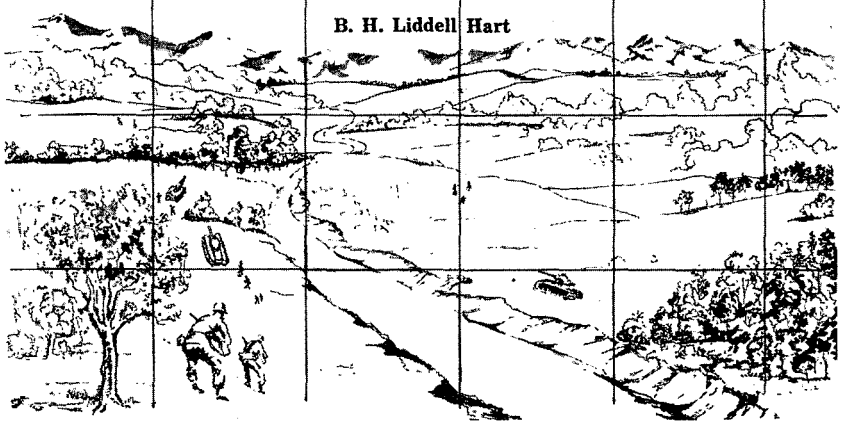
The Ratio of Troops to Space

B. H. Liddell Hart



SOME 30 years ago T. E. Lawrence—better known as Lawrence of Arabia—urged me to do a study of the ratio of force to space in war, his own conclusions being that it was of basic importance and contained the clue to many of the puzzles of military history. I have never found time to do a full exploration of the subject, but in my researches have been impressed repeatedly with its significance, particularly in its bearing on the prospects of attack and defense.

Recently I have been prompted, by some other work I have been doing, to summarize and analyze the evidence on this basic matter during the last century and a half—but more particularly on the two World Wars. It is a subject which ought to be much more fully explored.

One significant point which emerges from the initial analysis that I have made is the crucial importance of the time factor in relation to the ratio of force to space. A second is the significance of the ratio between the mobile reserves and the forces holding the front.

For at least a century and a half the number of troops needed to hold a front of any given length securely has been declining steadily. In other words, the defense has been gaining a growing material ascendancy over the offense. Even mechanized warfare has brought no radical change in this basic trend.

Looking at the experience of great armies since 1800, the first general conclusions may be drawn from the Napoleonic Wars. At that time a ratio of about 20,000

An analysis of the ratio of force to space, considering the important time element, indicates that a NATO force of 26 mobile divisions, properly deployed, would be reasonably good insurance against sudden attack

fighting troops to the mile, including reserves, was normal in holding a defensive position. That was the ratio of Wellington's three-mile front at Waterloo. Two days earlier Blücher had tried to hold a seven-mile front at Ligny with 12,000 to the mile and was defeated by a force slightly smaller than his own.

Ratio Changes

The numbers had dropped substantially 50 years later in the American Civil War of 1861-65. During the first three years of the war a ratio of about 12,000 fighting troops to the mile, including reserves, was normal in holding a defensive position. Later, as methods of defense developed, it was found that 5,000 men or fewer to the mile could withstand an attacker with double that strength. Lee's army held out for nine months in its long stretched line covering Richmond and Petersburg until its ratio fell below 1,500 to the mile.

The Franco-Prussian War of 1870 was decided by strategic and grand tactical maneuver before there could be any marked change of ratio. The figure of 12,000 to the mile was, therefore, normal in holding a defensive position. In the early battles, such as Gravelotte, however, the increased power of defense due to better firearms became very obvious.

In the South African War (1899-1902) the Boers—with magazine rifles and a high standard of shooting—repeatedly succeeded in repelling attacks by much larger British forces with a ratio of only 600 to 800 men to the mile. At Magersfontein the Boers had only 5,000 men on a front of six miles, and at Colenso only 4,500 men on a front of seven and one-half miles.

In the Russo-Japanese War (1904-5) a ratio of about 8,000 to the mile developed in the later and larger battles. These became protracted both in time and space. In the final great battle at Mukden, where each side had a strength of just over 300,000, the front was 40 miles long, and the struggle lasted two weeks before the Japanese extending flank leverage led the Russians to retreat.

World War I, 1914-18

The First World War provides many instructive situations. After the trench deadlock developed in the autumn of 1914, the Western Front stretched from the Swiss frontier to the Channel coast—approximately 450 miles along the curving contour of the trench line. During 1915, when the Germans were on the defensive in the West, they held this front with an average of 90 divisions. This was a ratio of one division for every five miles of front, or about 3,500 men to a mile. The last 100 miles at the eastern end, along the Vosges and the old fortress line, was regarded by both sides as unsuited for attack and was thus more thinly held. On the main stretch, therefore, the ratio was about one division for three miles of front (6,000 men to the mile).

The divisions actually holding the line had fronts of four to six miles in width (4,500 to 3,000 men per mile). With this ratio of troops to space, the Germans successfully repelled all the Allied attacks. Yet in the great autumn offensive of 1915

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the Allies, with a total of 140 divisions (an over-all superiority of three to two), managed to strike with an initial superiority averaging five to one on the sectors where they attacked.

As the war continued, both sides raised more divisions while increasing their scale of artillery support. In 1916 the Allies' strength on the Western Front was approximately 160 divisions against the Germans' 120; in 1917 it became 180 divisions against 140. But although the Allies made slightly deeper dents in the front, they failed in all attempts to break through it and generally suffered much heavier losses than the defenders.

New German Tactics

In 1917 the Germans developed new tactics of defense, using their increased number of divisions to give it greater depth. They aimed to have a division in reserve behind each division in the line, and only one-third of each frontline division was posted in the forward position. The Allies' method of long preparatory bombardment forfeited surprise and gave the Germans the chance to adjust their dispositions to meet the threat. On threatened sectors the defenders' ratio of troops to space now was often as much as one division to a mile. This was almost the Waterloo ratio of 20,000 men to a mile—although in the frontline itself the ratio was only 2,000 to 3,000 men to the mile.

With the collapse of Russia in 1918, the Germans were able to bring larger reinforcements to the Western Front. They took the offensive with 190 divisions against the Allied 170, a superiority of little more than 10 percent. By an improved technique of attack the Germans succeeded in driving deep wedges into the Allied front. But they never succeeded in pressing the exploitation far enough to achieve a complete breakthrough and produce a general collapse of the front.

The deepest and most dangerous penetration was in their first offensive, against the British right wing in March. They drove forward 40 miles in a week before being checked just short of Amiens. But at this time there were no adequate means of maintaining momentum in exploiting a penetration, because infantry was too slow and horse cavalry too vulnerable.

The initial success of the German breakthrough has been ascribed generally to the exceptional thinness of the defense on this sector held by the British Fifth Army. But that explanation does not stand up under analysis. The divisional fronts where the breakthrough occurred on 21 March were no wider than those of the Third Army at Arras, where the Germans' next heavy blow was repulsed a week later on 28 March. (On both sectors the forward divisions had fronts of about three miles apiece—which was considerably narrower than the average of the German and French.) The most significant difference in the assault conditions was the fog that cloaked the first assault, and the absence of fog when the Arras assault was launched.

But once the breakthrough was made, the Fifth Army was handicapped in checking it by having a lower ratio of reserves than the Third Army at Arras and the two other British armies farther north. There were only three divisions in reserve (apart from three cavalry divisions) behind the Fifth Army's sector of 40 miles, whereas 15 were in reserve behind the remaining 80 miles of the British front. That was the basic flaw in Haig's dispositions.

Once the German attacks of the spring and early summer had been checked, the scales of battle were decisively turned in the Allies' favor by the swelling stream of American reinforcements. Summing up the failure of the German attacks and the autumn success of the Allies, the British Official History of the campaign on the Western Front reached the conclusion that:

Even against the right wing of the Fifth Army, where the numerical superiority of the Germans was greatest, it was not sufficient to break through. . . . Armies even of the highest fighting capacity cannot make up for inadequacy of numbers by the valor of their troops or by the novelty and brilliance of their tactics; in a conflict between foes of the same standard of skill, determination and valor, numbers approaching three to one are required to turn the scale decisively, as they eventually began to do in the autumn of 1918. . . . The German efforts with insufficient numerical superiority only produced dangerous salients.

A large local superiority was often achieved during that war—even as high as 16 to one (by the British at Neuve Chapelle)—but there was no existing means of maintaining momentum long enough to attain a complete breakthrough. In the autumn of 1918 the Allies' over-all superiority of three to one in fighting strength enabled them to develop a multiple leverage and push the Germans out of successive defense lines, taking large quantities of prisoners in each assault. Yet even at the time Germany was driven to appeal for an armistice, and the Allied commanders discussed its terms, Haig frankly admitted:

Germany is not broken in a military sense. During the last weeks her armies have withdrawn fighting very bravely and in excellent order. Therefore . . . it is necessary to grant Germany conditions which she can accept.

World War II

On 10 May 1940 the Franco-British forces available to defend the 400-mile stretch of the Western Front amounted to the equivalent of 111 divisions—*a ratio of one division to three and one-half miles of front.* That was a more favorable ratio of force to space than when defense prevailed over attack early in World War I. The German attack on Belgium added a further 22 divisions to the Allies' total, raising it to 133 without lengthening the front. Moreover, the Germans employed eight divisions in their subsidiary and divergent attack on Holland, so that their total for the offensive on the main front was reduced to 128—a total slightly less than that of the Allies.

However, the Allied High Command, under Gamelin's direction, reacted and retorted to the German offensive in a way that threw its own dispositions off balance. Immediately putting into operation Plan D (which had been framed in the autumn, and dubiously accepted by the British), Gamelin rushed the Allied left wing far forward into Belgium. The force originally assigned in Plan D for this advance had been two armies (the French First and the British Expeditionary Force), but Gamelin had recently added another (the Seventh), while using one-third of the general reserve to back the advance. The total of about 30 divisions in these three armies included five of the six mechanized divisions and 15 of the 17 motorized divisions that the Allies possessed.

Weak Point

The hinge of the advance was left perilously weak—the two armies holding the French center having a total of only 12 divisions to hold nearly 100 miles of front facing the Ardennes. Worse still, they were ill-equipped in antitank guns and artillery, while the front itself was poorly fortified.

Four armies were kept on the right wing behind the heavily fortified Maginot Line. Together with the garrison of the line, and the part of the general reserve placed in this quarter, they amounted to the equivalent of more than 50 divisions. Only about 10 divisions of the general reserve actually were disposable—*and they were not a mobile reserve.*

The fatal miscalculation by which the weak French center was left exposed to

attack by the strong German center (46 divisions in three armies) was due to:

1. The Allied High Command's long-standing delusion that the Ardennes was "impassable" for mechanized and motorized forces.

2. The confident belief that if the Germans did try to advance along that unlikely path, they would have to pause on the Meuse line to bring up heavy artillery and the mass of their infantry, and thus could not mount such an assault until the ninth or tenth day—thus allowing the Allied High Command ample time to move reserves to that point, and repel the German assault when it came.

Two factors were instrumental in upsetting these calculations.

1. The Germans recently had decided to use three mechanized spearheads (comprising seven of their 10 panzer divisions) in this difficult sector as likely to be the line of least expectation.

2. These spearheads attacked the Meuse line as soon as they reached it, on the fourth day (13 May), and two of the three succeeded in forcing a crossing immediately (although the German High Command had previously shared the Allied High Command's view that an effective assault could not be mounted until the ninth or tenth day). The principal and decisive thrust was that of Guderian's corps of three panzer divisions at Sedan which was supported by a massive dive-bombing attack from the Germans' much superior air forces.

Once the Meuse line was pierced, and the spearheads broke out to open country, *their mechanized mobility formed the means of maintaining momentum* in exploitation, until the Channel coast was reached and the Allies' lines of supply cut—thus producing the collapse of the Allied left wing armies, and leading to the collapse of France.

At each stage of this exploiting drive, the Allied countermoves were ordered too late and carried out too slowly to have a chance of saving the situation. It was the Allies' failure to realize the tempo of mechanized operations, rather than a deficiency in the means, that proved the decisive factor.

An understanding of this new *tempo* could easily have foiled the German breakthrough—for the Allies at the start had six mechanized divisions (with two more available) and 17 motorized divisions against the Germans' 10 mechanized and seven motorized. There also had been ample time beforehand to block the German approach routes with mines, or even by the simple device of felling the trees along the forest roads through the Ardennes to the Meuse—a proposal that was urged on the French High Command but rejected on the ground of keeping the routes clear for their own cavalry's advance.

It was not the Germans' superior concentration of numbers on this sector that produced the result. That fact is very clear. Both the break-in and the breakthrough were achieved by the small fraction of mechanized divisions *before* the mass of the German infantry divisions, marching on foot and with horse transport, came into action. Moreover, although mechanization and motorization offered a *potential* advantage in rapid redeployment of force to achieve local superiority of force, that type of strategic mobility did not play any important part in the 1940 breakthrough. No such sudden relocation of force took place until after the Meuse line had been pierced, and then only by two mechanized divisions which had been transferred from the German right wing to reinforce the seven that had already broken through and were sweeping on to the Channel coast in their exploiting drive.

Subsequent Developments

With the understanding of the tempo and conditions of mechanized warfare, it soon became evident that no radical change had occurred in the basic trend of land warfare in this century and the last to-

ward a growing material ascendency of defense over attack, *pari passu*, and thus toward a diminishing ratio of force to space required to hold a front securely.

The first evidence was provided in North Africa by Rommel's frustration in his attacks on Tobruk in April and May 1941. Here, the 9th Australian Division, with one extra infantry brigade and two small tank regiments—a total of 24,000 fighting troops—held a poorly fortified perimeter of 30 miles (only 800 men to the mile). Yet it succeeded in repelling an attacking force of two German divisions (both mechanized) and three Italian divisions (one mechanized).

In the attacks launched by the British and Axis forces, in turn, during the next 12 months of the North African campaign, there was always an open desert flank for outflanking maneuver. In that way only was success achieved—while several times reversed by counterstroke.

A very clear test of defense against attack, without a wide open flank, was provided by the Battle of Alam Halfa at the end of August 1942, and the 2d Battle of Alamein in October.

In the first case, Rommel's attack suffered a severe repulse from Montgomery's defense with a force of similar strength.

In the second case, Rommel defended a length of nearly 40 miles with a fighting strength of 27,000 Germans and 50,000 Italians—a ratio of 2,000 to a mile of front. In terms of normal-scale divisions, the ratio was equivalent to one division for every eight miles of front (and for those in the line, a ratio of one to every 16 miles).

Montgomery, now greatly reinforced, attacked this thin (but well-mined) front with a superiority of eight to one in fighting troops over the Germans—three to one over the Germans and Italians combined—and six to one in effective tanks. Yet even with this immense superiority, the attack succeeded only after 13 days' struggle, and by sheer attrition—losing three times as many tanks as the defender in the process of wearing down the defender's tank strength to the vanishing point.

Normandy

In the Normandy campaign, analysis shows that Allied attacks rarely succeeded unless the attacking troops had a superiority of *more than five to one* in fighting strength, even though they were greatly helped by complete domination of the air (which at least doubles the value of ground forces, and in some staff calculations has been reckoned as trebling it). In some cases, attacks failed with odds of nearly 10 to one in their favor—as in Operation *Bluecoat*, the ably planned breakout attempt by the British Second Army near Caumont on 30 July 1944 to coincide with the American breakout thrust at Avranches. The 10-mile sector attacked was held by one depleted German division. Yet the massive blow failed to overcome the thin defense except on the western part of the sector, and even there it was checked on the third day when meager tank reinforcements at last began to arrive on the German side.

During much of this time the defender's ratio of force to hold the 80-mile stretch of the Normandy front was only equivalent to one normal-scale division to eight miles on the average. Once the breakout was eventually achieved, after eight weeks' struggle, the German reserves were so scanty and the space for outflanking maneuver so wide that the Allied armies were able to advance almost unhindered, especially on the right or inland wing. Their progress was all the easier because the bulk of the German divisions, unlike the Allied divisions, were not even motorized. However, when the approaches to the Rhineland were reached, the Allies were brought to a halt and kept at bay by the heterogeneous forces that the German Command scraped up. These improvised forces succeeded in holding frontages

wider than had ever before been thought practicable. Thus the war was prolonged unexpectedly for a further eight months.

Eastern Front

On the Eastern Front the Russian armies, in their turn, had been disrupted by the deep and swift thrusts of the panzer forces in the summer of 1941. Before the year ended, however, they were learning how to check these thrusts, and in 1942 developed the appropriate countertechnique. When the Russians' renewed and increasing reserves enabled them to change over to the offensive, they were faced by opponents who knew the technique. Even though the Russians benefited from the exceptionally wide space of the Eastern Front, the defense repelled attacks delivered with a superiority of seven to one, or even more. Moreover, the German panzer divisions, by virtue of their mechanized mobility, often succeeded in covering and defending frontages up to 20 miles against very heavy odds.

Analysis of the basic data of the campaigns in World War II point to conclusions very different from the surface appearance of events. They have an important bearing on the present defense problem of the North Atlantic Treaty Organization (NATO) in face of the Soviets' great superiority of numbers.

Other Factors

It is, of course, obvious that any numerical calculation of strength—in divisions or men—is subject to a variety of other important factors, particularly equipment, terrain, area, communications, training, tactical methods, leadership, *and* morale. These factors are far more variable, and thus more difficult to calculate, than numbers or length of front.

The obvious difficulty presented by such "variables" was always brought up as an insuperable objection by the general staff whenever the idea of operational research, based on the method of quantitative analysis, was urged in the years before World War II. Yet once it was accepted and belatedly started, its value came to be appreciated amply—first by the air staff, then by the naval staff, and eventually by the general staff. The practical benefit of quantitative analysis of the quantitative factors became very clear, and was not impaired by the "variables" in any such degree as had been imagined.

It is worth bearing this experience in mind when considering the possibilities of a "force to space ratio" analysis. Everyone who has to make plans in war or exercises, from the Supreme Command down to the platoon leader, actually works on a "force to space" calculation—but it is a rough "rule-of-thumb" calculation in which the *norm* is apt to be a product of custom and habit. It is desirable to replace that hazy proceeding by a norm derived from scientifically analyzed data—a better basis on which to make suitable allowance for, and adjustment to, the variables.

If such a basis had been worked out before the last war, it would have been a check on such a fatal miscalculation as was made in the distribution of the Allied forces on the Western Front in 1940 and apportioning the fraction that covered the Allied center on the Meuse.

By the middle of the war the need for a norm as a basis of calculation came to be recognized, and a broad guidance on force ratios was formulated in the official manual on *Umpiring*. However, it needs to be reexamined, clarified, and more fully defined.

Important Qualifications

In calculating the scale of force required for defense, it is necessary to emphasize, and keep in mind, three important qualifications to the evidence about the comparative power of the defensive and the offensive—as a safeguard against over-optimistic estimates of what will suffice.

The first qualification is that the offensive potentially carries one unique advantage. If the attack is made unex-

pectedly and with sustained speed of followthrough, it may split a slow-responding defense so deeply and disintegratingly as to *paralyze* resistance, annulling the comparative balance of numerical strength. Defense, however effective, can never produce such a catastrophic collapse of the enemy as does this tactical and strategical "fission-effect" of a sustained speed attack.

The second qualification, arising from the first, is that any calculation of numbers is dependent upon the standard of *performance*. The basic advantage of defense can be ensured only if a defense has adequate flexibility and mobility—the primary condition being that the defender has a clear understanding of the attacker's technique and its tempo. Lack of such understanding was the principal cause of the Allied disasters in 1940. The time factor is of crucial importance in relation to the ratio of force to space.

The third qualification is that the wider the front, relative to the forces, the more scope the attacker has for maneuver and thus the more chance to find gaps that he can penetrate in the opposing network of fire. Although on the Eastern Front the Germans often defeated setpiece offensives on sectors where the Russians had concentrated a seven to one superiority of force, the Russians usually succeeded in finding penetrable stretches somewhere on the front when their *over-all* superiority had risen to about three to one.

NATO

With the NATO forces it would be unwise to reckon that they could hold their own with as low a ratio as that on which the Germans managed to do, particularly in view of the NATO mixture of nationalities, different training systems, and other handicaps. However, if their forces had a ratio of two to three, that should be a safe insurance against a sudden attack, provided that they attain adequate mobility and flexibility. At present they are not adequate in these essential qualities, and this deficiency is more important than lack of numbers.

To have any real chance of repelling a sudden high-speed attack, the "shield force" must be composed of fully mobile divisions, always ready for immediate action, and highly trained. It is folly to imagine that it would be possible with forces of short-term service, even if their numbers were doubled or trebled. The need cannot be fulfilled unless the "shield force" is composed of professional troops or long-term conscripts—two years' service would be the minimum for the purpose. It would be best, and probably more economic, that all the divisions in the "shield force" should consist entirely of long-service Regulars.

The Soviet forces in Eastern Germany comprise 20 mobile divisions. Therefore, a NATO strength of about 13 ready-for-action Regular divisions should be able to check a sudden attack by this force without resorting to nuclear weapons or yielding ground. It would be better able to check such an attack than the present NATO shield force of 21 divisions which is handicapped by its large proportion of short-service conscripts.

Intelligence experts consider that the Soviet forces might possibly be raised to 40 divisions within about 10 days, although it would not be easy to bring up such a large reinforcement without being detected, thus giving NATO warning and time for countermeasures. Even if the Soviet striking force was thus doubled, a NATO force of 26 Regular divisions should suffice to keep it in check; or alternatively, 20 Regular divisions and a German citizen militia equivalent to 10 divisions, organized and trained for static or locally mobile defense.

Such a combination would be a much better shield than the 30 present type divisions of short service conscripts mixed with Regulars which the existing NATO plan aims to achieve. It could be more im-

mediately ready for action, more efficient in performance, and more truly economic.

If a surprise attack were promptly checked, it is unlikely that the incursion would be continued. Its chance of success in producing a *fait accompli* would have vanished, while persistence in it would hour by hour increase the risk of detonating a nuclear war which would nullify the aggressor's *object*. Moreover, according to authoritative estimates, the maximum strength to which the Soviet force on this front could be built up logistically, even after a month, is 60 divisions. In defense a NATO force of 40 divisions should suffice to keep that number in check and *without the use of nuclear weapons*. Such a strength can be attained within a month of mobilization even under present NATO arrangements.

Therefore, there is a good insurance against the most unlikely contingency of a massive invasion if the training and organization of the NATO force matches that of its opponents. The basic requirement is an improvement of quality rather than an increase of quantity.

It may be argued that a shield force on a two to three ratio, although a good insurance in relation to the Soviet forces on the NATO central front, would not be adequate with regard to space because of the width of that front. A fuller examination of this aspect of the problem may help to clarify the issue. In such an examination there are two key questions:

1. What is the *tactical minimum* of troops necessary to cover and control a given space?

2. What is the *strategical minimum*?

Tactical Minimum

The first question turns on a calculation of the extent of space that troops armed with modern weapons, other than nuclear ones, can cover with a closely interwoven network of fire. In examination, it soon becomes evident that the ratio of troops to frontage customary in recent wars, and in conventional military doctrine, does not correspond to the ratio of development in weapons during the last 100 years, and in their capacity to cover an area with a sustained downpour of fire.

Nearly a century ago, in the later stages of the American Civil War, Lee's army kept Grant's greatly superior numbers in check for many months until its strength fell below 1,500 men to the mile. More than half a century ago the Boers with a strength of only 600 to 800 men to the mile repeatedly succeeded in repelling attacks by British forces which vastly outnumbered them. Weapons have developed so immensely since then in range and power that it is hard to see why the *tactical minimum* considered necessary and customary in practice has not been adjusted proportionately.

Is there any reason other than custom fostered by caution? The surmise that this is the real explanation tends to be confirmed by examination of operations in both the First and Second World Wars. It is evident that attacks were often checked by small detachments or remnants that were heavily outnumbered, whereas attacks succeeded in many cases where the defenders were far more numerous relatively to the frontage. The contrast suggests that a buildup of the defense to the level suggested by custom and caution often aided the attacker by presenting him with a much increased target and one easier for him to destroy by concentrated fire.

There is abundant evidence from the last war to show that German divisions of depleted strength often successfully defended frontages of 20 to 25 miles (30 to 40 kilometers). There also are some notable examples on the Allied side of similar performance. So it is reasonable to consider a frontage of 25 miles (40 kilometers) as within the defensive capacity of a fully mobile division of present strength as is now coming to be recognized in high military quarters. Taking account

of the corps and army troops available to support a division, it represents a basic scale of about 1,000 men to the mile (600 men to the kilometer).

That scale is not much less than what proved adequate for effective defense in the later stages of the American Civil War, and more than the scale with which the Boers maintained their defense nearly 60 years ago. Thus it might be further reducible after a more thorough scientific analysis of recent war experience and weapon capabilities. Such a reinvestigation is very desirable. For a reduction of the *tactical minimum* considered necessary, to provide an effective curtain of fire and "control a given space," would reduce the problem of providing the *strategical minimum*—especially in mobile reserves—to maintain a forward defense of the NATO front as a whole.

For the time being, however, it is safer to take a scale of one mobile division for 25 miles (40 kilometers) of front as the *tactical minimum*. On that basis, 10 such divisions would be needed to cover the front—between the Baltic and the Bohemian mountains—that is threatened by the Soviet forces poised in East Germany. Beyond this number, adequate mobile reserves should be available to counterbalance the attacker's power—and inherent advantage—of concentrating his effort along a particular line of thrust.

Strategical Minimum

Here we come to the question of the *strategical minimum*. Views on the subject still tend to reflect the habit of thought and its doctrinal legacy that developed in World War I. The continuous trench front that came to be established in 1914 on the Western Front, and persisted throughout the war, left a lasting impression. It was deepened by the low mobility of forces at that time. Since then there has been a tendency to assume that the entire stretch of a frontier should be provided with the tactical minimum for effective defense of every sector for their support, both in forward troops and in local reserves. Thus the *strategical minimum* requirement has come to be regarded basically as no different from the *tactical minimum*.

This is a view which amounts to visualizing the extreme case, highly improbable, of having to meet a heavy attack on all sectors simultaneously, and demanding forces strong enough for defense everywhere. Its influence is apparent in suggestions and arguments that, without the use of nuclear weapons, NATO would need a standing force of as many as 70 divisions on its central front, even against Soviet forces of lower strength.

Such a view is contrary to the facts and lessons of war experience. In all wars previous to this century, the forces engaged were very small in proportion to the front as a whole—much *smaller* than they became in the last two wars, although *denser* on the battlefield. In the wars of the 18th and early 19th centuries, a battlefield strength of 20,000 men to the mile was normal, yet countries were successfully defended with a ratio of merely 250 men to the mile, or less, on the front as a whole—a strategical ratio of forces to space that was barely more than one percent of the tactical ratio.

The following examples from the wars of the 18th and 19th centuries, when weapons were of very short range and defensive capability depended mainly on mobility, illustrate the concept of strategical minimum.

War of the Spanish Succession

In 1709-13, when the French were on the defensive, they had a field force averaging only about 100,000 men to cover their frontier of approximately 400 miles (250 men to the mile *strategically*).

Seven Years' War

In the early stages, 1756-57, Frederick the Great covered his southern front of about 400 miles with nearly 100,000 men

(250 men to the mile *strategically*) against enemy forces double his strength.

Later, the enemy coalition brought its total forces in the field up to nearly 400,000 while his total rarely exceeded 150,000 (and diminished from losses during each year's campaign). With that total strength he had to cover an all-around frontage of about 1,500 miles (100 men to the mile *strategically*). Although suffering several bad reverses, offsetting his riposte successes, he succeeded in holding out until the enemy coalition dissolved in 1763.

Napoleonic Wars

In 1814, when Napoleon was thrown on the defensive after his defeat in the Battle of Leipzig, he had only 70,000 men to cover his 400-mile front in the north and northeast (180 men to the mile *strategically*). The Allied armies which crossed the Rhine to invade France amounted to 370,000 men—more than five times his strength—yet he succeeded in keeping them in check for three months.

During this period he inflicted nine sharp reverses on them before fate turned against him—when an intercepted letter revealed his plan, of moving round onto their communications, and thus encouraged them to move down the temporarily open path into Paris where their arrival produced the collapse of his regime.

American Civil War

From 1861 to 1864 the Confederates covered a front of 800 miles between the Atlantic and the Mississippi with a field force averaging about 200,000 men (250 to the mile *strategically*) and kept at bay an enemy double their strength.

The fact that is was possible to maintain an effective defense of a wide front with a *strategical ratio* of only 250 men to the mile, or less, is all the more significant because the *tactical ratio* for effective defense in open country was considered to be about 20,000 men to the mile (including local reserves) with the short-range weapons (smoothbore muskets and cannon) of the Napoleonic Wars and earlier, and about 12,000 to the mile with the improved weapons of the mid-19th century.

The immense difference between the *tactical* (battlefield) ratio and the *strategical* (entire front) ratio shows that the crucial factor in the defense of any wide front is the *time* factor. This turns not only on the relative mobility of the attacking and defending forces, but on the defender's correct appreciation of the attacker's lines of advance and the degree in which the attacker's mobility is restricted by natural obstacles, fortifications, and counterthreat.

The capability of covering a wide front with such small forces, while bringing sufficient tactical strength into action against the enemy's strategic line of advance and concentration, came from the ability to make a good appreciation of the enemy's likely routes of advance and objectives so that adequate forces could be moved there to bar his path.

It is difficult to see any good reason why this should be considered impossible now. The means of information, intercommunication, and movement are much better than in the past, and on balance they favor the defending side, increasing its chances of countering the attacker's initial advantage in surprise.

On NATO's central front it should not be too difficult to gauge an attacker's likely objectives and routes of advance. Although that front is 440 miles (700 kilometers) in extent, only the more northerly stretch of about 250 miles (400 kilometers) is suitable for surprise attack *and* rapid advance by the Soviet mechanized divisions in East Germany. Even within that northerly stretch the suitable routes are limited, and the direction of the enemy's main effort should become clear once he starts crossing the rivers near the border. Therefore, it should be possible to check him in the forward *zone*, by timely countermoves,

with a two to three ratio of forces, if the NATO covering force is composed of fully mobile and highly trained divisions, and is organized with more strategic flexibility.

The more northerly stretch of nearly 250 miles embraces the front from the Baltic to the valley of the Frankische Saale inclusive, so that a forward defense of the suggested scale (10 divisions) would not only cover the northern plain of Germany, but go well-around the westward bulge of Thuringia, and cover the routes to Frankfurt across the Thuringerwald.

Behind that end of the main front is posted the bulk of the US 7th Army, and it would be natural to continue such a disposition of the mobile reserves ready to counter a thrust either toward the valley of the Main and Frankfurt, or into Bavaria. Consequently, there would be a good insurance against a circuitous approach by the Soviets across the Thuringia-Bavaria frontier. Moreover, such a dog-leg move—first southward and then westward—would entail a loss of time and diminish the Soviets' chances of sustaining the speed-surprise required for success in a sudden coup. Another drawback, from the Soviets' point of view, is that Bavaria offers no objectives comparable in importance and accessibility with those between Frankfurt and the Baltic.

Conclusion

Analysis of recent war experience tends to show that the higher the ratio of the mobile reserves to the troops holding the forward position the greater is the prospect of defeating a concentrated thrust. In past practice the divisions in mobile reserve, not tied to a particular sector, often have been less than a quarter of the entire force. Analysis of operations suggests that a half of the force would be a better proportion, even where it entails thinning the forward defense to a hazardous degree.

This is the basis I have adopted in calculation, and from it comes the suggested figure of 26 mobile divisions as the NATO requirement for a shield force capable of meeting both force and space conditions. That number would provide a defense of two to three ratio against the possibility that the 20 Soviet divisions in East Germany might be raised to 40 within 10 days. It also would provide NATO with the requisite tactical minimum of 10 divisions as forward defense there, and three for a mobile screen along the mountainous Czechoslovakian border, with 13 more as mobile reserves for the front as a whole. That would be a reasonably good insurance against sudden attack in any direction.

The required number of divisions would be somewhat less if there were a citizen militia, of the Swiss type, available to man a deep network of defense posts in the forward zone as a means of helping to delay the enemy's advance while the divisions of the mobile reserve converged upon the threatened sector. This militia would need to be so organized that the posts could be manned at short notice by militiamen living or working nearby. It also would be desirable to have such a militia available in the rear areas as a check on an enemy airborne descent to seize keypoints there and block the countermoves of the NATO mobile divisions.

If a militia force of this type were available for local defense, the requirement for the main shield force might be reduced from 26 to 20 divisions—that is, a one to two basis *versus* the enemy's possible maximum in a surprise offensive on the Central Europe front.