in analyzing maskirovka is that there is much to be gained by appearing to be crafty and deceptive. Even if one is aware of such a predisposition, a posture of a craftiness enhances the anxiety of an opponent. The uncertainty of an analyst regarding methods, purposes and intentions creates an effect equivalent to fogging a photographic lense. Since this cultural predisposition has an adjective in the English language--Byzantine--and Byzantium was the mother culture of Russia, some have seen the problem as one of long standing, e.g.:

"The intriguing thing about Russia is her finesse, and therefore, to the unperceiving minds of the western world she is, and always has been, a mystery. But no country has been so frank; by signs and symbols, ever since she started borrowing from Byzantium, she has been at pains to put her writing on the wall. But she asked for a little imagination from the beholder. Instead of putting her heart openly on the table, to change the metaphor, she has preferred that she should go in search of it. The best, therefore, that she has within her she has enshrined.... If.. you look below the surface you will see that the outward form enshrines a great idea, the idiom of Russia, which is her own, and once having that firmly fixed in mind, you will come to see that this same idiom can take many forms... .⁶⁵

At the very least, one can suggest, moving past the distortions and imprecisions involved in any system of perception, e.g., British, French, German or American, that the Soviet system is a result of special efforts on their part to make it so. Separate from the question of masking or distortion is the extent to which the quality and the pervasiveness of maskirovka constitutes a potential force-multiplier for the Soviets, both tactically and

strategically, an element of uncertainty which permeates statecraft and policy as well, and a key component of Soviet military style.

Since the problem of verification has been handled at some length by various analysts, one can go on further to look at possible uses of deception, concealment and camouflage:

- to mask an increase or redeployment of otherwise identifiable weapons
- to block perception and identification of new weapons
- to distract from other activities
- to overload the perceptual-analytical system of an enemy
- to intimidate
- to lull
- to dither
- to habituate perception to patterns, and thus preoccupy when shifting before and after operations, thus playing to the U.S.-Western European hunger for linearity and tabulation in military analysis and operations⁶⁶
- to alter expectations, strategy and doctrine incrementally, and thus alter frames of references
- to present an image of strength in weakness through enlargement
- to present weakness in a case of strength through reduction

While analysts often see surprise as a point in time--e.g., Barton Whaley's view of surprise as a kind of battery discharge--deception can be attenuated. Deception does not announce itself; surprise, as a term, describes deception revealed or detected, the point at which it causes emotional and psychological reaction on the part of those targeted. Surprise, of course, may be unintended, or may be something which a deceiver wants to avoid, since it represents detection. Detection, then, may not be the point or zone of impact or effect of surprise, but something only perceived--if ever perceived--afterward.

A related problem is that of "institutional set," that is, the extent to which predisposition born of organizational norms performs perception in a way that makes it difficult to define a problem outside of an established

framework, a variant of the "halo effect," i.e., while initial impressions are fixed with relatively low energy, and subsequent corrections require far more energy. The effect can be seen in the literature of the verification and SALT treaties; even vigorous set-breakers calling for fresh perspectives focus on the standard unit-index of power and anxiety, intercontinental ballistic missiles. That a suggestion that ICBMs or espionage activity might mask different weapons or strategems would meet a great deal of resistance and hostility, as would any suggestion that the quality of perception of intelligence-gathering systems is short of accepted levels, assertions, or assumptions.

The multiplicity of maskirovka modes and techniques suggests a need to not only stand well back from the canvas, but to take apart the frame, view the picture from behind, and to do chemical analysis of the canvas and paints. Inasmuch as components, which in individual modes appear relatively non-strategic in function, could be assembled into a strategic threat, it would be very useful for the Soviets to assert that C, C & D under the framework of maskirovka is traditionally Russian, and, therefore, if furtive activities are detected, an immediate defense is available: it is not a case of crafty design or part of a broader pattern, but just a national trait.

The Forms of Surprise

Forms of surprise include the specific act in itself, timing of the act in terms of not only when it takes place, but how long it lasts, how fast it takes place, and what kind of temporal pattern is used. This, of course, fits within a definition of surprise as something that requires the visible use of force. This may not be the case. Concealment, surprise or

deception may be carried out in such a way that almost all these factors apply, but in a negative sense, keeping a targeted subject from perceiving what is being done to him. Parallel to the question of time is the aspect of space and volume--how much is involved, what kind of things are being changed, where are they being done, and what is the overall pattern of the shift or change in structure. This, in turn, stands next to qualitative aspects of change, e.g., denial, distortion, masking, decoying, misrepresentation, reconfiguration of forces along axes and in terms of mass, a new configuration of weapons, or a use of old weapons or new tactics--the standard forms of surprise iterated and reiterated in Soviet material on maskirovka.

If Soviet principles and techniques are abstracted and then translated into doctrine, policy and action, one could expect a wide range of apparent stratagems, tensions, and potentials, some real, some unreal, and many of which a target-victim would not be able to perceive or to pin down. The Soviet configuration of effort, that is their main axes of commitment of force, would not be clear, but would be kept hidden even after the outbreak of hostilities. A major surprise attack could be deployed from an apparently half-formed or flat-footed postures and routines which, on the surface of it, might even seem to put Soviet forces at hazard, the tradeoff being that the advantage gained from surprise outweighs the disadvantage of being in less than a fully balanced offensive array, a variant on Zhukov's well-known defense of the logic the sending of attacking forces into mine-fields. Beyond that, one could expect a steady and regular use of electronic and psychological warfare and sabotage not only to damage but to

numb, confuse and dither an enemy, and deny a sense of security about quantities, volumes, and intentions.

All major modern military forces have practiced deception and have experienced surprise to some degree. It is a frequent occurrence in war. Acceptance of that fact could be a major element of policy and of operational expectation, even to the point of inoculating those designated to respond under conditions of stress and monitoring them as they perform their tasks. Heightening the awareness of planners, analysts, and commanders of maskirovka is obviously of value. It also seems useful to reexamine criteria used in selecting people to perform highly precise tasks under pressure and stress, and perhaps at the very least, to avoid assigning of blame, a fairly normal bureaucratic procedure, and which is also resorted to frequently by Western journalists and historians post hoc.

A clearer perception of the degrees of decision-making and coping with the effects of major crisis and surprise is needed, i.e., a gradation of decision-making from administrative routine and policy-shaping through qualitative routines, e.g., personnel and resource decisions, to policy-making and on through to coping with sudden crises and operational surprise, a gradation not drawn very clearly in the conceptualization of decision-making, nor in personnel selection and training. It is, of course, a truism that simulations only approximate operational reality. In war, a vast increase of energy input into opposing systems yields a geometric increase of confusion and uncertainty, and those interfacing component products are further multiplied by the addition of that energy. Soviet doctrine anticipates the resultant turbulence. For example, in exercises, the Soviets move commanders in exercises up and down the chain

of command, to prepare them to take over if key command posts and commanders are destroyed. A similar recognition of the need to move designated headquarters about and to standardize the data base and communication system, but not develop any physical match between hierarchy and command-and-control systems is implicit in the Wave11 command-and-control system, developed by the British for their forces in Western Europe. Indeed, they have remarked on the American fixation on keeping hierarchy as well as highly detailed geographic information in their command-and-control systems.

Maskirovka and Soviet Science and Psychology

In several respects, the area of concealment, camouflage and deception, east and west, is somewhat analogous to command and control, in that it has a history, but one perceived only in fragments, as it emerges rapidly into a kind of "discipline." Technical, experiential and situational perspectives generate either vague or highly specific terms or jargon which tend to blur systemic perception and hamper communication between various practitioners and analysts. There are aspects of art, science and technology, and approaches and techniques are shaped by culture, and both national and institutional mind-sets.

In examining maskirovka as a Russian-Soviet stylistic phenomenon, as a paradigm suigeneris, it is useful to consider Soviet scientific research in respect to natural camouflage. In the Great Soviet Encyclopedia, under the heading "Protective Coloration and Form"⁶⁷ three types are noted: camouflage; aposematism (warning, e.g., bright colors on poisonous species); and mimicry. Three sub-types of camouflage are noted: cryptic, or imitative; concealing through counter-shading; and disruptive. No

Soviet sources are cited, but two works in English are.⁶⁸ In any event, this typology conforms roughly to that seen in western works on natural camouflage and patterning.⁶⁹

It is interesting to consider the long-standing interest evident in Russian and Soviet psychology toward the dynamics of attention. The "orienting reflex" has been most closely investigated in the USSR, and has led, ironically, to extensive study of individual differences.⁷⁰ The dynamics of perception relative to the altering of cueing and perspective has also been studied extensively.⁷¹

During the Second World War, the first publication of the Laboratory for the Study of Perceptions, under the Institute of Psychology at the University of Moscow, was a treatise on the psychophysiology of camouflage and reconnaissance including the following aspects:

- contrast sensitivity
- stereoscopic vision
- distance estimation
- perception of velocity of perceived objects
- color vision
- night vision
- sound perception and sound "camouflage"
- tactile perception for "blind" operations
- olfactory perception

The study was not designed for immediate field use, but designed to provide camouflage experts with a physiological data base.⁷²

In the late 1970s, a team of researchers at the Pavlov Institute declared that "the study of the relationships between the parameters of a stimulus acting on the sense organs and the perception of that stimulus is one of the most important problems of psychology and physiology,"⁷³ which takes contextual meaning in regard to maskirovka when related to Pavlovian psychology's focus on conditioning through stimulus and fear.⁷⁴

The extensive and well-known Soviet research on brain hemisphere function, born of the treatment of major brain trauma in World War II, may also be kept in view in considering the question of perception.⁷⁵ In the realm of surprise, Soviet research on the "orienting reflex" has drawn a distinction between the state of organisms in attention, and the startle reflex born of sudden and major surprise. In the former state, described as "agreeable," a vasodilation in the head is detected; in the latter, deemed "unpleasant," a vasoconstriction. Linked to this is a concern for locating the "threshold of the Breaking of the Law of Strength," i.e., the results of habituation, based on the knowledge that organisms subjected to series of non-harmful stimuli adapt to them as an environmental given,⁷⁶ referred to by Berznitz as the "FAE," or False Alarm Effect, the "credibility loss of the source of threatening information"--the boy crying wolf.⁷⁷

In a standard work on military psychology, the following typology of attention state is offered in conjunction with a discussion of maskirovka:⁷⁸

- attention without awareness
- attention with awareness
- endurance of attention on a single point
- capacity - ability to monitor numbers of points
- distributiveness - sorting and weighing capacity
- concentration in the presence of distractions
- stability - length of concentration over time

A Polish commentator, in considering the psychological aspects of surprise, pointed to the "enormous psychological strain...a sense of 'emptiness' in one's head (thoughts and ideas have 'fled') as well as impulsive chaotic actions." The most important psychological consequences, Paleski has suggested are:

- loss of time
- disorganization of mental faculties
- stupor or excitation

- organization dysphasia
- strain
- fear and possible panic
- weakening of morale⁷⁹

Dobrynin's definition of attention in a signed article in the GSE⁸⁰ touches on both the essence of maskirovka and on its overlap with command and control:

...attention has acquired enormous importance in connection with the creation of complex modern technical systems and man's specific activity in their operation, which demands finely tuned and well-developed attention mechanisms...

an observation especially interesting when the focus of Soviet psychologists on individual differences is kept in mind.

The element of creativity is implicit in Dobrynin's view that the "direct cause of arousal of attention is the meaningfulness for the personality of external stimuli, which include novelty, intensity, contrastive quality."⁸¹ Beyond that, factors which influence attention are identified as:

- persistence
- range
- distribution
- shifting of attention

Duration of attention is noted to be considerably longer when the stimulus is a concrete object or verbal symbol. A special interest is indicated in the ability of individuals to monitor several items simultaneously, and to shift the field of consciousness from one object to another. In view of those particular foci of interest, it is also interesting to note how many of the elements in the various definitive typologies of maskirovka aimed at exploiting or attacking the psychological

pre-dispositions or vulnerabilities of observers and foes of the Soviet system, e.g.:

Surprise permits forestalling the enemy in delivering strikes, catching him unaware, paralyzing his will, sharply reducing his combat effectiveness, disorganizing his control... .⁸²

Moreover, the "ways and methods" of vnezapnost--surprise--which follows this statement are virtually parallel to the technique of tactical maskirovka.

Maskirovka also fits into the confluence of military psychology and command-and-control in respect to the Soviet concept of "reflex control," which includes not only the ability to read-out enemy weaknesses and intentions and orchestrate them into the battle plan, but to lead the enemy down false trails in peacetime vis a vis choices, etc. Also implicit in this concept is the identification and use against the enemy of his "specified algorithms of decision which... (are) familiar to us, while practicing the fine art of applying non-repeating techniques, keeping one step ahead of the same strategem being employed by the opponent." In both of the above analyses, maskirovka, dezinformatsiya and imitatsiya are the main threads of the techniques under discussion, and bridge the world of Soviet military doctrine and psychology, e.g., "conscious imitation is reinforced when the result of an action coincides with a person's conception of particular mode."⁸⁴

The Soviets have long conducted scientific research in the areas of optics, natural camouflage and psychology of attention and perception, which are more than tangential and often near congruent with the issue of subterfuge and deception. In the realm of the practical, they have repeatedly stressed their inclination to practice such techniques, even in the

context of nuclear disarmament discussions and agreements. The Russian-Soviet penchant for crypticity has been seen in the space program, e.g. uncertainty about the fate of various space launches and astronauts, role of "civilian" versus "military" Salyut orbiting space stations, the status of fractional orbiting bombardment system and space battle platforms, and the "photo-forgery" case.⁸⁵ As already noted, expression of interest in such practices serves in itself as kind of a weapon, and as a filter.

Like the creation of a propaganda ministry, maskirovka serves to fog and warp the mirror of perception. For the careful analyst and the generalist policy-shaper and decision-maker alike, the institutionalization of dezinformatsiya and the mystique of maskirovka add to the wearing effects of vigilance. In battle, maskirovka raises such dilemmas as whether to fire against what may be decoys, and thus waste ammunition and reveal the base of fire, or to risk the massing close at hand of seemingly inconsequential forces which later threaten to swamp the defenses.

In the realm of strategy, in the late 1960s, the application of maskirovka and vnezapnost in strategic warfare was under close consideration, including high-altitude nuclear explosions to disrupt communications with electro-magnetic pulse; altering the phasing of strategic weapons, e.g., firing operational and tactical missiles, but holding back ICBMs; launching a general war from the context of conventional or local wars; and softening policy to lull an unwary opponent.

At this point, it is useful to consider the definition of strategic maskirovka: an execution of orders of high-level supreme commands and subordinate groups; measures to protect and secure preparations for

strategic operations and campaigns, but also disorientation through comparatively truthful intentions and activities of armed forces.⁸⁶ In the same vein, a recent discussion of maskirovka the authors observed that "...the more powerful the means of attack the enemy intends to use, the more important it becomes to have them expended on dummy targets."⁸⁷

With that in view, one may ask how much of what can be seen is part of a well-developed corpus of maskirovka, whether there is an order of analysis, codification and practice not seen, or in only a slightly less elegant and/but critical sense, an inventory of methods and devices not to be revealed short of major war. Are there classified Army, Navy and/or Air manuals and service school curricula on maskirovka? Is there a corps of experts? Or is maskirovka rather more ephemeral, generic, a kind of smoke screen, or will-o'-the-wisp, i.e., is maskirovka in itself? In this respect, a special paradox has been noted, that as Soviet deception became widespread in World War II, deception itself sometimes yielded a pattern for analysis.⁸⁸ It certainly preconditions observers to see any attempt to deceive as somehow more normative than what would be seen as the case if practiced in another context, or by other practitioners.

One extreme projection of the maskirovka paradigm is that the Soviets have put far less into weapons and more into long-term economic survivability than appears to be the case; that many of their military installations are dummies to make targetting more expensive by enemies, draw them into mortgaging or destabilizing their social and economic system in anticipation of a threat which has, in fact, been framed and mounted to effect destabilization. In such a prognosticatory structure, the primitive

standards of life which foreigners are allowed to see might be contrived to convey a sense of crudeness and incompetence.

Another possibility would be that major elements of technical surprise are being developed within this shadowy nexus, while perceivers of Soviet "threat" focus on the kinds of weapons most familiar to them, overlooking the possibility that they are never to be awarded a stand-up, decisive fight, but, rather, to be drawn in a spider's web of subtle conflict, and then entangled by their own struggling. The expense of high-technology weapons, the preferences of a sensate and general comfortable society for peace and for avoidance of military service generate a sense of resignation and habituation.

Within the logic of maskirovka, the Soviet threat, long visible, has not come to a crescendo, in spite of small hot wars, espionage, propaganda, and sabotage, nor will it. Therefore, it becomes accepted by many that part, or most, or all of the threat is in the eye of the beholder, or that there is no threat, or that a clear decision or major clash may never come, as it was with the Catholic-Protestant Wars. Such an extreme extrapolation of the logic of maskirovka conforms to the Leninist aphorism about lulling the bourgeoisie and smashing with a clenched fist at the maximum moment of relaxation; but if the mill grinds on, successfully, such a blow might never be needed. One could, after all, have a struggle in which loss would only be seen in hindsight--or in which it would never be seen or felt.

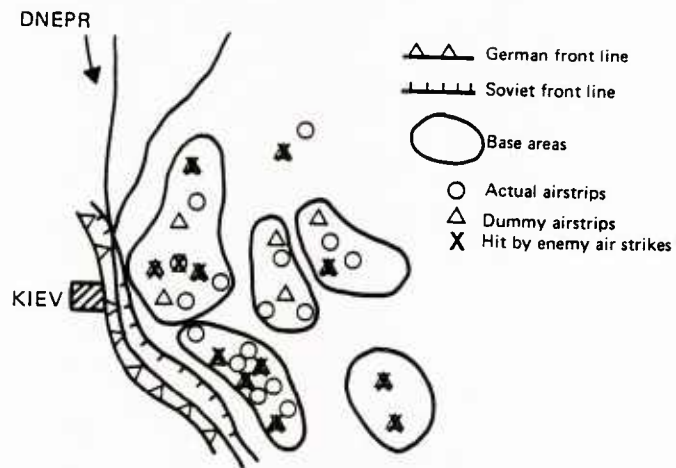
To seize upon an instance, in comparing the size and the apparent complexity of facilities on US vs. Soviet space and strategic weapon test facilities, (see Table 2) one confronts several quandaries: does the size of these facilities reflect the greater availability of land in the Soviet

Union. A more spacious mind-set? Greater inefficiency? A more ambitious program, a tendency to overbuild in a society where make-work is used to guarantee employment? Does the higher ratio of support to launch suggest maskirovka a la Voronezh 1943? (see Figure 2) Do sheer numbers and vast acreage point to dispersion within the bases--or, on a larger scale, is there a differential between major bases, i.e., are some designed mainly as a spoof? Or is redundancy of facilities the underlying logic? Are all these main facilities "written off" as potential targets, distracting from other, more furtively constructed and hidden major space-strategic missile facilities? Or is what you see really what there is?

To swing the focus of analysis to the other end of the tactical-strategic spectrum, why do photographs of Soviet ground exercises indicate little apparent effort at camouflage? Is maskirovka in use, and therefore not detectable? Or is the "real stuff" held back, for operational use only? Is what is shown is designed to elicit reaction on the part of the receiver? Or is the actual practice of the art of maskirovka far less advanced than doctrine, historical case description and assertion would have us believe? The disparity between tactical communications sophistication deception and on the one hand and a casual attitude toward maskirovka on maneuvers on the other is certainly perplexing.⁸⁹ It may, of course, in some cases, be a reflection of uneven conformity to doctrine and practice. For example, in discussing the importance of keeping a close watch on orienting points on the terrain, a Soviet analyst noted that in exercises, commanders rarely practiced active techniques of deception, most especially the use of dummies and decoys, beyond conforming to light and sound discipline.⁹⁰

Figure 2

VORONEZH FRONT - 1943 - c. October 20



Adapted from:
 E. Simakov, "Operativnaya Maskirovka V.V.C.V.
 Nastupatelnykh Operatsiy," in *Voyenno-Istoricheskiy
 Zhurnal*, (1977:2) pp. 19-26.

TABLE 2*

Major Rocket Sites	# of pads and silos	Launch-related support facilities	Dimension sq. mile
U.S. - Kennedy	21	16	c.100 about half water
Vandenberg	53	43	286
USSR - Tyuratam-Leninsk-Baikonur	80	95	3230
- Volgograd	31	72	2304
- Northern Cosmodrome-Pleetsk-Kochmas	42	65	2500

*Derived from Kenneth Gatland, et. al., The Illustrated Encyclopedia of Space Technology: A Comprehensive History of Space Exploration (New York: Harmony, 1981) pp. 34-44.

The warping of forces and doctrine to conform to perceived Warsaw forces and doctrine has long been the basis for debates in western defense and intelligence circles. The phenomenon of maskirovka raises the question as to not only where forces may be, but as to how many units of force are real and how many are false. Given the strategic problems of the Soviet Union in facing, by their own definition, the possibility of fighting in Europe and in China all at once, as well as at other points on their widely splayed periphery, one can ask if they would pre-commit their first-line forces to one or another theater, before the proverbial balloon went up, and the need for the shifting of reserves became apparent. Their strategic dilemma could predicate locating central reserves midway between the two potential fronts. The alternative would be the build-up of forces in each theater, in view of the possibility of outright destruction of or substantial damage to the transportation facilities for shunting, well beyond normal peacetime levels required theoretically for the right correlation of forces. Thus, the Soviet build-up in eastern Europe since the early 1970s, and the buildup of strong US-Chinese might in itself be a form of maskirovka--or a move toward assurance of proper defensive correlation of forces versus the spectre of a Soviet blitzkrieg⁹¹ which has been the major American and NATO doctrinal focal point since 1948.

In any event, the reality of what is beneath maskirovka remains indeterminate. The problems of "C, C & D" have certainly been better thought out and operationalized than in the West. Exactly how much further than can be seen is not clear, but maskirovka poses a quandary. To hide, to deceive, to mirror, to penetrate, are all implicit in its various definition and examples, and the spectrum of techniques is broad and

complex. Not just a military and war-related phenomenon, it cuts across the Ericksonian traid of doctrine-technology-style, and is a far more important aspect of the Soviet system than has been perceived thus far. Most elemental is the fact that the predisposition to such practices and the defense of them constitutes a commitment by the Soviets, albeit culturological or strategic, to the widespread and systematic use of deceit as policy, which makes appraisal of threat difficult and arms control efforts uncertain. The continual evocation of maskirovka as something endemic to Russia and Communism by the Soviets is, if it is taken on the face of it, a commitment to unreliability, not only as a kind of vague contaminant of statecraft, and warfare evident enough in all modern nations, but as a unique coefficient of unreliability, which makes straightforward dialogue with the practitioners dubious, dangerous and unpleasant. A vague sense of pressure is too vague to grapple with; subtle, convoluted ploys, too complex to make certain, or to convey to policymakers or constituencies hungering for simple data, simply presented, or evidence which meets legalist rules.

An analyst of Soviet deception has suggested that: "The real test of Soviet mastery of deception would come only during a conflict with NATO countries."⁹² In the definition of "conflict" lie the kernels of intertwined problems--perception, definition and prognostication. To what extent has Soviet psychology (and we might note the extent to which Stalin and Zhdanov intruded themselves as experts in this area) been bent to the refinement of "reflex control," dezinformatsiya, maskirovka, imitatsiya, and so forth? Are these all contiguous concepts and terms elements in some sort of holistic manipulative strategy?

The application of Pavlovian psychology to sinister ends in the purge trials of the 1930s, the "brain-washing" of prisoners in the Cold War, the use of psychiatric labelling and detention as elements of political control are visible enough. If one overlays the Pavlovian paradigm onto the tradition of maskirovka, it causes certain patterns to appear which are worthy of, at least, further consideration and analysis; if one goes one step further and assumes an orchestration of various modes of deception, camouflage and concealment, then one could hypothesize the use of maskirovka and its linked concepts and techniques to condition an adversary, to lull, to draw off from reality, and to stun and befuddle over time, or at what is deemed an appropriate time. The case of Operation Scherhorn suggests that maskirovka can also be used to elicit evidence of the inner dynamic of a perceiver-reactor, providing a way to penetrate a system and trace out algorithms. At the very least, one might wish to keep in mind the streak of forced optimism in the Soviet weltanschauung, in this contest and most especially Pavlov's view that:

...the chief, strongest and most permanent impression we get from the higher nervous activity by our methods is the extraordinary plasticity of this activity and its immense potentialities. Nothing is immobile or intractable. Everything may be achieved, changed for the better provided only that the proper conditions are created.⁹³

To follow in the conceptual footsteps of Berdyaev and Lenin, then one may ask: what is to be done? Procedures which could be used against such a fog-bank include:

- careful network analysis, leading to the design of fire plans, including randomized H&I fires against those critical chokepoints and nodes in zones of deployment which are vital to any major combined arms deployment

- multiple perception and verification instrumentalities, including interpretation of remote-sensing and command data by separate analysts, with independent conclusions
- maximization of IFF and first-shot kill capacity
- maintenance of a reservoir of techniques and systems not to be implemented or revealed to operational units prior to major commitment
- use of evaluators fresh to the data and setting to compare perceptions, e.g., cross-pollination of intelligence specialists between headquarters, use of front-line commanders and staffs as evaluators, multi-disciplinary analysis teams with minimum "insider" socialization and conditioning
- the adoption of pervasive and similar practices and postures, i.e., a mirror effect

In this respect, one notes that the preparing the system to react to surprise is evident in Warsaw Pact military professional literature. Paleski, for example, has argued the need for rigorous psychological selection of cadres, to maximize the following traits for coping with surprise:⁹⁴

- a strong nervous system
- quick-thinking
- quick orientation to the environment
- quick logical conclusion capacity
- sense of responsibility
- coolness under pressure
- ability to shift attention quickly

Other methods to inoculate against surprise are:⁹⁵

- maintain high readiness
- practice rapid estimates
- keep troops informed regarding the range of possible surprise techniques
- maintain composure among commanders and staff officers
- keep troops active
- move rapidly in correcting the imbalance resulting from surprise

and:

When training troops in peacetime exercises, one should not permit commanders to receive a large quantity of information which paints a clear picture of the situation.⁹⁶

Attempts have also been made to reduce various aspects of maskirovka and vnezapnost to algorithms; Shchedrov⁹⁷, for example, offers the following equation:

$$K = \frac{L_m - L_o}{L_m}$$

Where K = camouflage volume; L_m = route length in kilometers; and L_o = open sectors in kilometers.

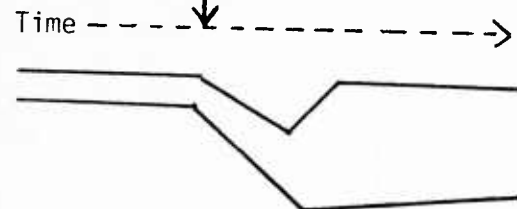
This method of analysis is seen as useful in measuring both natural advantage and work volume necessary to mask. In respect to coping, Paleski offers the following graphic model:⁹⁸

Level of correct actions

Troop actions taking into account possibility of sudden change

Troop actions failing to take into account the possibility of sudden change

Moment of Surprise



In spite of such attempts at reductionism, attainment of an exact or even a narrow-range maskirovka coefficient is unlikely. Is maskirovka nevertheless real, a contaminant, a fuzzy-set, a vital factor in analysis and appraisal? The implicit paradoxes--that what can be seen may not be, or may be something else, and that what cannot be seen may be the major part--are not easy to accept. Indeed, is it reasonable to expect that something so convoluted, passive and subtle can be part of the world-view

Table 3*

Maximum Distance at which Uncamouflaged Objects may be
Observed from Air by Day through a Highly Transparent Atmosphere

Objects Observed	Height, km	Slant Range, Km	
		Detection	Identification
Combat and transport machines outside of entrenchments and shelters	0.1 0.6-1 6-10	4-5 6-9 10-15	2-3 3-5 not identifiable
Military and transport installations in trenches and shelters	0.1 0.6-1 4	3-4 6-7 7-8	1.5-2 3-5 5
Artillery and AA Units in firing position	0.1 0.6-1 4	2-3 3-4 5	1.5-2 2-3 not identifiable
Trenches, communications, roads, artillery gun-pits	1 4 6-8	2-3 5-7 10-12	1-1.5 5-6 9-10
Bridges and other crossings	8-10	15-20	15-20

*From Table 1, A.A. Beketov, A.P. Belokon and S.G. Chermashentsev, Maskirovka
Deistvy Podrazdelenii Suizhopuitnuiz Voisk (Moscow: Voennoe Izdatel'stvo, 1976)
p. 23.

of Americans, raised in a culture which seeks direct solutions to problems, and which hungers after measurement and rectilinear forms in work, in play and in battle? Perhaps it is not as unlikely as it might seem at first glance.

American culture is not without its own traits of deception, from the artful hyperbole of Madison Avenue to trick plays in football, the traditions of industrial espionage, the "flim-flam" man, the con artist's "sting," the shrewd Yankee trader, and bluffing at poker. However, such phenomena are contrary to the concept of military honor, and indeed, the socialization of American military leaders aims at driving out Barnumism. Knowing the preference of Americans and of Western Europeans for linear warfare, one can hypothesize Soviet maskirovka strategems, the design of tactics which would ensnarl seekers-after-linearity in their own urge to impose order on fluidity, to models of hypnosis or lulling, gradation of what the Soviets call "reflex control" in which the bulk of an opponent's attention and resources are drawn, like iron filings to a magnet, toward arrays of armies and missiles.

The searcher after conspiracy can easily enough envision a regime, to whom time in the short run and constituencies mean little, plays its pieces subtly and deliberately in peripheral wars-of-national liberation, a strategy along the lines of Robert Asprey's model of "pressure-and-gain." While such prognostication awards too much coherence and effectiveness to Soviet strategy, nevertheless, a glance back at the checklist of what were viewed as vital bases in case of a general war in the late 1940s, and current U.S. or NATO access to those bases, raises a variant of Peirse's "irritation of doubt."

In conclusion, at a time of an explosion of remote-sensing technologies and with maskirovka and the Soviet focus on the psychology of attention in view, it may be well to consider the admonition of a psychologist of perception:

...seeing pictures is very different from seeing normal objects. This means that pictures are not typical objects for the eye, and must be treated as a very special case...⁹⁹

Footnotes

FOOTNOTES

Note: GSE=a Great Soviet Encyclopedia; CVE=Soviet Military Encyclopedia; Soviet journal page numbers for Voyennaya Mysl' and Voyenny Vestnik are from NTIS translations.

1. "On the Nature of Soviet Leadership," Rolling Stone (351) January 21, 1982, p. 13.
2. The suggestion by some Soviet writers that maskirovka was not dealt with in other than an anecdotal and fragmentary way until the mid-1970s is not quite true, e.g., cf. U.G. Stepanov, Maskirovka ot Radioelektronnogo Nablyudeniya (Moscow: Voenizdat, 1963) and Protivoradiolokatsionnaya Maskirovka (Moscow: Sovetskoye Radio, 1968).
3. A.A. Grechko, et. al., eds., Sovetskaya Voyennaya Entsiklopediya (Moscow, 1976), Vol. 4, pp. 175-176; n.a., Great Soviet Encyclopedia (New York: Macmillan), Vol. 15, 1977, "camouflage," p. 11; "Breach of Camouflage," Vol. 8, (1975), p. 17; "screen," Vol. 9 (1975), p. 423; also see John R. Scafe, Robert M. Pew and Michael W. Phelps, A Pilot Study of Russian Military Analysis Technology, Science Applications, Inc. 82-020FSRC, March 1981, p. 6.
4. Col. V. Shchedrov, "Camouflaging Troops During Regrouping and Maneuver," Voyennaya Mysl' (1966:6), pp. 61-69.
5. V.V. Shelyag, A.D. Glotochkin and K.K. Platonov, Military Psychology (Moscow: Military Publishers, 1972), p. 109. Some other terms related to maskirovka are:

imitatsiya - imitation

tozhnaya pozitsiya - false positions

tozhnuiy deistviy - false actions

tozhnuiy obzhekt - false objects

tozhnuiy raion - false area/sector

tozhnuiy farabater - false channel

maskirovka okravshivanye - camouflage painting

maskirovochnie pokruitnie - camouflage cover

maskirovochnie meropiyatiya - camouflage measures

maskiruishaya forma - deceptive contour

maskiruishaya svoista - camouflage features

maskirovochnaya yemkost - camouflage capacity

maskirovochnyye sredstva - camouflaging facilities

maskiruyushchiye svoystva mestnosti - camouflaging features of the terrain

c.f., Director of Soviet Affairs, AFIS, Soviet Military Concepts 1-79, pp. 155 and 170; Scafe, Pew and Phelps, op. cit., p. 6.

6. See Herman Kahn, On Thermonuclear War, 2nd ed. (Princeton: Princeton University Press, 1961) p. 300; D.J. Goodspeed, "War on the Eastern Front," Military Review (xxx:11) February, 1951, pp. 87-93; and

entries under "camouflage" in index, B.H. Liddell Hart, ed., The Red Army (New York: Harcourt Brace, 1965).

7. Shchedrov, op. cit. pp. 61-69.
8. See D.A. Ivanov, B.P. Savelev and P.B. Shemansky, Osnovuiy Upravleniya v Boiyu (Moscow: Military Publishers, 1977), pp. 312-313.
9. Yu. V. Chuyev and Ily. B. Mikhaylov, Forecasting in Military Affairs, transl. DGIS Multilingual Section, Translation Bureau, Ottawa, Canada (Washington, D.C.: U.S. Government Printing Office, n.d. (1980)), p. 55.
10. GSE, Vol. 15, p. 11.
11. Ibid., and CVE, Vol. 4, p. 175.
12. Ibid., p. 176; the fact that the "D"--dezinformatsiya--Department of the KGB was created in 1959 at about the time that the Strategic Rocket Forces, has been noted by some analysts, cf. William R. Harris, A SALT Safeguards Program: Coping with Soviet Deception Under Strategic Arms Agreement, Rand Paper 6388, September 1979, p. 13.
13. Garthoff, op. cit., p. 269.
14. See GSE, Vol. 15, p. 11; Kh. Adam and R. Gebel, "Military Camouflage," Voyennaya Mysl', #11, November 1971), especially Table 2 on page 3, this and subsequent VM citations and page numbers from FBIS Press translations.
15. A good deal of attention is given to smoke, including a focus on American experiments with types designed to blunt the effectiveness of radar and of nuclear weapons; Shchedrov, op. cit., p. 61; also see G.S. Zaitsev and A.Y. Kyznetsov, Dymovye Sredstva i Dymoovrazuischie Veshhestva (Moscow: Military Publishers, 1967).
16. V.I. Achkasov and N.B. Pavlovich, Soviet Naval Operations in the Great Patriotic War, 1941-1945 (Annapolis: Naval Institute, 1981), p. 75.
17. E.g., Stepanov, op. cit.
18. Major General A. Limno and Col. A. Gorkin, "The Effectiveness of Maskirovka," excerpted in Strategic Review (VIII:3) Summer, 1980, p. 103.
19. Op. cit., p. 56; for basic battlefield techniques, sketches and diagrams, see A.A. Beketov, A.P. Belevkov and S.G. Chermentsev, Maskirovka Deistvy Podrazdeleniye Suzhoputnuiz Voisk (Moscow: Military Publishers, 1976); also see I. Tolochkov, Maskirovka v Sovremennom Boiy: Izdanie, Vtoroe, Ispravlennoe i Dopolnennoe (Moscow: Izdatelstvo DOSAAF, 1975).

20. Quoted in John Despres, Lilita Dzirkals and Barton Whaley, Timely Lessons of History: The Manchurian Model for Soviet Strategy, Rand Paper, R-1825-NA, 1976, p. 16.
21. L. Gromov, Major General of Artillery, "Surprise in Combat," Anti-Aircraft Defense Journal, (1976:1), pp. 25-30.
22. Deter Sevin, "Operation Scherhorn," Military Review (46:3) March, 1966, pp. 35-43.
23. Raymond Garthoff, Soviet Military Doctrine (Glencoe: The Free Press, 1953), pp. 266-271.
24. James Lucas, War on the Eastern Front, 1941-45: The German Soldier in Russia (New York: Stein and Day, 1979), pp. 53-54, 96, and 181.
25. See Gunther Blumentritt, "Moscow," in Seymour, Friedin and Richardson, eds., The Fatal Decisions, transl. Constantine Fitzgibbon (New York: William Sloane, 1956), p. 47.
26. Wilhelm Speidel, The Reichswehr and Soviet Russia (Washington, DC: Office of the Chief of Military History, 1949), pp. 119-120.
27. N.a., "Russian and German Tactics in World War II," Military Review, (xxix: 6) September, 1949, p. 102.
28. N.a., Russian Combat Methods in World War II--DA Pamphlet 20-230 (Washington, D.C.: Department of the Army, 1950), p. 88.
29. F.W. von Mellenthin, Panzer Battles: A Study of the Employment of Armor in the Second World War, transl. H. Betzler, ed., L. C. F. Turner (Norman: University of Oklahoma Press, 1956), pp. 185-186.
30. "Russian and German Tactics....," pp. 101-2.
31. Harold Faber, ed., The Luftwaffe: A History (New York: New York Times Books, 1977), p. 235.
32. W. Kretschmer, "The Psychology of the Russian Soldier," Military Review (xxxi:12) March 1952, p. 86.
33. Op. cit., p. 294.
34. Walter Kerr, The Secret of Stalingrad (Chicago: Playboy Press, 1979), p. 227.
35. Louis B. Ely, The Red Army Today, (Harrisburg: Military Service Publishing Company, 1949), p. 87.
36. V.I. Achkasov and N.B. Pavolovich, Soviet Naval Operations in the Great Patriotic War, 1941-45 (Annapolis: Naval Institute, 1981), p. 318.

37. E.g., see V.Y. Savkin, The Basic Principles of Operational Art and Tactics, transl. U.S. Air Force (Washington, D.C.: U.S. Government Printing Office, 1977), p. 231.
38. Russian Combat Methods, p. 84-86.
39. Gromov, op. cit., p. 5.
40. Col. K. Kusch-Zharko, "Principles of the Art of Warfare in Defense," Voyennaya Mysl' (1973:9), p. 35.
41. Max Simon, Experience Gained in Combat with Russian Infantry, Historical Division, European Command (Washington, D.C.: Office of the Chief of Military History, 1949), p. 19.
42. Ivan Parotkin, et al., eds., The Battle of Kursk, (Moscow, Progress Publishers, 1974), pp. 217-18; in the First World War, non-Russian observers noticed similar procedures; Maj. Gen. Sir Ronald Knox in With the Russian Army 1914-1917 (London: Hutchinson, 1921), vol. ii, p. 493) noted Russian experiments with powders to blend trenchworks with natural earth, and recounts an anecdote of two Russian gunners simulating battery fire, one throwing bags of dust in the air as the other set fire to kerosene as he spit it out in a spray; also see Stanley Washburn, Field Notes from the Russian Front (London: Andrew Melrose, 1915), Chapter XX, "A Visit to the Trenches," pp. 249-258; and R. Scotland Liddell, Actions and Reactions in Russia, (New York: E.P. Dutton, 1918), p. 25.
43. Alexander Boyd, The Soviet Air Force Since 1918 (New York: Stein and Day), pp. 130-131.
44. Lt. Gen. Y. Dashevskii, "Organizatsiya i Provedenie Operativnoy Maskirovki," Voyenno-Istoricheskii Zhurnal (1979:4), p. 49.
45. See Edward J. Drea, Nomonhan: Japanese Soviet Tactical Combat, 1939, (Fort Leavenworth: Combat Studies Institute, 1981), esp. p. 67, which describes the use of sound equipment.
46. Allen F. Chew, The White Death: The Epic of the Soviet-Finnish Winter War (Lansing: Michigan State, 1971), p. 6.
47. Ibid., p. 26.
48. For details of the period, see Vaino Tanner, The Winter War: Fighting Against Russia, 1939-40. (Stanford: Stanford University Press, 1957).
49. Lilita I. Dzirkals, "Lighting War" in Manchuria: Soviet Military Analysis of the 1945 Far East Campaign, Rand P-5589, January 1976, pp. 29-30 and 55-60.

50. See Diplomatic Extracts, July 1945 SRH-040, Declassified September 13, 1979, pp. 87-88.
51. Edgar O'Ballance, Korea, 1950-1953, (Hamden: Archon, 1969), p. 30.
52. Roy B. Appleman, South to the Naktong, North to the Yalu, (Washington, D.C.: Office of the Chief of Military History, 1961), p. 739.
53. Joseph C. Goulden, Korea: The Untold Story of the War (New York: Times Books, 1952), pp. 61 and 328.
54. Robert Kilmarx, A History of Soviet Air Power (New York: Praeger, 1952), pp. 236-241.
55. Robert Frank Futrell, The United States Air Force in Korea, 1950-1953 (New York: Duell, Sloan and Pearce, 1961), p. 370.
56. Ibid., p. 567; also see Appleman, op. cit., pp. 486-487.
57. James F. Schnabel, The U.S. Army in the Korean War: Policy and Direction, the First Year, (Washington, D.C.: Office of the Chief of Military History, 1972), p. 64.
58. Roy G. Hermes, Truce Tent and Fighting Front, (Washington, D.C.: OCMH, 1966), p. 284; compare this description with the section on Soviet artillery tactics in Russian Combat Methods.
59. K. Kusch-Zharko, op. cit., p. 35.
60. Savkin, op. cit., p. 235.
61. For examples of the citation of cases interlaced with cheerleading, see Col. P.Y. Korolev, "In the Interests of Tactical Cover and Deception," Voyenny Vestnik (4:1977), p. 215; and Lt. Col. A. Chulanov, "Concealment and Surprise," Soviet Military Review (1), January 1981.
62. Interestingly, the references given for the entry "protective coloration and form" in the GSE are non-Soviet, even though a broad body of Soviet research in this area is believed to exist, cf., Vol. 2, 1979, p. 559.
63. Burton Whaley, Strategem and Surprise in War, ARPA Study #920F-9717, 1969), pp. 147-148.
64. D.D. Sokolovskiy, Soviet Military Strategy, 3rd ed., Harriet Fast Scott, ed. (New York: Crane Russak, 1975), p. 315.
65. Henry Charles Bainbridge, Peter Carl Faberge: Goldsmith and Jeweller to the Russian Imperial Court (London: Spring Books, 1966), pp. 40-41.

66. This a particularly interesting problem since the Soviets, and/or their surrogates, have had American prisoners during 10 years of war in virtual stress laboratory situations since 1945.
67. GSE, Vol. 2, 1979, p. 559.
68. A similar pattern appears in other Soviet scientific--and military--works, where often, a few Russian or Soviet references set the stage, and the rest of the references are western.
69. E.g., see J.N. Lythgoe, The Ecology of Vision, (Oxford: Clarendon Press, 1979), Chapter 7, "Camouflage and Advertisement," pp. 170-205.
70. R. Lynn, Attention, Arousal and the Orientation Reaction (Oxford: The Pergamon Press, 1966), p. vii.
71. E.g., see A.G. Logrineko and T.M. Sokoskays, "Leontev's Phenomenon: The Effect of Distance and Spacing," Voprosy Psikologii, (1975:5), pp. 13-15, reprinted in Soviet Psychology, (Summer 1976) pp. 75-96; and E.N. Sokolov and O.S. Vinogradova, eds., Neuronal Mechanisms of the Orienting Reflex (Hillsdale: Erlbaum, 1975).
72. See abstract of K.K. Kukcheev, "Physiological Basis of Camouflage," Nature (152) Nov. 20, 1943, p. 605.
73. A.M. Vvantskii, Yu. M. Zabrodin and L.V. Mateeva, "Evoked Potentials of the Brain and Errors of Perception," Zh. Vyss. nerv. Regat. Pavlov, 1978 (28:5) pp. 1037-46, reprinted in Soviet Psychology, Spring 1980 (xviii:3), p. 83.
74. Steven F. Maier, Martin E.P. Seligman and Richard L. Solomon, "Pavlovian Fear Conditioning and Learned Helplessness: Effects on Escape and Avoidance Behavior of (a) the CS-US Contingency and (b) the Independence of the US and Voluntary Responding," Chapter 10, pp. 299-342 in Byron A. Campbell and Russell M. Church, eds., Punishment and Aversive Behavior (New York: Appleton-Century Crofts, 1969.)
75. Robert S. Woodworth, Contemporary School of Psychology, 3rd ed. (New York: Ronald Press, 1964) pp. 94-97; also see Chapter 3, "Pavlovian Conditioning" in J.R. Millenson, Principles of Behavior Analysis (New York: Macmillan, 1967).
76. Lynn, op. cit., pp. 8-11.
77. Shlomo Breznitz, "False Alarms: Their Effects on Fear and Adjustment," in Irwin Sarason and Charles D. Spielberger, eds., Stress and Anxiety, Vol. 3, (Washington, D.C.: Hemisphere, 1976.)
78. Shelyag, Glotochkin ad Platonov, op. cit., p. 109-110.
79. Major-Manager Z. Paleski, "Psychological Aspects of Surprise," Voyennaya Mysl' (1971:7) p. 103.

80. N.F. Dobrynin, "Attention," Great Soviet Encyclopedia, Vol. 3, p. 42).
81. Ibid.
82. Vasiliy Ye. Savkin, Osnovnyye Printsipy Operativnogo Iskusstva i Taktiki (Moscow: Military Publisher, 1972) in Harriet Fast Scott and William F. Scott, The Soviet Art of War: Doctrine, Strategy and Tactics, p. 156.
83. The A-10 attack aircraft is seen as such an instance by Col. A. Berezkin, cf., "On Controlling the Actions of an Opponent," Voyennaya Mysl' (1972:11) p. 94); also see Maj. Gen. M. Ionov, "On the Methods of Influencing an Opponent's Decisions," Voyennaya Mysl' (1971:12) pp. 58 and 61-65.
84. Great Soviet Encyclopedia, vol. 20, p. 128.
85. See James E. Oberg, Red Star in Orbit (New York: Random House, 1981) pp. 129-31 and 146; U.S. Department of State, Selected Documents No. 12A-SALT II Agreement, Articles IV-5a, b, c; 6; 8; V-2b, and, in the Glossary, "Deliberate Concealment;" "Encryption;" "Functionally Related Observable Differences;" and "Verification."
86. CVE, Vol 3, p. 175.
87. Major General Eng. A. Limno and Colonel A. Gorkin, "The Effectiveness of Maskirovka," excerpted in Strategic Review (VIII:3) Summer 1980, p. 103; also see Shchedrov, op. cit., p. 61.
88. Seweryn Bialer, ed., Stalin and His Generals (New York: Pergasus, 1969), p. 616.
89. Compare pp. 59 and 154-55 in Ray Bonds, ed., An Illustrated Guide to Weapons of the Modern Soviet Ground Forces (New York: Salamander Books, 1981).
90. Major M.A. Ziyemin'sh, "...Plus Military Cunning," Krasnaya Zvezda, January 24, 1979, excerpted in Strategic Review (VII:4) Fall, 1979, p. 100.
91. E.g., see John Keegan, "Soviet Blitzkrieg: Who Wins?" Harper's (264:1584), pp. 46-53.
92. Jiri Valenta, "Soviet Use of Surprise and Deception," Survival (XXIV:2) March/April, 1982, p. 60.
93. Quoted in John McLeish, Soviet Psychology: History, Theory, Content (London: Methuen, 1975), p. 224.
94. Paleski, op. cit., p. 107.

95. Lt. Col. Kuleszynski, "Some Problems of Surprise in Warfare," Voyennaya Mysl' (1971:5) p. 108.
96. Ibid., p. 105.
97. Op. cit., p. 64.
98. Op. cit., p. 104.
99. R.L. Gregory, The Intelligent Eye (New York: McGraw Hill, 1970), p. 50.