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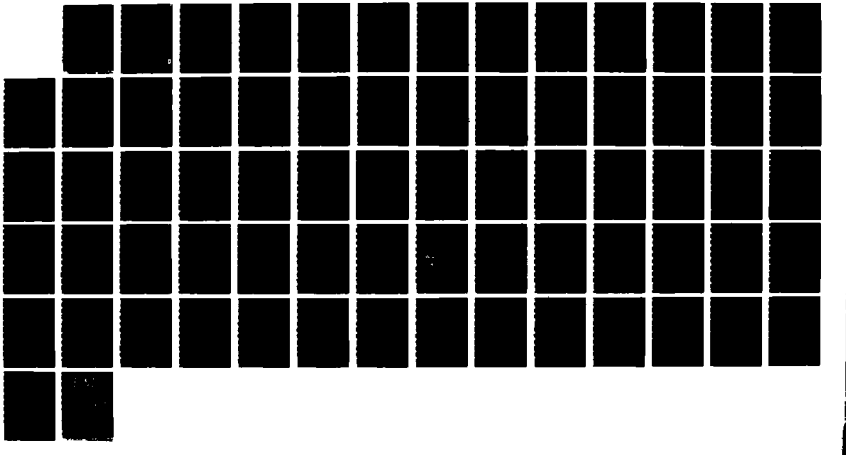

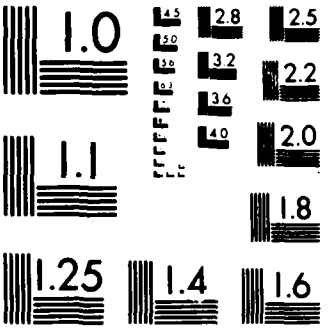

The Essentials of Operational Momentum

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This monograph discusses the concept of operational momentum as it relates to achieving and exploiting depth during offensive operations. Its purpose is to identify those elements which are essential to achieving and maintaining speed and mass required for operational momentum to overcome enemy resistance and penetrate in depth to strike decisive points. This presentation begins with the observation that success in the operational offensive ultimately requires striking the enemy in depth. It proceeds with an analysis of three different theoretical approaches to subject as developed by J. F. C. Fuller, Basil H. Liddell-Hart, and Mikhail Tukhachevskiy.

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ABSTRACT

THE ESSENTIALS OF OPERATIONAL MOMENTUM by MAJ BRIAN A. LOVATT, USA, 63 pages.

This monograph discusses the concept of operational momentum as it relates to achieving and exploiting depth during offensive operations. Its purpose is to identify those elements which are essential to achieving and maintaining speed and mass required for operational momentum to overcome enemy resistance and penetrate in depth to strike decisive points. This presentation begins with the observation that success in the operational offensive ultimately requires striking the enemy in depth. It proceeds with an analysis of three different theoretical approaches to subject as developed by J. F. C. Fuller, Basil H. Liddell-Hart, and Mikhail Tukhachevskiy. These theoretical approaches are subsequently examined in the context of selected major operations and campaigns conducted since the beginning of World War II. The results of this examination suggest essential elements for operational momentum which are presented in the conclusion to this paper along with perceived implications for the U.S. Army.

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I. Introduction

Achieving operational success in an offensive operation requires the ability to strike the enemy's decisive points in depth. The German destruction of the French Army in 1940, the Allies destruction of German Army Group B in 1944, and the Israeli encirclement of the Egyptian 3d Army succeeded as the result of effectively striking into the operational depth of the enemy. Each depended on the ability of the offense to achieve and maintain sufficient operational momentum to penetrate and maneuver against the enemy in great depth. It is the nature of this operational momentum which is the focus of this paper.

Achieving and maintaining the momentum required to strike into the enemy's depth has been a problem inherent in military operations since antiquity. Clausewitz described the problem as the diminishing force of the attack which eventually leads to its culminating point.[1] Hannibal struggled with it during his campaigns against Rome and modern operational commanders face it today.

By conventional definition physical momentum is the force of a moving body, a combination of speed and mass. It is stopped only by the resistance of an equal and opposite force. With sufficient speed and density mass will penetrate another entity in depth until it is either stopped by increasing resistance or passes through it. Operational momentum, therefore, can be described in military terms as the combination of speed and mass of an offensive operation required to overcome resistance and penetrate into the enemy's operational depth to strike decisive points. Operational depth is that area beyond the tactical

defenses of the enemy

> in which both defender and attacker can achieve freedom of maneuver, and if gained by the attacker provides the opportunity to destroy or disrupt the defender without engaging the majority of the defenses.[2]

This paper presents an examination of operational momentum as a means of gaining and exploiting operational depth. It seeks to identify the essential elements of achieving and maintaining speed and mass, reducing resistance in depth, and sustaining momentum over time. It considers the theories of J. F. C Fuller, Basil H. Liddell-Hart, and Mikhail Tukhachevskiy in order to develop specific points for examination. These theoretical points provide a basis for analysis of operational momentum in selected major operations and campaigns conducted since the beginning of the Second World War. The results of this analysis provide insight into the essential elements of operational momentum and suggest implications for the U.S Army.

II. A Theoretical Basis

Modern operational commanders and military theorists long have studied the problem of striking decisive blows against an opponent. The concept of the Napoleonic battle, in which a decisive maneuver led to the annihilation of an enemy, became the model by which operational success was gauged. However, events on the Western Front during World War I challenged this notion of the 'decisive battle'. Deep maneuvers against mass armies with continuous fronts became impossible. The concentration of forces required for a penetration

proved difficult and exploitation infeasible. Only the technological developments in mechanization and communications which emerged during and after the War restored battlefield mobility and the potential for maneuver and challenged military theorists to devise new methods for accomplishing a decisive stroke.

Perhaps the most significant modern military theorists on the subject of deep operations are J.F.C Fuller, Basil H. Liddell-Hart, and Mikhail Tukhachevskiy. Despite their differences, each recognized the need to strike deep and the inherent problem of increasing enemy resistance in depth. Fuller's doctrine of "Strategic Paralysis", Liddell-Hart's "Strategy of the Indirect Approach", and Tukhachevsky's theory of deep operations suggest concepts for sequencing events to achieve the operational momentum necessary for deep strikes.

Fuller held that the true objective of battle is the mental submission of the enemy.[1] He reasoned therefore that an attack on the brain of the enemy would be more decisive than one directed against the main body.

> The concept was 'strategic paralysis', to be brought about by attacking and cutting off the enemy's brains,in other words his field headquarters, from his fighting troops.[2]

It aimed at the destruction of the military organization by disabling the power of command and cutting the lines of communications to the fighting troops. In writing Plan 1919 he concluded that the decisive attack "should be directed against the enemy's rear in order to strike at the foundation of his fighting power."[3] The physical destruction of the main force remained secondary, to be destroyed after it had been entrapped, demoralized and starved

of supplies.[4]

For Fuller, speed was the key element of operational momentum. It provided offensive power by allowing rapid concentration, surprise and exploitation.

> Strategically time and space are relative - a handful of men at a certain spot at a certain hour is frequently a far more powerful instrument of war than ten times the number on the same spot twenty-four hours later.[5]

Quality and mobility took precedence over quantity and mass -

> the instrument must be highly mobile, also it must be as small as possible, for the smaller it is the less extensive this organization is, generally speaking the more readily it can be extemporized and the better it can be protected.[6]

He envisioned that deep operations would require great speed and offensive power to break through the enemy's tactical defenses before he could increase his resistance in depth. A rapid penetration would be followed by an immediate exploitation to strike decisive points in the enemy's rear, entrap the main force, and pursue those in retreat.

Liddell-Hart also believed that the aim of a decisive stroke should be to unhinge the enemy psychologically. He envisioned deep mobile strokes to cut the enemy's lines of communications at the greatest possible depth.[7] Such maneuvers in depth against the enemy's rear, he reasoned, would dislocate and unbalance the enemy psychologically, by causing him to feel trapped, and physically, by forcing him to turn to protect his rear.[8]

Like Fuller, Liddell-Hart emphasized speed over mass in offensive action. However, his concept for achieving operational momentum emphasized avoiding enemy resistance. The essence of this idea was the use of an *indirect approach*

following the line of least resistance and least expectation to the decisive point.[9] He also proposed to minimize enemy resistance through *dislocation* which he described as

> the result of a move which (a) upsets the enemy's dispositions and by compelling a sudden 'change of front', dislocates the distribution and organization of his forces; (b) separates his forces; (c) endangers his supplies; (d) menaces the routes by which he could retreat in case of need and re-establish himself in his base or homeland.
>
> In the psychological sphere, dislocation is the result of the impression on the commander's mind of the physical effects we have listed.[10]

Through *distraction* he believed it possible to deny freedom of action to the enemy by causing

> the distension of his forces or their diversion to unprofitable ends, so that they are too widely distributed, and too committed elsewhere, to have the power of interfering with one's own decisively intended move.[11]

The same effect is produced psychologically by "playing upon the fears of, and by deceiving the opposing command."[12] Thus, by reducing and avoiding enemy resistance in depth Liddell-Hart reasoned that speed and the economical employment of mass would permit rapid exploitation into the enemy's depths.

In contrast, Mikhail Tukhachevskiy believed in the necessity of the physical destruction of the enemy's main force through battle. In his view offensive operations should not culminate with the final destruction of the enemy's main force. Rather, "the main attack is launched in the first general engagement and the successive destruction of the weaker echeloned subunits is accomplished later on."[13] To achieve this he described a process of *operational containment* using superior mass to attack on a broad front to fix the enemy front in position while airborne motorized and mechanized forces attacked in depth to contain the

enemy's tactical and operational reserves and facilitate a rapid friendly advance. With these forces contained, the main attack would strike with overwhelming strength and maximum speed to penetrate the enemy's tactical depth and encircle the main force.[14]

> Only if the enveloping columns are able after the first attacks with tremendous superiority in men and equipment to develop their success quickly and without stopping is it possible in practice to encircle the enemy.[15]

Thus, for Tukhachevskiy operational momentum required sufficient mass to fix and destroy successive enemy echelons in depth, the capacity for rapid and continuous combat operations, and the ability to attack simultaneously in depth. Given these he believed it possible to conduct a destructive operation against the enemy's main force by penetration and encirclement.[16]

These three perspectives suggest different ways of combining speed and mass and reducing enemy resistance in depth to achieve operational momentum. The particular emphasis on speed or mass is relative to the physical or psychological nature of the decisive points and the aim of the operation. Despite their differences, each suggests specific elements in an operational process designed to achieve operational momentum.

III. Historical Analysis

Having identified three different theoretical approaches to achieving and maintaining operational momentum it is appropriate to analyze them in the context of modern history. The major offensive operations and campaigns since

the beginning of World War II provide a wide range of examples with which to assess the viability of these various theoretical concepts. For this purpose eight major operations and campaigns will be used to analyze the essential elements of an operational process that involves establishing a scale of action, achieving a rapid penetration, reducing resistance in depth, increasing the effects of speed and mass, and sustainment to achieve and maintain operational momentum.

Developing A Scale of Action

The first step in achieving operational momentum is to insure that the scale of action is appropriate to the forces available. "In calculating and planning the main operation," Tukhachevskiy wrote, "one should strictly harmonize the scale of actions with his resources."[1] It is also Liddell-Hart's first axiom of strategy and tactics: "*Adjust your end to your means.* - the beginning of military wisdom is a sense of what is possible."[2] The scale of action dictates requirements for concentration, frontage, and sustainment. It is determined by the nature of the offensive in terms of direction and depth, point(s) of penetration, anticipated resistance, and a physical or psychological aim. A reasonable scale of action balances the requirements for concentration, frontage, and sustainment with the means available in order to insure operational momentum.

Initial concentration requirements are determined by the quality, condition, and availability of friendly troops relative the nature of the operation. To achieve and maintain momentum Tukhachevskiy calculated that initial concentration must

be sufficient to accomplish successive destruction of enemy echelons in depth with respect to the sequence of tactical tasks envisioned - usually the penetration and breakthrough, exploitation and pursuit.[3]

> This is achieved primarily, by concentrating at the point of maximum effort forces vastly exceeding those of the enemy, and not only infantry, but also artillery, air, and other technical arms.[4]

The frontage required for an offensive is relative to its depth, the need operationally to contain the enemy's front, the ability to concentrate forces, and the rate at which they must be committed. Narrower frontages facilitate a rapid penetration to a limited depth by smaller concentrations. However, as Liddell-Hart and Tukhachevskiy concluded, the greater the scale of the operation the greater the frontage required to move and sustain the force and protection of its flanks.[5] Broader fronts, according to Tukhachevskiy, provide additional advantages. They allow a superior force to stretch the enemy's defenses and expose them to greater destruction, and allow the attacker to achieve overwhelming strength in the main effort against a weakened sector. Further, they facilitate the operational containment of the enemy's front by fixing his tactical forces and encouraging him to commit prematurely his operational reserves against supporting attacks.[6] When concentration is insufficient for a broad front Fuller envisioned narrower attacks on a *morcelated* front to penetrate weak sectors and envelop the tactical defenses of unattacked sectors in order to fix the enemy front and still allow for superior strength in the main effort.[7]

A reasonable scale of action must also insure the adequacy of the logistical

structure to sustain the operation. According to Tukhachevskiy this requires that lines of communications (LOCs), transportation, and supplies be sufficient to provide uninterrupted support of the operation in accordance with its mass, pace, and duration. Above all, logistics must insure full support to the main effort even at the risk of others.[8]

Sichelschnitt, the plan for the initial German campaign of 1940, provides an excellent example of balance in a scale of action. (Map 1.) German forces deployed in the west were roughly equal to those of France and her allies.[9] However, the purposeful deployment of some 93 divisions in three Army Groups along almost 400 miles of German frontier operationally contained the Allied Front and still achieved overwhelming strength for the main effort. Powerful attacks by Army Groups A and B along a *morcelated* front and the threat of attacks by Army Group C effectively spread and contained French forces. However, by concentrating 45 divisions, including seven out of ten panzer divisions, under Army Group A against a 70 mile front in the weak French center the Germans were able to achieve overwhelming superiority at the *schwerpunkt*. This superiority was increased further by concentrating five of the seven panzer divisions under Panzer Group Kleist for the main effort within Army Group A.[10] Based on experience in moving large units in Austria, Czechoslovakia and Poland, the Germans were particularly attuned to logistical requirements and went to considerable lengths to insure that LOCs, transportation, and supply were adequate for the operation and especially through the Ardennes.[11] This balance of frontage, concentration, and sustainment

allowed the Germans to break through the French defenses on the Meuse and into their operational depth to split the Allies and turn the French First Army.

The Soviet Operation *Skachok* (Gallop) (Jan-Mar 1943) illustrates a scale of action in which the requirements for concentration, frontage, and sustainment proved incompatible with the Soviet capabilities. (Map 4.) STAVKA's intent in "Gallop" was to drive the Germans out of the Donbas region and back across the Dnepr River - a depth of 300 kilometers. It was envisioned as an exploitation and pursuit in continuation of the Southwestern Front's December offensive which had broken through the Italian and Hungarian sectors along the Don River. However, in reality it was a new operation against newly established German defenses whose tactical integrity was yet unbroken. Because of this misperception the Soviets declined to use forces massed against the German 6th Army trapped in Stalingrad. Still, with an overall advantage of 2:1 in troops and 4:1 in tanks over Army Group Don, the Southwestern Front decided to attack with three armies abreast along a broad front of nearly 300 kilometers. There would be no second echelon armies or operational reserves to strengthen the attack.[12] Despite its breadth the operation could not prevent Army Group Don from shifting the 1st and 4th Panzer Army from opposite the Southern Front to meet the Soviet main effort.[13] With Soviet forces so spread the strength of the main effort proved severely inadequate for the depth of the operation and the succession of tasks to be faced.[14]

The Soviets also lacked the logistical means required for the scale of action envisioned in "Gallop." STAVKA's decision to conduct the operation without an

operational pause prevented the logistical build up required to support a front offensive in extended depth. LOCs destroyed by the Germans were not repaired. Mechanized transport was totally insufficient to displace supply bases forward and accomplish minimum distribution of supplies to forward units. The scarcity of resources prevented many divisions operating at less than 60% strength from being reorganized or reconstituted. As a result sustainment proved inadequate for the scale of action and reduced operational momentum.[15]

Similarly, Hitler's Ardennes offensive illustrates an imbalance between available resources and the concentration, frontage, and sustainment required for a 140 mile drive to seize Antwerp and split the Allies (Map 7). Hitler purposely limited the offensive to a 60 mile front in order to achieve concentration. However, with 16 out of 19+ divisions (including four out of seven panzer), committed on line forces could not be echeloned in depth. The narrow front and uncoordinated supporting attacks by Army Groups H to the north and G to the south failed operationally to contain the Allies.[16] By D+2 Bradley's 12th Army Group had shifted sufficient tactical forces, including over 500 tanks, to wipe out the initial German advantage of 3 : 1.[17] The narrow front and lack of depth of the attack prevented the Germans from protecting the flanks of the main effort and the LOCs essential to sustainment. Despite significant preparations logistics proved to be totally inadequate. When train loads of fuel did not arrive prior to the attack units were committed with only the fuel in their tanks. When fuel became available the inadequacy of the LOCs and the scarcity of mechanized transport

prevented it from being pushed forward to the panzers which soon became starved of fuel.[18] The inadequacy of German resources to achieve operational momentum in an operation of this scale came as no surprise to Rundstedt, C-in-C West.[19]

These examples suggest that the first element in achieving operational momentum is to insure that the scale of action is appropriate to the forces available. It requires the ability to envision the full scope and nature of an operation and calculate the requirements for concentration, frontage, and sustainment. Further, it requires the knowledge of one's own capabilities to determine if and how these requirements can be achieved.

A Solution for the Initial Penetration

Gaining the speed necessary for operational momentum requires a rapid penetration of the enemy's tactical depth. Tactical depth is that forward area occupied by defending units whose freedom to maneuver is restricted by their defensive mission. As long as the integrity of the defense is maintained the attacker is unable to exploit by maneuver into the enemy's operational depth.[1] The time it takes to penetrate these tactical defenses is time in which the enemy can increase his resistance in depth.

In an offensive the operational commander contributes to a rapid penetration of the enemy's tactical defenses by gaining a favorable combat power advantage at the point of penetration. This can be accomplished in three ways: selecting a weak enemy sector for the penetration, increasing the concentration of friendly

forces, or causing a dissipation of the enemy tactical strength. In the first, Liddell-Hart's indirect approach may be used to avoid resistance by selecting a direction of advance to the decisive point along the line of least resistance or least expectation. The second reflects Tukhachevsky's emphasis on concentrating mass to create an "overwhelming battering ram"[2] and

> a sufficient quantity of suppression means, insuring not just the defeat but the destruction of large enemy units - defending the front.[3]

Finally, as Liddell-Hart also suggests, it is possible to cause the physical or psychological dissipation of the enemy's strength through *dislocation*, *distraction*, deception and surprise.

The German 1940 campaign in the West reflects a combination of operational measures which contributed to a rapid penetration of French defenses (Map1). First, the main effort by Army Group A through the Ardennes was a classic use of an indirect approach. It was simultaneously the line of least resistance and the line of least expectation. The French, who continued to believe in the "impenetrability of the Ardennes," defended this 100 mile front with only four light cavalry divisions and ten infantry divisions of the 9th and 2d French Armies and no reserves.[4] The Germans further pinpointed the French weakness at Sedan on the Meuse River.[5] Second, as previously mentioned, the Germans effectively concentrated overwhelming combat power at the *schwerpunkt* under Army Group A and Panzer Group Kleist and added to that the weight of the Luftwaffe for the actual breakthrough at Sedan.[6] Third, through a combination of secrecy, deception

and *distraction* the Germans minimized French resistance opposing the main effort. The powerful attack by Army Group B into Holland became the "matador's cloak" which dislocated the French by drawing them north into Belgium.[7] Further, the possibility of a thrust into the Maginot Line by Army Group C kept the French unsure of the main effort until D+5.[8] By thus achieving tactical and operational surprise the Germans caught many French units largely unprepared and left them psychologically shaken and vulnerable to panic.[9] The combination of these operational measures enabled Army Group A rapidly to penetrate and break through French tactical defenses and into their operational depth in only six days.[10]

The success of Bradley's Operation "Cobra" in breaking through the German defenses in the bocage of Normandy illustrates another combination of operational measures designed to achieve a rapid penetration. (Map 6.) The continuous flow of Allied forces across the beaches provided ample concentration for a major operation. By attacking southwest from St. Lo Bradley avoided more direct approaches toward Falaise which the Germans expected and had heavily defended. In addition, Montgomery's attacks toward Falaise distracted, *dislocated* and fixed significant German forces around Caen. Seven of the ten panzer divisions in Normandy shifted to the defense of Caen leaving only three badly damaged armored formations to oppose the Americans at St. Lo.[11] Finally, Bradley concentrated nearly 2,200 bombers, 700 fighter bombers and 1,000 artillery tubes to suppress the narrow front of the main effort along the St. Lo road.[12] Together, these operational measures provided Bradley's First Army, especially Collin's VII Corps,

with the combat power advantage to achieve a rapid penetration which quickly became a breakout and pursuit to the Moselle River.

By comparison Operation Citadel, the German offensive to reduce the Kursk Salient, is illustrative of a failure to develop an operational solution to the problem of achieving a rapid penetration (Map 5). First, German intentions for the offensive were known in some detail in April thanks to a Soviet espionage agent code named 'Lucy'.[13] Second, because the points of penetration and directions of attack were known and rather obvious for a German attack on the Kursk salient, these approaches were most expected by the Soviets and heavily defended with the greatest tactical depth and concentration. Soviet rifle corps defended with two echelons of divisions to a depth of 15 to 20 Km.[14] On both the Soviet Central and Voronezh Fronts, the first echelon of armies deployed either one or two echelons of rifle corps. Second echelon armies formed a third front defensive belt. In total about 3300 tanks and self propelled guns were deployed.[15] Against this the Germans attempted a double envelopment to begin with penetrations by massed armor against a numerically superior and fully prepared enemy . After seven days of bitter fighting the German 9th Army reached its culmination point after penetrating only 2 to 12 kilometers into the tactical depth of the Central Front. In the south, 4th Panzer Army managed to penetrate into the operational depth of the Voronezh Front before the operation was called off. However it was incapable of defeating the Soviet operational tank reserves which as yet remained uncommitted.[16]

These examples illustrate the importance of a rapid penetration in preserving the mass of the offense, avoiding unnecessary resistance, and enabling the attack to exploit freedom of maneuver. It is an essential element in achieving operational momentum. However, as these examples suggest, it is the ability to devise and implement operational solutions for achieving a rapid penetration which is fundamentally most important to operational momentum.

Reducing Resistance in Depth

Once the main effort of an offensive operation has penetrated the enemy's tactical depth it immediately encounters increasing resistance as the enemy seeks to prevent a breakout into his operational depth. This resistance threatens operational momentum by slowing its speed and dissipating its mass. The amount of resistance the enemy can direct against the main effort is dependent on his ability to direct or redirect forces in depth and interdict the line of advance, and the time available to him. Unless the offensive maintains sufficient operational momentum to overcome this resistance it will reach its point of culmination before it can achieve freedom of maneuver in the enemy's operational depth.

The operational challenge is to reduce this resistance in depth to a level which can be overcome by the operational momentum of the offensive. It requires the means by which to impede the enemy's ability to direct or redirect forces against the main effort, prevent the interdiction of critical LOCs, and deny him the time he requires to increase his resistance in depth. Operational containment by

attacks on a broad or *morcelated* front can fix the enemy front and impede his ability to shift tactical forces against the main effort. Also, the strength of enemy forces in depth can be dissipated along the line of advance of the main effort through *distraction* and deception which cause the enemy to commit forces to unprofitable ends or *dislocation* which unbalances the enemy's disposition by forcing him to react to sudden change of fronts and prevent a timely shift of forces against the main effort.

However, Fuller and Tukhachevskiy believed that only by attacking the enemy in depth simultaneously with attacks against his front is it possible to minimize resistance in depth and facilitate a rapid advance. Attacks in depth can contain the enemy's rear, delay and disrupt his reinforcements, and deny him freedom of action in his own operational depth. They can also be use to secure key terrain and critical LOCs along the line of advance, and to impede the enemy's destruction of LOCs, barrier emplacement, and other countermeasures.[1] Fuller imagined "mosquito attacks waged by motorized guerrillas forces against the enemy's area of communications."[2] These motorized guerrillas would "search the area of advance, picket bridges and tactical points, block roads, etc "and "fight off the enemy swarm and so clear the area of advance."[3] He saw such 'advanced actions,' similar to those of Soviet forward detachments, far ahead of the main effort to create favorable conditions for a deliberate attack.[4] Tukhachevskiy envisioned an "airborne motorized and mechanized campaign" and the use of bombers and attack aircraft to attack rear areas of the enemy's corps, armies and army groups,

interdict LOCs, block or fix operational reserves, and create deep barrier zones which deny the enemy freedom of movement and delay reinforcement. [5]

While attacks in depth impede enemy efforts to increase resistance in depth, it is the tempo of the offensive which limits the amount of time available to him. Fuller concluded that it is the rapid transition, without pause, from the attack and tactical penetration to exploitation and pursuit which leads to victory.[6] It requires, as Tukhachevskiy reasoned, successive strokes which "follow one after the other without any interruption in terms of time, intensity of battle, and in organizing communications and supply lines."[7] By achieving such a rapid tempo the enemy may be denied the time he requires to increase his resistance in depth.

The German campaign in the west in 1940 provides an excellent example of actions which effectively reduced resistance in depth to preserve operational momentum (Map 1). Elaborate deception schemes in the German *Sichelschnitt* plan effectively concealed the real *schwerpunkt* even as late as D+5.[8] Therefore, Gamelin refused to shift forces from the Maginot Line and within one hour of the Army Group B's attack reacted to the 'matadors cloak' by executing the Breda Variant of the defense plan which committed the Seventh Army, in operational reserve, to the left flank of the First Army Group as far north as Breda, Holland, leaving at most only 13 divisions in operational reserve.[9] He was so taken in that he concentrated his limited air assets against Army Group B through D+1.[10] In addition the attacks by Army Groups A and B and the threat of attacks by 'C' fixed the front of the French 1st Army Group and prevented tactical forces from being

shifted toward the main effort.[11]

German attacks in depth were particularly significant in reducing French resistance in depth. The Luftwaffe relentlessly bombed French reinforcements and supply columns causing great physical destruction and psychological instability in rear areas. "All over northern France the roads told the same story of troops caught on the move, the wounded soldiers crying for help amid the piles of abandoned equipment."[12] Moreover, these air attacks significantly delayed and disrupted the assembly and movement of counterattack forces trying to move forward to prevent a German breakout from their bridgeheads across the Meuse. Such a lack of reserves near Sedan encouraged Guderian's early breakout on D+3.[13]

Sichelschnitt also included a variety of special operations to attack the Allies in depth. Airborne forces attacked government facilities and airfields and captured key defenses and vital bridges over the Rhine and Maas Rivers and Albert Canal. Special army 'Brandenburg' units assigned to the Abwehr and detachments from the *Grossdeutschland* Regiment were used in Holland, Belgium, and Luxembourg to secure critical bridges and LOC's and to undermine local defenses. The results of these actions ranged from the spectacular success at Eben Emael to the dismal failure in Der Haag. However, together they reduced Allied resistance in depth and facilitated German operational momentum.[14]

Finally, the speed with which Army Group A, especially Panzer Group Kleist, penetrated the Ardennes, forced the Meuse, and broke out from its bridgeheads denied the French the time they required to increase resistance in depth. The

French High Command had

> calculated that it would take the Germans fifteen days to bring up strong enough forces - 40 divisions with heavy artillery and 100,000 tons of munitions - to make a serious attempt on the Meuse line from Namir to Sedan.[15]

Thus, Gamelin's orders on D+1 to move 11 operational reserve divisions to the area of Sedan so as to arrive between D+4 and D+11 seem reasonable. However, the three Panzer Corps under Hoth, Reinhardt, and Guderian reached the Meuse on D+2, crossed on D+3 and began attacks out of their bridgeheads on D+5. These attacks overran the deployment areas of French operational reserves even before the lead elements could assemble.[16] Without time the French had little hope of increasing resistance in depth to stop the momentum of Panzer Group Kleist.

Operation COBRA provides another example of how minimizing resistance in depth can preserve operational momentum (Map 6). The Germans failed correctly to assess Allied intentions for the breakout from the Normandy lodgement. Attacks by the British and Canadians around Caen

> reinforced Field Marshal Von Kluge's fatal conviction that the Anglo-Americans remained principally interested in rolling across the Falaise plain, and that it was the American attack further west that was diversionary. Kluge himself went to the Caen front.[17]

Accordingly, Kluge shifted the preponderance of his Panzer formations toward Caen away from Bradley's main effort. Constant allied pressure along the length of the front prevented the Germans from shifting tactical forces and consumed their reserves.[18] Close air support and interdiction by IX Tactical Air Force flying in advance of the main effort by Collin's VII Corps effectively cleared German resistance along the line of advance destroying or damaging nearly 600 German

tanks and assault guns and over 1500 other vehicles in the first week of the operation. Against Anglo-American air power operating in depth the German tactics of massing tanks in depth which had proved so effective on the Eastern Front became suicidal in France.[19] Finally, Collin's emphasis on immediate exploitation of a successful tactical penetration in order to accelerate the breakout denied the Germans time to regain their balance. Once Collins' divisions broke through the German tactical depth they immediately transitioned to a high speed exploitation destroying German LOCs, overwhelming surprised panzer elements in depth, and seizing key bridges over the Seine River. As a result a large portion of the German LXXXIV Corps was encircled and the door was held open for the pursuit by Middleton's VIII Corps.[20] This rapid exploitation of success allowed Bradley to maintain operational momentum in the face of German disorganization.[21]

By way of contrast the 1944 German Ardennes offensive illustrates an operation which quickly culminated when resistance in depth could not be reduced to a level which could be overcome by operational momentum (Map 7). German deception schemes, such as the creation of the "ghost" 25th Army north of the Ardennes and false radio profiles in the Ardennes, and close operational security which covered the actual buildup did achieve operational surprise which the Germans were able to exploit. During the first 48 hours of the operation panzers spearheading the attack penetrated up to 15 miles before increasing resistance in depth began to erode their operational momentum.[22] However beyond this, German

efforts to minimize allied resistance proved unsuccessful. First, they were unable to prevent Bradley and Hodges from directing forces against the main effort. As mentioned earlier, the lack of operational containment meant that tactical forces could be shifted to threatened sectors. The 7th Armored and 30th Infantry Divisions joined Hodges from the Ninth Army on D+1 and most of U.S. VII Corps and Patton's Third Army were redirected against the 6th and 5th Panzer Armies respectively.[23]

Further, German attacks in depth were insufficient to contain the rear of Hodges' First Army or facilitate a rapid German advance. The Germans lacked the assets for air interdiction and remained themselves vulnerable to over 4000 Allied aircraft waiting for the weather to break.[24] Two special operations, *Stosser*, an airborne drop, and *Grief*, the infiltration of the special Panzer Brigade 150 (with its contingent of American impersonators) failed to secure key roads or significantly disrupt C2 and communications and interdict LOCs.[25] As a result, the Germans were unable to deny Bradley freedom of maneuver in his own rear areas or significantly disrupt the flow of strategic reserves under XVIII Airborne Corps moving to reinforce Bastogne and blunt the penetration by 1st SS Panzer Corps.[26] Also, the failure of special forces to secure critical LOCs denied the main effort the rapid advance it required to exploit operational surprise.

Finally, the main effort by 6th Panzer Army was unable to advance faster than U.S. forces could react to increase resistance in depth. The physical and mental agility of American forces gave them the advantage in economizing time. This,

together with the scarcity of useable roads, the lack of mechanized transport, and the greater than expected American resistance prevented the offensive from achieving the rate of advance required for operational momentum.[27]

By these examples one can see the relationship between resistance in depth and operational momentum. The more effective an operation is in reducing resistance in depth the greater the operational momentum relative to rate and depth of a penetration. Therefore, minimize enemy resistance in depth is absolutely essential to achieving and maintaining operational momentum.

The Factor of Speed

Even when opposed by minimum resistance an offensive operation still requires a combination of speed and mass to penetrate the enemy's operational depth and achieve freedom of maneuver. Speed in an operation, as Fuller suggests, is a source of power. It is essential for rapid concentration, exploitation and pursuit in a deep maneuver.[1] Tukhachevskiy saw speed as critical to the success of a destructive operation, enabling the attacker to destroy successive enemy echelons in depth, encircle his main force by envelopment, and pursue enemy forces in flight.[2] Both saw that speed in an offensive denies the enemy the time to regain his balance and increase resistance in depth.[3] Thus, speed can multiply the effects of mass for the attacker compared to the defender.

The speed required for operational momentum, as Fuller reasoned, comes from the ability "to economize time in action."[4] It requires uninterrupted action along

the quickest line of advance to the objective. Fuller envisioned continuous operations, especially at night, by highly mobile and flexible forces fighting encounter engagements and rapidly transitioning to the exploitation and pursuit.[5] Similarly, Tukhachevskiy saw successive operations over extended periods without halts and attacks from the march as the means of achieving speed. Like Fuller and Liddell-Hart, he felt that the key to such a pace is timely decision making, anticipation of future events, and initiative.[6] Moreover, they agree that speed also is achieved by following the quickest line of advance as determined by distance, natural obstacles and enemy opposition. Tukhachevskiy explained,

> The direction for the main attack is selected such that when the enemy dispositions, the terrain, and the friendly forces and equipment are taken into account it will be possible in the shortest time and most facile manner to achieve the destruction of the enemy army.[7]

The German campaign of 1940 provides a classic example of the role of speed in producing operational momentum (Map 1). According to Lord Gort, Commander of the British Expeditionary Force (BEF) in France in 1940,

> The speed with which the enemy exploited his penetration of the French Front, his willingness to accept risk to further his aim, and his exploitation of every success to the uttermost limits emphasized, even more forcefully than in any campaign of the past, the advantage which accrues to the commander who knows how best to use time and to make time his servant and not his master.[8]

In just 10 days Panzer Group Kleist raced nearly 250 miles through the Ardennes and across northern France to the mouth of the Somme at Abbeville to trap the French First Army and BEF against the Channel coast. It more than fulfilled Guderian's call for speed.

> The tank attack must be carried out with the utmost speed in order to take advantage of the surprise effect. It must drive deep into the hostile front, prevent the reserves from going into action and convert tactical gains into strategic ones. In other words speed is the main

> requirement of armored forces. As Frederick the Great said, "the faster the attack, the fewer men it costs. By making your battle short you will deprive it of time to rob you of many men. The soldier who is led in this manner will gain confidence in you and expose himself gladly to all dangers."[9]

This accomplishment was one of an army geared to sustain a tempo of battle which emphasized speed achieved by individual initiative and quick decisions and actions to exploit new situations against an enemy whose pace of battle had changed little since 1914.[10] The ability of the Germans to achieve this speed was based on several factors. First, as previously described, they were successful in reducing French resistance in depth. Second, also mentioned earlier, the direction of the main effort through the Ardennes proved to be the quickest. However, beyond this it was the ability of the Germans to achieve and maintain a rapid pace of combat without interruption through three major operational phases which enabled them to penetrate and achieve freedom of maneuver in the operational depth of the French. In the first phase their technical ability to execute and maintain an approach march through the Ardennes enabled Panzer Group Kleist and XV Panzer Corps to penetrate 75 miles to the Meuse in just three days, arriving on D+2, 24 hours ahead of their own schedule and well ahead of French estimates.[11] Having caught the French off balance they immediately forced a crossing over the Meuse and by D+3 had secured local bridgeheads which they expanded on D+4. On D+5 Guderian again seized the initiative and transitioned to the third operational phase - the breakout into the operational depth of the French.

Two distinct factors can be credited for this pace of battle - the battle

worthiness of the spearhead formations and the initiative of tactical and operational commanders. With the exception of a one day halt to secure vulnerable flanks, the panzer and panzergrenadier formations of Army Group A maintain virtually uninterrupted operations for two weeks covering in excess of 250 miles. The initiative shown by individual combat commanders such as Guderian with XIX Panzer Corps, Rommel with 7th Panzer Division and Balck with 1st Panzergrenadier Regiment in continuously pressing the attack quickly exploited enemy weakness to break through French defenses.[12] This combination of energy and initiative forced the rapid breakout, exploitation, and pursuit, destroyed the French 9th Army and then gained freedom of maneuver to cut off and encircle the bulk of the French First Army Group and the BEF.

During the British Operation "Compass", General O'Connor's Western Desert Force demonstrated how speed could compensate for a lack of mass to achieve operational momentum against the Italian Tenth Army in North Africa (Map 2). Prior to his initial attacks against the Tenth Army's camps at Nibeiwa and Tummars O'Connor anticipated opportunities for exploitation and held his most mobile force, the 7th Armored Division, as his *corps de chasse*.[13] He deliberately positioned the 7th Armored so that it could strike west quickly to cut off any escape by the Italians and exploit any opportunity for a rapid attack on Bardia, the Italian's principal defenses in Lybia. With the success of these attacks, despite having to release another division from his command, O'Connor launched the 7th Armored in pursuit of the Italian Tenth Army as it reeled back to Bardia.[14]

The speed with which the O'Connor transitioned to the exploitation with the 7th Armored Division racing through the desert around the Italian south flank enabled him to cut off the Italians in Bardia from their line of communication to Tobruk and Italy. By the time he took Bardia O'Connor had already launched the 7th Armored Division in pursuit of the Italians west toward Tobruk which subsequently fell under O'Connor's relentless pressure.[15]

With his mechanized forces exhausted and his supplies depleted, O'Connor was forced to delay further pursuit in order to reconstitute his force and establish forward supply magazines while the Italians continued to flee toward Benghazi. With only half his stocks replenished and a force of only fifty cruiser tanks O'Connor decided to risk a parallel pursuit to the south across 150 miles of rugged but unopposed desert to cut off a numerically superior but desperate Italian Army fleeing toward Beda Fomm. In winning the race to Beda Fomm O'Connor gained a superior position from which his forces were able to destroy the remnants of the Italian Tenth Army. Lybia was now open to the Allies.[16]

From these examples it can be seen that speed in an operation can deny time to the enemy and multiply the effects of mass against decisive points. It allows limited mass to be used to greater effect and is therefore essential to achieving and maintaining operational momentum. These examples suggest that such speed requires the stamina for continuous operations and the agility to transition rapidly from one operational sequel to the next.

The Application of Mass

Although speed can multiply the effects of limited mass operational momentum depends on three additional factors relative to the application of mass. First, as previously discussed, the scale of action in an operation must not exceed the forces available. Fuller reasoned that force requirements are ultimately determined by the nature of the objective or decisive point and the approach to it.[1] If, as Tukhachevskiy reasoned, resources are "insufficient to strike a decisive blow it is still possible to weaken him considerably- and thereby prepare favorable conditions for more decisive encounters."[2]

Second, the application of mass across time and space must materially and economically contribute to the aim of the operation. Liddell-Hart wrote:

> *Keep your objective always in mind,* while adapting your plans to circumstances. Realize that there are more ways than one of gaining an objective, but take heed that every objective should bear on the object.[3]

The approach to the objective is a matter of ends and means. To Fuller:

> The object is to defeat the enemy and if this can be done by direct approach so much the better. The indirect approach is a necessary evil. Which should be followed depends entirely on weapon power.[4]

At the tactical level it is necessary to concentrate mass in order to achieve overwhelming superiority at a decisive point. In an operation mass also may be concentrated against a single objective along a single axis or, as Liddell-Hart suggests, it may be committed along converging axes, or in sequence against successive objectives, or synchronized against simultaneous objectives.[5] Regardless of the method, operational momentum requires that the application of

mass achieve unity of effort toward an overriding operational aim and avoid dissipation to unprofitable ends.

Third, achieving the full effect of mass requires the ability to change the direction of commitment. To Tukhachevskiy this was the essence of maneuver, the union of efforts, achieved by the ability to anticipate changes in the situation and change the direction of concentration as required.

> Thus, during the course of a single operation the decisive direction may change. For example, during the breakthrough it will be perpendicular to the front and with the subsequent envelopment and encirclement actions it will be parallel to it, etc.[6]

Further, as Liddell-Hart points out, the ability quickly to change the direction of mass allows the offensive to exploit weaknesses and opportunity, and avoid resistance and execute alternate branches of a campaign plan.[7] Therefore, mass must also possess physical agility.

As previous discussions have suggested, the German 1940 Campaign in the West the application of mass by the German Army accomplished was a significant factor in achieving operational momentum (Map 1). Although total forces available to the Allies and the Germans were comparable the individual tasks assigned to each German Army Group proved to be within its means. The 29+ divisions assigned to Army Group B together with the employment of major airborne forces was sufficient to dislocate and operationally contain the Allied left wing.[8] The mere 19 divisions of Army Group C bolstered by convincing deception schemes portrayed a sufficient threat to induce the French not to shift forces from behind the Maginot Line.[9] By this economical employment of forces

to distract, dislocate and contain the French, Army Group A with 45 divisions was more than adequate to penetrate the Ardennes and the weak French center and achieve operational depth.

The simultaneous tactical concentration of seven panzer divisions in three panzer corps quickly overwhelmed and broke through French defenses along a 80 mile front. As these formations drove deep they converged into a powerful armored fist less than 30 miles wide and executed a gradual right wheel along the Somme which simultaneously threatened to envelop the Maginot Line, strike at Paris, and turn the French 1st Army.[10] Although Hitler's intentions west of the Meuse remain unclear, Guderian has claimed that his aim was always the Channel coast.[11] Nevertheless, the ability of Guderian, Kleist and Rundstedt to concentrate and sequence the application of mass and to change decisively the direction of commitment achieved and maintained operational momentum.

Rommel's employment of *Panzerarmee Afrika* in his Gazala Campaign of 1942 illustrates the problems of achieving the full effects of mass required for operational momentum (Map 3). In this campaign the balance of forces was roughly equal with the British expected to gain in strength. Rommel's initial successes were largely due to his ability to concentrate tactical forces against decisive points and to shift and change the direction of the main effort based on changes in the situation and opportunities for exploitation. When his main effort by the *Afrika Korps* became bogged down while trying to envelop the British 1st Armored Division at Mersa Brega, Rommel quickly exploited the unexpected

success of Group Marcks' supporting attack by shifting his *schwerpunkt* to that axis. He then changed the direction of the *Africa Korps* to exploit the success of Group Marcks which had infiltrated into the rear of the British 1st Armored Division.[12] Next, he deployed his main effort toward Msus which simultaneously threatened the British at Benghazi to the west and Mechili and Gazala to the east. Then by launching a feint toward Mechili he caused the British to shift their armor to the east uncovering Benghazi and the 4th Indian Division. "With his characteristic agility Rommel changed his direction, lunged to the coast and cut off the Indians."[13] Although the bulk of the 4th Indian escaped, Benghazi with its enormous stocks of supplies fell to Rommel. With no possibility for a counter offensive the British Eighth Army was ordered back to the Gazala line to cover Tobruk before Rommel could mount a pursuit.[14]

As he approached the Gazala Line, Rommel faced two problems - prepared defenses and increased British strength which gave them a 1.5 : 1 superiority in tanks over the combined German and Italian strengths (2.6 : 1 British to German).[15] Here again Rommel's ability to maneuver the mass of his main effort, comprised of the *Afrika Korps* and XX Italian Corps, around the southern flank of the Gazala lines threatened to produce the full effect of mass. On this occasion, however, after gaining initial success in overrunning two Indian Brigades and element of the British 7th Armored Division, Rommel split his forces sending elements north and east to cut LOCs while others continued to fight pitched battles with significant British armor scattered in operational reserves. The

loss of momentum caused by dissipation of his mass and lack of resupply forced Rommel to reconcentrate and resupply his force in the British rear. He was then able to attack back to the west, breach the center of the Gazala defenses and establish control of that central area known as the Cauldron.[16]

After breaking out from the Cauldron, the mass of Rommel's maneuver forces began to dissipate. For ten days he committed forces to costly ground and air attacks against the isolated outpost of Bir Hacheim which was no longer decisive to his aim.[17] Supporting Luftwaffe assets were reassigned for attacks on Malta. In his next move he again spread his forces in simultaneous fanlike drives to cut the coast road and envelop the Gazala Line, seize El Adam and destroy the remaining British armored reserves. Consequently, the enveloping force proved to weak to prevent the bulk of British forces from withdrawing to El Alamein.[18]

Rommel pursued the Eighth Army to the Egyptian frontier taking Tobruk in the process. However, the mass of the *Panzerarmee Afrika* was dangerously depleted. Only 44 tanks now remained in the *Afrika Korps*. Mass could no longer contribute significantly to operational momentum against an enemy who would not be panicked. Rommel's offensive had reached its point of culmination.[19]

Clearly, mass is a perishable source of power. For it to contribute fully to operational momentum it is essential that its application be economical relative to the scope of the operation and constantly directed against the decisive points defined by the aim of the operation. Failing in this, mass will dissipate through the wastage and friction of combat, and misdirection to unprofitable ends.

Sustaining Operational Momentum

Maintaining the operational momentum of an offensive is threatened by perishable nature of mass. Therefore, in addition to preserving mass by avoiding or reducing resistance in depth and economic application, operational momentum must be logistically sustained in accordance with its mass and speed throughout the depth and duration of the offensive. Therefore, sustainment must overcome those problems which evolve from the extended depth, rapid consumption, and limited resources which often characterize operations in depth..

Operations in depth require the ability to move and distribute supplies along extended lines of communications which the enemy will have tried to damage and will try to interdict. Therefore, the selection of frontages and deep attack objectives should insure that each major unit has its own transportation lines "capable of insuring uninterrupted delivery of supplies - even with the most rapid troop movements."[1] Forward resupply of forces in depth, as Fuller imagined, could employ a combination of protected supply convoys whose vehicles possessed tactical mobility commensurate with the fighting forces, and aerial resupply columns.[2] As the depth of an operation causes LOCs to become overly extended or vulnerable he envisioned the possibility of maneuvering communications and field logistics depots in order to maintain the freedom of action in the field.[3]

Next, sustainment must overcome the problem of rapid consumption which can temporarily exhaust critical supplies. While prestocking forward depots and

magazines may provide an initial margin of supply and simplify distribution, Tukhachevskiy recognized the need to balance the expenditure of resources with the significance of the engagement relative to the overall operation.

> Waging a battle with unrestricted consumption of artillery shells undeniably provides a tactical solution of the battle problems, but occasionally or usually will develop into insuperable difficulties in an all-out, full scale operation in depth.[4]

Therefore, it is necessary to achieve economy of effort by establishing priorities, regulating supply consumption and weighting the main effort even if risk taking is required elsewhere.

The final problem for sustainment is that of limited resources available for an operation. Normal supplies and materiel must be supplemented through innovation and initiative. Fuller envisioned the reintroduction of foraging and the deliberate capture and use of enemy stocks and logistics.[5] Tukhachevskiy emphasized the need to regenerate the force by insuring that each element has sufficient restorative equipment to repair equipment commensurate with the rate of advance in a given direction.[6] Implicit in this is the need to recover useable equipment from the battlefield.

The German campaign of 1940 was sustained by a combination of procedures. Although lines of communications to the rear were unsecure for several days the Germans reduced their vulnerability to interdiction by reducing their dependence on resupply from the rear. Divisions carried their own fuel, ammo and food. Additional fuel was foraged from commercial petrol stations and captured depots. In addition, each division in the attack had its own pool of mechanics, spare tanks

and tank crews with which to regenerate combat power for the main effort. Army supply services were used only in emergencies and remained concerned mainly with the resupply of ammunition along individual, unprotected supply roads.[7]

O'Connor's sustainment problems in North Africa during Operation "Compass" were considerably more difficult due to the harsh environment, the extended LOCs and the considerable depth of the operation, and the fact that North Africa was a secondary theater of war with its own sea LOCs (Map 2). Nevertheless, O'Connor was largely able to sustain operational momentum during a 10 week campaign across 500 miles of desert. During each phase of the operation O'Connor extended his line of forward supply depots and prestocked magazines. As successive ports of Bardia, Tubruk and Benghazi fell to O'Connor he established new supply bases to shorten his LOC and allow freedom of maneuver to his forces.[8] He also minimized the problem of inadequate transportation by "swiftly organizing captured Italian trucks into new supply units."[9] In Bardia and Tobruk alone over 900 Italian trucks were captured and pressed into service.[10]

Despite these measures, O'Connor continued to be faced with the problem of inadequate logistical resources for his mass and speed. However, he maintained his operational momentum by shifting the priority of support to his main effort and taking risks. Rather than allow depleted magazine stocks to force an operational pause while the Italians fled to Bardia, O'Connor launched the 7th Armored Division in pursuit while he replenished his base.[11] Similarly, rather than sit for 10 days at Mechili to stock new magazines while the Italians escaped

to Benghazi, O'Connor accepted risk in order to launch the attack which ultimately cut off and destroyed the Italian Tenth Army.

> There would be just enough fuel for the armoured division to start with full fuel tanks, enough supplies to allow it to carry its own quota of food and ammunition. A convoy of trucks could follow with two days' food, water and petrol, and two re-fills of ammunition. That was all. There was no hope of future supplies reaching the division before these were exhausted.[12]

Although this proved to be a close margin, the risk taken to sustain operational momentum was more than equalled by the payoff.

Many similar solutions appear in Rommel's Gazala campaign. However, Rommel also demonstrated the ability to maneuver his communications and logistics to sustain operational momentum (Map 3). When Rommel's forces nearly became starved of supplies after maneuvering to the rear of the Gazala Line, Rommel personally led a waiting column of some 1500 trucks loaded with needed supplies through a gap in the Gazala line to resupply his main effort stranded in the British rear. Then by attacking back through the Gazala Line, Rommel established a more direct and more secure main line of supply into the'Cauldron.'[13] These actions demonstrate the feasibility of "maneuvering" communications and logistics to achieve freedom of maneuver in the enemy's depths.

Sustainment as can be seen is essential to maintaining operational momentum. It must overcome the problems of depth, consumption, and limited resources associated with deep operations and insure that the flow of materiel and services is appropriate to the mass, speed and duration of the operation.

Section IV. Conclusions and Implications

From the preceding analysis six elements can be identified as essential to achieving and maintaining the operational momentum required to penetrate the enemy's operational depth and gain freedom of maneuver. First, is a reasonable scale of action in terms of frontage, concentration, and sustainment which is appropriate to the capabilities of the forces available. Second is an operational solution which will achieve a rapid and exploitable penetration of the enemy's tactical depth. Third is to minimize enemy resistance in depth by a combination of simultaneous attacks in depth to disrupt the enemy's rear and secure critical points along the line of advance, and rapid penetrations to deny him time. Fourth, is maximum speed, through rapid operational transitions and uninterrupted operations along the quickest line of advance to deny the enemy time and multiply the effects of mass. Fifth is to achieve the fullest effects of mass through tactical concentration and an operational scheme which commits mass economically and insures that it is constantly directed against decisive points as defined by the aim of the operation. Last is the sustainment of speed and mass throughout the duration and depth of the operation by "maneuvering" logistics and LOCs in depth, regulating consumption relative to the overall aim, and developing additional sources of supplies.

In addition, two further conclusions can be reached about the relative balance between speed and mass in operational momentum. First, the relative proportion of speed to mass must be compatible with the physical or

psychological aim of the operation. Achieving psychological paralysis by shock action and deep attacks against the brain of an organization may require more speed than mass. Conversely, the physical destruction of an enemy main force requires a greater proportion of mass. If the aim of the operation is inconsistent with the enemy's vulnerabilities it is unlikely that the aim will be achieved. Second, a balance between speed and mass seems to offer the greatest potential for success. Relying too heavily on either speed or mass risks weaknesses in the other which the enemy may be able to exploit. Therefore, mass must be adequate to achieve minimum favorable probabilities for success at decisive points with speed multiplying the effects of mass in time through exploitation and pursuit.

These conclusions suggest four implications for the U.S. Army with respect to its doctrine, organizational structure, and ability to meet the challanges of future war. The first imlpication concerns the basic doctrine of AirLand Battle as presented in FM 100-5, Operations. While it is more than adequate in addressing most of the essential theoretical precepts and many practical considerations of operational momentum, it would benefit from reinforcement of five points. First, considerations in developing a reasonable scale of action should be addressed in more pragmatic terms.[1] Second, the importance of rapidily transitioning to the exploitation and pursuit appears much more central to the success of an offensive operation than suggested in FM 100-5.[2] Third, the concept of depth in offensive operations should stress the necessity to relate deep attacks to minimize enemy resistance with the operational requirement to

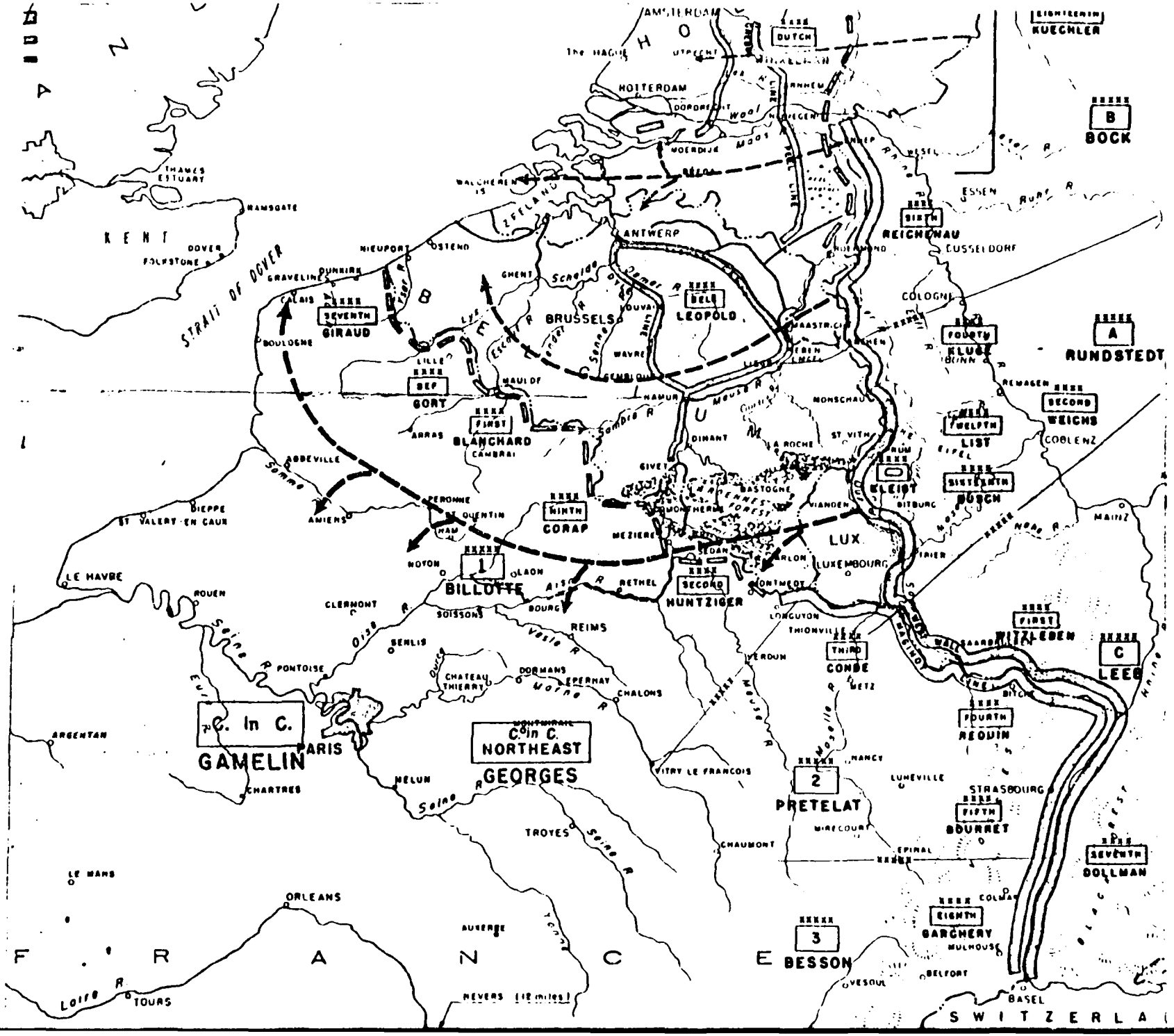
achieve operational depth and freedom of maneuver.[3] Fourth, unity of effort based on an overriding operational aim dictate the economical application of mass and sustainment effort. Finally, considering the tenets of airland battle which tend to emphasize speed over mass, it is necessary to consider the implications to operational momentum when the aim of an operation is physical rather than psychological.

The second implication relates to implementing doctrine. Despite the quality of the concepts presented in FM 100-5, doctrinal implementation with respect to the essentials of operational momentum lags behind. FM 100-15, Corps Operations, is still in draft form and does not reflect an appreciation of many of the essentials of operational momentum. The "Concepts for Offense" and "Conduct of Offensive Operations" as presented, uses the words of AirLand Battle and little more. For example, "Missions for deep attack will be those forces, features or facilities whose destruction, denial of use, or control will contribute most to the success of the attack."[4] Worse still, FM 100-16, Support Operations: Echelons Above Corps, simply does not focus on the planning and conduct of combat operations by armies or army groups. Considering the recent emphasis on corps and multi-corps operations this is a serious weakness.

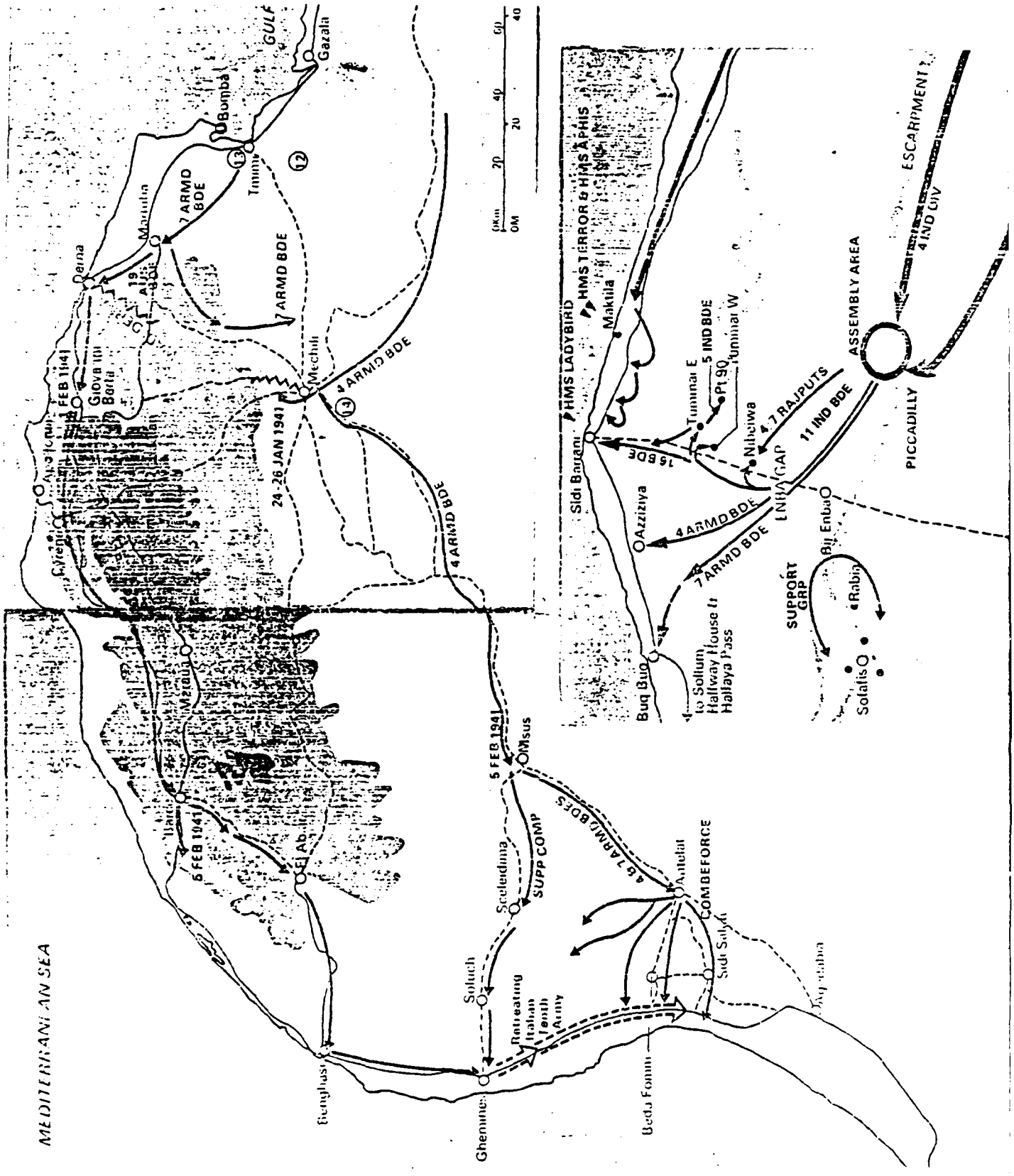
Third, considering the sustainment requirements for operational momentum the current lack of logistical structure at corps and above appears inadequate to to sustain the pace, mass, and duration of a deep offensive operation. It is questionable whether the present CSS organization is capable of overcoming the

problems associated with depth, rapid rates of consumption and finite sources of supply to sustain more than the most modest offensive operations. Its capabilities must be raised to a higher level of confidence if operational momentum is to be possible.

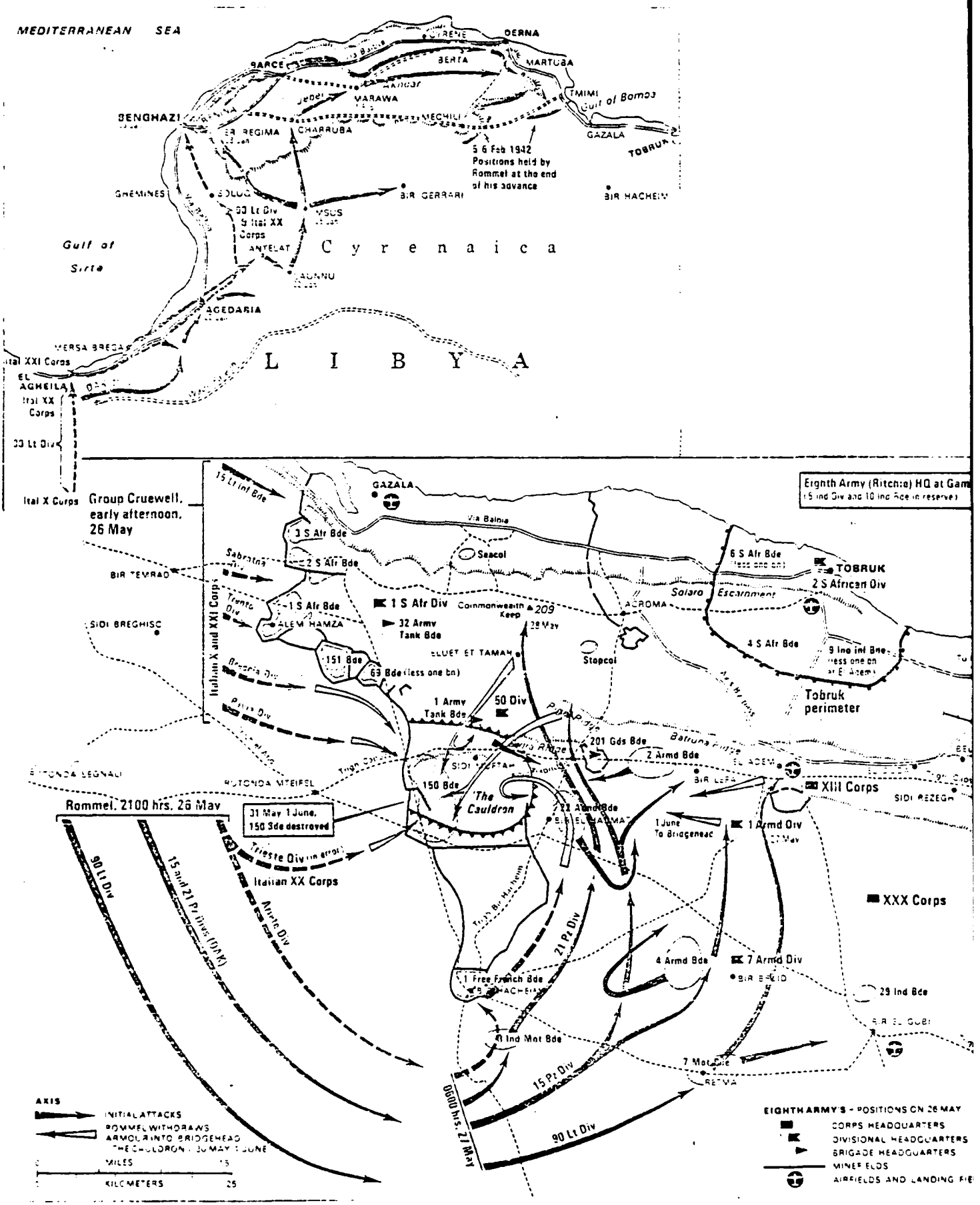
Finally, while it is unlikly that the U.S. Army will ever initiate an offensive operation on the sweep of recent history, except possibly as a counterstroke, such operations are certainly embraced by the doctrine of the Soviet Union which has invested in a force structure designed to achieve operational momentum. It is the reality of this capability combined with a doctrine which emphasizes the essentials of operational momentum for which the U.S. Army needs to be absolutely prepared.



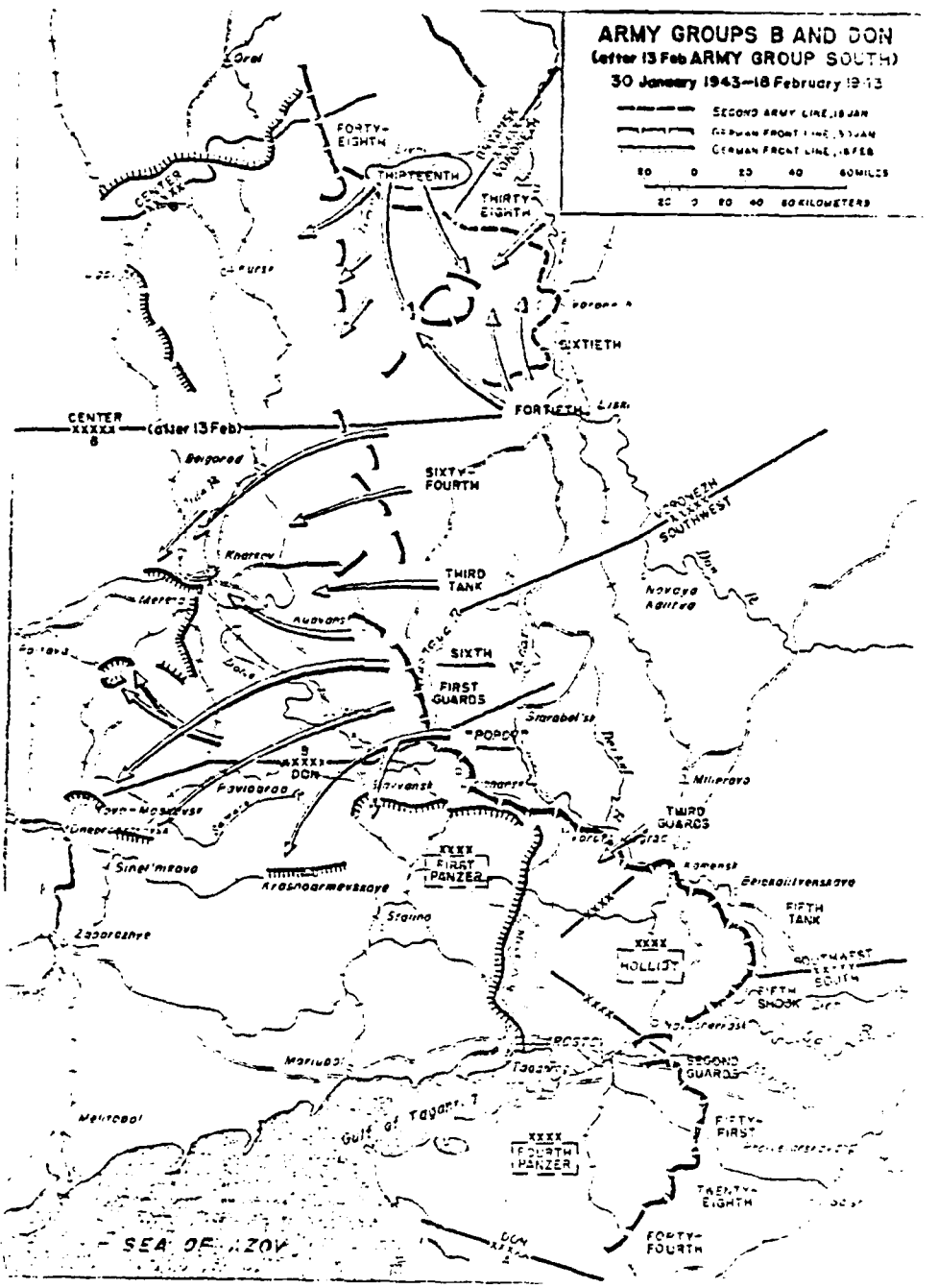
Map 1. The German Campaign of 1940[1]



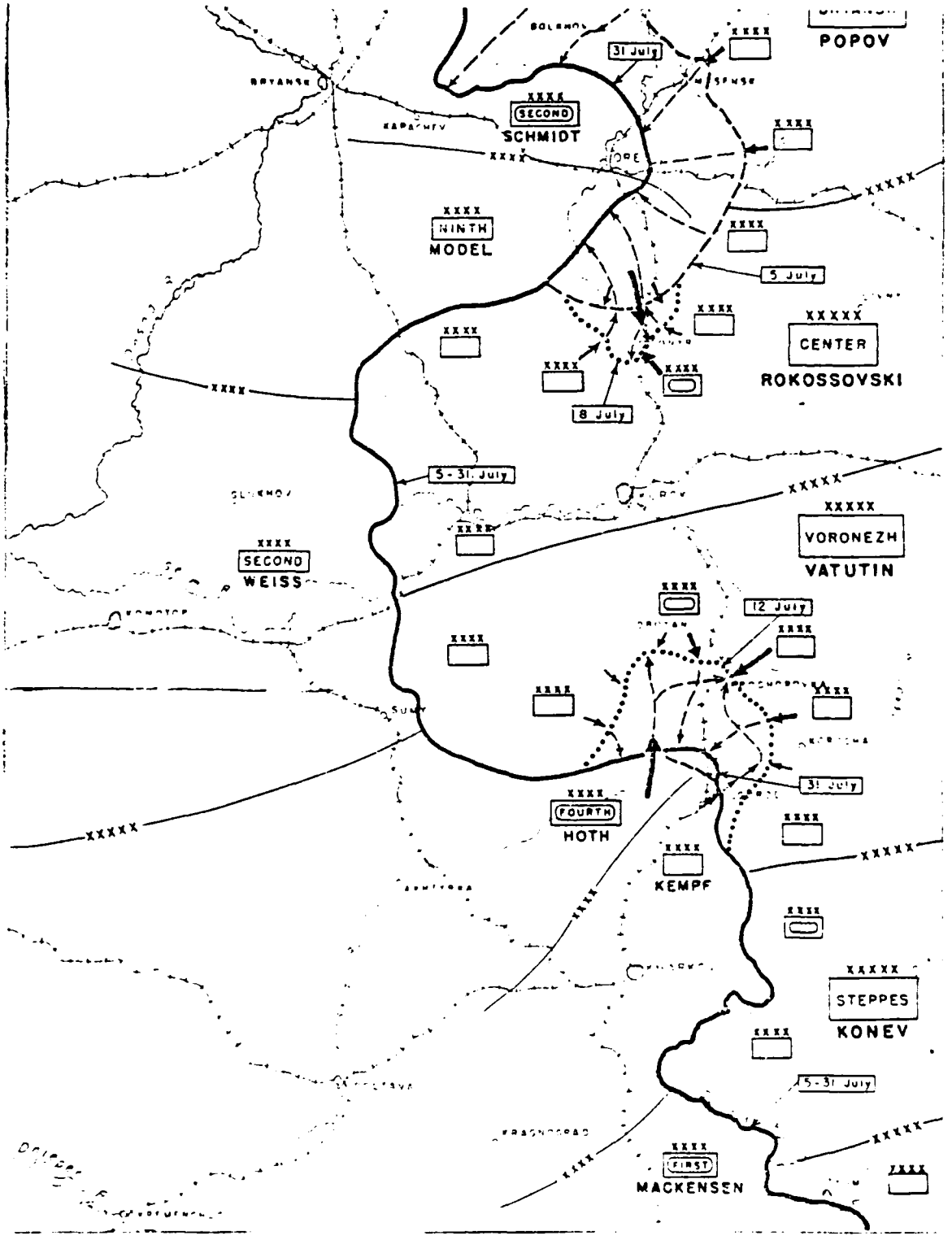
Map 2. Operation "Compass" in North Africa[2]



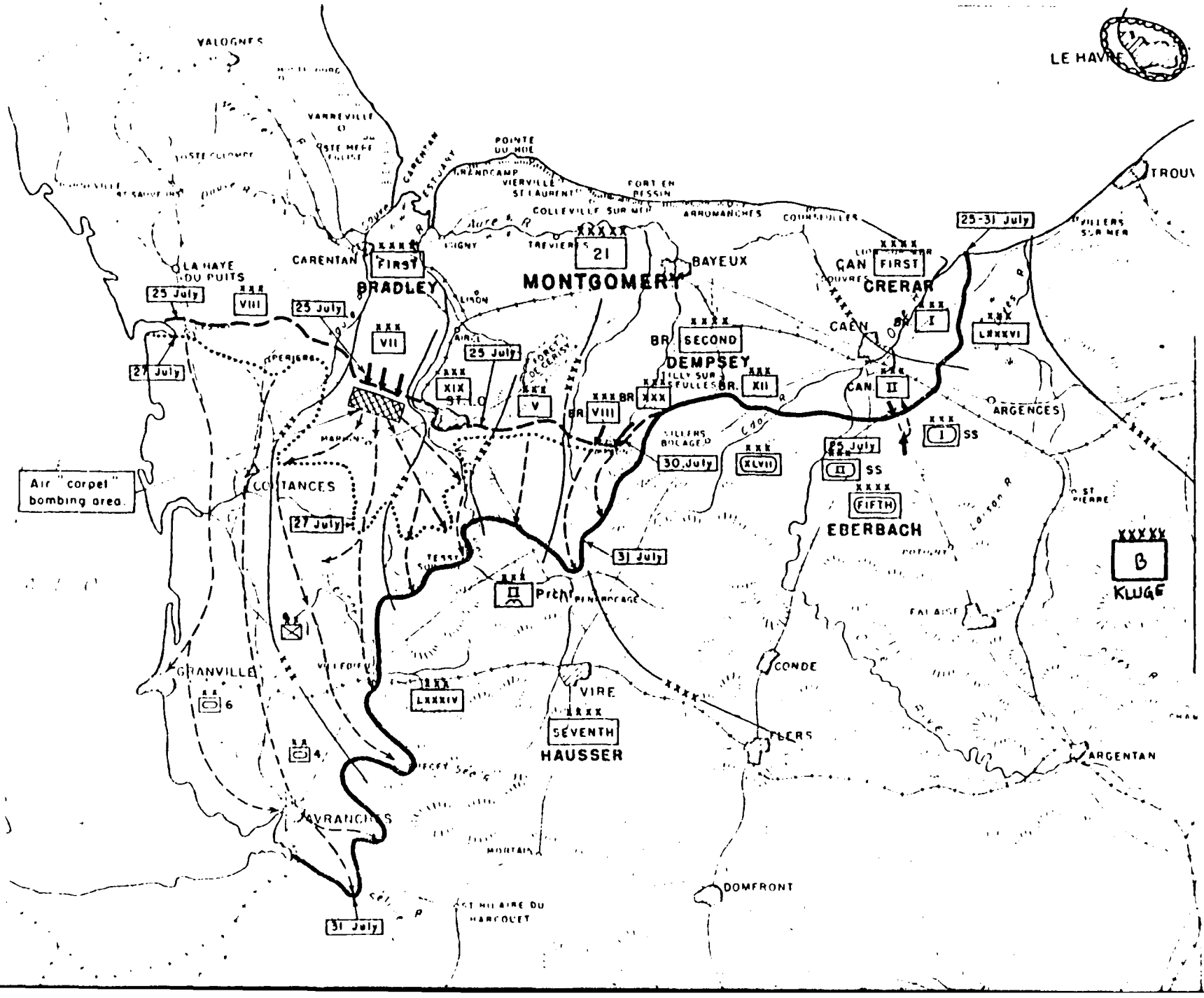
Map 3. Rommel's Advance to Gazala[3]



Map 4. The Soviet Operation "Gallop"[4]



Map 5. Operation Citadel and the Battle of Kursk[5]



Map 6. The Allied Breakout in Normandy[6]

Map 7. The German Ardennes Offensive[7]

ENDNOTES

Section I. Introduction.

1. Carl von Clausewitz, On War, edited and translated by Michael Howard and Peter Paret, (Princeton, NJ, 1976), pp. 527-528.

2. Charles L. Crow, "Tactical and Operational Depth," School of Advanced Military Studies Course Reading, "Evolution of Operational Art." (Fort Leavenworth, KS, 1986), pp. 2-3. Crow defines tactical depth as "that which is occupied by defending units whose mission severely restrict their freedom of maneuver, and the continued occupation of which will maintain the integrity of the defense thereby denying the attacker the opportunity to destroy or disrupt the mass of the defending forces by maneuver."

Section II. Theoretical Basis.

1. J. F. C. Fuller, Armored Warfare, (London, 1943), p. 41.

2. Anthony John Trythall, 'Boney' Fuller, (New Brunswick, NJ, 1977), p. 60. Fuller went on to say that the destruction of the enemy's fighting strength "can be achieved principally by destroying the military organization either by wearing it down, through fighting his soldiers, or by rendering it inoperative by putting his power of command out of action (brain warfare)."

3. Ibid., p. 55, as taken from J. F. C. Fuller, Memoirs, p. 130, and pp. 72-73.

4. Ibid., pp. 72-73; Brian Holden Reid, "J. F. C. Fuller's Theory of Mechanized Warfare." The Journal of Strategic Studies, December, 1978, p. 297. Reid describes this as the *coup de grace* to be administered after the enemy has been paralyzed by attacks on his supply lines. Fuller, Armored Warfare, pp. 41 and 94. Fuller discusses the need to force the enemy to face fuel starvation.

5. Fuller, Armored Warfare, p. 35.

6. Ibid., p. 41.

7. B. H. Liddell-Hart, Strategy, (New York, 1974), p. 331. Specifically, Liddell-Hart said, "the nearer to the force the cut is made, the *more immediate* the effect; the nearer the base the *greater* the effect." He

continues by saying that usually "more success and more effect is to be expected from cutting his communications as far back as possible."

8. Ibid., pp. 326-327.

9. Ibid., p. 327. In describing the indirect approach Liddell-Hart emphasized the need to consider both physical and psychological aspects of various moves against the enemy. A move around the enemy's front against his rear avoids resistance. "In the profoundest sense, it takes the *line of least resistance*. The equivalent in the psychological sphere is the *line of least expectation* They are two faces of the same coin, and to appreciate this is to widen our understanding of strategy. For if we merely take what obviously appears to be the line of least resistance, its obviousness will appeal to the opponent also; and this line may no longer be that of least resistance."

10. Ibid., pp. 326-327.

11. Ibid., p. 328.

12. Same as note 11..

13. Mikhail Tukhachevskiy, "New Problems in Warfare," Art of War Colloquim, (Carlisle Barracks, PA, November, 1983), p. 18.

14. Ibid., pp. 5, 11-13.

15. Ibid., p.13.

16. Ibid., pp. 16-17. Tukhachevkiy innumerates a total of six requirements for a successful deep operation:
    (1) broad frontal attack
    (2) reliable preparations
    (3) sufficient quantities of suppression means
    (4) secrecy
    (5) suddenness of beginning
    (6) attacks in depth by armored and airborne assaults against division., corps and army reserves.

Section III. Historical Analysis.

Developing the Scale of Action.

1. Tukhachevskiy, "New Problems in Warfare," Art of War Colloquim, p. 19.

2. Liddell-Hart, Strategy, p. 335.

3. Tukhachevskiy, "New Problems in Warfare," pp. 13-14, 17, 26, 42. Although Tukhachevskiy saw the destruction of enemy forces in depth being accomplished by main forces, he was quick to add the potential for airborne assault landings to destroy individual formations.

4. Ibid., p. 42.

5. Liddell-Hart, "The 'Man-In-The-Dark' Theory of Infantry Tactics and the 'Expanding Torrent' System of Attack." The Journal of the Royal United Services Institution, (February, 1921), p. 13.

6. Tukhachevskiy, "New Problems in Warfare," pp. 5, 13, 16-17.

7. Fuller, Armored Warfare, p. 114, and Trythall, 'Boney' Fuller, pp. 62-63.

8. Tukhachevskiy, "New Problems in Warfare," pp. 48-49, 67-68.

9. Alister Horne, To Lose A Battle, (New York, 1984), pp. 217-218. Horne credits the Germans with 136 divisions of which 30% were classified as first rate, and from 2,200-2,400 to 3,000 tanks depending upon source. The Allies he credits with 136 French, Belgian, British, and Dutch divisions of varying quality, and from 3,000 to 3,432 tanks. See also William A. Shirer, The Collapse of the Third Republic. SAMS Reprint, p. 609. Shirer reports 136 German divisions and 2,580 tanks versus 157 divisions and 2,285 tanks fielded by the Allies. See also Don W. Alexander, "Repercussions of the Breda Variant." French Historical Studies, (Spring, 1974) p. 461 for an assessment of French capabilities based on French sources.

10. Ibid., pp. 185-186. Horne reports German deployments on D-Day, 10 May as 45 and 1/3 divisions, including 7 panzer, under Army Group A for the main effort and 29 and 1/3 divisions, including 3 panzer, under Bock's Army Group B for the attack into Holland and the north of Belgium. See also pp. 194-195, 197. Army Group is designated the "matadors cloak" designed to draw the Allies north into Belgium Leeb's Army Group C

with 19 divisions would remain deployed south from Luxembourg to the Swiss frontier. Elaborate deception schemes were intended to cause the French to believe that serious attack would come from Leeb's Army Group C. See also Shirer, The Collapse of the Third Republic., p. 605; Len Deighton, Blitzkrieg, (New York, 1980), pp. 182-186, and Richard Natkiel, Atlas of World War II, (New York, 1985), p. 19.

11. Ibid., pp. 267, 275. Horne cites the German's superb organization and route discipline which prevented chaos on overloaded roads and credits this to the accumulation of experience in moving large units in Austria, Czechoslovakia, and Poland. See also Horne, p. 456, and Len Deighton, Blitzkrieg, p. 208 for examples of logistical planning. Also Shirer, The Collapse of the Third Republic, p. 632. The lead elements of Panzer Group Kleist actually completed the 75 mile advance in 3 days reaching the Meuse 24 hours ahead of schedule.

12. David M. Glantz, LTC, "From the Don to the Dnepr: A Study of Soviet Offensive Operations, Dec1942 - Aug 1943", (Fort Leavenworth, KS, 1986), pp. 101-103, 105, 107-109, 111-114, 129. Also Eric von Manstein, Lost Victories, (Navato, CA, 1982), pp. 370-371,439-440.

13. Ibid., pp. 114,125-126,169. See also Manstein, Lost Victories, pp. 387-388, 397, 408-409.

14. Ibid., pp. 164-170. See also Manstein, Lost Victories, pp. 437-441.

15. Ibid., pp. 103-105, 165.

16. Peter Elstobe, Hitler's Last Offensive, (New York, 1971), pp. 30, 44 , 51, 209-212 provide discussion of concentration and deployments. See also pp. 203-204, 338, 359). The planned attack by 15th Army in the north which could have contained additional Allied forces and added protection for the main effort by 6th Panzer Army was cancelled the day before it was to be launched. Operation Northwind against Dever's U.S. Sixth Army Group was designed to draw Patton's Third Army south away from the Ardennes but was called off. See also, Hugh M. Cole, The Ardennes: Battle of the Bulge. The United States Army in World War II, (Washington, D.C., 1965), pp. 650-651.

17 Elstobe, Hitler's Last Offensive, pp. 210-212, 215 Also Hugh M. Cole, The Ardennes: Battle of the Bulge, (Washington, D.C., 1965), p. 427.

18. Elstobe, Hitler's Last Offensive, pp. 91, 151, 210, 233, 237, 321, 379. See also Milton Shulman, Defeat in the West, (New York, 1968), p. 306

19. Elstobe, Hitler's Last Offensive, p. 290. Rundstedt, C-in-C West is quoted as having said, " It was a nonsensical operation, and the most stupid part was the setting of Antwerp as the target. If we reached the Meuse we should have gotten down on our knees and thanked God - let alone try to reach Antwerp." See also Shulman, Defeat in the West, p. 311 for Rundstedt's analysis of reasons for the failure of the operation.

A Solution for the Initial Penetration.

1. Charles L. Crow, "Tactical and Operational Depth," School of Advanced Military Studies Course Reading, "Evolution of Operational Art." (Fort Leavenworth, KS, 1986), pp. 2-3.

2. Tukhachevskiy, "New Problems in Warfare," p. 42.

3. Ibid., pp. 16-17.

4. Horne, To Lose A Battle, p. 165. See also Alexander, "Repercussions of the Breda Variant", p. 487.

5. Deighton, Blitzkrieg, p. 189.

6. Horne, To Lose A Battle, pp. 306, 325-333. Also Deighton, Blitzkrieg, p. 220.

7. Ibid., pp. 259, 267, 276-277. On page 267 Hitler is quoted as having said, "I could have wept for joy; they'd fallen into the trap!" See also Alexander, "Repercussions of the Breda Variant", p. 486. Also, Shirer, The Collapse of the Third Republic, pp. 605, 675.

8. Ibid., pp. 195,197. Leeb's Army Group C with 19 divisions would remain deployed south from Luxembourg to the Swiss frontier. Elaborate deception schemes were intended to cause the French to believe that serious attack would come from Leeb's Army Group C. See also, Shirer, The Collapse of the Third Republic, p. 675. On 15 May General Georges was still more concerned with the defense of the Maginot Line than the breakthrough on the Meuse.

9. Ibid., pp. 236-237. Many units had restored normal leave. See also pp. 348-351. Initial panic appears to have begun at Sedan on 13 May, D+3.

10. Ibid., pp. 413, 456.

11. Russell F. Weigley, Eisenhower's Lieutenants, Vols. I. (Bloomington, 1981), pp. 218, 240, 245. See also Shulman, Defeat in the West, pp. 189-190.

12. Weigley, Eisenhower's Lieutenants, pp. 220-224.

13. Jukes, Geoffrey, Kursk: The Clash of Armor, (New York, 1970), pp. 45-47.

14. LTC David M. Glantz, "Soviet Defensive Tactics at Kursk, July 1943", (Carlisle Barracks, PA, February 1985), p. 7.

15. Ibid., p. 16.

16. Ibid., pp. 18-19

Reducing Resistance in Depth.

1. Fuller, Armoured Warfare, pp. 88-89, 92-93, also Trythall, 'Boney' Fuller, pp. 72-73, 99, and Reid, "J. F. C. Fuller's Theory of Mechanized Warfare." The Journal of Strategic Studies, p. 299. See also Tukhachevskiy, "New Problems in Warfare," pp. 5-8, 11-12, 16-17, 20-22.

2. Fuller, Armoured Warfare, p. 92.

3. Ibid., p. 56.

4. Ibid., p. 92.

5. Tukhachevskiy, "New Problems in Warfare," pp. 5-8, 11-12, 16-17, 20-22.

6. Reid, "J. F. C. Fuller's Theory of Mechanized Warfare," p. 298.

7. Tukhachevskiy, "New Problems in Warfare," p. 46.

8. Horne, To Lose A Battle, pp. 195, 277. On D+1, 11 May, Gamelin was still directing the French Air Force against Army Group B. See also Shirer, The Collapse of the Third Republic, p. 675. On 15 May General Georges

was still more concerned with the defense of the Maginot Line than the breakthrough on the Meuse.

9. Alexander, "Repercussions of the Breda Variant", p. 486, and Horne, To Lose A Battle, pp. 164-165. See also, Shirer, The Collapse of the Third Republic, p. 606.

10. Same as note 8.

11. Shirer, The Collapse of the Third Republic, p. 675.

12. Horne, To Lose A Battle, p. 420.

13. Ibid., pp. 348, 351-355, 375, 420, 566. On page 375 Horne describes the scene. After having broken up a French counterattack "and the lack of any other immediate French threat made the weakness of the whole enemy position apparent to Guderian. At this point he turned the 1st and 2d Panzer Divisions west to break through the French defenses in the spirit of his famous '*Klotzen, nicht Kleckern.*' Literally, "Wallop them, don't tap them."

14. Deighton, Blitzkrieg, pp. 192-207 provide the most complete details of a variety of special operations. Also, Horne, To Lose A Battle, pp. 250-258.

15. Goutard, English ed., The Battle of France, 1940, p. 140; as cited in Shirer, The Collapse of the Third Republic, p. 627.

16. Deighton, Blitzkrieg, pp. 207-208. The first elements of the French reserves were to arrive on 14 May, D+4, and the last were to close by 21 May, D+11.

17. Weigley, Eisenhower's Lieutenants, p. 245.

18. Ibid., p. 239.

19. Ibid., pp. 242-243.

20. Ibid., pp. 228-236.

21. Ibid., pp. 220-221.

22. Elstobe, Hitler's Last Offensive, pp. 47, 311. The Germans initially stunned the Allies who were unable to respond to the attack by the German Fifth Army during the first 36 hours. German deceptions actually reinforced Allied assessments that the Germans were concentrating major forces near Aachen for a spoiling attack to the north of the Ardennes. See also Shulman, Defeat in the West, p. 284. Here the author describes initial German successes in penetrating U.S. defenses.

23. Cole, The Ardennes: Battle of the Bulge, p. 427, and Elstobe, Hitler's Last Offensive, pp. 210-212.

24. Elstobe, Hitler's Last Offensive, pp. 211.

25. Ibid., pp. 141-148, 282-283. Elstob provides considerable detail of German special operations forces. See also Shulman, Defeat in the West, pp. 290-291, 299-301.

26. Ibid., pp. 209-212.

27. Cole, The Ardennes: Battle of the Bulge, p. 670. Cole cites six reasons for the German failure in the Ardennes: 1) the tenacity of the American defense which exceeded German expectations, 2) failure of tactical and logistical support to keep pace with the operation, 3) lack of required road nets especially at Bastogne and St. Vith, 4) failure to secure the shoulders of the penetration, 5) the slow operational buildup of German forces in the salient prevented depth, 6) the tactical reaction of American forces in committing reserves had been more rapid than the Germans anticipated. See also Shulman, Defeat in the West, pp. 294-295, 311, and Elstobe, Hitler's Last Offensive, pp. 386-387.

The Factor of Speed.

1. Fuller, Armoured Warfare, pp. 17-18, 35, 42-43. See also "The Role of the Tank in Future Ground Warfare", Armor. July - August, 1950, pp. 27-28, and Reid, "J. F. C. Fuller's Theory of Mechanized Warfare," pp. 297-300.

2. Tukhachevskiy, "New Problems in Warfare," pp. 13-14, 17, 45-46.

3. Ibid., p. 12, and Fuller, Armoured Warfare, pp. 17-18, 35, 42-43.

4. Reid, "J. F. C. Fuller's Theory of Mechanized Warfare," p. 300.

5. Fuller, Armoured Warfare, pp. 91-92. See also Fuller, "Warfare and the Future." Armor, March - April, 1953, pp. 44-47, and Fuller, "The Role of the Tank in Future Ground Warfare." Armor. July - August, 1950, pp. 27-28.

6. Tukhachevskiy, "New Problems in Warfare," pp. 42-44.

7. Ibid., p. 42.

8. Fuller, A Military History of the Western World, Volume III, (New York, 1956), pp. 408-409 as quoted from the Supplement to the London Gazette, October 10, 1941, p 593 1.

9. Heinz Guderian, Major General, "Armored Forces", The Infantry Journal Reader, edited by Joseph I. Greene, (Garden City, New York, 1944), pp. 480-481.

10. Shirer, The Collapse of the Third Republic, pp. 618-619. With Gamelin's C2 system it usually took 48 hours for an order to be passed from his HQ or Georges' to the tactical unit on the front compared with the German's forward, decentralized C2 system in which commanders were encouraged to make timely decisions from the front.

11. Ibid., p. 632. See also Horne, To Lose A Battle, p. 275, and Deighton, Blitzkrieg, pp. 207-208.

12. Horne, To Lose A Battle, pp. 337-345. Horne describes the critical actions in forcing the Meuse and expanding the bridgeheads and emphasizes the role of commanders like Guderian, Rommel, and Balck in forcing the breakthrough.

13. Correlli Barnett, The Desert Generals, (Bloomington, IN, 1982), p. 35.

14. Ibid., pp. 38-41.

15. Ibid., p. 45.

16. Ibid., pp. 53-59.

The Application of Mass.

1 Trythall, 'Boney' Fuller, pp. 55, 72-73.

2. Tukhachevskiy, "New Problems in Warfare," p. 15.

3. Liddell-Hart, Strategy, p. 335.

4. Reid, "J. F. C. Fuller's Theory of Mechanized Warfare," p. 302.

5. Liddell-Hart, Strategy, pp. 332-333.

6. Tukhachevskiy, "New Problems in Warfare," pp. 25-26, 42.

7. Liddell-Hart, Strategy, pp. 329-331.

8. Deighton, Blitzkrieg, pp. 191-204. See also, Horne, To Lose A Battle, p. 195.

9. Horne, To Lose A Battle, pp. 195,197. Leeb's Army Group C with 19 divisions would remain deployed south from Luxembourg to the Swiss frontier. Elaborate deception schemes were intended to cause the French to believe that serious attack would come from Leeb's Army Group C. See also, Shirer, The Collapse of the Third Republic, p. 675. On 15 May General Georges was still more concerned with the defense of the Maginot Line than the breakthrough on the Meuse.

10. Shirer, The Collapse of the Third Republic, p. 632, and Deighton, Blitzkrieg, Map pp. 224-225. See also Horne, To Lose A Battle, pp. 436-438 for discussion of French perceptions of threats to Paris.

11. Heinz Guderian, General, Panzer Leader, (New York, 1952), p. 92.

12. K. J. Macksey, Major, The Afrika Corps, (New York, 1968), pp. 61-62.

13. Barnett, The Desert Generals, p. 134.

14. Macksey, The Afrika Corps, p. 65.

15. Ibid., pp. 69-71.

16. Barnett, The Desert Generals, pp. 146-150.

17. Macksey, The Afrika Corps, p. 78, and Albert Kesselring, General Field Marshal, "Comments on the Campaign in North Africa", Volume 2, MS# C075, p. 4.

18. Walter von Mellenthin, Panzer Battles, (Norman, OK, 1956), p. 137.

19. Ibid., pp. 150-152.

Sustaining Operational Momentum.

1. Tukhachevskiy, "New Problems in Warfare," p. 48.

2. Fuller, "Warfare and the Future," Armor, March - April, 1953, p. 45, and Fuller, "The Role of the Tank in Future Ground Warfare", Armor, July - August, 1950, p. 27.

3. Fuller, Armoured Warfare, pp. 51-52, 88.

4. Tukhachevskiy, "New Problems in Warfare," pp. 67-68.

5. Fuller, Armoured Warfare, p. 52, and Trythall, Boney, p. 132.

6. Tukhachevskiy, "New Problems in Warfare," p. 48.

7. Deighton, Blitzkrieg, 208, and Horne, To Lose a Battle, p. 456.

8. Barnett, The Desert Generals, pp. 42, 49, 52-53. See also Macksey, The Afrika Corps, p. 138, and Barrie Pitt, The Crucible of War, (London, 1980), p. 165.

9. Barnett, The Desert Generals, p. 42.

10. Ibid., pp. 42, 49.

11. Ibid., p. 40.

12. Ibid., p. 53.

13. David Irving, The Trail of the Fox, (New York, 1978), pp. 204-206. See also Barnett, The Desert Generals, pp. 149-151.

Section IV. Conclusions and Implications.

1. FM 100-5, Operations, (Washington, D.C., May, 1986), pp. 10, 29-30.

2. Ibid., pp. 17, 96, 100, 110, 112 provide a clear understanding of exploitation .

3. Ibid., pp. 15, 37-38, 106.

4. FM 100-15, Corps Operations. Final Draft. (Fort Leavenworth, KS, February,1985), p. 5-29.

Maps:

1. West Point Atlas of American Wars. Vincent J. Esposito, Brigadier General, Chief Editor. Volume II, (New York, 1964), map 12.

2. Pitt, The Crucible of War, pp. 92-93,and 170-171.

3. Natkiel, Atlas of World War II, p. 46.

4. Earle F. Zeimke, Stalingrad to Berlin: The German Defeat in the East, Washington, D.C., 1968, pp 83, 95.

5. West Point Atlas of American Wars. Vincent J. Esposito, Brigadier General, Chief Editor. Volume II, (New York, 1964), map 38.

6. West Point Atlas of American Wars, Esposito, Brigadier General, Chief Editor, map 53.

7. West Point Atals of American Wars, Esposito, Brigadier General, Chief Editor, map 61.

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