Ground Maneuver and Air Interdiction in the Operational Art

PRICE T. BINGHAM

To attain strategic goals in a theater of war, a commander exercises operational art through his design, organization, and conduct of campaigns.[1] Unfortunately, engagements and battles generally seem to have received more attention than campaigns. This could be because it is easier to understand engagements and battles. Compared to campaigns, engagements and battles are much more confined in time and space and involve many fewer variables interacting with each other. Their comparative simplicity also makes them more susceptible to modeling, especially in models that focus on numerical attrition. As a result, there are those who seem to assume that a campaign can be described as merely the addition of attrition totals resulting from multiple tactical events.[2] Such a tactically oriented perspective seriously distorts reality because it ignores a theater commander's ability to exercise operational art, influencing time and space considerations in a way that creates conditions *leading to* attrition (when this is the best means of achieving a campaign's objectives). This failure to appreciate the potential of operational art may explain why some have tended to discount the value of air interdiction.

The Importance of Movement in a Successful Campaign

To appreciate the value of air interdiction, we need to understand how moving rapidly relative to the enemy contributes to a successful campaign. As Napoleon saw it, "Marches are war . . . . Aptitude for war is aptitude for movement . . . . Victory is to the armies which maneuver."[3] By moving quickly relative to the enemy, Napoleon's forces gained the advantages of surprise, concentration, and position needed to provide the best chance of winning key engagements and battles.[4] Even more important, rapid relative movement enabled his forces to *exploit* the outcomes of engagements and battles—perhaps by a penetration, envelopment, or pursuit—making it possible for his campaigns to achieve far more than a sum of their tactical components would suggest.

The importance of rapid relative movement to a successful campaign explains why some inventions have had such a profound effect on the conduct of war. Yet, as valuable as the railroad, telegraph, truck, tank, and wireless radio have been in waging war, these inventions have been constrained in their effect because they allowed a commander to directly influence the movement of only his own forces. As a result, even a skilled commander could find it difficult to attain success because usually his enemy also had the ability to move quickly and thus could counter his plan. To a large extent the ability of the enemy to move unimpeded beyond the range of artillery explains why a stalemate occurred on the Western Front of World War I and then endured for so long.

All this began to change with the invention of the aircraft. Soon commanders were using aircraft to perform air interdiction, at last achieving the ability to complement and reinforce their ground maneuver by attacking enemy maneuver. Since then using air power to perform air interdiction has often, though not always, made an important contribution to the success of a campaign.

Much of the reason air interdiction has not always been effective is explainable by the failure of many commanders and staff officers to understand *how* or *why* air interdiction contributes to a campaign's success. Many believe that the value of air interdiction lies in its ability to isolate the battlefield, denying the enemy reinforcements and supplies needed to win engagements and battles. Others measure air interdiction's contribution by the amount of destruction it causes. While both of these traditional views contain some truth, neither truly grasps the essence of air interdiction's value to a campaign.

How and Why Air Interdiction Contributes to a Successful Campaign

Air interdiction does, indeed, make its contribution by either destroying enemy forces or delaying and disrupting their movement; however, in order for either effect to contribute fully to the successful outcome of a campaign, air interdiction and ground maneuver must be *synchronized* so that each complements and reinforces the other.[5] Synchronization is important because it can create a dilemma for the enemy that has *no* satisfactory answer. His dilemma is this: if he attempts to counter ground maneuver by moving rapidly, he exposes himself to unacceptable losses from air interdiction; yet if he employs

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Lieutenant Colonel Price T. Bingham, USAF, is the Chief of the Airpower Doctrine Division, Airpower Research Institute, Center for Aerospace Doctrine, Research, and Education, Maxwell Air Force Base, Alabama. He is a graduate of the US Air Force Academy and previously served in the Doctrine and Concepts Division, Headquarters, US Air Force. He has flown fighters in the Tactical Air Command, US Air Force Europe, and Pacific Air Force. During the last of three tours in Southeast Asia, Colonel Bingham served as a fighter and tanker controller in the Military Assistance Command, Vietnam, and US Support Activities Group tactical air control centers.

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measures that are effective at reducing losses caused by air interdiction, he then cannot maneuver fast enough to counter the ground component of the campaign. Thus, regardless of the action the enemy chooses to take, he faces defeat.

The reason why ground maneuver and air interdiction must be synchronized is found in the way the effectiveness of each is influenced by the complex nature of land.[6] Land, unlike a fluid medium such as the ocean or atmosphere, has infinite variations in gradient and strength. Moreover, its strength varies depending on location, weather, and traffic.[7] Vegetation and man-made structures also add to its complexity. All of these features influence ground maneuver. Depending on the type of units involved (i.e. their degree of mechanization), land's nature determines how large a ground force can be moved, where it can be moved, and, perhaps most important, how quickly it can be moved.

These same aspects of land's nature also influence air interdiction by determining how easy it is for aircrews to find enemy ground forces. Obviously the search for the enemy is important to effective air interdiction because aircrews delivering direct-attack munitions first must find the enemy in order to destroy him. But that is not the only reason. Although air interdiction can delay and disrupt an enemy's movement by destroying his forces, it can also have the same effect *if the enemy does not dare to move quickly for fear of being found.*

Today, as in the past, aircrews performing air interdiction against ground forces must find the enemy by making a visual search. This requirement to search visually for mobile ground units is due to the way land's complexity influences the usefulness of technologies such as radar. Even the availability of the joint surveillance and target attack system (JSTARS) will not change this reality if aircrews still need to see a target before they can hit it with their munitions.[8] The LANTIRN system (low-altitude navigation and targeting infrared system for night) does not change this either, as LANTIRN is basically just a means for helping aircrews see, despite darkness and haze.

The effectiveness of an aircrew's visual search depends, to a large extent, on enemy actions. By far the most effective way an enemy can influence an aircrew's visual search is by preventing the search from taking place. This explains why air superiority is a prerequisite for effective air interdiction. (Air superiority also makes a key contribution by hindering or even preventing the enemy's air force from observing or interdicting our own ground maneuver.)

If an enemy is unable to achieve air superiority and prevent a visual search, he can use concealment, camouflage, deception, and dispersal to make the search more difficult.[9] Another way an enemy can make visual search more difficult is by taking advantage of environmental factors, maneuvering his forces through complex terrain or during darkness and periods when weather restricts visibility.[10] Finally, an enemy can use his air defenses, both airborne

and ground-based, to threaten and harass flight operations in a way that degrades an aircrew's ability to make an effective search.[11] Predicting which measures an enemy will use, or their effectiveness, is of course extremely difficult. The bottom line, though, is that *most air interdiction simulations (and even some real-world planning) tend to make assumptions that seriously underestimate the problems aircrews face in finding mobile targets.*

An enemy's ability to make an aircrew's visual search more difficult depends greatly on whether ground maneuver *or the potential* for ground maneuver is influencing the type of ground forces he is employing and how quickly he wants to move them. For example, an enemy's concealment, camouflage, deception, and dispersal measures are likely to be less effective if he is employing mechanized forces as opposed to dismounted infantry. Similarly, the need to move quickly allows him less time to make such measures effective and may force him to move even when environmental conditions do not handicap an aircrew's visual search. Finally, rapid movement is likely to decrease the effectiveness of ground-based air defenses, making it more difficult to degrade the search for targets.[12]

World War II, Italy

Campaigns in World War II, the Korean War, and the Vietnam War are worth examining because they show the importance of employing ground maneuver and air interdiction in a way that creates an irresolvable dilemma for the enemy. In World War II, the experience in Italy provides an especially useful contrast between what can be achieved by air interdiction alone and when combined with ground maneuver. In early 1944 the Allies possessed air superiority, and their armies, exhausted by three attempts to break the Gustav Line, needed little direct air support. Taking advantage of this situation, Allied airmen issued a definitive directive on 19 March for a unilateral air interdiction campaign named Operation Strangle. Its purpose was "to reduce the enemy's flow of supplies to a level which will make it impractical for him to maintain and operate his forces in central Italy."[13] The directive made no mention of the role of Allied ground forces because the airmen expected that air interdiction *alone*, by simultaneously cutting all lines of communication leading south from the Po Valley, would cause the Germans to withdraw.[14] After an intense effort it slowly became apparent to Allied air leaders that their original objective was unduly optimistic. As a result, on 25 April 1944 they issued a new objective, to make it impossible for the Germans to maintain their forces in the face of a *combined air and ground* Allied offensive called Diadem.[15] Soon after Diadem began on 11 May 1944, the combination of air interdiction and ground attacks presented German commanders with a new and more difficult problem.

Allied deception caused Generalfeldmarschall Albert Kesselring, the German commander, to delay committing his reserves to the battle on the

Gustav Line. Meanwhile, General Frido von Senger und Etterlin, commander of the XIV Panzer Corps, was forced to depend on his own forces to hold the western end of the line.[16] General von Senger's ability to do this, however, was severely handicapped by air interdiction. Damage to the rail system caused by air interdiction had forced the Germans to devote more and more of their scarce motor transport to moving supplies normally transported by rail.[17] Only by this and other adaptations were the Germans able to maintain a satisfactory supply situation, although there were some distribution problems.[18] At the same time, these adaptations required much of the available motor transport and fuel supply, severely degrading the tactical mobility of German combat units.

The problem facing General von Senger and other commanders, therefore, was how to conduct a flexible defense, rapidly shifting ground forces laterally along the line in the face of Allied air interdiction. The effectiveness of this air interdiction was increased by the fact that German troop movement required six to eight times more road capacity than did resupply.[19] Moreover, German dependence on daytime use of motor transport to make timely tactical moves made it easier for the pilots of roving fighter-bombers performing air interdiction close beyond the front to find targets. Thus, German commanders faced the dilemma: if they attempted the rapid ground maneuver needed to contain Allied ground attacks, they made it more likely that they would lose ground forces and scarce transport to air attack.

Heavy losses soon caused most German commanders to choose to reduce the risk of air attack by not moving during the daytime, despite the critical nature of the ground battle. Their decision added to the delays caused by detours resulting from air interdiction. Under these conditions German defenses were unable to hold against Allied ground attacks, and the combination of Allied air interdiction and rapid ground pursuit soon turned the resulting withdrawal into a near rout.[20] That the dilemma created by Allied ground maneuver and air interdiction played a key role in the German defeat becomes clearly apparent in General von Senger's postwar remarks:

> The enemy's mastery of the air space immediately behind the front under attack was a major source of worry to the defender, for it prevented all daylight movements, especially the bringing up of reserves. We were accustomed to making all necessary movements by night, but in the event of a real breakthrough this was not good enough. In a battle of movement a commander who can only make the tactically essential moves by night resembles a chess player who for three of his opponent's moves has the right to only one.[21]

World War II, Normandy

At the same time these events were unfolding in Italy, a similar situation was occurring in France. As in Italy, air superiority ensured that Allied air power could be devoted to air interdiction. Initially, the air interdiction

focus on the enemy rail system was similar to that in Italy, but instead of preventing supplies from reaching the front, the objective was to ensure that "enemy forces attacking the bridgehead did not increase at a more rapid rate than the Allied forces defending and extending it."[22] When attacks on rail yards proved less effective than desired, reports from Italy on the feasibility of bridge attacks resulted in the focus shifting to bridges, especially those across the Seine River.[23]

Field Marshal Erwin Rommel, who had responsibility for defending the coast from Brittany to the Netherlands, fully appreciated the threat to mobility posed by air interdiction. Profiting from his experience with Allied air power in North Africa, he recommended dispersing the German mobile reserves near the coast where they could move quickly against any landing, despite the threat posed by Allied air interdiction. The Commander-in-Chief West, Field Marshal von Runstedt, lacking similar experience with the problems Allied air interdiction could create, disagreed. He believed placing reserves inland would make it easier to concentrate them once the main landing was identified. His tank commander, General Geyr von Schweppenburg, calculated it would take only 24 to 48 hours to move armored divisions into position.[24]

As it turned out, Rommel was right. Allied deception combined with air interdiction to critically delay the movement of German reserves to Normandy. One way air interdiction created delays was by destroying the rail system west of Paris and the bridges across the Seine, forcing German units to make long road marches with many detours.

Destruction caused by roving fighter-bombers led to the second significant way air interdiction delayed the movement of German forces to Normandy. To avoid air attacks such as those that cost the Panzer Lehr division 85 armored vehicles (including five tanks) and 123 trucks, 80 of which were gasoline tenders, German commanders attempted to reduce the probability of detection by abandoning daylight movement and emphasizing concealment and camouflage measures.[25] Although these measures reduced losses, they also produced significant delays made worse because movement was confined to the short, six-hour summer nights. These measures help explain why it took units like the Ninth and Tenth SS Panzer divisions coming from Poland as much time to road march the last 200 miles as they needed to make the 1300-mile rail journey to Paris.[26] Summing up the impact of air interdiction Rommel reported on 10 June 1944,

> During the day, practically our entire traffic—on roads, trucks and in open country—is pinned down by powerful fighter-bomber and bomber formations, with the result that the movement of our troops on the battlefield is almost completely paralyzed, while the enemy can maneuver freely. Every traffic defile in the rear areas is under continual attack and it is very difficult to get essential supplies of ammunition and petrol up to the troops.[27]

Besides being a key factor in the ability of the Allies to achieve a lodgment in Normandy, air interdiction made a significant contribution to the Allies' successful breakout. Through Operation Goodwood on 18 July 1944 and Operation Bluecoat on 30 July, the British fixed German attention and most Panzer divisions on the left side of the Allied line, establishing ideal conditions for Cobra, the US attack on the right flank, which began on 25 July. By 31 July the German High Command was becoming aware of the threat posed by Cobra, causing Hitler to order a counterattack at Mortain toward Avranches to cut off Patton's advance. Yet even before this counterattack had begun, Allied air interdiction severely constrained it by forcing the Germans to begin it at night and with only four of the six divisions their plan called for. Meanwhile, during the breakout a few Allied leaders demonstrated that they understood how rapid movement contributed to a successful campaign by searching for ways to outflank and bypass German units so they could quickly move deep into the German rear area. Unfortunately, other Allied leaders failed to exploit fully their tactical successes and the superior ground mobility gained through the delays and disruption air interdiction was inflicting on German maneuverability. As a result, the Allies missed opportunities to envelop and destroy large portions of the German army at Falaise, on the Seine, and later on the Beveland Isthmus.

Even with these missed opportunities, the speed of the Allied ground pursuit complemented and reinforced air interdiction, causing the Germans immense losses in both men and equipment. The rapid Allied advance often forced the Germans to move during the day to avoid being cut off, while simultaneously reducing the number of routes available to the retreating Germans. Besides creating great confusion and congestion on the remaining routes, these actions also made it easier for Allied aircrews performing air interdiction to find and destroy large numbers of German vehicles. This destruction, in turn, caused the Germans to abandon many other vehicles, including almost all their remaining heavy weapons, which weakened German resistance and slowed their retreat, making our ground pursuit even more effective.

World War II, The Battle of the Bulge

The German offensive in the Ardennes, *Wacht am Rhein*, that began early on 16 December 1944 showed that being on the defensive did not prevent Allied ground maneuver and air interdiction from combining to create a dilemma for the *Wehrmacht*. Attempting to avoid this dilemma, Hitler's plan called for German forces, led by the Sixth SS Panzer Army, to exploit the element of surprise by attacking when weather conditions would keep Allied air power from finding German forces. Hitler hoped these conditions would enable his forces to make a rapid breakthrough and advance quickly across the Meuse to Antwerp. Seizing Antwerp would isolate 25 to 30 divisions of the US First

Army and British 21st Army Group from their supplies, leading to their destruction as well as the capture of vast quantities of war materiel.[28]

Unfortunately for the Germans, poor weather and hilly Ardennes terrain made it very difficult for their armored forces to move quickly cross-country. This created a significant handicap for the often-cautious Germans, hindering their ability to maintain a high-tempo advance and preventing them from bypassing stubborn US resistance at numerous roadblocks and particularly at the road hubs of St. Vith and Bastogne.[29]

Although initially the poor weather was a serious handicap to Allied air power, as the Germans had hoped, air interdiction still was able to make some significant contributions. On 18 December, for example, a squadron of American fighter-bombers found and attacked the lead units of *Kampfgruppe Peiper* as it crossed the Ambleve at Cheneux. While this attack destroyed only a dozen vehicles, including two tanks, it created a precious two-hour delay that gave US ground forces the time they needed to prevent the Germans from reaching a better road at Werbomont.[30]

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Elements of the US 4th Armored Division near Piney, France, in August 1944 roll past the rubble of a German column that was strafed and bombed by Allied air forces.

Finally, on 23 December the weather cleared, enabling Ninth Air Force, augmented with a division of heavy bombers, and Eighth Air Force to begin heavy air attacks. By 29 December, Ultra intercepts revealed that air interdiction had closed many routes, critically delaying the delivery of fuel and ammunition that the German forces needed to advance.[31] According to the commander of the Fifth Panzer Army's artillery, "The attacks from the air by the opponent were so powerful that even single vehicles for the transport of personnel and motorcycles could get through only by going from cover to cover."[32]

Contained and defeated by Allied ground forces that possessed vastly superior relative mobility, the Germans were forced to withdraw.[33] During their withdrawal the rugged terrain and wet weather continued to create conditions that made it easier for Allied fighter-bombers to find lucrative targets and inflict immense destruction. One especially noteworthy example occurred when air interdiction destroyed a bridge over the Our River at Dasburg on 22 January 1945, allowing Allied fighter-bombers to destroy almost 3000 vehicles the Germans could ill afford to lose.[34]

After World War II, airmen were convinced of the value of air interdiction. Unfortunately, many still did not see any need to synchronize it with ground maneuver. Instead, according to an exuberant prize editorial published in the Spring 1951 issue of the *Air University Quarterly Review*, air interdiction was simply a means for "isolating the battlefield so the enemy can neither get out in retreat nor get supplies in to help him fight. This is done by blasting bridges, railheads, and supply dumps. An enemy that has been successfully interdicted is a doomed enemy, for he can neither retreat nor advance—all he can do is dig in and watch his supplies run out."[35]

Korea, Operation Strangle

The cost of not understanding the importance of synchronizing ground maneuver and air interdiction in a way that creates a dilemma for the enemy became apparent in the Korean War's Operation Strangle. Besides having the same name as the Italian air interdiction operation, there were other similarities. When the plan was conceived in 1951, the ground war involved little movement. As had been the case in Italy, airmen in Fifth Air Force believed air interdiction *alone* could inflict enough destruction on the enemy's supply system to force his withdrawal.[36] To achieve this objective they put similar emphasis on the destruction of railroads and bridges.[37]

Unfortunately, Operation Strangle in Korea was as disappointing as its namesake had been in Italy. As in Italy, the static nature of ground operations meant that the enemy did not have to move large units rapidly. Static conditions also reduced the amount of supplies the enemy needed, as well as giving him enough time to make the repairs and transshipments needed to move supplies, despite the damage caused by air interdiction. In addition, as had been the case

in Italy, the enemy made effective use of darkness, poor weather, camouflage, concealment, and dispersal to prevent airmen from finding lucrative targets.[38] Yet despite the failure of Strangle, Korea also provides several examples of air interdiction and ground maneuver complementing and reinforcing each other in a way that posed a Hobson's choice for the enemy commander.

Korea, Invasion by the North

The first example occurred during the North Korean invasion. North Korea's strategy depended on using rapid ground maneuver led by armored forces to win quickly, before outside intervention could be effective.[39] Since South Korean forces possessed no antiarmor capability, they were soon overrun. Task Force Smith, the first US ground element to reach Korea, suffered the same fate for the same reasons. The United Nations desperately needed time to move strong ground forces to Korea.

Fortunately, air interdiction provided much of this respite, and it was able to do so because its effectiveness was enhanced by the North Korean army's need for rapid movement. Moving by road in columns, the North Koreans made it relatively easy for aircrews to find them. In one effective attack on 30 June 1950, airmen found North Korean vehicles jammed bumper to bumper waiting to cross the Seoul railroad bridges.[40] Such opportunities evoked from one airman the remark that the North Koreans "were not too well indoctrinated in what air power could do. Either that or they had a lot of guts, because we would time and time again find convoys of trucks that were bumper to bumper against a bridge that had been knocked out, and we'd go in to strafe them, and every man in the truck would stand up where he was and start firing his rifle at us. I don't think that I would have done that with the power that we were putting on them."[41]

Eventually the great destruction caused by air interdiction posed a painful dilemma for North Korean commanders. Like the Germans in World War II, the North Koreans chose to reduce their losses by using darkness, dispersal, and concealment to make it more difficult for airmen to find and attack their forces. The problem for the North Koreans was that this decision seriously delayed their advance and, around Pusan, impeded the tactical mobility they needed to break through the United Nations' defenses.[42]

Korea, Pusan Breakout

The ability of ground maneuver and air interdiction to complement and reinforce each other also contributed to the destruction of the North Korean army when the United Nations went on the offensive. With North Korean forces fixed by fighting on the Pusan perimeter, General Douglas MacArthur used his superior operational-level mobility to make an amphibious landing in the North Korean rear at Inchon. This landing, combined with air and ground

pressure around Pusan, forced the weakened North Koreans to begin a withdrawal from Pusan on 22 September 1950. Soon their withdrawal turned into a rout that ended with the disintegration of the North Korean army.

This disintegration was the result of the dilemma air interdiction and ground maneuver created for enemy commanders. The North Koreans had to move quickly to avoid envelopment and destruction by the pursuing Eighth Army; however, speed required daylight movement, making it easier for aircrews performing air interdiction to find and attack North Korean units. Forced to choose between destruction by air or by ground forces, many North Korean units broke up or surrendered, allowing United Nations ground forces to advance deep into North Korea.[43]

Korea, the Chinese Intervention

China's intervention eventually led to a third example of effective air interdiction, but only after near disaster. By foot movement at night through the hills, hiding during the day, the Chinese were able to avoid detection by airmen as they infiltrated 300,000 troops into Korea to positions around advancing road-bound United Nations forces.[44] It may be that General MacArthur was not aware of how conditions affecting the ability of airmen to find targets during October and November 1950 differed from conditions in the Pacific during World War II and earlier in Korea when air interdiction was so effective. In any case, General MacArthur was shaken by the magnitude and seriousness of the attacks that began on 26 November 1950 when Chinese infantry swarmed down from their hidden locations in the hills. That UN ground forces were able to avoid destruction was due in large part to the way ground maneuver and air interdiction complemented and reinforced each other.

Possessing air superiority, retreating UN ground forces could move quickly, even during daylight hours, without fear of air attack. In contrast, Chinese units attempting rapid pursuit to deliver a knockout blow often found themselves under intense air attack (from both air interdiction and close air support) as they moved along roads during the day or with their lights on during the night.[45] By the middle of December the Chinese decided they could no longer afford the heavy losses caused by air attack and broke off their pursuit.[46] Following this decision and the failure of the Chinese January 1951 offensive, the war became less fluid, making it much more difficult for aircrews to find targets, thus setting the stage for Strangle.

Southeast Asia, Rolling Thunder and Linebacker I

Despite the poor results achieved by supply-oriented interdiction efforts in World War II and Korea, there was still a tendency during the Vietnam War for commanders to measure the effectiveness of air interdiction in terms of the quantity of supplies destroyed.[47] This orientation could be the

reason Rolling Thunder (March 1965-November 1968) is often judged a failure.[48] In contrast, many see Linebacker I (March-October 1972) as a success. Examining the difference between the two efforts provides more evidence that ground maneuver and air interdiction need to be synchronized.

In contrast to Rolling Thunder, which was designed to interdict North Vietnamese infiltration routes into the South, Linebacker I was directed against North Vietnamese forces which were using tanks and artillery in a surprise, fast-moving offensive that took advantage of poor weather.[49] When the weather began to improve, however, aircrews found many lucrative targets and began inflicting immense damage.[50] Before long the North Vietnamese were forced to reduce their losses by slowing their offensive's tempo, giving the South Vietnamese the time they needed to prepare defenses that could hold. Learning from their failure, the North Vietnamese waited until they could be certain US air power would not be able to intervene before they launched their next major offensive.[51]

The European Scenario

Seeing how many past military successes were the result of the dilemma created by the often unintentional synchronization of ground maneuver and air interdiction, we need to determine whether synchronization can be useful in the future, especially if defending against a Soviet offensive. Such an offensive, according to Soviet doctrine, must achieve its objectives quickly, before we could employ nuclear weapons or before internal strains could develop within the Soviet bloc.[52] This is why Soviet forces are organized, trained, and equipped for a campaign that would use surprise and intense firepower to help tank-oriented mobile forces quickly advance deep into our rear area.

Although the Soviets see highly mechanized ground forces as essential to winning a campaign quickly, they do not ignore air power—either their own or ours. Instead, they believe that success depends on the *combined* efforts of air and ground forces, stressing that air superiority is vital to the success of their offensive. Besides protecting advancing ground units from air attack, the Soviets need air superiority so their air power can provide the reconnaissance, transportation, and fire support needed by their ground forces to maintain a high-tempo advance.[53]

The nature of Soviet capabilities (force size and emphasis on surprise, shock, initiative, coordination, and depth) makes it quite unlike any threat we have faced in the past. Our ground forces, with their relatively constrained force structure and poor position (especially if the Soviets achieve surprise), would face a situation much worse than that in the Ardennes in 1944.

The air power situation is just as serious. Unlike that in 1944, a much smaller portion of our already constrained aircraft force structure is likely to be available to perform air interdiction because of the critical importance of

battling the Soviets for air superiority. Moreover, because of this struggle for air superiority, it is likely that many of our aircraft tasked to perform air interdiction would be operating, at least initially, from bases that had been or still were under attack by Soviet missiles, aircraft, special-purpose troops, and perhaps even airborne forces. Besides this handicap, which would reduce the number and timeliness of our air interdiction sorties, our ability to exercise control over these sorties would likely be degraded by attacks on our command centers and communications facilities. In addition, during the early stages of a Soviet offensive, the best we could do probably would be to gain temporary local air superiority over a relatively shallow area beyond the forward line of our troops. Even here, Soviet ground-based air defenses would likely force airmen to fly at high speeds and low altitudes, seriously degrading their ability to find advancing Soviet forces, as well as reducing aircraft range and payload.[54] The speed of the Soviet advance and their use of camouflage, concealment, and deception would magnify the problems aircrews would face in finding mobile targets.[55]

Preparing for the Future

Past campaigns have often achieved success even though few commanders seemed to understand how or why ground maneuver and air interdiction complemented and reinforced each other, let alone the importance of their synchronization. Instead, favorable circumstances, including air superiority and often overwhelming air resources, generated dubious choices for the enemy more by accident than by design. Unhappily, this is not likely to be the case if we are faced with a Soviet offensive. As this assessment should make clear, not only do we need to quickly gain and then maintain air superiority, we must also synchronize ground maneuver and air interdiction. Otherwise, we ourselves could be facing an agonizing dilemma: whether to fight conventionally and lose, or resort to nuclear weapons to stave off defeat with the risk of cataclysmic escalation. This dilemma makes it vital that we explore ways to improve the employment of ground maneuver and air interdiction.

The best place to start is with doctrine, both joint and service. We need to ensure that doctrine emphasizes the importance of campaigns, rather than engagements and battles, and explains the vital role maneuver can play in achieving success.[56] In doing this, doctrine should clarify the unique advantages that result when air interdiction and ground maneuver are planned and controlled so that they combine to influence time and space considerations in a way that presents the enemy with choices allowing no escape.

Next we need to examine organizations charged with planning and controlling ground maneuver and air interdiction to see whether modifications would make it easier to achieve synchronization. For example, given the critical role played by the visual search for the enemy's mobile forces and ground maneuver's ability to influence this search, it should be apparent that ground

maneuver plans (timing and location) should be made only after carefully considering how they will complement and reinforce air interdiction in achieving the campaign's objectives. At the same time, air interdiction must be planned and controlled to be responsive to the dynamics of ground maneuver. Thus, campaign success is likely to depend on the ability to closely integrate the development of ground maneuver and air interdiction plans, as well as on quickly adjusting the execution of both to exploit fleeting opportunities.

Still another aspect deserving examination is the method (and therefore the munitions) we use to perform air interdiction. With current munitions, aircrews must be able to find the enemy's mobile forces. Unfortunately, the fight for air superiority (including developments in Soviet air defenses) will make it very difficult for us to achieve the degree of unimpeded presence aircrews need to find the enemy. Soviet development of directed-energy weapons, such as lasers that could blind aircrews searching for targets, further complicates this problem. As a result, the future effectiveness of air interdiction could be in doubt unless we can reduce the need for aircrews to search visually for enemy mobile forces. This is a main reason why we should give more attention to munitions such as smart, stand-off, air-scattered mines.[57] Mines would complement the use of direct-attack air interdiction munitions by helping to establish and maintain an air power presence even when aircrews cannot be continuously overhead.

Conclusion

Using air power to perform air interdiction has had a telling effect on the outcome of many campaigns. Yet, like most developments in war, it has taken time to understand how and why air interdiction makes an important contribution to success. To a certain extent this delay could be the result of a tendency to treat war in the air and on the ground as separate endeavors, rather than as intimately related parts of a unified whole. It could also be the result of an emphasis on tactical events, instead of the campaign. Whatever the reason, in the past we usually were able to succeed. Recent and possible future Soviet developments, however, bring success into question if we do not understand how and why ground maneuver and air interdiction must be synchronized to confront the enemy with an intractable operational dilemma. To help avoid future defeat, it is now more important than ever that we prepare for tomorrow by reexamining where we have been.

NOTES

1. See US Department of the Army, *Operations*, Field Manual 100-5 (Washington: GPO, 5 May 1986), p. 10; and Edward N. Luttwak, *Strategy: The Logic of War and Peace* (Cambridge, Mass.: Harvard Univ. Press, 1987) pp. 91-112.

2. For example, see Barry R. Posen, "Is NATO Decisively Outnumbered?" *International Security*, 12 (Spring 1988), 186-202. Posen attempts to perform an admittedly abbreviated "campaign analysis," while totally ignoring

how air power in the form of air interdiction might influence ground force ratios. The only mention of air power in his "campaign" analysis is in a footnote where he states that due to space constraints he has omitted "certain important issues, such as NATO and Pact attack helicopters and close air support aircraft."

3. Le Comte de Dervieu, *The Transformations of War*, cited by J. F. C. Fuller, *The Conduct of War, 1789-1961* (New York: Minerva Press, 1968), p. 50.

4. Robert McQuie, "Battle Outcomes: Casualty Rates As a Measure of Defeat," *Army* (November 1987), pp. 30-34. Historical evidence indicates that casualties are not usually the reason battles are lost. Instead, defeat results largely when resolve is shaken by other considerations. Maneuver can have such an impact because it causes a defeated force to "look toward the future and an enemy's potential capabilities rather than toward the past and the casualties he has inflicted."

5. Field Manual 100-5, p. 17. Synchronization is defined as "the arrangement of battlefield activities in time, space, and purpose to produce maximum relative combat power at the decisive point." When addressing ground maneuver and air interdiction from a campaign perspective, this definition would be more accurate if the word "battlefield" is deleted.

6. For an excellent discussion of land's nature, see Richard E. Simpkin, *Race to the Swift* (London: Brassey's Defence Publishers, 1985), pp. 57-77.

7. This complexity, where even minor details have a significant effect on combat capability, explains why modeling the role of ground in war, even at the lowest tactical level, has proved to be so difficult.

8. In contrast, as early as World War II, radar made it relatively easy for aircrews to find and attack enemy ships and aircraft.

9. Target factors that influence an aircrew's ability to find enemy ground forces visually include its size, shape, contrast, motion, number, and pattern.

10. A complex environment makes it necessary for aircrews to search many objects to determine which is a valid target, while simultaneously making this search more difficult. An environment's illumination makes searching easier by influencing a target's contrast. Attenuating or scattering light is still another way the environment affects the search for targets.

11. A good example of this occurs when enemy defenses force aircrews to adopt the tactic of flying at high speeds and low altitudes.

12. Rapid movement degrades ground-based air defenses in a variety of ways. Mobile systems must be more rugged, which tends to reduce performance. Rapid movement limits the time available to get into suitable overwatch positions, restricting coverage. It makes command, control, and logistics more difficult. Most important, rapid movement increases dependence on the reconnaissance, resupply, and firepower provided by air power, presenting air defenses with a significant identification problem. Unfortunately, studies of ground-based air defense effectiveness often fail to address this problem of airspace control, which is one of the most important ways time and space considerations create dilemmas for a commander.

13. Wesley F. Craven and James L. Cate, eds., *The Army Air Forces in World War II, Volume Three, Europe: Argument to V-E Day January 1944 to May 1945* (Chicago: Univ. of Chicago Press, 1949), p. 373.

14. Ibid., p. 374.

15. John Slessor, *The Central Blue: Recollections and Reflections* (London: Cassell and Company, 1956), p. 579.

16. G. A. Shepperd, *The Italian Campaign, 1943-45* (New York: Praeger, 1968), p. 252.

17. Craven and Cate, p. 383.

18. F. M. Sallagar, *Operation "STRANGLE" (Italy, Spring 1944): A Case Study of Tactical Air Interdiction* (Santa Monica, Calif.: Rand, February 1972), pp. 44-59.

19. Ibid., p. 62.

20. Shepperd, pp. 263-84.

21. Frido von Senger und Etterlin, *Neither Fear Nor Hope* (New York: E. P. Dutton, 1964), p. 224; cited by Sallagar, p. 66.

22. E. J. Kingston McCloughry, *The Direction of War* (New York: Praeger, 1955), p. 85, cited by William W. Momyer, *Air Power in Three Wars* (Washington: GPO, 1978), p. 165.

23. Craven and Cate, pp. 158-61, and W. W. Rostow, *Pre-Invasion Bombing Strategy: General Eisenhower's Decision of March 25, 1944* (Austin: Univ. of Texas Press, 1981), pp. 39-41.

24. Dieter Ose, "Rommel and Rundstedt: The 1944 Panzer Controversy," *Military Affairs*, 50 (January 1986), 7- 11.

25. David Irving, *The Trail of the Fox* (New York: E. P. Dutton, 1977), p. 375.

26. Craven and Cate, p. 220.

27. B. H. Liddell Hart, ed., *The Rommel Papers* (New York: Harcourt, Brace, 1953), pp. 476-77.

28. Seymour Freiden and William Richardson, eds., *The Fatal Decisions* (New York: Berkley, 1968), p. 241.

29. See Jean-Paul Pallud, *Ardennes 1944: Peiper and Skorzeny* (London: Osprey, 1987), pp. 15-16; and Russell F. Weigley, *Eisenhower's Lieutenants* (Bloomington: Indiana Univ. Press, 1981), pp. 478-80, 483-84, and 530-31. The sector chosen for the Sixth SS Panzer Army's attack was unsuitable for a rapid

breakthrough, especially if opposed by a stubborn defense, because the steep slopes of the narrow valleys and the saturation of the soil from November and December rains greatly hindered and often prevented off-road vehicular movement.

30. Pallud, p. 32.

31. Ralph Bennett, *Ultra in the West the Normandy Campaign, 1944-45* (New York: Charles Scribner's Sons, 1979), pp. 217-18.

32. Craven and Cate, p. 695.

33. Weigley, p. 575.

34. William B. Reed et al., eds., *Condensed Analysis of the Ninth Air Force in the European Theater of Operations* (Washington: Headquarters, Army Air Forces, 1946, rpt. Office of Air Force History, 1984), p. 43.

35. R. C. Weller, "Some Truth About Air Support," *Air University Quarterly Review*, 4 (Spring 1951), 3.

36. Robert F. Futrell, *The United States Air Force In Korea, 1950-1953* (Washington: Office of Air Force History, 1983), pp. 433-74; and Edmund Dews and Felix Kozaczka, *Air Interdiction: Lessons From Past Campaigns* (Santa Monica, Calif.: Rand, September 1981), pp. 15-18, 22, 40, 46-62.

37. Dews and Kozaczka, pp. 59-62.

38. Ibid., p. 58.

39. Robert Leckie, *Conflict: The History of the Korean War* (New York: G. P. Putnam's Sons, 1962), pp. 42-58.

40. Futrell, p. 33.

41. Ibid., p. 85.

42. Ibid., pp. 171-75; and Dews and Kozaczka, pp. 59-61. It is important to recall that during the Korean War air attacks inside the bombline, but beyond artillery range, were called close air support. Today these attacks would often be called battlefield air interdiction.

43. Futrell, pp. 163-75, 207-14; and Leckie, pp. 144-47.

44. Leckie, p. 195.

45. Ibid., p. 215.

46. Futrell, pp. 261-64.

47. Guenter Lewy, *America in Vietnam* (New York: Oxford Univ. Press, 1978), pp. 383, 390.

48. Ibid., p. 391.

49. Dave Richard Palmer, *Summons of the Trumpet* (San Rafael, Calif.: Presidio Press, 1978), pp. 244-51.

50. It was, in the words of one veteran F-4 pilot, "unbelievable . . . I've never seen anything like it—columns of tanks, columns of trucks, even men marching along the road." W. Scott Thompson and Donald D. Frizzell, eds., *The Lessons of Vietnam* (New York: Crane, Russak, 1977), p. 160.

51. Lewy, pp. 198-202, 210.

52. C. N. Donnelly, "The Soviet Operational Manoeuvre Group," *International Defense Review*, 15 (No. 9, 1982), 1177-86, and *Heirs of Clausewitz: Change and Continuity in the Soviet War Machine* (London: Institute for European Defence and Strategic Studies, 1985), pp. 20-27.

53. See John Erickson, Lynn Hansen, and William Schneider, *Soviet Ground Forces: An Operational Assessment* (Boulder, Colo.: Westview Press, 1986); and Phillip A. Petersen and John R. Clark, "Soviet Air and AntiAir Operations," *Air University Review*, 36 (March-April 1985), 36-54.

54. The problem finding vehicles, such as tanks, can be appreciated by realizing that at 3.3 nautical miles a tank will subtend (i.e. occupy) the same angle as a pin-head from nine feet away (J. R. Walker, "Air-to-Surface Weapons," *Weapons and Warfare*, ed. K. Perkins [London: Brassey's Defence Publishers, 1987], p. 36). For a discussion of how the distance between a base and the target affects aircraft performance, see my article "Operational Art and Aircraft Runway Requirements," *Airpower Journal*, 2 (Fall 1988), 52-69.

55. William P. Baxter, *Soviet AirLand Battle Tactics* (Novato, Calif.: Presidio Press, 1986), pp. 129-30; and Mark J. Reardon, "Countering Soviet Smoke," *Armor*, 95 (May-June 1986), 36-39.

56. The late military theorist Richard Simpkin believed movement is the key to the fundamental difference between most Western armies (including the US) and the Soviet army (also the German and Israeli armies). In his opinion, "The Anglo-Saxon moves between fights, the Russian fights between moves . . . . For Soviet mobile forces, fighting is not an end in itself or, except in the narrowest sense, a means of imposing one's will on the enemy. It is a means to the continuation of purposeful movement." Simpkin, *Red Armour* (London: Brassey's International Defence Publishers, 1984), p. 89.

57. Thanks to recent developments in sensors, as well as power supplies and kill mechanisms, it should be possible for us to develop a stand-off, smart, air-scattered mine that can damage or destroy soft-skin or light-armored vehicles moving on roads, even if the mine is located as far as 100 meters from the road. Because of its stand-off capability, such a mine would be extremely difficult to detect or clear quickly, making it difficult for an enemy commander to estimate whether he could afford the losses that would result from attempting to move quickly along an uncleared road. For one design approach to such a munition, see my article "NATO Needs a New Air Interdiction Approach," *Armed Forces Journal International*, 124 (October 1986), 112. Also see C. E. E. Sloan, *Mine Warfare On Land* (New York: Brassey's Defence Publishers, 1986), pp. 3-8 and 123-31.