

## 5

---

## Section Tactics, Two-versus-One

Never break your formation into less than two-ship elements. Stay in pairs. A man by himself is a liability, a two-ship team is an asset. If you are separated, join up immediately with other friendly airplanes.

Major Thomas B. "Tommy" McGuire, USAAF

### Background

*Section* is the term used to describe a team of two fighters acting in concert against the adversary. This concept was first employed early in World War I by the Germans Oswald Boelcke and Max Immelmann. Even in the infancy of air combat, it was readily apparent that one-versus-one engagement has serious flaws in practical application. Among these failings is inadequate defense against surprise attack by an unseen opponent. It has been estimated that throughout the history of air combat 80 to 90 percent of downed fighter pilots were unaware of their danger until the moment of the attack. Surprise, then, and, conversely, the avoidance of surprise, must be considered the most vital element in air combat.

The first rule of all air combat is to see the opponent first. Like the hunter who stalks his prey and maneuvers himself unnoticed into the most favorable position for the kill, the fighter in the opening of a dogfight must detect the opponent as early as possible in order to attain a superior position for the attack.

Lt. General Adolph Galland, Luftwaffe

Most aircraft, and particularly single-seat fighters, have blind spots that cannot be monitored visually on a continuous basis by the pilot. The underside of the aircraft and the rear hemisphere are usually the most troublesome areas. Although these regions can be checked sporadically by rolling and turning the aircraft, this technique may not be adequate against an attacker with high closure. Additionally, one-versus-one combat, and particularly weapons employment during combat, demands that the

pilot's full attention be devoted to the opponent he sees, leaving little or no opportunity for him to defend against a second attack.

There are no eyes for your backside, no eyes for who is coming from below ... if you are single you have too many blind spots.

Colonel Erich "Bubi" Hartmann, GAF

In theory, the operation of two fighters together can alleviate this problem by allowing each of the two pilots to cover the blind zone of the other before an engagement and by allowing one pilot to prosecute an attack confident in the knowledge that his vulnerable areas are being protected by his wingman. A fallout of this strategy is the old military principle of concentration of forces, as greater firepower can be brought to bear on the adversary.

Although this principle of "mutual support" sounds straightforward enough, it has given rise to a multitude of tactical doctrines designed to exploit its advantages. Most of these doctrines have been successful to some degree under certain combat conditions. Three of the most common are discussed here, but it should be recognized that there may be many tactical variations within each broad doctrine, all of which, obviously, cannot be covered in detail.

### **Fighting Wing**

Fighting wing tactics, sometimes called "welded wing," designate a leader and a wingman. The leader's primary responsibilities are navigation, forward-hemisphere search for the enemy, attack planning, and engaged maneuvering, and he has a secondary responsibility of rear-hemisphere visual coverage. The wingman flies a rather loose formation on the leader; his primary task is maintaining a rear-hemisphere defensive lockout, and he has secondary forward-hemisphere duties.

The position flown by the wingman is shown by Figure 5-1. In actuality this is not a rigid position, but rather is a maneuvering area roughly described by a cone-shaped airspace extending aft of about 60° off the leader's tail. Distance from the leader varies with the performance of the aircraft involved. Generally the wingman needs to maintain sufficient separation to preclude any danger of collision with the leader in the event of unexpected heavy maneuvering, but he must be close enough to facilitate the task of remaining behind the leader during maximum-performance turns. This formation task becomes nearly impossible when aircraft separations are allowed to approach the equivalent of about one minimum turn radius for the aircraft involved. Because of the increase in the speeds of fighters and their turn radii since World War I, maximum separations in fighting wing have also increased dramatically. Typical maximum separations have ballooned from about 200 ft in World War I, to 600 ft in World War II, 1,000 ft during the Korean War, and 3,000 ft for the Vietnam conflict. Since turn radius increases with altitude, at high levels, separations up to twice these values might be workable. Minimum comfortable maneuvering distances also have expanded, primarily as a result of

the possibility of greater closure between leader and wingman, from 20 to 30 ft during the biplane era to 200 to 300 ft for modern jets.

Fighting wing "formation" is not really a formation at all, but an engaged tactical doctrine. Pre-engagement formations used with fighting wing have varied widely. These sections may cruise in "echelon," with the wingman behind and to the side, as depicted in Figure 5-1 (right echelon when the wingman is on the leader's right side). The wingman might also fly directly abeam the leader in what is known as "line-abreast" or "combat-spread" formation. The fighters could even choose to cruise in "trail," one directly behind the other, a formation also known as "line astern." Separation between aircraft in these cruise formations typically has varied from one extreme to the other, between the minimum and maximum ranges outlined here. The wingman is usually "stepped-down" (i.e., lower in altitude) a few feet, which makes it easier for him to stay out of the way should the leader decide to turn sharply toward the wingman. During the biplane days, stepping-up was common because of better wingman visibility looking forward and down. The merits and shortcomings of each of these pre-engaged tactical formations are discussed in a later chapter. Suffice it to say here that echelon is probably the tactical formation most widely used in conjunction with fighting wing, but that line abreast is probably better, since this arrangement offers each pilot an equal view of the other's rear hemisphere. The difficulty with line abreast is that the wingman is initially forward of the prescribed fighting wing position and may not be able to regain it in the event of unexpected heavy maneuvering.

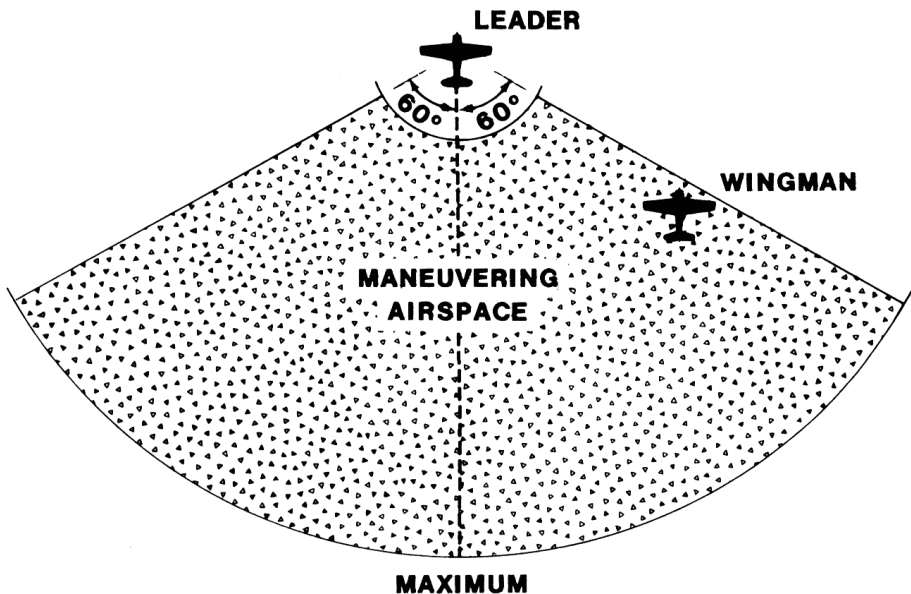


Figure 5-1. Fighting Wing Formation

*Engaged Maneuvering*

Once the engagement begins, the fighting wing leader essentially fights the opponent one-versus-one, while the wingman hangs on for dear life. The wingman should attempt to maintain a position as far off the leader's tail as practical to give himself the best possible view of the leader's vulnerable rear hemisphere and to afford the leader the chance to check the wingman's six o'clock. Within limits, greater separation between fighters also provides for better visual coverage and quicker support by the wingman should the leader be attacked. In general, however, the greater the aircraft separation and the farther forward the wingman flies, the more difficult the task of maintaining the position. A great deal of practice, therefore, is required to produce an effective fighting wing wingman.

Mainly it's my wingman's eyes that I want. One man cannot see enough. When attacked I want first for him to warn me, then for him to think. Every situation is different and the wingman must have initiative and ability to size up the situation properly and act accordingly. There is no rule of thumb for a wingman. . . . The wingman's primary duty is protection of his element leader. It takes the leader's entire attention to destroy an enemy aircraft. . . . Good wingmen, smart wingmen, are the answer to a leader's prayers.

Lt. Colonel John C. Meyer, USAAF

In addition to improved defensive coverage, fighting wing tactics have several other advantages as compared with operating as a single aircraft in a combat environment. One of the greatest pluses is that it takes much less training for a pilot to fly fighting wing well enough to stay with his leader than it takes to enable that pilot to survive on his own. Trained fighter pilots are almost always in short supply during wartime, and fighting wing allows inexperienced pilots to engage in combat under the tutelage of a veteran leader at reduced risk. Actual combat is the best teacher, but historically the highest attrition rate for fighter pilots has occurred during their first few combat missions. Fighting wing can get the fresh recruit through this vulnerable period while he is serving the useful function of offering some visual support to the leader. A second set of eyeballs can be invaluable in the combat environment.

A steadily increasing percentage of the young and inexperienced pilots were shot down before they reached their tenth operational flight—soon it was more than five percent.

Lt. General Adolph Galland, Luftwaffe

The other major advantage of fighting wing is concentration of fire. The lead is essentially maneuvering two firing platforms rather than just one. Under the ground rules of fighting wing it is the wingman's responsibility to stay with and cover his lead, not to engage the bogey. Any attention paid to the opponent detracts from the wingman's defensive potential. Against most maneuvering fighter opponents, when concentration of fire is not critical and shot opportunities are likely to be fleeting, the leader usually will do all the shooting. But quite often an enemy fighter's defensive reaction to the leader's attack sets up a shot for the wingman. Against

heavily armored, nonmaneuvering targets, especially bombers, the lead may clear the wingman to fire, either simultaneously or in rapid succession, to make best use of all available firepower. The wingman may also be allowed to finish off a defeated or crippled opponent as an effective means of building confidence and combat weapons-firing experience. In this case the lead clears his wingman to attack and temporarily assumes the duties and position of wingman himself. In the case of a relatively experienced wingman, there may be a pre-engagement agreement between team members that the wingman may attack any bogey he sees first, and assume the temporary lead. As a rule, however, the wingman should attempt to get the leader's eyes on the bogey and let him decide whether and how to attack. Obviously, if the leader is threatened severely by an attacker, it is the wingman's duty to warn the leader and counterattack immediately.

It is true to say that the first kill can influence the whole future career of a fighter pilot. Many to whom the first victory over the opponent has been long denied either by unfortunate circumstances or by bad luck can suffer from frustration or develop complexes they may never rid themselves of again.

Lt. General Adolph Galland, Luftwaffe

Another scenario in which fighting wing provides concentration of fire is with multi-crew fighters having rear-hemisphere weapons. The close spacing between aircraft makes it difficult for an attacker to bounce one fighter without coming under fire from both. This also accounts for some of the logic behind close bomber formations.

### *Analysis of Fighting Wing Doctrine*

In addition to its obvious benefits, fighting wing doctrine has some serious flaws. With the exception of the pre-engagement line-abreast formation, the wingman's position behind the leader results in reduced visual coverage of the wingman's six. Moreover, once he is engaged, the lead is likely to be too busy with the bogey to provide adequate support to his wingman in any event. Although the wingman is theoretically burdened only with defensive lockout responsibility, in practice he is so occupied by maintaining position during hard maneuvering that he may be of little defensive value to either the leader or himself. In this case he is literally "hung out to dry." Many a wingman has been lost without the leader even being aware of it.

Lack of offensive efficiency is also a serious problem with this doctrine. The bogey pilot is essentially fighting only one opponent. Having one of his adversaries in sight virtually assures having the other in sight. From an offensive point of view the fighting wing leader must engage the opponent one-versus-one. If his aircraft is superior to the bogey, this may be practical, but he clearly cannot hope to defeat a better fighter that is well flown unless the bogey can be taken by surprise. Even this is more difficult with two aircraft rather than one, since the section is more visible.

Neither is fighting wing compatible with most energy tactics. As detailed previously, most of these methods require the energy fighter to trade position advantage for an energy margin, then convert that energy to a position advantage with a zoom climb. Although the leader of a fighting

wing section may be capable of pulling this off safely, the zoom often leaves the wingman behind, below, and very vulnerable. Angles tactics are much more appropriate for fighting wing, but they are not likely to bring success unless the section fighters have a turn-performance advantage over their adversary. If this is not the case, the section may be forced to resort to hit-and-run methods, but under some circumstances (e.g., when the section aircraft have a large energy advantage over a bogey that is not all-aspect missile equipped) extension/pitch-back tactics may be workable. A considerable T/W advantage (or initial energy advantage) usually is required for this method, since the leader is generally restricted to partial power for benefit of the wingman. Otherwise the wingman would have a difficult time keeping up during the extensions and zooms.

It was my view that no kill was worth the life of a wingman. . . . Pilots in my unit who lost wingmen on this basis were prohibited from leading a [section]. They were made to fly as wingmen, instead.

Colonel Erich "Bubi" Hartmann, CAF

Even with its many failings fighting wing has survived from early World War I right up to the most recent air combats, and it probably will continue to find applications as long as manned fighters exist. In most cases it is still superior to engaging one-versus-one in a hostile combat environment.

### **Double Attack**

Double attack, also known by many other names, is a system by which each aircraft of a pair of fighters can support the other without remaining in the rigid structure prescribed by fighting wing. This doctrine permits the section to split, allowing for coordinated, sequential attacks. There is still a leader and a wingman in this method, but the relationship can change back and forth during an engagement.

#### *Pie-Engagement Considerations*

Pre-engagement formations used with double attack doctrine are generally the same as with fighting wing (echelon, line astern, or line abreast), except that aircraft separation can be increased somewhat since there is no longer a requirement for the wingman to remain closely behind his leader once the section is engaged. Greater separation between fighters can provide better visual coverage of the teammate's rear hemisphere, allows the fighters more maneuvering room to counterattack a bogey that may attack the other fighter, and makes it more difficult for a single bogey to see or attack both fighters simultaneously.

The ideal separation between fighters using double attack doctrine depends on several factors, one of which is the turning radius of the aircraft involved. It does little good for the wingman to detect an attack on his partner if something cannot be done about the situation quickly. In addition to warning the threatened pilot to take evasive action, the wingman should be able to bring offensive pressure to bear on the attacker in minimum time. In general, this task is easiest when separation between fighters is on the order of one or two turn radii, since this gives the

wingman maneuvering room to turn and point weapons at the attacker. This maneuvering space is often not available in close fighting wing formations. Obviously, optimum lateral spacing will vary with turn radius, as this performance parameter varies with fighter speed and altitude.

Cockpit field of view and enemy weapons are also important considerations. To illustrate the interaction of these seemingly unrelated factors, Figure 5-2 shows two fighters in line-abreast, or combat-spread, formation. This figure depicts typical "blind cones" behind each fighter. At least one of the pilots has an unobstructed view from the cockpit of all airspace around the section, except the cross-hatched region between the aircraft marked "danger zone." Arcs are also drawn to represent the maximum effective firing range of the enemy's weapons in the rear quarter of each fighter. These weapons could be guns, rockets, or missiles. The goal is to space the fighters so that an enemy cannot achieve firing parameters undetected.

Visualize how greater cockpit field of view, and more narrow blind cones, would tend to push the danger zone farther aft. A similar effect is

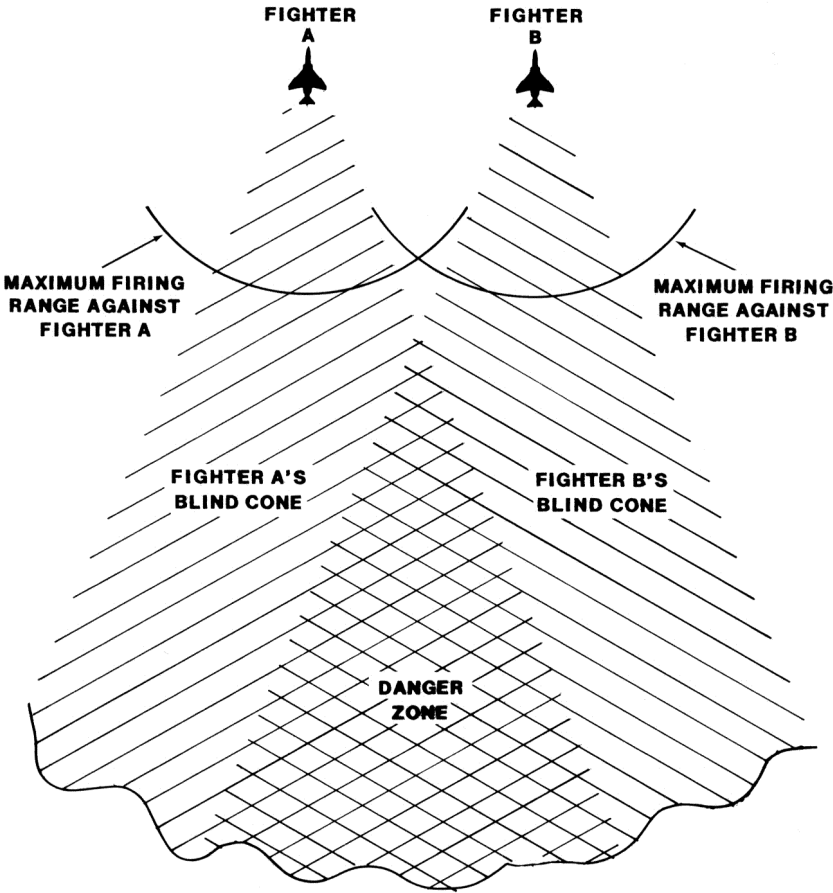


Figure 5-2. Aircraft Spacing in Combat Spread

accomplished by increasing lateral separation between fighters. It can also be seen here that allowing one fighter to fall back behind the other into an echelon formation would cause the danger zone to recede farther from the lead fighter, offering it greater protection, but cause it to approach the trail fighter, which makes it more vulnerable. This illustration should make very clear how the longer max-range of the AAM struck a deathblow to the close aircraft spacing required by fighting wing doctrine, which had been so effective in a guns-only environment.

The maximum firing range of the enemy's weapons, particularly AAMs, can vary substantially depending on altitude, fighter speed, bogey closure, etc. These factors may, therefore, need to be taken into consideration by the defending pilots. Generally speaking, higher altitudes and slower speeds require greater separation between fighters if a bogey is to be denied an AAM firing opportunity within the section's danger zone. Typical separation between fighters in combat spread in a modern AAM environment is on the order of one to two miles.

The physical size of the aircraft involved also plays an important part in determining the optimum section spacing. While minimum separation is largely dependent on turn radius, field of view, and weapons considerations, maximum split is limited by aircraft size and visibility conditions. The fighters need to remain close enough together for there to be little danger of them losing sight of each other under prevailing visibility conditions. When approaching the limits of this range, each pilot must spend more and more time watching his teammate, which leaves less time for offensive or defensive scanning. Unless the enemy fighters are considerably larger than the friendlies, bogey size is often a more restrictive factor than the size of the section's aircraft. As a bogey approaches firing range within the blind cone of one fighter, range from the bogey to the target's wingman may be considerably greater than the separation between fighters. Fighter spacing, therefore, must be restricted to provide reasonable assurance that an enemy approaching firing parameters on one fighter will be detected by the other.

Under many conditions of visibility, bogey size, and weapons ranges, maximum allowable separation between fighters may be less than that required to ensure that the enemy cannot fire within the section's danger zone. Under such circumstances, high speed and low altitude may restrict the bogey's AAM firing envelope sufficiently to solve the problem. Allowing the fighters to weave may also help by effectively reducing the size of the blind cones. Weaving, however, makes fighters more detectable because of the increased probability of sun reflections off various parts of the aircraft catching the enemy's attention. Weaving also slows a section's forward progress, which may allow a slower bogey to close from the rear.

Optimum vertical separation between fighters in section is determined by environmental, performance, and aircraft structural design factors. For instance, the wingman would not want to be stepped-up on the sun side of his leader, since the leader's vision would be impaired as he looked into the sun to check the wingman's rear hemisphere. The wingman would normally step up when he is on the leader's down-sun side and fly below the leader when he is up-sun of the leader.



Large vertical separations between fighters can reduce defensive capability, since the lower aircraft may not be able to climb up quickly to the level of the wingman to render assistance without losing so much airspeed that it becomes ineffective. Higher performance fighters can, therefore, afford larger altitude splits.

Aircraft structural design enters the picture because of its effect on cockpit field of view. A modern low-wing fighter, for instance, often has a more restricted field of view behind and down because of the obstruction of the wing. If one fighter is stepped-up in this case, its wing might obscure a large portion of the wingman's rear hemisphere. When necessary this problem may be alleviated by rolling the aircraft periodically to check the hidden region, but generally it is better to avoid the problem altogether by readjusting relative aircraft altitudes.

In general, within the limits described, larger splits, both horizontally and vertically, provide better offensive potential. This is partially because greater separation affords more maneuvering flexibility and partially because enemy fighters are less likely to see both aircraft simultaneously. However, this improved offensive potential may be gained at the cost of reduced defensive capability, because of visibility and performance factors. Usually the prudent section will opt for splits nearer the minimum limits in high-threat areas, or when the immediate chances of engaging offensively are slim. Wider splits are more appropriate in low-threat conditions and in the final stages of an offensive attack.

### *Engaged Maneuvering*

It is in the engaged phase that double attack departs most dramatically from fighting wing doctrine. For example, when the enemy is spotted by the wingman, no time is wasted getting the leader's eyes on the target. If the wingman is in a favorable position and he considers attack to be advisable, he assumes the lead and attacks. The new wingman positions to cover his teammate, usually high above the fight. Since the wingman is relieved of his close-formation requirement, he can devote full attention to the more important task of providing effective visual coverage. His maneuvering requirements are also reduced, so the wingman can use this opportunity to increase his energy level, making him more effective in case he later becomes engaged.

It is wonderful how cheered a pilot becomes after he shoots down his first machine; his moral[e] increases by at least 100 per cent.

Captain Ira "Taffy" Jones, RAF  
40 Victories, WW-I

Once the section has split, there is a subtle shift from the leader/wingman relationship between pilots to an engaged fighter-free fighter relationship. The pilot of the engaged fighter is the one more closely involved with the adversary. In essence, he is the section leader at that moment. The first duty of the engaged fighter in offensive double attack is to press the attack. The result of this attempt will be either destruction of the target or loss of the offensive. At the first sign that the offensive is being lost (i.e., impending overshoot, energy depletion, etc.), the engaged-fighter

pilot should disengage immediately and call in the wingman to assume the offensive. The engaged fighter-free fighter roles then reverse, and the new free-fighter pilot assumes the duties of visual coverage and replenishment of his expended energy until he is called once again into the fight by the engaged pilot.

Only one man can shoot down an opponent. If one airman has tackled his enemy the others cannot assist. They can only look on and protect his back. Otherwise, he might be attacked in the rear.

Baron Manfred von Richthofen

To be most effective, the pilot of the double attack free fighter needs to keep the engaged fighter in sight and stay close enough to offer adequate visual support and quick response to an attack on his teammate without getting in the way. In order for the pilot of the free fighter to provide the quickest defensive reaction potential, he must maintain high energy (preferably higher than that of the engaged fighter), minimize separation from the fight, and avoid letting the fight get too far behind his wing-line. Probably the most effective technique for meeting all these parameters is to maneuver in a plane perpendicular to that of the fight. For instance, if the bogey and the engaged fighter are making essentially level turns, the free-fighter pilot can perform a series of vertical or very steep oblique loops around the fight. He can also use a series of high and low yo-yos. Conversely, if the fight is progressing vertically, the free fighter can arc around the fight in level turns. In this way the free fighter stays close to the fight and can keep the engaged fighter within about 90° of the nose for a quicker defensive response. This is especially important for slow-turning fighters. In addition, the free fighter's turn rate is "decoupled" from the fight in this manner. This means the fight itself may be allowed to go through two or three turns while the free fighter completes just one revolution in a perpendicular plane. The free fighter can therefore hold lower G and build an energy reserve for future offensive or defensive maneuvering.

In most situations involving double attack, there are clearly defined engaged and free fighters, but this is not always the case. For instance, when both pilots have the target in sight prior to the attack, they may take an "offensive split" in an attempt to "bracket," or surround, the bogey. One such scenario is illustrated in Figure 5-3. In this case the section is meeting the bogey head-on (time "1") and takes a wide offensive split, forcing the opponent to choose one fighter or the other to engage (time "2"). This choice gives the other fighter flight-path separation, which its pilot uses to make a lead turn to gain a good advantage at the pass (time "3").

In the case of the offensive split, the bogey pilot is allowed to choose which fighter he will engage. Until that choice is made, both aircraft in the section are, theoretically, engaged fighters. If the bogey continues merrily straight ahead, both fighters could convert to its rear hemisphere. When the bogey pilot chooses to engage one fighter, this should leave the other in a more favorable offensive position. Following the pass, this more offensive fighter usually will assume the engaged-fighter role and commence

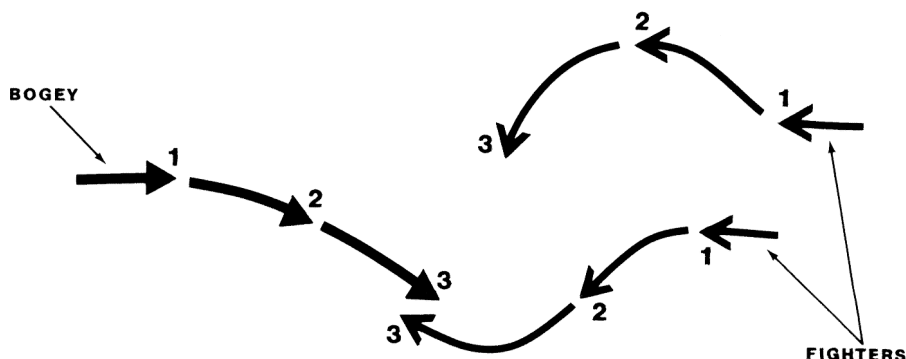


Figure 5-3. The Bracket

double attack maneuvering; or both fighters may choose to disengage from the attack together for a hit-and-run maneuver.

Throughout World War II, fighting wing was the tactical doctrine of the U.S. Army Air Force (USAAF) in the European theater. A few highly experienced teams, however, recognized the limitations of these tactics and developed their own variations, generally along the lines of double attack. Probably the most famous of these teams was made up of Captains John Godfrey (16.33 victories) and Don Gentile (19.83 victories). These pilots' success was so astounding, and their methods so revolutionary, that Luftwaffe Reichsmarschall Hermann Goering supposedly stated he would trade two of his best squadrons for their capture. The following encounter sounds suspiciously like a double attack bracket. Godfrey and Gentile are flying P-51B Mustangs against the lone Me 109.

"Break! Break! One coming in at 4 o'clock to you!"

"Okay, break starboard," said Gentile.

They broke together and the 109 made a head-on pass.

"All right, Johnny," said Gentile, "when he comes back around on the next turn you break right and I'll break left."

They circled and the 109 came boring in for another head-on attack. He looked mean and vicious. He was bold enough to joust with two Mustangs. As the planes bored straight at each other's spinner, Gentile ordered the foxing maneuver:

"Now!"

Gentile broke sharply to the left; Godfrey to the right. They honked their sticks back, climbed and came barreling down on the 109's tail.<sup>1</sup>

Defensively, the engaged fighter—free fighter roles also can become somewhat blurred. Whenever one fighter becomes defensive, the other fighter should immediately attack the bogey. In this case there will be two engaged fighters until the bogey can be placed on the defensive, releasing the original defensive fighter to become free. This situation is depicted in Figure 5-4. In this scenario the right-hand fighter is threatened by a bogey detected at its six. The threatened pilot breaks to the right, away from his wingman, to defend against the attacker. If the bogey continues to press

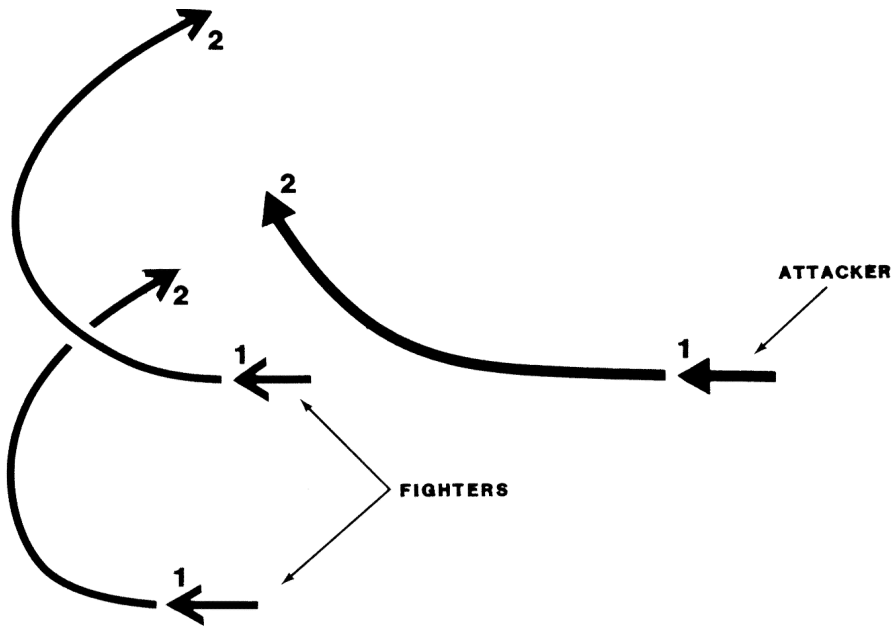


Figure 5-4. The Sandwich

the attack, as shown here, it quickly becomes sandwiched by the second fighter.

The sandwich is an ideal defensive maneuver when the threatened fighter can be identified early in the attack. This identification is made easier by the wider cruise formations available with the double attack doctrine. When the bogey does not commit clearly to one fighter early in its attack, a "defensive split" may be used to force the attacker's hand. This technique is illustrated in Figure 5-5.

In this scenario the fighter section is cruising in combat spread, line abreast, when a bogey is detected closing from six o'clock at time "1." The attacker's position between the fighters, and the relatively long range, makes it difficult to determine which of the fighters the bogey pilot intends to attack. Therefore the fighters take a defensive split north and south, turning away from each other. Assuming the attacker is still beyond the range of his weapons, these turns can be of the energy-sustaining variety rather than break turns. The defensive split quickly forces the attacker to commit to one fighter or the other, and, in pressing the attack on one fighter, the bogey must turn its tail to the other, often causing the attacker to lose sight of the free fighter. In this engagement the northern fighter is engaged more heavily and is definitely defensive. The defender can expect to be fired on around time "2" if the bogey is carrying all-aspect missiles, and he almost certainly will be required to perform a guns defense at about time "3" against a gun-equipped attacker.

The bogey's overshoot between times "3" and "4" leaves the engaged-fighter pilot (assuming he has survived to this point) with the options of either continuing his turn, as shown, or reversing nose-to-nose, setting up

a scissors. Against a gun-equipped attacker with a definite angular advantage, reversing at this point subjects the defender to another close-range gun shot, unless the defender is much more maneuverable (i.e., has a tighter turn radius). The reversal option also tends to drag the fight away from the free fighter, delaying any help it may be able to render. Engaging the bogey in a slow-speed, close-range knife fight can even leave the free fighter helpless to assist, since a missile fired at the bogey under these conditions might very easily guide on the friendly fighter instead. This would greatly reduce the popularity of the free-fighter pilot at the bar following the mission.

A better option here is probably to continue to turn in the same direction, as shown at time "4." This action delays any further weapons firing by the attacker and pulls the fight back toward the free fighter. If the bogey continues to press the attack in this case, it will turn belly-up to the free fighter coming in from the south. The free fighter would then be in an excellent position to sandwich the bogey, probably unseen, and achieve either gun- or missile-firing parameters. If the bogey detects the free fighter's attack, a switch may occur, with the bogey releasing the original defender to concentrate on the other fighter. In this case the original free fighter becomes engaged, usually on at least equal terms, and can begin one-versus-one maneuvering or disengage. Meanwhile the original defender is now free to catch his breath, recover some energy, and assume a cover position, usually high above the fight, to await his turn at the opponent while watching for additional ("wild-card") bogeys.

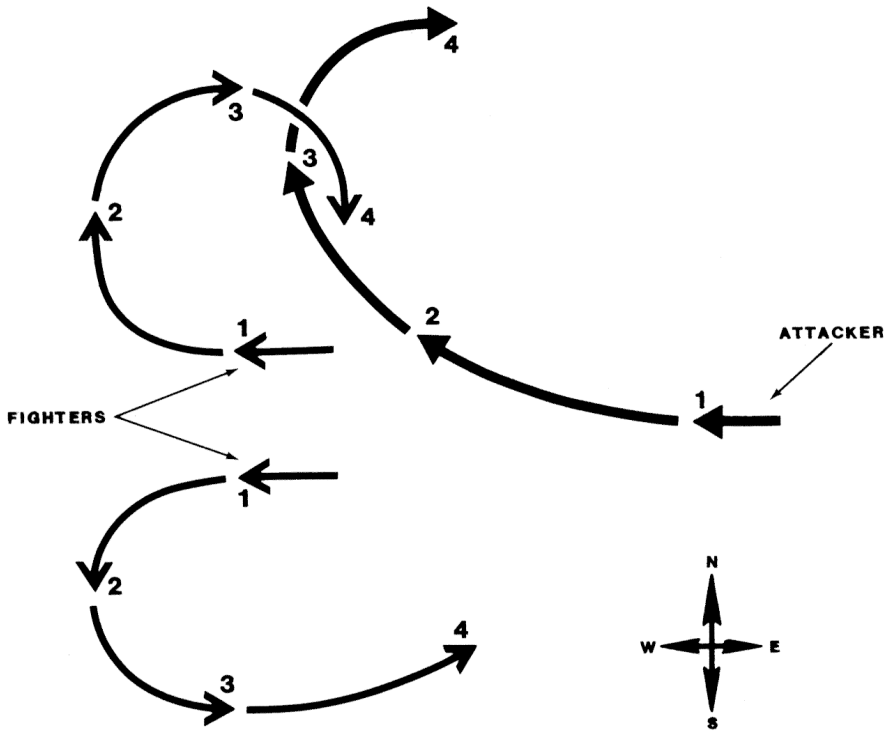


Figure 5-5. The Defensive Split

Again the team of Godfrey and Gentile provides a combat example of the defensive split. The maneuvering following the split is also very representative of offensive double attack doctrine.

Don was the first to see the ME-109.

"Johnny, at six o'clock high there's a single bandit."

I looked back, and there he was high above us. I gazed in disbelief as his nose dropped and he plummeted down on us.

"Don, the crazy son of a bitch is bouncing us."

"I know. When I yell, 'Break,' you break right and I'll break left."

I watched as the 109 dropped closer and closer. "Break, Johnny."

I pulled sharply to the right, and thought at first I had broken too late as the 109 pulled on my tail. I tightened my turn and met Don halfway around as he tried to fire on the 109 in a head-on attack. I went around twice more, with the Jerry on my tail, before Don could reverse his turn and swing down for a rear attack. But this German pilot was a smart, capable flyer. As Don brought his guns to bear, he split S and dove to the ground. Don and I followed him, our motors roaring in pursuit. He pulled out of his dive and banked left, which brought him close to me. I followed him and fired. He wasn't one to sit still, however, and changed his turn to swing into Don. I followed, firing intermittently. Don, meanwhile, had climbed for altitude, and I kept the Jerry busy in a tight turn. As I fired, I saw flashes on his wing, fuselage and even his motor, but the pilot wouldn't bail out. Turning all the time and losing height, we were now just above the tree tops, and the 109's engine was spewing smoke. I had no forewarning that my ammunition was running out, but as I prepared for the final burst only silence came as I pressed the tit.

"Finish him, Don. I'm all out of ammunition."

Don, who had been maneuvering above us waiting for the Jerry to break out of the turn, zoomed down in front of me and made one pass at the courageous German flyer. His shots hit home, and the 109 crashed into the ground.<sup>2</sup>

A common variation on the defensive split is a high/low split. In this case one fighter pulls up steeply (either vertically or obliquely toward the wingman) while the other turns away level or nose-low. This tactic generates both a vertical and a horizontal split and again forces the attacker to make a choice. If he attacks the low fighter, the high fighter can come over the top of its vertical or oblique loop and dive down on the bogey. This can be a very effective tactic when a section is attacked by a low-T/W adversary who does not have the poop to reach the high fighter in its zoom.

The high/low split has some serious limitations, however. One of these is the slow speed resulting from the high fighter's zoom climb which leaves it vulnerable to a second, unseen, attacker. Another is the beautiful look-up shot it presents to a missile-equipped opponent. A third consideration is the relative energy of attacker and defender. If the bogey is closing from the rear quarter at the same altitude or higher, it has an energy advantage over the defending fighters. This energy margin may allow even a low-powered bogey to zoom with the high fighter, catch it at the top of the loop, and cause real problems long before the low fighter can become a factor.

The high/low split was used very effectively by the Chinese and Russian

MiG-15s against U.S. F-86 Sabres in Korea. The MiGs would stay very fast, near the maximum speed of both aircraft types, so the attacking Sabres could not achieve a significant energy advantage. Since the MiG had a substantial T/W advantage over the guns-only Sabres, the MiG splitting high was usually in little danger of being caught in its zoom.

In general, the high/low split should not be attempted against an all-aspect missile threat, or when the section is attacked by a fighter nearly equivalent in zoom capability. The relative merits of the sandwich (fighters turn in the same direction) and the split (fighters turn away from each other horizontally or vertically) depend on several factors. One of these is the range at which the attack is detected. To be effective, the sandwich (Figure 5-4) requires that the attacker be approaching a range approximating the lateral separation between the defending fighters and be firmly committed to one target. If the attack is discovered early, it may be possible to delay defensive maneuvering until just prior to the bogey's open-fire point, to allow the range to close and the target to be determined. A slight miscalculation here, obviously, would be unfortunate. The long range of an attacker's AAM also may preclude this option. Under such circumstances the defensive split (Figure 5-5), either the level or the high/low variety/ may be more appropriate.

It is apparent that the sandwich and the high/low split, which place the free fighter in a threatening position within 90° to 180° of turn, are more efficient than the left/right horizontal split, which typically requires 270° to 360° of turn before a firing position can be achieved. Another disadvantage of the level defensive split is the great separation generated between the fighters (several miles at today's speeds), which easily can cause the free-fighter pilot to lose sight of the fight, with disastrous results. The high/low split, when appropriate, reduces this separation significantly.

Another tactic is something of a combination of the sandwich and the split. The "half-split," as illustrated by Figure 5-6, involves one pilot turning hard away from his wingman, who in turn extends straight ahead. In practice the pilot of the extending fighter may need to turn slightly to keep sight of his wingman and the attacker, and he may also choose to climb or dive while extending.

At time "1" the section (in combat spread) detects an attacker behind it closing fast, but still out of range. The pilot of the southern fighter turns left (away from his wingman) using sustained-G levels to conserve energy and separate from his wingman. The pilot of the northern fighter, meanwhile, extends essentially straight ahead and watches the bogey and his wingman. In this case the bogey pilot chooses to attack the southern fighter, a fact that becomes evident before time "2." The defender now tightens his turn to defeat the attack, while the wingman comes back hard to sandwich the attacker. Figure 5-7 illustrates how the section can counter if the bogey attacks the extending fighter.

In this scenario the positions at time "1" are the same as for the previous example, and the section employs the same half-split. This time, however, the bogey follows the extending fighter. When the situation becomes clear, at time "1," the pilot of the southern fighter reverses his turn direction

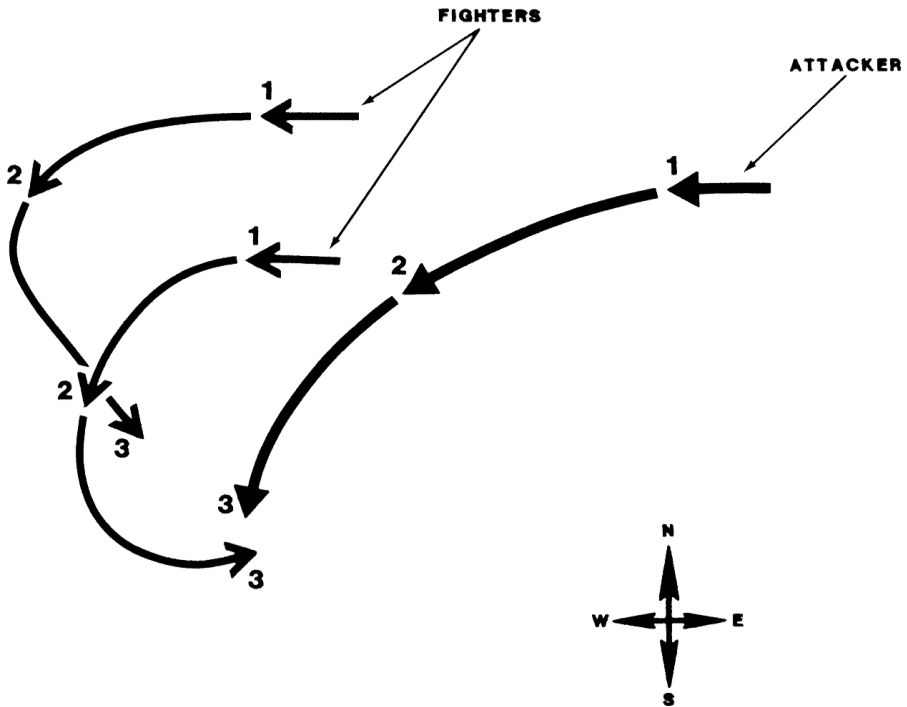


Figure 5-6. The Half-Split (Bogey Attacks Turning Fighter)

back toward his wingman, who continues to extend, turning only to keep sight of the bogey. This extension "drags" the bogey out and assists the wingman in positioning for a shot. At time "3" the attacker has closed the range sufficiently to force the defender to break into his attack; but by this time the free fighter has achieved a sandwich (time "4"). A barrel-roll attack commenced at about time "3" may assist the free fighter in gaining an offensive position.

As with the pure defensive split, the half-split forces the attacker to commit to one fighter or the other, so that the section can clearly define the engaged fighter and the free fighter. Separation is increased to allow maneuvering room for the free fighter, but it is not increased so far that the defenders are likely to lose sight of the attacker or each other. In addition, the sandwich usually can be set more quickly with this method than with the pure defensive split.

One other defensive tactic which deserves mention at this point was developed by the U.S. Navy early in World War II. For some time after America's entry into the war, the Navy found their F4F Wildcat fighters badly overmatched by the Japanese Zero, which could both out-turn and out-climb the Wildcat. The Wildcat's strong points, aside from a slightly faster top speed, were better roll rate, particularly at high speeds, heavier armor, and armament better suited to fighter-versus-fighter engagements (most models had six .50-cal machine guns as opposed to the Zero's two 20-mm cannon and two synchronized .30-cal-class machine guns).

To survive under these conditions, the Navy adopted hit-and-run tac-



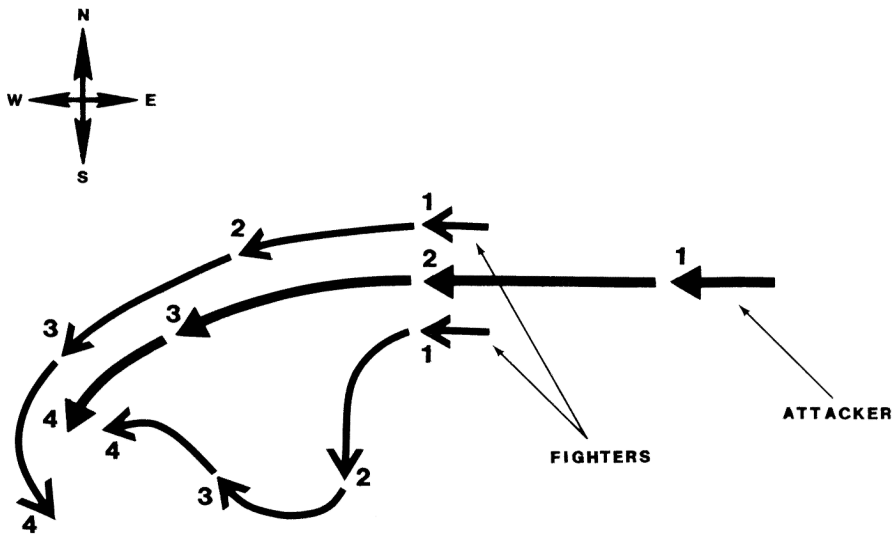


Figure 5-7. The Half-Split (Bogey Attacks Extending Fighter)

tics and relied heavily on teamwork between and among sections of two fighters. The classic defensive tactic of this time was known as the beam defense maneuver or, more commonly, the "Thatch weave," after LCDR John Thatch, who introduced it. Figure 5-8 shows how it worked.

At time "1" the fighters are in a fairly wide (about 1,000 ft for the F4F) combat-spread formation when the northern fighter is attacked. The fighters immediately turn hard toward each other. In the case illustrated the bogey presses its attack on the northern fighter and is met almost head-on at time "1" by the free fighter with all guns blazing. The Wildcat pilots were more than happy to go toe-to-toe with a Zero in this manner because of greater firepower and a more durable aircraft. Navy pilots were also well trained in high-deflection shooting and forward-quarter attacks.

After meeting his wingman (time "2"), the defending pilot uses his superior roll rate to reverse his turn quickly to set up another pass with his wingman, who also reverses. This technique generates repetitive firing passes against the bogey, and it also allows the defender to offer protection to his wingman, should he come under attack by a second bogey. The secrets to this tactic lie in the initial wide line-abreast formation (separation greater than fighter turn radius) and heavy gun firepower. Because of the short-range high-aspect shots provided, this technique would not be appropriate for fighters equipped only with RQ missiles, or even all-aspect missiles, unless they have very good min-range capabilities. In such scenarios, the sandwich or half-split probably would be better. In the situation for which it was developed, however, the Thatch weave was very effective. It could also be considered the forerunner of a new engaged doctrine for fighters known as "loose deuce," which is covered later in this chapter.

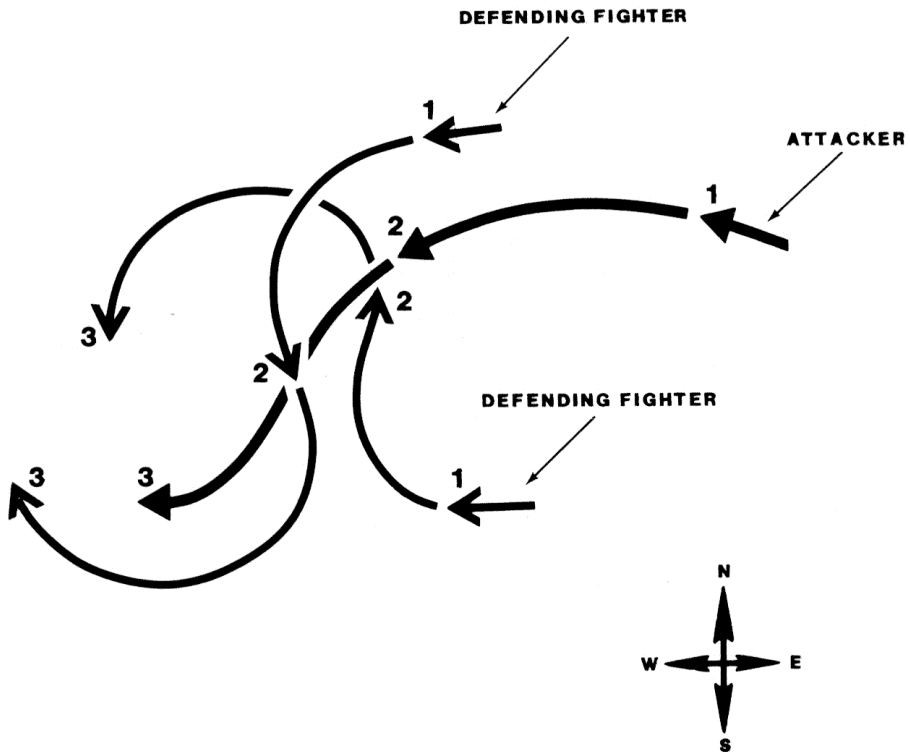


Figure 5-8. Thatch Weave

### *Analysis of Double Attack Doctrine*

Double attack allows two fighters to split for better mutual support. There are still a leader and a wingman, as in fighting wing, but these roles are allowed to change back and forth during an engagement as the situation warrants. After the engagement begins, the leader/wingman relationship becomes one of engaged fighter-free fighter. Offensively, after the initial attack, which can be made by both fighters simultaneously or in rapid succession, the fighter with the greatest offensive potential becomes the engaged fighter and commences one-versus-one maneuvering while the free fighter assumes a cover position. The duties of the free-fighter pilot are to remain in the general area and maintain a visual lockout for other hostile aircraft, but he is not tied rigidly to the engaged fighter, as he is in fighting wing. The engaged-fighter pilot's responsibility is to attack and destroy the target, if possible. If the offensive advantage is endangered, the pilot of the engaged fighter should call in his wingman for help and disengage before becoming truly defensive. The engaged fighter-free fighter roles then reverse, and the engagement continues. Offensively the pilot of the free fighter should attempt to maintain a favorable position from which to attack the bogey if needed, but he should not engage until he is called in by the engaged pilot. The exception to this rule occurs when the engaged fighter becomes defensive. In this case the pilot of the free fighter is obligated to attack the bogey immediately, while the engaged fighter pilot does his best not to get shot. When not in extremis, the defensive

engaged fighter may be able to maneuver so as to make it easier for the free fighter to gain an offensive position, as illustrated in Figures 5-4 through 5-8.

The advantages of double attack doctrine over fighting wing doctrine are considerable. Offensively, it is much more efficient and effective to allow the fighters to split. The bracket attack can be absolutely devastating. In an engagement, the division of roles allows the engaged pilot more tactical latitude than he has in fighting wing. He does not have to be concerned with out-maneuvering his wingman and becoming separated. In addition, he is now free to use either angles or energy tactics as appropriate. By using these methods, a pair of fighters can defeat even a more capable adversary. One pilot attacks the bogey, causing it to bleed energy, until he can no longer maintain an offensive advantage. Then the engaged pilot calls his wingman down to assume the attack and the cycle is repeated. The bogey is forced to fight each fighter in rapid succession and is denied an opportunity to regain lost energy. Meanwhile the free fighter is building energy for a fresh attack. Eventually the opponent is worn down in this manner until he no longer can successfully defend himself. His preoccupation with his current partner may also cause him to lose sight of the free fighter, resulting in a more effective unseen attack on the next cycle.

Defensively, double attack is also superior, particularly in a missiles environment. The wider cruise formations allowable provide better visual coverage of the vulnerable rear hemisphere and give the fighters more maneuvering room to support each other when they are attacked. Greater lateral and vertical separation between fighters also makes it less likely that both will be seen by an attacker. Also, since the wingman is not required to stay behind the leader once engaged, he can more comfortably maintain a line-abreast cruise formation, which provides better visual mutual support. Once the leader is engaged, the free-fighter pilot can be much more effective defensively, since less of his attention is required for maintaining position. The section's option to split when attacked makes it very difficult for a bogey to press an attack on one fighter without quickly being threatened by the other.

Double attack is not all roses, however. This doctrine requires more training, experience, and judgment on the part of the wingman than does fighting wing. Communications are also more critical, especially if the section has not fought together extensively. The lack or loss of a radio, or communications jamming, can hinder coordination and greatly reduce double attack effectiveness. Another possibility that must be considered in a hostile environment is the wild-card bogey. Two-versus-one engagements can quickly become two-versus-two or two-versus-many. If the pilot of the free fighter is attacked and forced to defend himself, the engaged fighter may be left without support at a critical moment, resulting in two one-versus-one engagements. Because of the greater separation between the fighters and their widely varying directions of flight in double attack, it is considerably easier for hostile aircraft to split the section, breaking down the mutual support. For the same reasons, double attack

carries a higher risk of the fighters becoming separated simply through loss of sight.

Although some double attack principles were used occasionally during World War I, the doctrine is generally considered to have been developed during the Spanish Civil War in the late 1930s by Werner Moelders of the German Condor Legion. The installation of radios in most German fighters, the increased difficulty of defending against high-speed attacks from the rear, and the necessity of engaging more maneuverable opponents led to use of the loose pair, which the Germans called the *rotte*. This doctrine provided the Luftwaffe with a considerable advantage over their foes early in World War II, but eventually it was accepted and employed to some extent by most of the Allied air forces, and it survives today as probably the most common air-to-air doctrine in use.

### **Loose Deuce**

Why let rank lead, when ability can do it better?

Commander Randy "Duke" Cunningham, USN

"Loose deuce" is the popular name of a tactical doctrine developed by the U.S. Navy during the Vietnam conflict. Rather than being an entirely new doctrine, loose deuce is actually a rather minor variation of double attack, but its use today is general enough that a discussion of loose deuce is warranted here.

#### *Similarities with Double Attack*

Like double attack, loose deuce is based on a loose, coordinated pair of fighters in mutual support. Pre-engaged philosophy and cruise formations are essentially identical in these two doctrines. Combat spread is probably the most common cruising formation, for all the reasons described earlier. A pre-engagement leader is designated, but once they are engaged the pilots revert to engaged fighter-free fighter roles. Variations on the bracket attack (Figure 5-3) are also the bread and butter of loose deuce. Defensive loose deuce maneuvering is essentially identical to that of double attack, and the techniques illustrated in Figures 5-4 through 5-8 are all relevant.

#### *Engaged Maneuvering*

In offensive engaged maneuvering philosophy, however, the two doctrines diverge. The primary responsibility of the loose deuce free-fighter pilot is to position for his own attack on the bogey, rather than simply covering the engaged fighter. While the offensive double attack free-fighter pilot is primarily defensive, and awaits the engaged pilot's call before attacking, the loose deuce free-fighter pilot is not under any such restrictions. Each pilot is responsible for visually clearing his wingman and himself. The engaged pilot devotes most of his attention to offense, however, and the free pilot's duties are split about fifty-fifty between offense and defense.

The pilot of the engaged fighter in double attack doctrine fights the bogey one-versus-one until he destroys the target or he faces imminent loss of the offensive. Ideally, there should never be two fighters offensively

engaged at the same time. One fighter pulls off the target before the other engages. This is not the case with loose deuce, as the free-fighter pilot constantly works for a favorable attack position and then strikes on his own. This may result in both fighters attacking the target simultaneously, but sustained offensive maneuvering against the same aircraft is to be avoided. Once the free-fighter pilot launches his attack the original engaged pilot usually should disengage to rebuild energy and position for another attack.

There is a peculiar gratification in receiving congratulations from one's squadron for a victory in the air. It is worth more to a pilot than the applause of the whole outside world. It means that one has won the confidence of men who share the misgivings, the aspirations, the trials and the dangers of aeroplane fighting.

Captain Edward V. "Eddie" Rickenbacker, USAS

Although the distinction between double attack and loose deuce may seem minor, it results in some major tactical differences. While in double attack doctrine the pilot of the engaged fighter is expected to get the kill while the free-fighter pilot stays out of his way and cheers, it is more often the free fighter that gets the shot in loose deuce. The engaged fighter sets up the kill by forcing or inducing the bogey to maneuver predictably, thereby making it easier for the free fighter to position for a shot. This is exactly the role of the engaged fighter in defensive situations using double attack, as discussed in conjunction with Figures 5-4 through 5-8. Loose deuce carries this philosophy into the offensive also. This is not to say that the engaged-fighter pilot should not attempt to shoot the bogey if the opportunity is presented, but he should not risk loss of the offensive (e.g., by risking a gross overshoot or by depleting energy excessively) to do so. When he is opposing a fighter of equal or superior maneuverability, this quite often means that the engaged pilot must be less aggressive in prosecuting his attack. A classic example of this is illustrated by the situation shown in Figure 5-9.

In this scenario the engaged fighter has attained an offensive position in the bogey's rear hemisphere, but it is still beyond effective guns range (assume guns only). Double attack doctrine would call for pure and lead pursuit to close to guns range with proper lead for a high-deflection snap-shot against the hard-turning target at time "2" (broken flight path). If this attack is unsuccessful, the engaged fighter will most likely overshoot and lose the offensive. The attacker will probably have bled considerable energy in this high-G attack, and he may even be in danger of becoming defensive if the bogey pilot decides to exploit the overshoot by reversing to initiate a flat or a rolling scissors. At the very least the high-angle, close-range overshoot temporarily takes the pressure off the bogey, allowing the defender the option of reversing, unloading for acceleration, or diving away to escape before the free fighter can take up the attack.

Loose deuce doctrine would dictate a less aggressive approach to this situation. Rather than pulling for an immediate but low-percentage shot, the pilot of the engaged fighter employs pure and lag pursuit instead, to

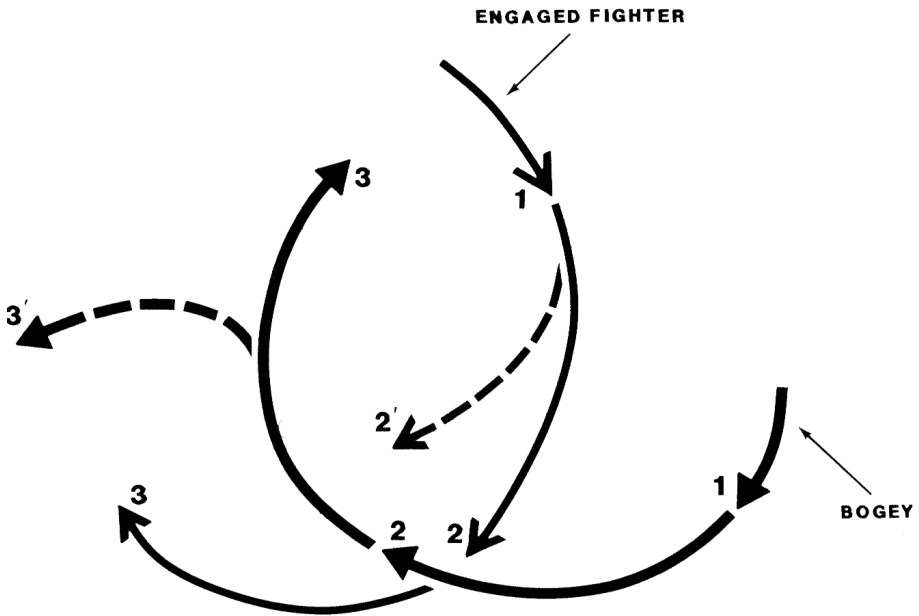


Figure 5-9. Loose Deuce Engaged-Fighter Maneuvering

establish a commanding position deep in the bogey's rear hemisphere (solid flight path). By maintaining increased nose-tail separation with the defender at time "2," the engaged pilot avoids a serious overshoot, preserves his energy, and achieves a temporary lag-pursuit position.

If the bogey pilot reverses after time "2," he subjects himself to a gun attack, as shown by the broken flight path to time "3'." He is therefore encouraged to continue turning in the original direction (solid flight path to time "3"), which makes him predictable for a longer period of time. This predictability may allow the free fighter to position for an unseen attack that is more effective and lethal. As a rule of thumb, the engaged fighter needs to force the adversary through about 360° of predictable turn in order to allow the free fighter a reasonable chance of success, especially when only RQ weapons are involved. Having accomplished this task, the engaged fighter has served its purpose; but if the engaged pilot allows the bogey to change its maneuver unpredictably (possibly because of a premature, unsuccessful attack), the free-fighter pilot's attack plan will be spoiled and the fight will be prolonged unnecessarily. The bogey may also be unpredictable if the engaged fighter does not apply sufficient pressure. The target must be threatened to the point where any significant change in its defensive maneuver will get it shot by the engaged fighter. Applying just the right amount of pressure is the engaged pilot's most critical duty. He should plan and execute the attack with the goal of maintaining this pressure as long as possible, and he should take only those shots which will allow him to maintain that pressure.

This technique has a very close analogy in basketball. The offensive ball handler can attempt to charge through the defense, taking whatever shot at the basket becomes available at the risk of throwing the ball up for grabs, or

he can prosecute his charge only until his path is blocked, then pass off to his wide-open teammate for an easy basket. In double attack, the teammate (free fighter) positions for the offensive rebound, while in loose deuce he looks for an open shot. The ball handler (engaged fighter in loose deuce) sets up the shot by forcing the defense to concentrate on his play for the basket.

The pilot of the free fighter in loose deuce doctrine is responsible for positioning as quickly as possible into a lethal firing position. The first step in this process is to predict the bogey's future flight path and the resulting movement of the lethal weapons envelope. The pilot must then decide on the fastest way to reach this envelope, and maneuver accordingly. This process, which is illustrated in Figure 5-10, highlights the importance of bogey predictability.

At time "1" in this scenario the fighters have bracketed the bogey, which is meeting the southern fighter head-on. The wingman, coming in from the north, has performed a lead turn and has a good offensive bite at the pass, forcing the bogey to turn hard left to defend. Since the pilot of the northern fighter is in the best position to apply pressure, he assumes the role of engaged fighter. Rather than attempting an immediate, high-angle attack, however, the engaged fighter avoids overshooting the defender's six o'clock by easing into a lag position at time "2," pushing the bogey around in a predictable left turn. A reversal by the bogey at this point would subject it to a gun attack by the engaged fighter.

Meanwhile the pilot of the free fighter pulls his nose up into a fairly

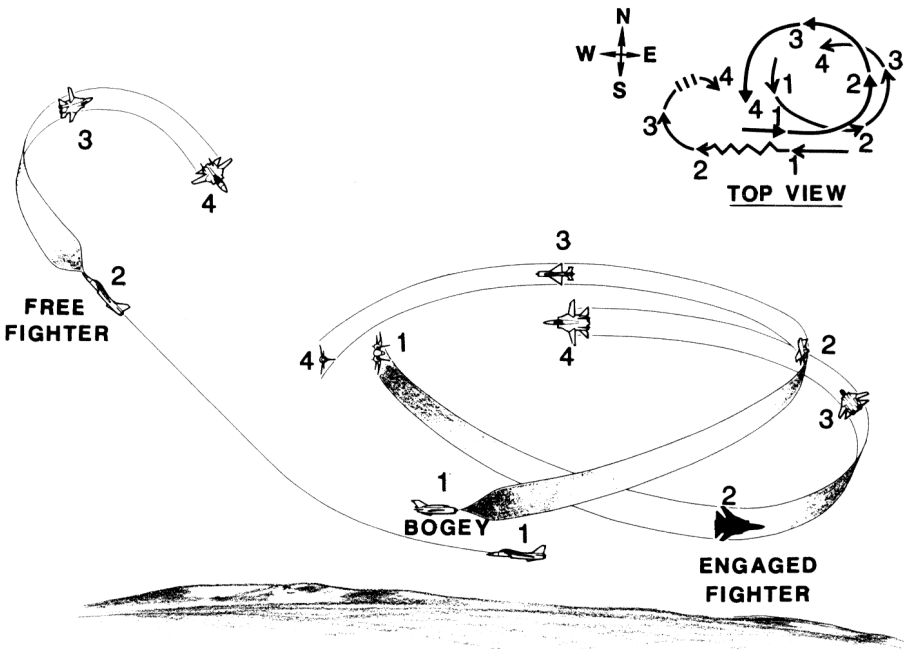


Figure 5-10. Loose Deuce Free-Fighter Maneuvering

steep zoom climb and extends straight ahead. Looking back over his shoulder at time "2," he has a nice view of the fight and can begin to plan his attack. The bogey is in a shallow oblique climbing left turn, and the engaged fighter is pushing it around the circle using lag pursuit in a low yo-yo. If this situation continues the engaged fighter will eventually pull to the inside of the bogey's turn in order to close the range and maintain offensive pressure. If the free-fighter pilot can attack from outside the target's turn, from its belly-side, he will have created a bracket. Therefore, the pilot of the free fighter plays his oblique turn between times "1" and "4" for a high-side gun attack from the bogey's belly-side at time "4." Such a well-planned, unseen attack should have a high probability of success.

Analysis of this engagement shows that the engaged fighter did a good job of maintaining offensive pressure on the bogey, occupying the defender's attention and forcing a predictable turn through about 270°. This gave the free-fighter pilot the necessary time to project the bogey's flight path and position for an effective shot. The free fighter's pull-up at time "1" served several purposes. First of all the straight-ahead extension buys the free fighter some time until the flow of the fight can be determined. If the engaged fighter had overshot at time "1," and the bogey had reversed, the fight could have proceeded to the right instead of to the left as shown. By not committing himself to a left or a right turn immediately at the pass, the pilot of the free fighter has preserved the option of performing an oblique turn either left or right at time "2" to optimize his attack after the engagement has settled into a predictable pattern. The extension also gets the free fighter outside the horizontal bounds of the fight to facilitate a belly-side entry. In addition, extending away from the fight and zooming well up above the plane of the bogey's turn increases the chances that the opponent will lose sight of the free fighter. A small turn one way or the other between times "1" and "2" might be justified if the pilot of the free fighter can take advantage of the sun to mask his attack.

The free pilot's choice of a pull-up at time "1" could also be altered by the weapons available. Positioning above the fight is quite favorable for a gun attack, since the high-side attack offers somewhat greater margin for error and is practiced often. Missile armament, however, leads to other considerations. It might be preferable, for instance, to extend away in a dive at time "1," which would give the free fighter a more desirable look-up shot coming back into the fight, as well as generating more separation from the target for missile min-range considerations. Such a nose-low extension can also hamper the defender's visual problem by removing the free fighter from the bogey's altitude, and possibly by masking the aircraft against the terrain. For a RQ missile attack the free pilot should generally plan to attempt a belly-side entry and a launch as close as possible to 90° off the target's tail on the belly (cold) side. Although this high AOT is not strictly "rear quarter," it may be ideal for missile guidance if acquisition is possible at this aspect. An AAM launched on the target's belly-side tends to stay there through much of its flight, making it unlikely the target pilot will see it. As the target continues to turn away from the missile, more and more of a tail-on aspect is presented, which decreases track-crossing rate and improves fuzing in the end-game. Planning for a 90°



AOT belly-side launch also provides more margin of error, since if the free-fighter pilot is a little late in positioning for the shot he should still have a good RQ firing opportunity.

One other consideration is pertinent in situations where the bogey is all-aspect missile equipped. In the engagement shown in Figure 5-10, the free fighter presents the bogey with a lovely look-up shot at about time "3." The diving-extension option just discussed for the free fighter at time "1" might provide some protection from this situation. Another free-fighter option against an all-aspect missile is to pull up steeply vertical at time "1," loop over the top of the fight, and attack the bogey from high inside its turn, with either guns or all-aspect missiles. This maneuver was depicted in Figure 2-19. Remaining inside the bogey's turn in this way prevents it from pointing at the free fighter for a shot and generates something of a vertical bracket with the engaged fighter coming up from below. It is somewhat easier for the bogey to defend against, however, with a break turn to the left in the general direction of both the antagonists. The free fighter is also more likely to be seen in an attack from the inside (hot side) of the bogey's turn.

At time "2" in Figure 5-10 the pilot of the free fighter chose a right-hand oblique turn as optimum for his attack. This option is known as "counter-flow" because the free fighter is turning in the opposite direction to the general flow of the fight, i.e., free fighter turns right while bogey turns left. This option quite often results in the quickest attack for the free fighter. In this case the free fighter is in position as the bogey completes about 270° of turn. The "in-flow" option, with the free fighter turning left in this case, would have required about 360° of bogey turn for the free fighter to gain a firing position.

Although counter-flow maneuvering is usually quicker, it is also more difficult. During the final stages of the attack (time "3" to time "4"), the fighters approach almost head-on with high closure and rapidly changing target aspect. These conditions make attack timing very critical and lead to a large number of missed shot opportunities. Although the in-flow attack takes longer, things are changing much more slowly in the final phase of the attack, so the approach can be less hurried, with easier timing and greater precision. Generally in-flow maneuvering results in greater separation for missile min-range considerations. Another factor here is maintaining sight of the fight. In this case the counter-flow turn allows the free-fighter pilot to watch the bogey through the entire maneuver. The in-flow option here would have required "kicking the fight across the tail," with added probability that visual contact would be lost, at least temporarily. This is not a general characteristic of in-flow maneuvering, however. In some situations counter-flow turns require pulling the bogey across the tail, so this consideration should be factored into free-fighter attack planning.

#### *Engaged Fighter—Free Fighter Responsibilities*

In summary, the primary responsibility of the pilot of the free fighter in loose deuce doctrine is to kill the bogey as quickly as possible, without placing himself in undue danger. Generally this goal is accomplished most

effectively by keeping sight of the bogey, using the vertical plane, and maintaining a high energy level while maneuvering to the target's belly-side. When convenient, environmental conditions should be exploited to mask the attack (i.e., sun or terrain masking). The free-fighter pilot's secondary responsibility is to maintain visual defensive coverage for himself and his wingman as protection against additional threat aircraft, SAMs, etc.

The loose deuce engaged-fighter pilot, on the other hand, is primarily responsible for maintaining offensive pressure on the bogey to force it into a predictable flight path for the free fighter. If during this process the bogey presents an opportunity, the engaged pilot should not hesitate to blow it away; but, in general, if the bogey can be forced into a predictable flight path, the free fighter will have the quicker chance to reach a lethal position. The pilot of the engaged fighter should employ lead, pure, and lag pursuit, high and low yo-yos, and barrel-roll attacks as appropriate to remain a serious offensive threat for as long as possible without severely depleting his energy. Although the bogey may be induced into a predictable flight path from a defensive position (e.g., the drag technique shown in Figure 5-7), this technique is less desirable since the bogey pilot usually has the option of disengaging or switching his attention from one fighter to the other at critical moments, frustrating or delaying the desired outcome of the engagement. The pilot of the engaged fighter, therefore, should maintain a high energy level and exercise sound judgment as to the amount of offensive pressure that can be exerted without increasing the risk of becoming defensive. Once it is trapped in a serious defensive situation, the engaged fighter becomes more of a hindrance than an asset to the free fighter, especially in slow-speed scissoring conditions, in which the bogey is unpredictable and too near the engaged fighter to provide a safe target. Whenever facing imminent loss of the offensive, or when effective offensive pressure cannot be maintained, the engaged pilot should call his wingman back into the fight and assume the role of free fighter if practical. The engaged-fighter pilot's secondary responsibility is to maintain a defensive visual lockout for himself and the free fighter. Practically speaking, since the engaged pilot will have to devote almost all of his attention to the bogey, his defensive lockout is likely to be very marginal, leaving the free fighter with most of the defensive load. Multiple-crew fighters can be much more effective at this, since offensive and defensive duties can be divided among crew members.

#### *Analysis of Loose Deuce Doctrine*

Loose deuce has some considerable advantages over other doctrines in the two-versus-one scenario. Use of the fighters in a shooter/shooter relationship, rather than in shooter/cover roles, as with double attack, results in much greater offensive efficiency. When a section is fighting a better-turning opponent, double attack doctrine usually requires considerable time to wear down the bogey's energy before an effective firing position can be achieved. Loose deuce, on the other hand, can provide a shot opportunity much quicker, often within only one turn.

Defensively against a single threat loose deuce and double attack doctrines are essentially identical. In a nonsterile environment, however, loose deuce fighters are more vulnerable to attack since the free-fighter pilot's attention is split between offensive and defensive responsibilities. Referring to Figure 5-10, for instance, note how little support the fighters can render each other at about time "2." A "break" call from the wingman in case of a second bogey attack or a SAM sighting is about all the help that could be offered for a considerable period of time with the fighters so widely separated by distance and direction of flight. A good double attack free-fighter pilot, however, would most likely be high above the fight at time "2," inside the bogey's turn, in a much better position defensively.

The only proper defense is offense.

Air Vice-Marshal J. E. "Johnnie" Johnson, RAF

Although double attack might offer a more effective defense against unexpected threats in the two-versus-one nonsterile environment, in some cases the best offense truly may be the best defense. Lack of offensive efficiency in double attack doctrine, particularly when the fighters are opposing a better-turning bogey, prolongs the engagement unnecessarily, thereby subjecting the section to higher risk of attack. In many cases, especially in low- to medium-threat environments, loose deuce maneuvering allows the section to terminate the engagement quickly and rejoin in a good defensive formation before coming under a second attack. A section using double attack doctrine would run a higher risk of being bounced by another bogey, but it probably would be better able to defend against such an attack. In a very high threat environment, however, when even a loose deuce section can expect to be jumped during a two-versus-one engagement, double attack may be the doctrine of choice. Double attack also becomes more viable against a very inferior bogey aircraft or pilot, since the engagement can be terminated quickly.

Communications between fighters is essential for high effectiveness with either loose deuce or double attack. The engaged-fighter pilot in double attack should give the free-fighter pilot as much warning as possible before calling him in to assume the offensive role. Likewise, the free pilot may need to communicate defensive action to the engaged pilot in case of a second attack.

In loose deuce both fighters have defensive duties that require communications. In addition, the engaged pilot should tell his wingman what he is trying to force the bogey to do and how effective he expects to be at this task. Meanwhile, the free-fighter pilot probably has a better picture of the overall situation and often can make the job easier by directing the engaged pilot to influence the bogey's turn in one direction or the other. Defensively this may mean that the engaged fighter drags the bogey in the best direction for the free fighter's position. Offensively the bogey's maneuver can sometimes be influenced by intentional overshoots and by giving the bogey flight-path separation during a forward-quarter pass to induce a turn in the desired direction. All offensive directions by the free-fighter pilot to the engaged pilot are advisory only, however, and the

engaged pilot should not follow any directions that would place him in unacceptable jeopardy.

Another situation calling for rapid communications is when the bogey pilot "switches" his attention from one fighter to the other. Such a switch usually demands a swap in engaged fighter-free fighter roles and should be called out instantly by whichever pilot first sees it. Loose deuce also leads to problems in clearly defining the free fighter-engaged fighter roles, since there are many instances when both fighters are attacking simultaneously. Generally it is the free pilot's responsibility to announce his attack and call for a role switch if he judges himself to be better positioned to assume the duties of engaged fighter. In cases where both fighters remain engaged for any period of time, offensive and defensive efficiency are both impaired. Neither pilot can provide effective defensive lockout in this situation. In addition, the two engaged fighters tend to drift toward the same piece of sky (generally inside the bogey's turn), where they are easy to see and can be fought as one aircraft, much like the situation with fighting wing doctrine. The fighters also tend to get in each other's way, and the danger of midair collisions increases. Double attack doctrine suffers fewer problems in role definition because responsibilities are more clearly divided.

Communications have always been a problem in air combat, and they probably always will be. Much attention is required in training to ensure timely, descriptive, and brief commentary. Personal call signs and standardized brevity codes should be used, and all transmissions by one pilot must be acknowledged by the other. In combat situations there may be hundreds of fighters in the area on the same radio frequency, which can render even essential communications virtually impossible. This situation should be avoided whenever possible by use of several different tactical frequencies (but all fighters in any local engagement area should be on the same frequency), and strict radio discipline must be observed.

Intentional comm-jamming might also be a fact of life in combat, and it is usually accomplished by broadcasting high-power noise on the opponent's tactical frequencies. Jam-resistant radios, very short transmissions, and frequent channel changes may offer some relief. Very low altitude operations may also enhance communications, as terrain may blank the enemy's ground-based jamming transmitters. Quite often two pilots in close proximity will be able to communicate adequately through the noise. This fact, and the somewhat reduced communications requirements of double attack, may favor this doctrine over loose deuce in heavy comm-jamming conditions. Either doctrine is still usable in this environment with practice, but reduced efficiency can be expected of both. Fighting wing doctrine is probably least affected by comm-jamming (intentional or otherwise), but depending on the bogey aircraft, its weapons, and its pilot abilities, fighting wing may not be effective either offensively or defensively.

Some forms of nonverbal communications can also be useful in comm-out or limited-comm conditions. In very close pre-engagement formations, hand signals may be used. In wider formations, coded movements of the leader's aircraft, such as rolls, short repetitive turns, or short climbs

and dives, can be employed for signaling. Other visual signals, such as dumping a little fuel, jettisoning external fuel tanks, and creating burner puffs have also been used. During World War I, before installation of radios in fighters, even color-coded flare pistols were widely employed as signaling devices.

In the air you cannot find a general or a colonel. Who has the most kills, he was the leader. ... It worked very well in the war.

Colonel Erich "Bubi" Hartmann, GAP

The complexities of both double attack and loose deuce doctrine require a high degree of pilot training and experience to be effective. While the wingman in fighting wing doctrine has few responsibilities other than formation flying and defensive lockout, this is certainly not the case in the more advanced doctrines. Particularly with loose deuce, a high level of responsibility, skill, and judgment are required of both pilots. For greatest efficiency members of the section should constantly train, talk, eat, and sleep together. Each team member must know what the other is thinking, what he will do in various situations, his strengths and weaknesses. This intimate knowledge also serves to reduce some of the communication requirements in combat.

One has to know one's flying partner.

Baron Manfred von Richthofen

### **One-versus-Two Maneuvering**

The foregoing discussions have demonstrated the power and effectiveness of two fighters operating in mutual support against a single adversary. But what about the other side of the coin? How can a single fighter survive and even prevail when outnumbered two-to-one? The answer is "Very carefully!" First of all the pilot of the singleton must realize when he is engaging two opponents that he has already broken one of the cardinal rules of air warfare: Do not engage without advantage. This sage piece of advice can be ignored only at great risk. In this case the singleton pilot is outnumbered, so he already has one strike against him and can ill afford another. He must weigh all the tactical factors carefully and attempt to optimize them in his favor.

#### *Offensive Maneuvering*

One should force the battle upon the enemy, not have the battle forced upon oneself.

Major Sholto Douglas, RAF  
6 Victories, WW-I  
(Marshal of the RAF during WW-II)

Surprise and offensive advantage are two of the most important factors to consider. The singleton pilot should stalk his victims carefully and attain a favorable position before committing to the attack. High in the section's rear hemisphere, out of the sun, is a favorite position. From such a perch the fighter may be able to dive on the section unseen, close quickly, and

eliminate one of the bogeys before the section knows what hit it. If he has been successful and is still favorably positioned, the attacker may choose to take on the remaining bogey one-versus-one, or simply dive away and disengage at high speed. If the first attack is unsuccessful, the disengagement option is usually called for. Depending on weapons and environmental considerations, other attacks may also be viable or even preferable, but the high, diving approach has been most successful.

If you have to fight with the eyes only, not with using instruments [such] as radar . . . then the first thing that I do is I go to the sun and I come from the sun as I start my attack. . . . Always with your eyes fly into the sun and never have the sun in your backdoor. . . . That's very dangerous.

Colonel Erich "Bubi" Hartmann, CAF

When preparing to engage a section offensively, the singleton pilot is presented with the choice of which bogey to attack first. Generally the best choice is the more vulnerable bogey, which is usually the one behind in echelon or trail formations. The rear hemisphere of this "sucked" bogey is probably least well guarded visually, making surprise easier. In addition, the "acute" bogey, the one ahead in the formation, will require some time to get turned around and into position to support the wingman. Figure 5-11 depicts the preferred method of attacking an echelon pair.

This figure shows a section of bogeys in echelon formation. At time "1" the singleton closes on the wingman from very nearly six o'clock, probably in a dive to increase closure and take advantage of sun position for surprise, and to provide greater attack speed for possible escape if the attack is detected or is not successful. High six o'clock is a very difficult area to defend, but it may not be optimum for environmental conditions (e.g., high overcast clouds that may highlight the attacker) or weapons, so a climbing

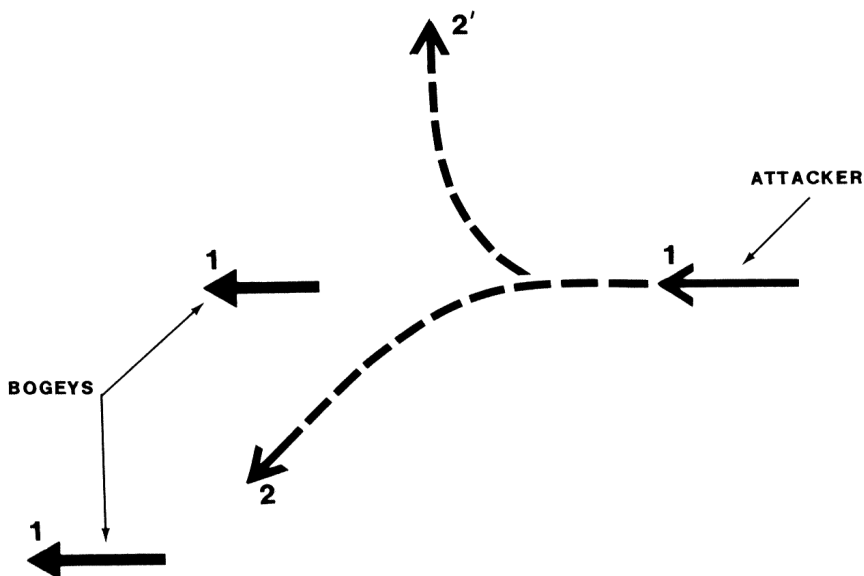


Figure 5-11. Attacking a Section in Echelon

approach may be preferable. One useful compromise is to dive slightly below the bogey's altitude and then attack from low six o'clock in a shallow climb.

Following the initial attack on the wingman, the singleton pilot can assess the situation and decide whether to continue the attack on the leader (track 2) or break away and bolt for home (track 2'). Factors to be considered here are fuel state, the degree of surprise achieved, success of the first attack, and relative performance of the bogey aircraft and their weapons and pilots. Quite often an aggressively flown singleton achieving a surprise attack can so demoralize a hostile section that it completely forgets about its offensive potential and reacts only defensively.

The following engagement describes John Godfrey in his P-47 making an inadvertent solo attack on an unsuspecting pair of German Me 109s which are apparently stalking a formation of American B-17 Flying Fortress bombers ("Big Friends").

When I saw two ME-109's in back of the Fortresses, I peeled off from formation and dived on them. "Shirt Blue Purple One, this is Shirt Blue Purple Two. Cover me. I'm diving on two 109's attacking the rear box of Big Friends. Over."

There was no answer. Looking to my rear I saw that no one was following me, but it was too late for me to change my mind; I'd committed myself to the attack and had to follow through. There was cloud cover down below, and maybe this influenced my judgment. The two ME-109's flew blissfully along unaware of my approach from 8,000 feet above them. Their Number Two man flew to the rear in much the same fashion as we did. For this reason I chose him for my first target, and when his wings touched both outside circles of my ring sights, I let him have it. Strikes appeared all over the plane and suddenly his engine was smoking. Still flying faster than the leading ME-109, I banked into him and pressed the firing button again. Strikes all around, but still he flew on. I straightened into line astern of him and fired again. Bits of his plane were breaking off. With my finger pressed firmly on the firing button I watched the frantic efforts of the pilot as he stood up in the cockpit and threw himself over the side, his body hurtling by me. I pulled my plane up and slowly my air speed slackened<sup>3</sup>.

As explained, the combat-spread or line-abreast formation normally offers the fighter section the best defensive lockout and maneuvering potential. Attacking a combat-spread section is therefore somewhat more difficult. Again, stalking the prey is in order to reach a favorable position before attacking. In this case there is no trailer to pick on, but some areas are generally more vulnerable than others. For instance, since the wingman's primary duties are to maintain position with his leader and visually cover the leader's rear hemisphere, this area is usually well defended. The leader, on the other hand, is often burdened with navigational and offensive responsibilities and does not have to watch the wingman so closely to maintain position, so the wingman's rear hemisphere is normally less well guarded. Singling out the wingman in a combat-spread formation is not always easy, but, given a little observation time, the attacker can usually determine the wingman's aircraft as the fighter that maneuvers more

radically in an apparent effort to scramble back into position after a section change in direction.

Quite often there will be some altitude split between the fighters, and typically the wingman will be the higher of the two, allowing himself some energy margin which can be useful for maintaining position during heavy maneuvering. When performing a diving attack, it is usually preferable to hit the high bogey first, since it will take the low bogey longer to be a threat because of its lower energy level. Diving on the high bogey also allows the momentum of the attack to carry through the first target and down onto the second. Additionally, this technique prevents the attacker from ever being co-altitude with either bogey prior to the attack, which reduces his chances of being seen. Bogey visual lockout is normally best in their altitude band.

As in most aspects of tactics, there is some difference of opinion about whether to attack the leader or the wingman of a section.

If you attack a formation . . . that is deployed ... so that the risk in attacking any one aircraft is equal, always take a crack at the one who appears to be leading; he may be a big shot!

Group Captain Reade Tilley, RAF

The leader in most cases will be more experienced and more dangerous, and therefore he will be the more valuable target; but he is also likely to be harder to surprise. It is true that once the section leader has been eliminated the wingman should be less effective as a single, making a double score easier to achieve. If this particular leader keeps losing wingmen, however, he will not be a leader very long, and he can be picked off after he has been demoted to wingman.

The peacetime qualifications for promotion—age and seniority—do not apply in war.

Air Vice-Marshal J. E. "Johnnie" Johnson, RAF

All else being equal, an attack from the right side of an enemy section is often most effective. This is because the usual right-handed cockpit control configuration of most fighter aircraft makes it more difficult for the pilot to twist around to the right than to the left for visual lockout. Defensive break turns to the right are also usually a little slower, for the same reason.

Always attack a lone enemy fighter from slightly to starboard of dead astern, as 95% of all pilots keep a better lockout to port, as it is natural to turn both the aircraft and body to the left.

Group Captain Reade Tilley, RAF

When it is necessary to attack a section from below, the lower bogey is normally the target of choice. It must be recognized, however, that the higher bogey will have greater energy than the target and can become a threat much faster. A climbing attack normally should not be made unless the attacker can maintain a significant speed margin over the bogeys. Even so, the singleton pilot should not plan to stay with the low bogey for more than a quick, slashing attack before turning his attention to the high bogey.



Figure 5-12 illustrates one method of attacking a section in combat spread. In this scenario the bogey section is in combat spread, with the wingman stepped-up on the right flank. At time "1" the fighter dives on the wingman from a position high and slightly outside the section. Aside from the reasons already discussed, an attack from outside the section on the wingman's side was chosen here for several other reasons. First, this area receives less visual attention from the pilot of the target aircraft, since his primary area of responsibility is inward, toward the six o'clock region of the leader and the section as a whole. Second, such an approach increases the range between the attacker and the section leader on the far side of the formation and presents him with a reduced aircraft profile, both of which limit the chances of the attacker being detected by the leader. Third, this angle of approach provides good visibility of both bogeys throughout the attack.

Always above, seldom on the same level, never underneath.

Major Edward "Mick" Mannock, RAF

In this example the attack is detected just as the fighter approaches maximum missile-firing range, and the target breaks. If possible, the attacker should put a missile in the air at this point, even if he is still out of parameters, just to give the target bogey something to think about other than mutual support. Whether the initial attack succeeds or not, the dive will carry the attacker through the section and down toward the next target (or threat). In this case both bogeys break into the attack, allowing the fighter to slide down onto the leader, who has been thrown into trail. This is a very advantageous situation for the attacker, since he can now work on the leader while keeping track of the wingman on the same side of the aircraft. The wingman's position out in front will leave the singleton

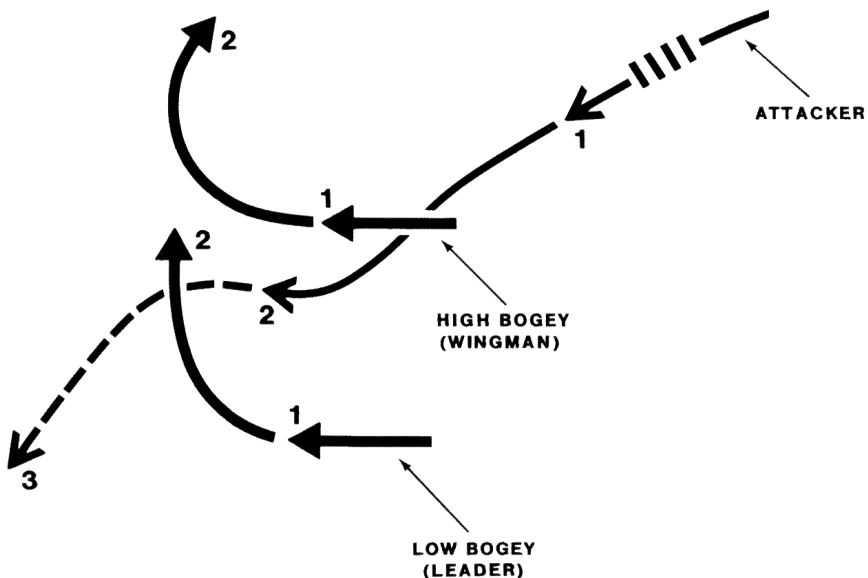


Figure 5-12. Attacking a Section in Combat Spread

pilot with considerable time to hammer the leader before having to worry about the second threat. Time "2" also presents an ideal escape situation in which the attacker can reverse and dive away, out the six o'clock of both bogeys (track to time "3").

It is well if you are against odds never to stay long after one machine.  
Lt. Colonel W. A. "Billy" Bishop, RAF

Figures 5-6 and 5-7 illustrated the half-split, one of the most effective counters offered by double attack and loose deuce doctrines against such an attack. Figure 5-13 shows one technique the attacker can use in response to the half-split defensive maneuver. Here the initial setup is identical to that of Figure 5-12. Once again the attack is detected at time "1," and the target bogey breaks into the attack. Again the attacker should put a missile in the air at this point, since he has obviously been seen and no longer needs to worry about the missile smoke giving away his location. Even if it is fired for effect at this point, a weapon in the air gives the attacker a great psychological advantage, assuming of course that his weapons load allows such an expenditure. A target under missile attack also is likely to dissipate much more energy in its defensive maneuver, making it less of a threat later on.

The pilot of the southern bogey (the leader in this case), determining that he is not immediately threatened, extends to gain separation from his wingman. Rather than pressing for a gun pass on the original target or breaking away toward the second bogey as in Figure 5-12, the attacker eases into a lag position on the northern bogey while keeping an eye on the

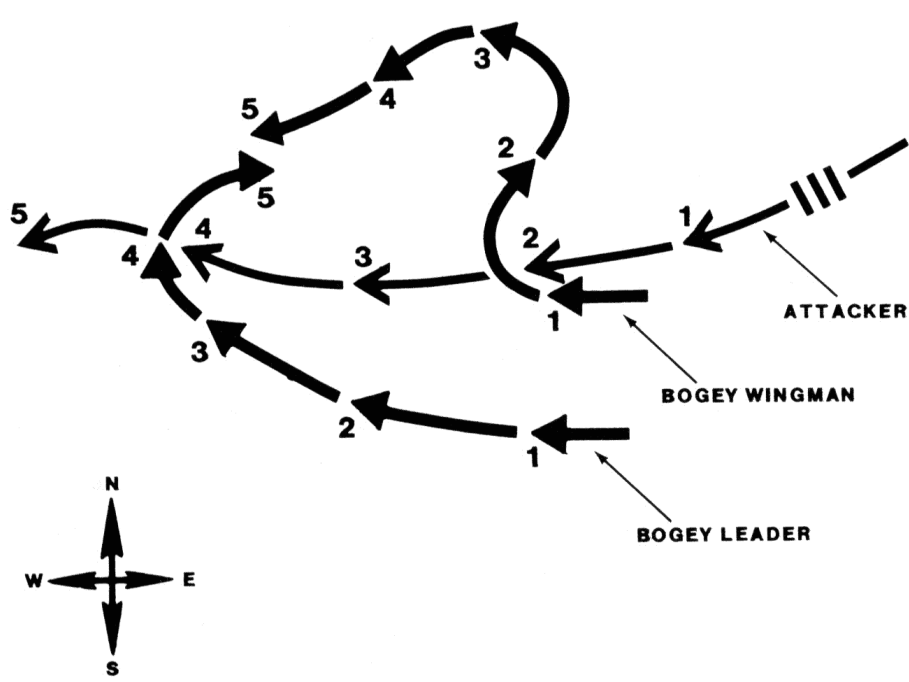


Figure 5-13. Countering a Defensive Half-Split

southern bogey. At time "2" the attacker is still not committed to an overshoot of the original target, and he has created some confusion as to which bogey is being threatened. Is the attacker really pursuing the southern bogey, or is he merely establishing a lag position on the northern one? An unloaded condition, or a slight turn with a steep bank toward the northern bogey, may make this feint more effective, as long as the other bogey can be kept in sight. When the attacker is gun equipped, this lag position can be very threatening to the northern bogey, since a reversal of its turn direction at this point could subject it to a gun attack with the wingman possibly too far away to offer any help. If the attacker is only equipped with missiles, this ploy may be less credible, but it can still be effective.

At time "2" the northern bogey has turned its tail to the wingman and is opening very rapidly. With great separation in both distance and direction of flight, it will be some time before the northern bogey can be of any assistance to the leader. At this point the attacker switches targets and pursues the second bogey, whose pilot continues to drag and calls for his wingman to reverse for a bracket. Unfortunately for the bogeys, the split has generated so much separation by this time that the wingman cannot get back into the fight soon enough. Between times "3" and "4," the attacker makes a gun or missile run on the second bogey and then reverses, exiting the engagement at time "5." The attacker should realize that between times "2" and "4" he will be bracketed and most probably will lose sight of the first target while concentrating on the second. He should, therefore, be aware of his tenuous situation and be careful not to press his second attack too long or turn so much that he is drawn back toward the first bogey, where escape may be doubtful. Note that time "5" has the bogeys meeting almost head-on with their mutual support broken down and the section in general disarray. It will be some time before these bogeys can rejoin in an effective defensive formation to guard against further attacks.

Time "2" in the foregoing engagement is a critical one. The attacker's switch at this point puts maximum strain on the bogeys' coordination. Should the northern bogey not execute a reversal at this time, it would be stranded way out in right field, even farther from the action.

In summary, when the pilot of a single fighter attacks a section he should seek the element of surprise. A rear-hemisphere attack on the more vulnerable bogey is usually optimum. The attack should be planned so that each bogey can be threatened in turn, with minimum threat to the attacker by the other bogey. If the attacker is detected, maximum confusion should be generated by weapons firings and switches at critical moments. Both bogeys should be kept in sight if at all possible, and concentration on any one bogey must be kept to a minimum. If the bogeys remain in welded wing, they might be engaged as a single adversary, with the wingman the more likely target. When the bogeys employ an effective split, however, it is generally not in the singleton's favor to engage in prolonged combat. In this case the attacker should attempt to avoid a bracket by keeping both bogeys on one side of his aircraft, and he should plan to hit

and run unless one bogey is destroyed quickly or the singleton has a significant advantage in weapons, performance, or pilot training.

*Defensive Maneuvering*

Generally speaking, unless the single fighter has a tremendous performance or weapons advantage, prolonged maneuvering with a section of well-coordinated opponents can be very unhealthy and is not recommended. The element of surprise and an offensive advantage should be sought in an effort to reduce the odds quickly to a more manageable one-versus-one situation. If this goal cannot be achieved, the object of the singleton pilot should be to disengage and live to fight another day.

Speed is life.

Israeli Tactics Manual

The luxuries of surprise and offensive advantage are not always available, however, so the well-dressed fighter pilot should have some techniques in his wardrobe to survive an attack by an adversary section until an escape opportunity can be generated or until help can arrive. The general theory here is to keep both bogeys in sight, or to have one in sight and have a good idea of the other's position and threat potential, and attempt to avoid critically defensive situations. As a rule, energy should be conserved religiously, but there are occasions when energy must be traded for position. The following examples should serve to illustrate some of these techniques.

In Figure 5-14 the single fighter is approached by a hostile section that begins an offensive split north and south at time "1" in an attempt to bracket, as shown in Figure 5-3. The singleton pilot picks one side of the enemy formation and turns sharply (but not depleting energy) in that direction, trying to get outside the bracket (time "2"). In choosing a turn

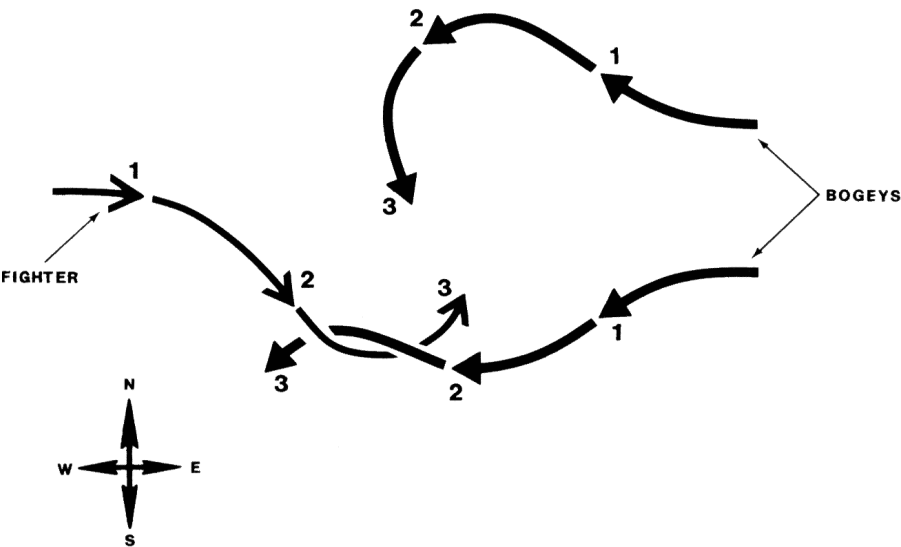


Figure 5-14. Defending against a Bracket: Case 1

direction, the singleton should generally pick the side of the closest hostile fighter, if there is any discernible difference in range. In response to this tactic, the near bogey must continue heading away from its wingman in order to achieve a bracket. The wingman will require some time to react to the situation and begin his turn back into the action. By this time (time "2") the northern bogey has been left somewhat out of the fight as the other bogey drags away from it, so that the singleton will pass the southern bogey long before the wingman can get into a RQ firing position.

As the situation is developing, the pilot of the singleton must watch the northern bogey carefully to observe its reaction. If this bogey pilot reacts quickly, he may be able to gain an effective offensive position before the singleton passes the southern bogey. This may require the singleton to come back left again to negate the attack from the north. In general, switching to the northern bogey should be delayed as long as possible without allowing it to gain too much position advantage. Just how much is too much depends on relative fighter performance and the bogey's weapons. If the singleton pilot can delay until he is passing outside the southern bogey, this bogey is likely to turn south (nose-to-tail with the singleton), placing the bogeys in trail (time "3"). Allowing the first bogey some flight-path separation at the pass may induce its pilot into turning south, as shown. Now the singleton can come hard back left to negate the wingman's attack from the north. If the bogeys have all-aspect missiles, the singleton pilot should be prepared to make a defensive maneuver at about time "3." At this point the singleton is no longer in any immediate danger from the first bogey and can concentrate on defending against the second. If the second bogey has not been allowed a significant offensive position advantage, its attack can be defeated and the singleton should be able to disengage before the first bogey can return to the fight.

Allowing the first bogey a small offensive advantage at the pass induces it to initiate an engagement turn. Subsequently, the pilots of both bogeys are likely to consider their roles to be that of "engaged fighter," causing confusion and reducing the efficiency of either double attack or loose deuce maneuvering. When the bogeys can be induced into turning in the same direction like this, both their offensive and their defensive mutual support is poor.

A tactic the 109s are very keen on is known as "Boxing." 109s come over top and split into two groups, one on either side of you. Suddenly one group will peel down to attack from the beam. You turn to meet the attack, the other group come in and sit on your tail. If you are leading a section or squadron you can fox them easily by detailing half your force to watch one side and half the other. When you are alone and two box you, it's easy providing you work fast. As the first one starts his dive, chop the throttle, yank the nose around, fire a quick squirt in front of him, then skid into a sloppy half roll, keep the stick well back, and pull out quickly in a skidding turn. The second 109 will have lost sight of you beneath his wing. You should be in a good position to pull up and give him a burst at close range.<sup>4</sup>

A very well coordinated bogey section, however, often can prevent the singleton from getting outside the section at the pass. This can be done

when the pilot of the free bogey (northern bogey in this case) reacts quickly to the single fighter's turn away from him. Figure 5-15 shows this situation. As in the previous scenario, the bogey section splits at time "1" and the fighter responds with a turn to the south. This time, however, the northern bogey reacts quickly, turning back to close the singleton and apply immediate pressure. If the defender continues in his attempt to get outside the southern bogey, the northern bogey will achieve a very threatening position. Again the defender delays as long as possible, and then turns hard left to negate the attack of the northern bogey (time "2"). In so doing, the singleton must turn away from the southern bogey, giving it lateral separation and probably some position advantage. In this case the pilot of the southern bogey chooses to take advantage of this lateral separation, turning across the fighter's tail and arriving in a nose-to-nose position at time "3."

The singleton's situation at time "3" is heavily dependent on the weapons involved and the relative performance of the aircraft. When the singleton is faster, it may be able to escape, as shown by the broken flight path to point "4'." If the singleton is slower, the defender may not have the option of escaping, but his fighter's very lack of speed and probable turn-radius advantage can be used to pounce on the engaged bogey (the original southern bogey), which has turned nose-to-nose. The free bogey (original northern bogey) overshoot and has been spit out of the fight. This gives the singleton pilot a considerable amount of time to concentrate on the engaged bogey before the free bogey can become a threat again. A gun would be very valuable to the singleton in this situation, since this weapon would probably yield quickest results against the engaged bogey in the flat or rolling scissors that is likely to develop. The singleton's task here is to destroy the engaged bogey quickly, but in so doing it should not get so slow that defense against the free bogey becomes impossible. The pilot of the

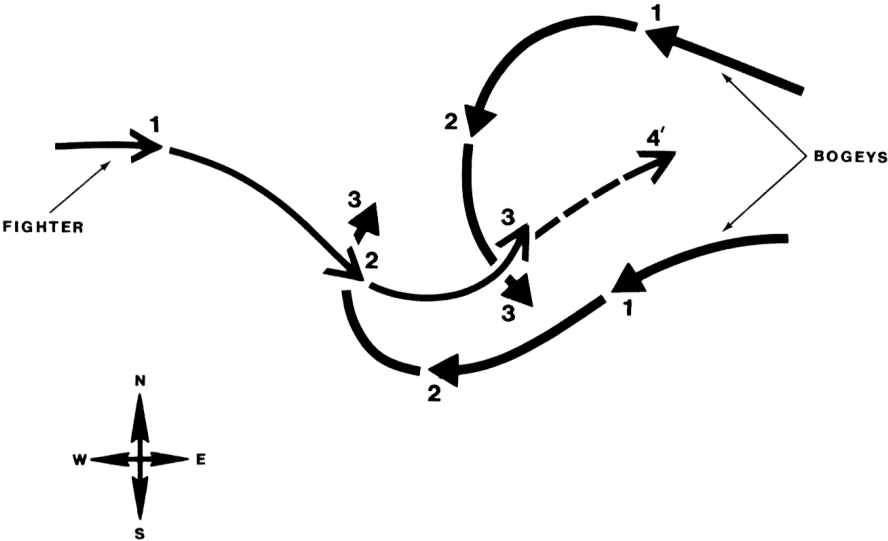


Figure 5-15. Defending against a Bracket: Case 2

single fighter also desperately needs to reacquire and track the free bogey visually. This may be difficult, since sight will most likely be lost temporarily at the overshoot occurring at time "3," but reacquiring sight is important for determining the point at which the singleton must switch off the engaged bogey and defend against the free bogey.

Even if the free bogey is not visually reacquired, however, its pilot's task is not a simple one. He has a long way to go to rejoin the fight, and an engaged bogey pilot who is fighting for his life cannot make the single fighter predictable. The free bogey will also likely have a large speed advantage as it reenters the action, which makes attack timing critical and difficult for its pilot. In addition, guns tracking an aircraft in a scissors, particularly a rolling scissors, is next to impossible, and lobbing a missile into a slow-speed scissors is like flipping a coin to decide which aircraft is the target.

A kill is a kill.

Anonymous

Figure 5-16 shows how the singleton pilot might respond to the free fighter's attack later in this engagement. At time "4" the singleton has gained a good advantage on the engaged bogey in the scissors but has not been able to deliver the coup de grace. Meanwhile the free bogey is reentering the fight from the south. The pilot of the single fighter sees the free bogey and determines that a reversal to continue the scissors would place the attacker at too great an advantage. Therefore the singleton switches off the engaged bogey to defend against the free bogey, generating an overshoot at time "5." At this point the defender has the option of attempting an escape (the broken flight path to point "6'") or continuing the engagement by reversing as shown by the flight path to point "6." Against much faster bogeys the first option may not be available, and if it is attempted the defender must watch the bogeys carefully to determine whether they have had enough or intend to press their attack. The second option is essentially a repeat of the previous phase of the engagement; namely, hassling one bogey (in this case the one that just overshot) while keeping track of the other.

If all-aspect missiles are carried by the bogey fighters, they can make switches such as that shown in Figure 5-16 very hazardous. In this case close proximity to the engaged bogey may be the singleton's best protection against the free bogey. The engaged bogey might be used as a shield until the free bogey reaches min-range for its missile, and then the singleton can perform a switch more safely.

The F-4 had a hotter afterburner heat source than the MiGs, and with both MiG and wingman in my sight, it was difficult to fire, lest the missile kill my "wingie."

Commander Randy "Duke" Cunningham, USN

Returning to Figure 5-15 for a moment, and assuming the bogeys are more maneuverable but slower, the singleton simply cannot afford to get tied up one-versus-one with the engaged bogey as just outlined. Success in

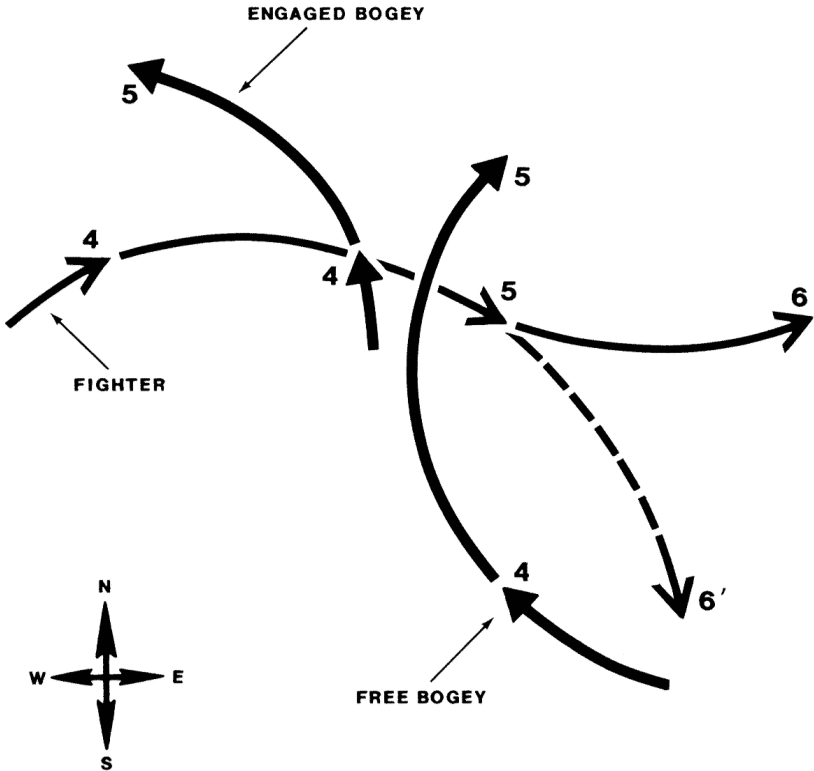


Figure 5-16. One-versus-Two Engaged Maneuvering

such an endeavor requires energy tactics. As described in earlier chapters, energy tactics involve a rather protracted process of very predictable turns to deplete the opponent's energy, then some sort of zoom climb at a critical moment to convert an energy margin into a position advantage. Against bogeys using double attack doctrine, this process may be allowed to continue for a while, since the engaged bogey usually will appear to be winning the fight in the early stages. The free bogey in this case can be expected to stay out of the fight, but it will have the opportunity to conserve its energy. Energy tactics require the pilot of the singleton to devote very close attention to the engaged bogey and his own performance, which hinders keeping track of the free bogey. When the proper time for the zoom is reached, the high-energy free bogey may very well be in a position to threaten. Almost superhuman technique and lots of luck would be required for the pilot of the single fighter to time his zoom consistently so as to be immune from both bogeys. Bogey missiles make this process even more hazardous, as the bogeys' look-up shots against a very slow speed target are likely to be superior to the singleton's look-down opportunities. It is also very difficult to mask an aircraft in the sun against two widely separated bogeys.

If the bogeys employ loose deuce techniques, the very predictability and time involved in energy tactics will usually allow a well-flown free bogey to reach an effective offensive position, often undetected. In light of these realities it is not recommended that the high-wing-loaded fighter attempt



prolonged engagement with any one aircraft of a bogey section. Instead the singleton pilot should maintain high energy and use his aircraft's superior speed to separate from the fight whenever the opportunity is presented. Time "3" in Figure 5-15 is such a point, following successive forward-quarter passes with both bogeys. The high-T/W singleton may be able to extend away from both bogeys (broken flight path to point "4"), taking care to watch at least the more threatening opponent, probably the one on the left (original southern bogey) in this case. Against guns-only bogeys, escape may be possible here. When the opponents are missile equipped, however, it soon may be necessary to defend against a weapon, pass through the bogeys once more, and attempt another extension. This process can be repeated (i.e., attempting to get outside a bracket and passing each bogey in turn as nearly head-on as possible) until the singleton can escape ... at least theoretically. Problems most often arise when the singleton pilot temporarily loses sight of one of the bogeys and then is seriously threatened. Maintaining adequate energy is another problem, especially when a singleton is required to defend against hostile missiles. In addition, limited combat endurance may force an escape attempt under less than optimum conditions.

In a scenario in which the single fighter has a very great T/W advantage over bogeys that are not equipped with all-aspect missiles, the pilot of the single fighter might choose to remain offensively engaged by employing extension/pitch-back tactics as described in the last chapter (Figure 4-7). As long as both bogeys can be kept in sight, the singleton pilot may be able to make repeated passes through the hostile section at high speed, taking forward-quarter gun or missile shots as they become available.

### *Summary of One-versus-Two Maneuvering*

Although one-versus-two is certainly not an attractive scenario, there are numerous examples throughout air combat history in which a single aggressive, well-flown fighter has successfully made a shambles of an enemy formation. The necessary ingredients include attaining an offensive advantage by a surprise hit-and-run attack, maintaining high energy, and knowing when to disengage. When he is caught in neutral or defensive situations, the singleton pilot should maneuver to avoid brackets by keeping both bogeys on the same side of his aircraft, try to keep track of both opponents, maintain high energy, and watch for escape opportunities. Forced to maneuver against two well-flown adversaries, the pilot of a single fighter must be particularly aggressive in an attempt to cut the odds quickly. Engagements prolonged by tentative maneuvering inevitably lead to more serious defensive situations for the singleton.

### **Notes**

1. Grover C. Hall, *Ji., 1000 Destroyed*, p. 209.
2. John T. Godfrey, *The Look of Eagles*, pp. 107—8.
3. *Ibid.*, pp. 83-84.
4. Group Captain Rcade Tilley, "Fighter Tactics," *USAF Fighter Weapons Review* (Summer 1981), p. 10.