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DEVELOPING A METHODOLOGY TO DESCRIBE  
THE RELATIONSHIP OF MOBILITY  
TO COMBAT EFFECTIVENESS

17 February 1967

**HISTORICAL EVALUATION AND RESEARCH ORGANIZATION**

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DEVELOPING A METHODOLOGY TO DESCRIBE  
THE RELATIONSHIP OF MOBILITY  
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## INTRODUCTION

### Purpose of the Study

This study, "Developing a Methodology to Describe the Relationship of Mobility to Combat Effectiveness," has been undertaken for the Research Analysis Corporation (RAC) by the Historical Evaluation and Research Organization (HERO). In essence, the study directive (reproduced in Appendix A) requires HERO to examine the extent to which mobility has historically been related to the combat effectiveness of land forces, and in the process to ascertain the possibility of deriving from historical experience a methodology for describing this relationship in terms currently useful to the US Army.

### Study Concept

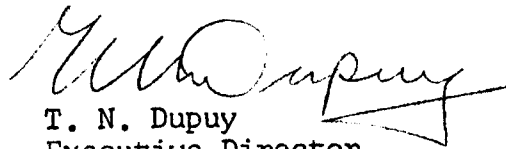
In light of the fact that less than seven weeks were available in which to perform this study, and in consideration of the vast scope of relevant historical example, HERO has concentrated on a broad examination of the extent to which historical example could provide one or more useful approaches to methodological development. We have not been unduly concerned either with the comprehensiveness of the supporting analyses, or with detailed consistency between the various component sections of this examination. It is understood that this approach is consistent with the desires of RAC.

We have been gratified, however, that the results of our examination have tended to corroborate analytical findings of earlier HERO studies on the potential relationship of qualitative and quantitative analyses of combat data. This has added greatly to our confidence in the conclusions derived from this particular study effort.

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As Executive Director of HERO, the undersigned assumes full responsibility for the contents of this report.

  
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Washington, D. C.  
17 February 1967

## BASIC DEFINITIONS

For the purposes of this study, we established the following basic definitions relating to mobility:

Mobility. The ability of military units to move as effective formations from place to place, to include the ability to support the units logistically during and after movement. Mobility is a relative concept, and should not be equated with any absolute rates of movement or of speed. Mobility is meaningful militarily only in terms of the relative movement capabilities of opposing forces.

Maneuver. The use of mobility to gain positions or to effect combinations of military advantage, or to alter situations which are disadvantageous.

Strategic Mobility. The capability of large military formations to move beyond the limits of the battlefield, or between theaters of operation.

Tactical Mobility. The capability of any military unit to move and maneuver on the battlefield or in the presence of an enemy. This has three distinct aspects: (1) the approach to contact; (2) movement while actively engaged in combat operations; and (3) support of units in combat by: firepower, commitment of reserves, and logistic support.

## TACTICAL MOBILITY IN HISTORY

### Mongol Mobility

The mobility of Genghis Khan's troops--tactical as well as strategic--has never been matched by other ground soldiery. He seems to have had an instinctive understanding that force is the product of mass and the square of velocity. No other commander in history has been more aware of the fundamental importance of seizing and maintaining the initiative; of always attacking, even when the strategic mission was defensive.

We know little of the details of the training system of Genghis Khan. We do know that each troop, squadron, and regiment was capable of precise performance of a kind of battle drill that formed the basis of Mongol small-unit tactics. Such precision required constant practice under close and demanding supervision. The battlefield coordination of units, within the toumans, and between toumans and the larger hordes, is evidence of painstaking practice in precombat maneuvers by forces of all sizes.

At the outset of a campaign, the Mongol toumans usually advanced rapidly on an extremely broad front, maintaining only courier contact between major elements. When an enemy force was found, it became the objective of all nearby Mongol units. Complete information regarding enemy location, strength, and direction of movement was immediately transmitted to central headquarters, and in turn disseminated to all field units. If the enemy force was small, it was dealt with promptly by the local commanders. If it was too large to be disposed of so readily, the main Mongol army would rapidly concentrate behind an active cavalry screen. Frequently a rapid advance would overwhelm separate sections of an enemy army before its concentration was complete.

Genghis and his able subordinates avoided stereotyped patterns of moving to combat. If the enemy's location were definitely determined, they might lead the bulk of their forces to strike him in the rear, or to turn his flank. Sometimes they would feign a retreat, only to return at the charge on fresh horses.



Most frequently (as in Genchis' operations in Persia, 1220-1221), the Mongols would advance behind their screen of light horsemen in several roughly parallel columns, spread across a wide front. This permitted flexibility, particularly if the enemy were formidable, or if his exact location was not firmly determined. The column encountering the enemy's main force would then hold or retire, depending upon the situation. Meanwhile the others would continue to advance, occupying the country to the enemy's flank and rear. This would usually force him to fall back, to protect his line of communications. The Mongols would then close in to take advantage of any confusion or disorder in the enemy's retirement. This was usually followed by his eventual encirclement and destruction.

The cavalry squadrons, because of their precision, their concerted action, and their amazing mobility, were easily superior to all troops they encountered, even when these were more heavily or better armed, or more numerous. The rapidity of the Mongol movements invariably gave them superiority of force at the decisive point, the ultimate aim of all battle tactics. By seizing the initiative, and exploiting their mobility to the utmost, the Mongol commanders, rather than their foes, almost always selected the point and time of decision.

The battle formation was composed of five lines, each of a single rank, with large intervals between each line. Heavy cavalry comprised the first two lines; the other three were light horsemen. Reconnaissance and screening were carried out in front of these lines by other light cavalry units. As the opposing forces drew nearer to each other, the three rear ranks of light cavalry advanced through intervals in the two heavy lines to shower the enemy with a withering fire of well-aimed javelins and deadly arrows.

The intensive firepower preparation would shake even the staunchest of foes. Sometimes this harassment would scatter the enemy without need for shock action. When the touman commander felt that the enemy had been sufficiently confused by the preparation, the light horsemen would be ordered to retire, and synchronized signals would start the heavy cavalry on its charge.

In addition to combining fire and movement--and missile action with shock action--the Mongols also emphasized maneuver and diversions at all tactical levels and in all phases of combat. During the main engagement, a portion of the force usually held the enemy's attention by frontal attack. While the opposing commander was thus diverted, the main body would deliver a decisive blow on the flank or rear.

In his early campaigns, Genghis Khan's cavalry armies were frequently frustrated by the strong walls of Chinese cities. After intensive, analytical study--plus the adoption of Chinese weapons, equipment, and techniques, and considerable empirical experience--the Mongol leader in a few years developed a system for assaulting fortifications which was well-nigh irresistible. An important component of this system was a large, but mobile, siege train, with missile engines and other equipment carried on wagons and pack animals. Genghis conscripted the best Chinese engineers to comprise the manpower of his siege train. Combining generous terms of service with the compulsion of force, he created a most efficient engineer corps.

Sometimes, however, even the strongest cities were overwhelmed and captured before they were fully aware that any large force of Mongols was in their vicinity. This was particularly exemplified by Subotai's capture of Kiev, December 6, 1240. The leading Mongol light horsemen attempted to pursue defeated enemies so closely and so vigorously as to ride through the gates before these could be closed. Even if the enemy were sufficiently alert to prevent this, he rarely anticipated the speed, efficiency, and vigor with which the Mongol engines of war--ballista and catapult--were put into action within a few minutes of the arrival of the leading cavalry units. The Mongols discovered that a prompt and vigorous assault, covered by a hail of fire from these machines, would often permit them to scale the walls and to seize a portion of the defenses before the surprised enemy was prepared to resist.

#### Gustavus Adolphus and Tactical Mobility

Most of the extensive modifications in equipment, weapons, and organization introduced by Gustavus Adolphus were for the combined purposes of increasing firepower and enhancing tactical mobility. Usually there were interactions between his efforts to improve both firepower and mobility. For instance, by increasing the rate of fire of his infantry (both by reducing musket weight and by speeding the loading process), he could reduce the number of musketeer ranks from eight or more to six, he could have two, or even three, ranks fire simultaneously, while (instead of remaining stationary as had been the generally adopted Spanish practice) the entire formation moved forward, to provide a kind of infantry small-arms rolling barrage.

Prior to the innovations of Gustavus, cavalry was employed either in the German reiter fashion (relatively slow-moving heavy cavalry, primarily dependent upon pistol firepower), or in the French fashion as a shock action force, whose operations could not be effectively coordinated with the stationary infantry. Gustavus to some extent combined these two methods, for the purpose of achieving close coordination between his more mobile infantry firepower and cavalry shock capability. His cavalry, armed with pistol and saber, was formed in six ranks (later in three). The pistol was a gesture; the real effect came from the saber charge. The first rank fired when it was close to the enemy, the other two held fire, retaining the pistol for emergency use. Detached musketeers stationed between cavalry squadrons provided the firepower that shook the enemy line. While the cavalry charged, the musketeers would reload, to be ready to fire another volley for a second charge or to cover a retreat. Additional firepower was provided by the mobile regimental cannon.

There was one disadvantage to this system: by tying the cavalry to the infantry and artillery, Gustavus sacrificed the speed and momentum of the horse, save for the final distance of the charge. On the other hand, it was better than anything yet devised and, for maneuver purposes, it successfully integrated infantry mobility and firepower with cavalry mobility and shock capability.

The Swedish artillery was organized into permanent regiments of six companies. Of the six companies, four consisted of guns and gunners, one of sappers, and one of men with special exploding devices. Thus, instead of being operated by hired civilian specialists, the artillery was organized as a distinct and regular branch of the army, manned almost entirely by Swedish troops, thus facilitating integration with the other services. After some experimentation Gustavus adopted the 3-pounder "regimental gun," which revolutionized the role of artillery; each regiment of foot and horse in Gustavus' army had one (later two) of these cannon. This assured the availability of mobile firepower with the infantry. The enormous advantage which this provided in battle was soon imitated in other armies.

Most of Gustavus' innovations were adapted from others, and he was not the only one to improve the military system. But no one else so surely bridged the gap between conception and achievement; none other fitted their innovations into a completely integrated system with its own set of unifying principles. His accomplishments were many: by increasing infantry mobility he gave to combined infantry and cavalry the capacity for coordinated

offense; he increased firepower and made it the preliminary for both maneuver and shock--thus enhancing mobility. He made artillery mobile, and integrated it into the combined arms team; by this generally enhanced mobility he made linear formations more flexible and responsive to the commander's will.

The results of these innovations had their first major impact on other European armies at the Battle of Breitenfeld, September 17, 1631. Two days earlier an imperial army of 36,000 men, under Baron Jan Tilly had seized Leipzig. Gustavus, with 26,000 men, joined a Saxon army 16,000 strong at Dübén, 24 miles to the north, and moved against Tilly.

Tilly took a stand at Breitenfeld, four miles north of Leipzig. Under harassing fire from the imperialists, Gustavus drew up his lines with Saxon cavalry, under Elector John George on the left wing, Saxon, Swedish and other German infantry in the center, and his Swedish cavalry on the right wing.

The German left-wing cavalry opened the battle, sweeping around behind the main body of the Swedish cavalry and attacking Gustavus' reserve. The maneuverable Swedish horse wheeled and pinned the German horsemen between them and the reserve, forcing the Germans to flee in disorder. Tilly's right wing meanwhile attacked the Saxons, driving them completely from the field.

This left about 30,000 imperial troops, opposed to 26,000 Swedes. Tilly now attempted to envelop the exposed Swedish left flank. The Swedes, shifting with agility, countered the movement, repulsing the imperial attack. Gustavus then personally led his right-wing cavalry, followed closely by infantry and artillery, around Tilly's left flank, recapturing the Saxon guns as well as the unwieldy imperial artillery, which had been left behind when Tilly attacked. Cut off from their communications to Leipzig, and under fire from their own and the quick-firing Swedish artillery, the imperial army broke and fled when Gustavus pressed home his attack.

The maneuver which won the battle was the direct result of the mobile combined arms capability which Gustavus had created.

### Frederick the Great and Mobility

Unlike Gustavus, Frederick the Great made few fundamental changes in tactics, organization, or equipment. His principal

contribution to tactical mobility was to perfect weapons, techniques, and tactics, through intensive training and strict discipline, to achieve a hitherto unknown precision in performance on the battlefield. The result was greater speed in firing--in other words, more firepower--from his infantry and from his artillery, and a greater speed and responsiveness in movement and maneuver, which almost invariably assured him the tactical initiative in combat, even when he was placed at a strategic disadvantage.

Frederick had inherited from his father one of the best-drilled, best-equipped armies in Europe. Frederick improved upon this superb instrument of warfare. His father had reduced the infantry line to three ranks and brought them closer together. Iron ramrods, long in use for pistols, had been adopted for the musket. The men had been trained to fire as many as five rounds a minute, as compared to two in most other armies. The Prussian infantrymen advanced steadily and continuously in step in slow time, firing volleys at intervals on command, starting at 100 paces. The men of the first rank, and later of all three, fired with bayonets fixed. Reduction of the number of ranks and the distance between them made it possible to form a column of march with a front that could be accommodated on an ordinary road. The march column could swiftly be formed into line to the flank, by a simple flank movement, or could deploy into line to the front by a series of half-right and half-left column movements to bring the elements in the rear abreast of those in the van, followed by simple right-angled column movements by each subordinate unit.

The cavalry consisted of cuirassiers, dragoons, and hussars. The first two were organized into 5-squadron regiments, the last into 10-squadron regiments, about 120 men to the squadron. The artillery organization was by battalion, with the customary guns in calibers from 3- to 24-pounders.

For battle the infantry was formed into two lines, about 300 paces apart. The cavalry, formed into two or three lines, was on the flanks. The army was divided into four commands for control; two wings of infantry and two of cavalry. Maneuver by elements was almost impossible once this rigid formation was adopted; neither the organization nor the deployment permitted it. The only way to maneuver, therefore, was to move all or part of the entire army to the oblique, an extremely difficult movement that only Frederick was able to achieve, thanks to the perfection of his drill and the discipline of his troops. The success of the oblique depended also on knowledge of the enemy's dispositions and on surprise to prevent reinforcement of the threatened flank.

Reconnaissance and intelligence were therefore emphasized; and every opportunity that might afford surprise--weather, terrain, etc.--was exploited. An advance guard held the enemy in place to prevent shifts in his line to meet the main attack. The attack itself was characteristically vigorous, fire from infantry and artillery almost continuous.

Under Frederick there was a renewed importance of the shock power of cavalry in battle. Firearms were taken from the horsemen, and they were taught instead to charge at full speed, ignoring the enemy fire, with sword in hand. To enhance mobility, the cavalrymen's equipment was made as light as possible, thus permitting greater speed to increase the fury of the charge. Close order and alignment were achieved by constant drill, and the Prussian cavalry could move with practically the same precision as the infantry. Eight to ten thousand mounted men could charge for hundreds of yards in perfect order, then reform for movement almost immediately. Of 22 battles fought by Frederick, it is said that his cavalry won 15.

Frederick gave his artillery greater mobility so that it could support the hard-riding cavalry and his fast-moving lines of infantry. The Austrian artillery was particularly effective, and he sought to offset the enemy's advantage by the use of horse artillery, which could accompany the cavalry. The cannoniers were individually mounted, instead of going on foot or by wagon. He employed mostly light guns and howitzers that could be moved quickly. These he placed at important points to protect his line and support the advance. In an attack his 3- and 6-pounders dashed out ahead of the infantry. At 500 paces from the enemy, the gunners dismounted, unlimbered their guns, and opened fire at the enemy until the infantry line caught up with them.

The most renowned example of Frederick's tactical mobility and flexibility was the Battle of Leuthen, December 6, 1757.

Prince Charles' Austrian army, nearly 80,000 strong, lay in a five-mile-long line of battle, facing west in undulating country, a few miles from Breslau (Wroclaw). Cavalry protected both flanks. The Austrian reserves lay behind the left wing. Frederick, who had arrived from central Germany after a 12-day forced march of 120 miles, seized the offensive. With 36,000 men he moved toward the Austrian right, in four columns; two infantry columns flanked by two cavalry columns. Under cover of a range of low hills, he changed direction obliquely to the right, leaving his left-hand column of cavalry in his rear, facing the enemy. Still out of sight of the Austrians, the infantry was thus marching past the

enemy front in two parallel columns, half of his cavalry in the lead, half in the rear. Charles, meanwhile, had moved his reserves to bolster his apparently threatened right wing.

When Frederick's marching columns came opposite the Austrian left flank, the king faced his infantry to the left and attacked in two lines, echeloned from the right; the pressure increasing as each successive battalion moved in. At the same time massed Prussian artillery fire shot at the apex of the Austrian left flank, ranged in a vee. The Prussian cavalry on the right flank enveloped and charged into the broken Austrian left and threw it back on the center. Charles attempted to form a new line against this attack, at the same time throwing his right-wing cavalry against the Prussian left flank. But the Austrian horse was caught and scattered by the rear half of Frederick's cavalry, who then charged in on the Austrian right flank. Thus caught off balance, the Austrians never rallied. Nightfall alone enabled the escape of the vanquished across the Schwiednitz River to Breslau.

"Masterpiece of maneuver and resolution," Napoleon later commented. Leuthen is generally considered to be the chef d'oeuvre of the man who was perhaps the ablest tactician of military history.

### Tactical Mobility and the American Revolution

In the latter part of the 18th Century, just before and during the American Revolution, two independent but related innovations in warfare had very significant effects on tactical mobility. In the first place, bitter experience in the French and Indian War taught the British (and the French as well) that the tightly packed drillfield formations of European combat were not readily applicable to the forested wilderness of America. The British, therefore, developed a new type of highly disciplined light infantry, more mobile, and capable of fighting effectively in open order formations. The new light infantry was effective in European combat as well, mainly as skirmishers. France and other European nations followed this British example. The Germans, for instance, armed their light infantrymen (whom they called jägers) with rifles, rather than with the ordinary military musket which was the principal military weapon then in use in the English and other armies.