6

Section Tactics, Two-versus-Two

The advantages of mutual support and the potential effectiveness of section maneuvering were detailed in the last chapter. The recognition of these benefits in air combat has become nearly universal, so that the pair has been a part of the fighter doctrines of the air forces of most nations for some time. Although many doctrines prescribe pre-engagement formations of more than two fighters, most notably divisions of four aircraft, once they are engaged these divisions normally split into elements of two aircraft, and their pilots attempt to coordinate their maneuvering and provide for mutual support. In most cases these pairs also attempt to cooperate with the other section or sections within their original division. This technique is investigated further in the next chapter.

Since the pair has become so widely employed, combat between hostile sections is quite common, and therefore training for this scenario is of great importance. This chapter is devoted to the elements involved in employing one fighter section against another; but before diving into the attack on this subject, a few general comments are in order.

Human Limitations and Task Loading

> The guy you don't see will kill you.
>
> Brigadier General Robin Olds, USAF

Although the tactics discussed here are based on many of the same principles that were introduced in the previous chapter, on two-versus-one maneuvering, in practice the addition of one more aircraft to the equation makes a world of difference. The reason for this is human limitations. Most people can handle one job at a time. Many highly skilled and well-trained people (it is hoped that this group includes fighter pilots) can accomplish two tasks concurrently. In air combat this might include maneuvering against a bogey while keeping track of a wingman's position and providing him with some visual defensive coverage. For the two-

versus-one free-fighter pilot, depending on doctrine, the tasks include controlling and positioning his own aircraft with respect to either the bogey or the engaged fighter and keeping track of the other aircraft (not to mention checking his own six). To be manageable, this task loading requires extensive training.

The two-versus-two scenario further complicates matters with the addition of a second bogey aircraft that also requires monitoring. This gives each pilot three aircraft to watch during heavy maneuvering while maintaining some facade of a defensive lockout for additional bogeys. Result: Overload! Even in the sterile environment, very few fighter pilots handle this task loading consistently, regardless of the amount of training they receive, a fact that is quite disturbing considering the likelihood of this scenario in combat.

> [Like] nearly all other pilots who come face to face with the [enemy] in the air for the first time, I could hardly realize that these were real live, hostile machines. I was fascinated by them and wanted to circle about and have a good look at them.
>
> Lt. Colonel W. A. "Billy" Bishop, RAF

Human reaction under conditions of task overloading is a well-established phenomenon. First the operator devotes less attention to each task in an attempt to complete them all. At some point, however, this process leads to neglect of one task, which renders the operator ineffective in that area. Depending on the perceived relative importance of each task, the operator then must either concentrate on the completion of one task to the detriment or exclusion of the others, or drop it altogether in favor of a more critical task. The longer this overload condition exists the more tasks are discarded to allow the operator to concentrate on the perceived most critical element, eventually resulting in what might be called "task fixation." Beginning instrument flight students can easily relate this process with the tendency to fixate on one aircraft instrument to the exclusion of all others during hectic moments of blind flying. Add to this situation the stress of air combat, and the predictable result might be described in layman's terms as "Going to hell in a handbasket."

> He who gets excited in fighting is sure to make mistakes.
>
> Baron Manfred von Richthofen

What can be done to reduce the impact of these recognized human limitations? The most obvious route is through constant training and practice, so that the pilot becomes proficient at each task of his mission and can accomplish each one with less attention and effort, thereby leaving more time for the others. Standardized procedures and habit patterns can also play an important part here by allowing the pilot to perform certain portions of the overall mission "automatically" while he devotes brainpower elsewhere. This is where a firm foundation in the basics of aircraft maneuvering and one-versus-one tactics is vital. The pilot simply does not have time to be thinking about optimum techniques of turn and acceleration, or whether the situation calls for a high yo-yo or a barrel-roll

attack, if he is to have brainpower remaining for the other elements of his mission. The less concentration the juggler must spend on any one object, the more balls he can keep in the air for a longer period of time. Unlike swimming and bicycle riding, however, the skills required for success in multi-aircraft combat are lost quickly and must constantly be practiced if they are to be retained.

> He must be able to loop, turn his machine over on its back, and do various other flying "stunts"—not that these are actually necessary during a combat, but from the fact that he has done these things several times he gets absolute confidence, and when the fight comes along he is not worrying about how the machine will act. He can devote all his time to fighting the other fellow, the flying part of it coming instinctively.
>
> Lt. Colonel W. A. "Billy" Bishop, RAF

Overloading can also be curtailed by reducing the number of tasks that each pilot must perform to accomplish his mission. To some degree this is the basis on which all the previously discussed mutual-support tactical doctrines are built; namely, division of responsibilities. Using fighting wing doctrine in a two-versus-two encounter, for instance, allows the leader to fight one bogey while keeping track of the other: only two major tasks. The wingman meanwhile must only fly formation and maintain a defensive lockout: again, only two tasks. Tactics, however, are a two-way street, in that the adversary's tasks are also affected. In this case the use of fighting wing by one section reduces the number of aircraft which must be watched by the opposing section, since both fighting wing aircraft remain close enough together to be considered as one unit. This tactic, therefore, makes the job of the opposing fighters easier, and it might be self-defeating. Obviously the choice of tactical doctrine must be based on all known and expected factors, and in many cases on assumptions and conjecture, as well.

A second method of reducing the pilot's task loading is through the use of multi-crew aircraft. A second crewman in each fighter may be able to cover some of the tasks of the pilot during combat, such as keeping track of one bogey aircraft or performing defensive lockout duties for his own fighter or for his wingman. Design and employment of multi-crew fighters does have tradeoffs, however, since these are usually larger, more complex, and more expensive aircraft, and they often have reduced performance relative to single-seat fighters.

Another strategy for minimizing pilot overload is to make each task necessary in air combat as easy as possible. This is largely a function of aircraft and weapons-system design. Every task is composed of a great number of subtasks, each requiring some of the pilot's time and attention. Reducing the number and difficulty of these subtasks makes the whole job quicker and easier, freeing the pilot to "keep more balls in the air." Desirable features in fighter design include good handling qualities in all operating regimes, dependable engines that can take abuse, unrestricted cockpit visibility, and clear, dependable communications. Factors such as these are often overlooked by designers, but they may be every bit as

important as the more widely recognized predictors of fighter-aircraft combat effectiveness such as turn, climb, and speed performance. This is especially true for multi-plane engagements. Another very important factor in this environment is relative aircraft size and the effects of camouflage on visual detectability. Obviously the fighter pilot would prefer to be flying the smallest thing in the sky in order to make the opponent's visual acquisition and tracking tasks as difficult as possible.

In the area of weapons systems, effective envelopes and lethality are two of the most important factors. All-aspect capability is desirable, since this can greatly reduce the maneuvering required to attain a firing position. High lethality is necessary because the fighter must be able to destroy the target at the first opportunity. The price of the time and attention necessary for a second attempt may be unacceptably dear in the hostile combat environment. Other, less obvious, factors include weapons-system delays, such as gunsight and radar settling times, which should be minimized; and relaxed aiming requirements (i.e., off-boresight guided missiles). Weapons-system operating switches should be minimized, and design and placement should enable the pilot to manipulate them without looking inside the cockpit or taking his hands or feet off the aircraft controls. In addition, the pilot benefits if all readouts and information necessary for full operation of the aircraft and the weapons system are displayed so that his eyes can remain outside the cockpit constantly during an engagement.

> I will not say that I fought this action ideally, but I led my formation to a fairly favorable firing position. Safety catch off the gun and rocket switches! Already at a great distance we met with considerable defensive fire [from the bombers]. As usual in a dogfight, I was tense and excited: I forgot to release the second safety catch for the rockets. They did not go off. I was in the best firing position, I had aimed accurately and pressed my thumb flat on the release button—with no result. Maddening for any fighter pilot!
>
> Lt. General Adolph Galland, Luftwaffe
> (During his last combat engagement,
> after eight years of combat and 104 victories)

Regardless of training or attempts to minimize the number and difficulty of the fighter pilot's tasks in combat, he is still likely to reach a saturation point if he is exposed to the difficult two-versus-two environment for an extended length of time. Just how long the pilot can keep all the balls in the air depends on all the factors discussed here and many more. This length of time can also change daily, depending on the pilot's physical and mental conditions, weather, etc. Once overload is reached, another length of time will pass before calamity, such as one fighter being attacked by an unseen bogey, results. In recognition of the fact that this result is only a matter of time, tactics should be devised with overload in mind. For example, when the fighter section anticipates it will be overloaded long before the bogeys are (e.g., because of pilot experience level, relative aircraft design, or relative aircraft size), hit-and-run tactics might be adopted to limit exposure to the two-versus-two environment. Or the section may plan to begin the engagement offensively and aggressively,

with the hope of quickly reducing the odds, and then make the transition to a more conservative, defensive posture as the anticipated point of overload is approached.

> 1 scooted for our lines, sticky with fear. I vomited brandy-and-milk and bile all over my instrument panel. Yes, it was very romantic flying, people said later, like a knight errant in the clean blue sky of personal combat.
>
> "W. W. Wmdstaff," RFC
> Anonymous American WW-I Ace

Conversely, if the bogeys can be expected to reach overload first, tactics can be geared toward extending engagement time and maintaining a constant pressure on the bogeys, at minimum risk, until the opposing section makes a critical mistake. In this case it has been found that the majority of losses can be expected early in a two-versus-two engagement, while the opposing section is likely to have its best situation awareness. As the engagement wears on, the section retaining its situation awareness longer (i.e., the section least likely to overload) should enjoy greater and greater probability of success.

> If you come back from an operation with a kill but without your wingman, you lost your battle.
>
> Lt. Colonel Dietnch Hrabak, Luftwaffe
> 125 Victories, WW-II

In developing a two-versus-two tactical doctrine, overload considerations should be weighed at least equally with aircraft and weapons-system performance comparisons. Training for this scenario should also emphasize the pilot's ability to recognize the signs of impending task overload, so that some allowance can be made (e.g., disengagement or a transition to defensive tactics) before disaster strikes. Recognition of opponent overload is more difficult, and this condition is not normally apparent until it results in an obvious mistake.

Two-versus-Two Tactical Doctrine

All of these factors are important in two-versus-two tactics, which the remainder of this chapter addresses more specifically. These tactics arc based on the same doctrines described in the previous chapter on two-versus-one and one-versus-two scenarios.

The viability of fighting wing doctrine in the two-versus-two arena depends largely on the enemy's engaged doctrine, and also on relative pilot, aircraft, and weapons-system performance. If the bogeys also use fighting wing, the two-versus-two scenario essentially becomes one-versus-one. In this case all the tactics discussed in the one-versus-one chapters are relevant, including the modifications made necessary by relative aircraft and weapons-system performance. A discussion of this situation is therefore unnecessary.

When the bogeys are expected to employ a more advanced tactical doctrine (i.e., some form of double attack or loose deuce), the fighting wing section can be considered the singleton as it was described in the one-versus-two discussion in the previous chapter. In actuality the welded

wing fighters will probably be somewhat less effective offensively than the singleton because they will be easier to see and they will be less maneuverable. They should be better equipped defensively, however, because of the additional set of eyeballs available. Success under these conditions depends on the same factors outlined for fighting wing in two-versus-one scenarios. The leader conducts the offensive and defensive maneuvering plan while the wingman maintains the fighting wing position and provides defensive lockout and support. Surprise and offensive advantage should be sought whenever possible prior to engagement, normally with the intent to hit and run if the initial attack is not successful. If it is forced to engage in the role of singleton against two bogeys, the fighting wing section must keep track of both bogeys, maintain high energy, employ timely switches, and look for opportunities to escape. In general, without initial advantage and surprise, the probability of success in this scenario is poor for a fighting wing section unless it possesses a tremendous advantage in pilot, aircraft, or weapons-system performance.

In the converse situation, a section of fighters using double attack or loose deuce against welded wing bogeys, two-versus-one tactics can be employed with high probability of success. When the adversary section is expected also to employ one of the more advanced tactical doctrines, the situation becomes much more interesting.

Attack Phase

Figures 5-11, 5-12, and 5-13 illustrated some recommended methods by which a single fighter might attack a bogey section operating in mutual support. These methods are equally applicable to the case of one section attacking another from the rear hemisphere with some element of surprise. The most useful attack formation for this case is usually considered to be a sucked echelon (where the wingman is more than 45° aft of the leader's beam) or trail. This arrangement provides for rapid sequential attacks on each target bogey in turn, while providing some protection for the lead fighter during the attack. It should be recognized, however, that such a formation in general is rather poor defensively, and its use is recommended for only a short duration to improve offensive potential during an actual attack. In order to avoid unpleasant surprises, the fighters generally should maintain a more defensive posture, such as combat spread or an acute echelon (where the wingman is greater than 45° off the leader's tail), until just prior to the actual attack run.

The rules outlined in the previous chapter concerning which bogey to attack first are equally applicable here. In general, the aft bogey in the formation is more vulnerable and should be bounced first. For line-abreast formations the higher bogey is usually more vulnerable, since it will take longer for the lower wingman to offer support. When two combat-spread bogeys are about level with each other, the wingman (when he can be determined) is usually the easier to surprise. It may also be possible in such situations to attack both bogeys simultaneously.

But what if surprise cannot be achieved, and the two sections turn toward each other approaching head-on, essentially neutral? The bracket,

as illustrated in Figure 5-3, is still the primary method of attack. In this case each section should normally attempt to bracket the other. The section with the widest initial lateral separation, or the section that commences the bracket first, generally has the advantage. Figure 6-1 illustrates the use of the bracket against the three standard fighter formations: combat spread, echelon, and trail.

In each case the friendly section (bottom of the figure) begins in combat spread, since, as explained earlier, this is normally the most effective pre-engaged formation. At time "1" in the first example a hostile section is detected approaching head-on, also line abreast. Assuming that none of the

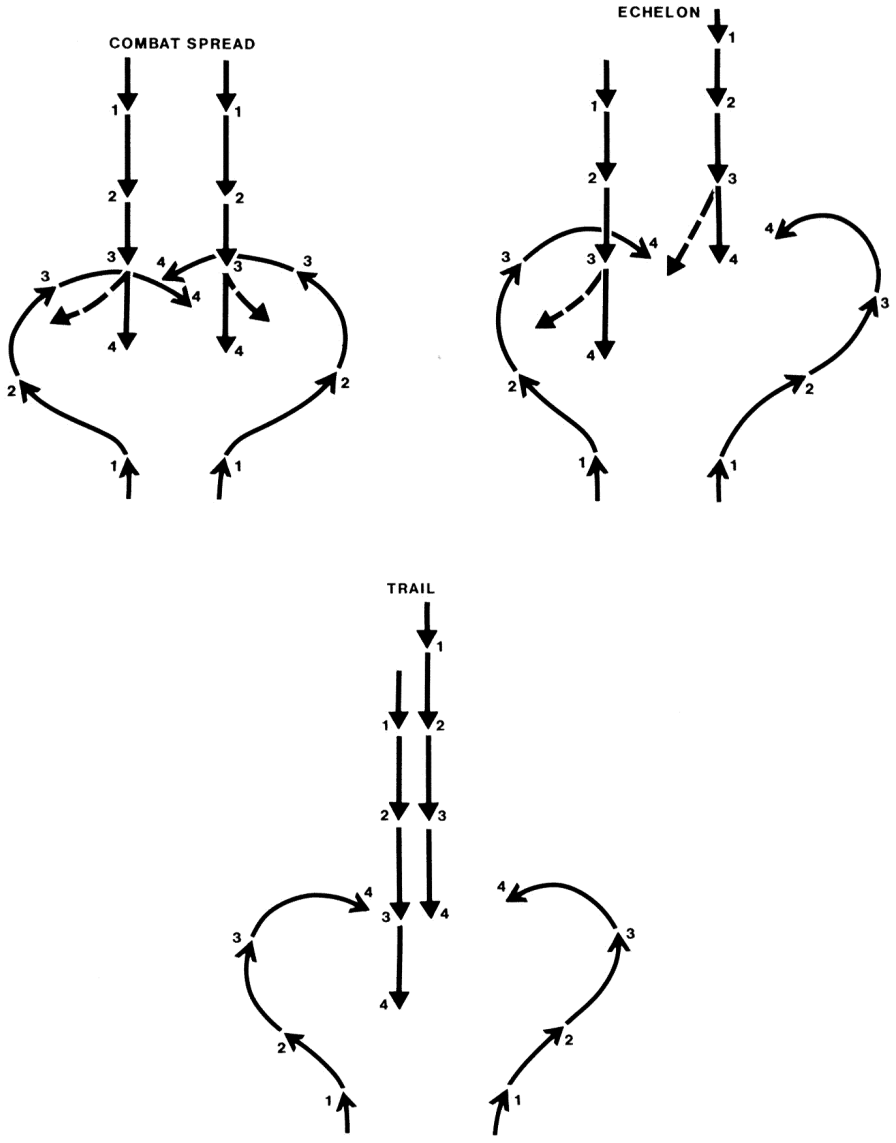

Figure 6-1. Bracketing a Section

fighters has all-aspect missile capability, or that the sections are already inside minimum firing range, the friendly section begins a bracket to convert to a rear-hemisphere position. By time "2" the attackers have successfully bracketed the hostile section and each fighter has generated some lateral separation for a reversal and a lead turn back toward the targets. Note that at time "3" each attacking pilot has a clear view of all aircraft, targets and wingman, on one side of his fighter. The bogey pilots, however, have to look both left and right to get the full picture, greatly adding to their visual acquisition and tracking problems. Odds arc, neither defender can keep track of everybody by this point.

In this depiction, between times "3" and "4" the attacking fighters pass behind the bogeys on their respective sides of the formation and attack the one on the opposite side. Although the attackers may have built enough lateral separation to gain substantial advantage against the nearest bogey, especially if the bogeys continue straight ahead as shown, there will be even more separation with the opposite target. In addition, the bogeys are likely to feel most threatened by the attacking fighter on their side of the formation and will probably turn toward this attacker in defense (i.e., each bogey is likely to turn away from its wingman), as shown by the broken flight paths from time "3." Such defensive moves turn the tail of each bogey at the other attacking fighter, which may very well be unseen by the target in any case. For all these reasons the attacking fighters are more likely to have better rear-hemisphere shot opportunities against the bogey on the far side of the enemy formation. If this turns out not to be the case, they have the option of choosing either bogey at the last instant, since they have a clear view of the entire situation throughout the attack.

It should be noted here that although both bogeys may be brought under attack, double attack doctrine does not, in general, allow engaging both bogeys simultaneously. If at least one kill is not obtained in the initial attack, the pilot of the more offensive fighter will normally continue to press his attack while the other pilot assumes the role of free fighter.

Another name for this bracket tactic is the "heart attack." This name might come from the heart-shaped figure inscribed by the flight paths of the attacking fighters; but it may also derive from the near-midair-collisions that often occur between the attackers at about time "4" in this illustration. The danger of a collision may be lessened if the attackers also take an altitude split, one going high and the other low at time "1." An added benefit of this procedure is to produce both vertical and horizontal brackets simultaneously, further compounding the bogeys' problems.

Moving now to the second example of Figure 6-1, the same approach scenario is seen, except that the bogeys are in echelon. Depending on the altitude differences between the opposing sections, the change in bogey formation may not be readily apparent to the attackers at time "1," but this is not critical. They simply begin their bracket as before, and at time "2" it becomes apparent to the pilot on the left that he should begin his counter-turn to pass behind the bogey on his side of the formation. The attacker on the right, however, since his bogey is more distant, must delay or ease his counterturn or risk crossing ahead of the bogey on his side. This delay

allows him to build more lateral separation and results in a greater angular advantage against this bogey at the pass, assuming the bogey does not turn into the attack. So the attacker on the right usually will have a better shot on the trailing bogey than on the leader. The left-hand attacker can press the far-side bogey (the trailer in this case) as before, resulting in both fighters converging on the more vulnerable trail bogey, with the enemy leader in a poor position to offer support. The bracket in this case is self-adjusting, and whether the trail bogey continues straight ahead, turns right (as shown by the broken flight path), or turns left, it is probably in a heap of trouble.

The third example in Figure 6-1 shows the bogey section in trail or in a very sucked echelon formation. In this case it should be obvious to each attacker by time "2" that he is facing a trail formation (all these examples assume, of course, that the attacking section has both bogeys in sight), which makes the trailer the most likely target for both. This situation is also probably the most dangerous to the attackers from a midair collision standpoint, and at about time "3" some radio coordination may be called for to clarify which fighter has the lead on the attack.

Obviously the attackers would like to destroy both bogeys, either simultaneously or in rapid succession in the initial attack. The bracket, or "pincer," attacks are designed with this goal in mind; however, if only one bogey can be eliminated, the attacking fighters should still be in an offensive position and can use the two-versus-one tactics already described to engage the remaining bogey. On those occasions when both bogeys survive the initial attack, the considerations outlined previously govern whether the section should attempt to engage two-versus-two or disengage. Mission objectives also play an important part in this decision. Merely disrupting and delaying the enemy formation, or forcing fighter-bombers to jettison their air-to-ground ordnance to defend themselves, may accomplish the attackers' purpose. In other cases only bogey destruction may be acceptable. Some of these considerations are addressed further in Chapter 9, which discusses fighter missions.

The advanced tactical doctrines, when employed in the two-versus-two environment, usually attempt to isolate one bogey from its wingman, and then eliminate each bogey in turn using two-versus-one techniques. Examples of this procedure can be seen in the Figure 6-1 echelon and trail scenarios. In each case the trail bogey is isolated and attacked by both fighters. Ideally this target can be destroyed before the bogey leader, temporarily neutralized by his position, can return and provide support to his wingman.

Figure 6-1 gives examples of how this "divide and conquer" approach might be pursued through use of an offensive bracket. Figure 6-2 illustrates another technique, sometimes called a "drag tactic." In this example the opposing sections, both in combat spread, approach head-on, as in the first scenario of Figure 6-1. Here, however, the attackers (bottom of figure) split only one fighter in an apparent bracket attempt. The other fighter continues merrily along toward a head-on pass with the bogey on its side of the enemy formation. At time "2" the bracketing fighter begins a counterturn

back toward the near bogey, which is forced to defend by turning into the attack, while the fighter on the right turns away from its bogey. This turn-away is intended to induce the right-hand bogey into turning away from its wingman by allowing it lateral separation and some offensive advantage. The bogey pilot sees a lot of fighter belly, the "Blue Max" flashes before his eyes, and he goes for what appears to be an easy kill against an enemy who apparently does not see him. The dragging pilot must time his turn-away very carefully so as not to give the bogey a decent shot at the pass (time "3"), considering its weapons capabilities. Meanwhile the bracketing pilot passes outside his bogey at time "3," then essentially ignores it and heads straight for the other bogey. Between times "4" and "5," the pilot of the dragging fighter continues to tempt the bogey pilot by holding him near, but preferably just outside, an effective firing envelope. Against a slower bogey, arcing is useful for this purpose because it allows the bogey to stay fairly close so that its pilot does not get disinterested and start looking around at what is going on. By time "5" the bogey has been suckered into a sandwich, with its wingman way off in left field and unable to render assistance. Following destruction of this bogey, the fighters can rejoin in a good defensive formation and either exit the fight or return to engage the remaining bogey.

Although the drag can be a very useful device, it is in general more risky, and therefore less desirable, than the bracket. Intentional drags place one fighter at an unnecessary disadvantage while it serves as the "bait." This pilot could be in serious danger if his supporting wingman comes under attack and must defend himself or just becomes distracted and loses sight of the dragging fighter. There is also the possibility that the bogeys may not

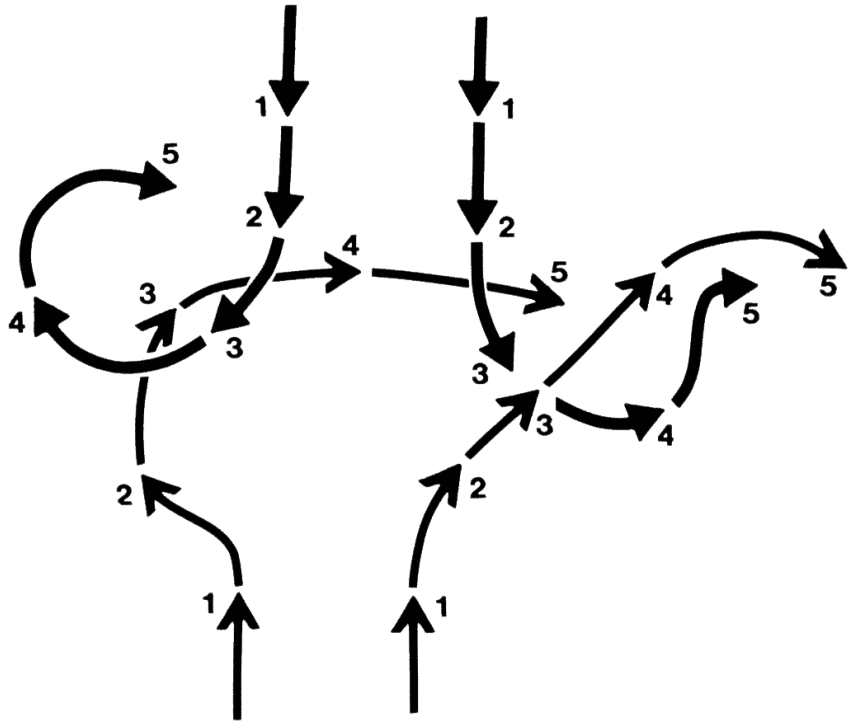

Figure 6-2. The Drag

fall for the ruse, and both of them might pounce on the bracketing fighter. In this case the dragger is often positioned poorly to offer immediate support. Good communications and coordination are required for this tactic, since it would be a disaster if both fighters decided to drag at the same time!

Engaged Maneuvering

Assuming no bogeys are eliminated in the initial attack and two-versus-two maneuvering is indicated, there remains the question of which tactical doctrine to employ. For the reasons stated earlier in this chapter, fighting wing doctrine holds little promise of success unless the bogeys can also be expected to use this tactic (or to operate as single, uncoordinated fighters) and can be beaten in a turning fight, considering opposing weapons, pilots, engagement conditions, etc. Either double attack or loose deuce can be employed in this scenario, but both require some modification. The question of which doctrine is the better of these two is guaranteed to generate some spirited discussions around the bar.

In the last chapter a comparison between these two doctrines in the two-versus-one environment concluded that loose deuce was probably more effective in this scenario because of greater offensive efficiency. Such advantage, however, is not gained without costs, which in this case include increased training requirements, reduced defensive capability, and greater dependency on communications (and therefore greater vulnerability in comm-jam environments). In low- to medium-threat two-versus-one scenarios, the greatly enhanced offensive efficiency of loose deuce probably offsets these disadvantages. The two-versus-two scenario, however, might be considered merely a very high threat two-versus-one environment. It is unlikely, for example, that one bogey can be isolated and engaged in the classic loose deuce manner (as illustrated by Figure 5-10 in the last chapter) without interference from the free bogey. The same statement applies to double attack doctrine to an even greater extent (because it will probably take longer to destroy the engaged bogey), but at least the free fighter can be assigned to defend against any attack.

Following an unsuccessful initial attack using double attack doctrine, the fighter with the better offensive advantage should engage one of the bogeys. The free-fighter pilot then assumes the responsibility of keeping visual track of the free bogey and covering the engaged fighter in the event of attacks from this or other (wild-card) bogeys. The pilot of the free fighter should avoid engagement if at all possible, but of course he must defend himself if he is attacked. In this case he must notify the engaged pilot of the situation and should try to disengage as quickly as possible to resume his covering responsibility. If the engaged fighter is threatened, the free-fighter pilot issues a warning and attacks the offending bogey. This attack, however, is not for the purpose of engaging, but rather for removing the threat to the engaged fighter. Rapid destruction of the attacking bogey is the goal, but simply causing its pilot to break off his attack is usually sufficient. Once this has been accomplished the free-fighter pilot should not press his attack further; doing so would usually be to the detriment of his defensive duties.

The pilot of the free fighter in double attack must exercise a great amount of discipline if he is to fulfill his defensive responsibilities fully in the two-versus-two environment. There is an almost insurmountable urge for both fighters to become entangled in separate one-versus-one engagements. This situation is very dangerous in hostile environments, where either fighter may be jumped by wild-card bogeys. Fighters engaged one-versus-one are also quite vulnerable to attack by the other member of the bogey pair, which may be able to coordinate a switch at a critical moment.

In order for double attack doctrine to be practical in the two-versus-two scenario, the fighters should have turn performance at least as good as that of the bogey aircraft. The fighters should be able to handle themselves one-on-one with the bogeys, since this situation is so likely to occur. Better turn performance also enables the free fighter to frustrate attacks by the free bogey without having to become involved in prolonged offensive or defensive maneuvering. The engaged fighter will also benefit from greater turn performance, since the angles tactics best used with such an advantage place more pressure on the engaged bogey, making it more difficult for this aircraft to escape or break away temporarily for an unsuspected attack on the free fighter.

It is ideal if, once engaged, the pilot of the engaged fighter can prosecute his attack until the bogey is defeated. Switching engaged fighter-free fighter roles is hazardous in the two-versus-two environment and should be avoided when possible. There are two good reasons for this. First, the pilot of the engaged fighter will probably lose track of the free bogey and will require some radio assistance from the free-fighter pilot to locate this bogey during any role switch. Even if the free bogey can be located, the new free fighter (original engaged fighter) is likely to be low on energy and out of position at the time of a role switch, poorly prepared to defend against either the free bogey or a wild card.

A role switch is quite often necessary, however, when either fighter becomes defensive. If the engaged fighter gets into trouble or is threatened by a second bogey, the free fighter should attack in order to relieve the threat. Once he is out of immediate danger, the engaged-fighter pilot should normally assume the role of free fighter while the new engaged-fighter pilot continues to press his attack. Likewise, if the free fighter becomes defensively engaged, the engaged-fighter pilot should terminate his individual engagement as quickly as possible and offer assistance to his wingman as the new free-fighter pilot.

When the bogeys have a maneuverability, weapons, or training advantage that would likely make one-versus-one engagement a losing proposition, both double attack and loose deuce doctrines incur serious problems. With some modifications, however, they may still be viable in the two-versus-two environment. As mentioned previously, it is unlikely that one bogey can be isolated long enough for the attackers to engage it in classic engaged fighter-free fighter maneuvering without interference by the free bogey. This opportunity is even less likely when a section is engaged with superior bogeys.

In such situations double attack and loose deuce might evolve into a series of offensive attacks such as the brackets and drags illustrated in

Figures 6-1 and 6-2. At the conclusion of each attack, whether it was successful or not, the section can quickly rejoin in an effective defensive formation (usually combat spread), then either disengage or maneuver to return for another attack. If tapped during this defensive interval, the section can employ one of the techniques illustrated by Figures 5-4 through 5-8 (defensive splits, sandwich, etc.).

The purpose of this method is to place the greatest possible offensive pressure on the bogeys while minimizing the risks of becoming separated into probably fatal one-versus-one engagements. If an attempt is made to remain offensively engaged for an extended period with multiple bogeys, particularly with smaller and more maneuverable bogeys, there is a very high risk of an unseen attack on one fighter at a vulnerable moment. By striking quickly and then rejoining for defensive mutual support, the section reduces the probability of separation, and it is better able to defend against unexpected attacks.

One of the disadvantages of this method, however, is that in reforming for better defense, the attackers usually place the bogey (or bogeys) in an offensive position behind the section, and in many cases the enemy will be lost from sight. This is certainly an undesirable situation, and, depending on the bogeys' weapons, disengagement may be the best choice at this point, particularly if the fighters have a speed advantage. Returning to face an all-aspect missile threat from multiple unseen bogeys is generally not conducive to reaching retirement age.

Section *Reversal Techniques.* Against less formidable opposition, such as when one bogey has been eliminated and the remaining opponent is not equipped with all-aspect missiles, a reattack may be much less hazardous. At this point a technique is needed for reversing the course of a section in formation. The prime consideration in development of this tactic should be defensive mutual support. Figure 6-3 illustrates some common methods.

With the in-place turn both fighters turn in the same direction simultaneously. In this example the fighters begin at time "1" in combat spread, either co-altitude or with an altitude split. The pilot on the left turns away from his wingman and will usually lose sight of him between times "1" and "2," regaining sight between times "2" and "3," after the wingman crosses behind and pulls to the inside of the turn. This reversal offers reasonable visual cover to the fighter originally on the side of the turn, but it places the other fighter in trail and out of sight during most of the reversal. An attack on the trailing fighter at time "2," for instance, could be disastrous.

The next example is the cross turn, in which each fighter turns inward, toward its wingman. The fighters meet nose-to-nose just prior to time "2" and continue their turns until they are reestablished line abreast at time "3." This turn provides better visual coverage for the fighters throughout the reversal, since each pilot can see the other aircraft except for possibly a few seconds after they cross. Neither fighter is well positioned for the pilots to offer other than visual and moral support, however, at any time between when the fighters cross and then regain combat spread at about

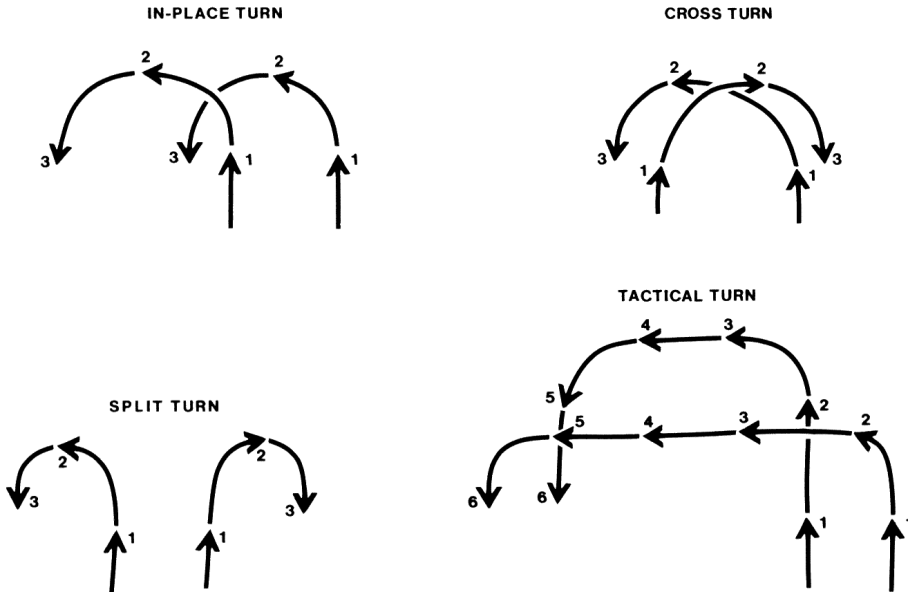

Figure 6-3. Section Maneuvering

time "3." Another problem is the separation that may occur at the conclusion of the reversal. If the fighters begin the turn at time "1" separated by less than one turn diameter and make level turns, their separation will increase at time "3," possibly causing loss of sight and generally reducing defensive capability. Such a wide split may, however, facilitate a bracket attack against bogeys detected at long range in the rear hemisphere. The cross turn can also be used to reduce separation when the section is originally split by more than one turn diameter.

Some of the problems associated with increased separation in the cross turn may be alleviated by split-plane maneuvering. Both fighters can turn obliquely nose-high, or one can turn nose-high and the other level or nose-low. Both these methods tend to reduce final lateral separation, but the latter has some valuable fringe benefits. One is that the low fighter has improved coverage from its higher wingman. Also, the fact that the fighters do not pass so close to one another during the turn makes it more difficult for a bogey pilot to see and track both fighters during the maneuver. This effect is enhanced if the higher fighter at time "1" goes high while the other stays low.

The third maneuver depicted in Figure 6-3 is the split turn, where each fighter turns away from the other. This method is useful as a means of allowing closely spaced fighters to achieve a wide bracket against bogeys detected in the rear hemisphere, but it is undoubtedly the poorest reversal so far considered from a defensive standpoint. Each pilot is out of sight of his wingman for most of the turn, and the extended separations generated are conducive to losing sight completely. Modern high-speed fighters could easily be six to eight miles apart at time "3." At such ranges one pilot is not likely to find his wingman until a fireball marks the spot! This maneuver is therefore not recommended except for very tight turning

aircraft, possibly as an offensive or defensive tactic against a threat that is well defined and in sight of both fighters. (The defensive split was ids-cussed in Chapter 5.)

All the reversals discussed to this point have the common problem of exposing both fighters to attacks from one direction while they are turning to meet a threat from the other direction. Referring to Figure 6-3, bogeys approaching from the top of the page (i.e., the forward hemisphere at time "1") could be big trouble if they tapped the fighters from their belly-side during any of these reversals. Since little protection is available from such an attack, these turns can all be quite dangerous in a hostile environment, and they are better suited to conditions when the threat sector can be well defined.

The last illustration in Figure 6-3 depicts the tactical, or "taco," turn. Also known as the delayed turn or cross-over turn, this turn is referred to here as tactical, taco, or delayed to avoid confusion with the cross turn. The tactical turn accomplishes the reversal in two segments of 90° each. At time "1" in this example a "taco turn left" is called, whereupon the fighter on the right begins an immediate left turn. The pilot of the left-hand fighter delays his turn for a few seconds and continues straight ahead to time "2," when he, too, turns left. At time "3" both fighters complete 90° of turn and regain a line-abreast formation. They can then continue in this new direct-tin for some time, as shown, to provide them an opportunity to search the area thoroughly in all directions, or they can immediately commence another "taco ninety left" to complete the reversal. As with the other turns described, split-plane maneuvering is also useful with the delayed turn. Generally the inside fighter turns nose-high during the first stage (time "1" to time "3") while the outside fighter stays level or nose-low. At time "4" the fighter high on the outside (right in this case) can dive toward the inside of the turn while the inside fighter completes a climbing left turn from time "5" to time "6."

There are several advantages to this method over the others described. The periods when one fighter is in a poor defensive position, or out of sight, are kept to a minimum (here a short period between times "2" and "3," and again between times "5" and "6"). In cases when the threat sector is not well defined, the taco turn provides for visual coverage of the section's belly-side throughout the turn. Since only one fighter is doing any serious turning at any given time, the other pilot is free to clear the vulnerable belly-side of his wingman. In addition, dividing the reversal into two 90° segments with a straight-line segment (time "3" to time "4") in between tends to place a rear-hemisphere threat on one side of the section, inside the turn. In this case a bogey trailing the section at some distance at time "1" will normally be caught on the inside (left side) of the section's turn by time "6." Narrowing the threat sector to one side of the section greatly facilitates visual acquisition of an attacking bogey. The drawback here, however, is that the large effective radius of the section's turn is much like arcing in the one-versus-one case, and it allows the bogey to cut across the circle and gain an angular advantage on the section.

The taco turn can also be very useful when the section wishes to Disney-

gage from slower bogeys in the rear hemisphere but must go either around or through the bogeys to get home. This situation is illustrated in Figure 6-4. In this scenario the section is line abreast and headed away from home, and it suspects a slower bogey is somewhere behind it out of range. Perhaps the bogey has all-aspect weapons and superior maneuverability, and the section would like to avoid tangling with it on the way back to the barn. One possibility is a 90° taco turn right or left, followed by a long extension. The bogey is likely to counter by trying to cut the section off using lead pursuit (time "2"). Eventually, however, the slower bogey must drift back into a long trail once more (time "3"). At some point the section then performs a second taco ninety in the same direction and streaks for home (time "4"). The bogey attempts to close by again using lead pursuit, but it still can't get close enough for a shot.

Although it is effective, this technique may not be practical in all cases. The straight-line extension between turns must be lengthy or the bogey may still manage an intercept. Constraints on the section's combat fuel endurance or area restrictions (e.g., there may be hostile SAM sites on either side of the engagement area) may force the section into a tighter reversal, requiring it to fight its way back to the bar.

One further reversal method is worth mentioning for its usefulness in select situations. This is the section vertical pitch-back, where both fighters perform simultaneous half Cuban-8s (i.e., a vertical pull-up to the top of a loop, then a roll to an upright attitude and a dive back down to near the original altitude). When a lower-energy bogey that is not equipped with all-aspect missiles is behind the section, this method allows the section to remain line abreast throughout the reversal and either meet the bogey head-on with minimum flight-path separation or pass overhead at an unreachable altitude. Against a guns-only bogey a section Immelmann might be better. The Immelmann (described in Chapter 4) is a vertical pull-up to the top of a loop, followed by a roll to the upright attitude and acceleration while remaining roughly level. This method keeps the sec-

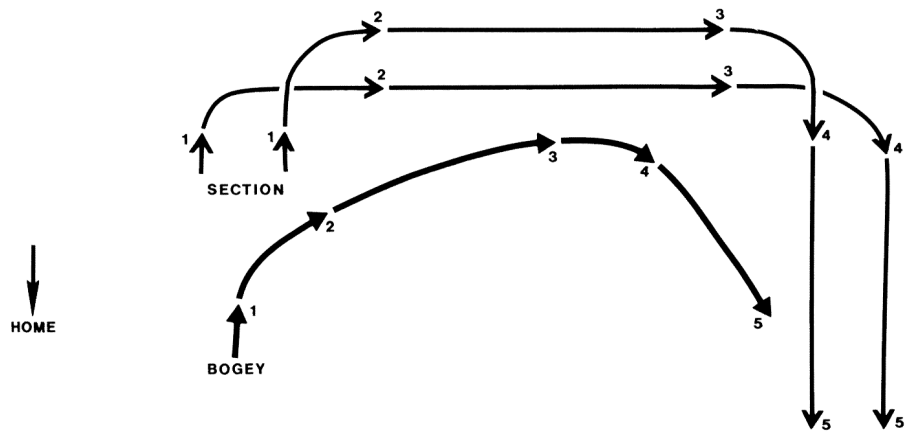

Figure 6-4. Tac-Turn Disengagement

tion high above the low-energy bogey, out of guns range. Another possibility is the section vertical reversal, where both fighters pull up into a near-vertical zoom, perform a rudder reversal or some other end-swapping stunt at very slow speed at the peak of the zoom, and accelerate steeply back downhill for a simultaneous pull-out.

While these maneuvers can be very valuable in certain situations, they do have severe limitations. High-energy bogeys may catch the fighters at slow speed near the top of their pitch-backs, with disastrous results, and all-aspect missiles just love those high, slow targets. These techniques can also be dangerous in high-threat environments, where the section may be jumped by wild-card bogeys or fired at by SAMs while the aircraft are at slow speed.

Strike-Rejoin -Strike.

> The best approach to a battle ... is surprise, make your attack and disappear and start a new attack. Don't get engaged and make it a dogfight.
>
> Lt. General Adolph Galland, Luftwaffe

The study of one hypothetical engagement using the "strike-rejoin-strike" technique may best serve to illustrate most of the key elements involved in the employment of a section in the two-versus-two environment. In Figure 6-5 the fighters are in combat spread on patrol headed north when the pilots spot a hostile section approaching head-on. A split is called at time " 1" to bracket the bogeys, but shortly after the split is commenced,

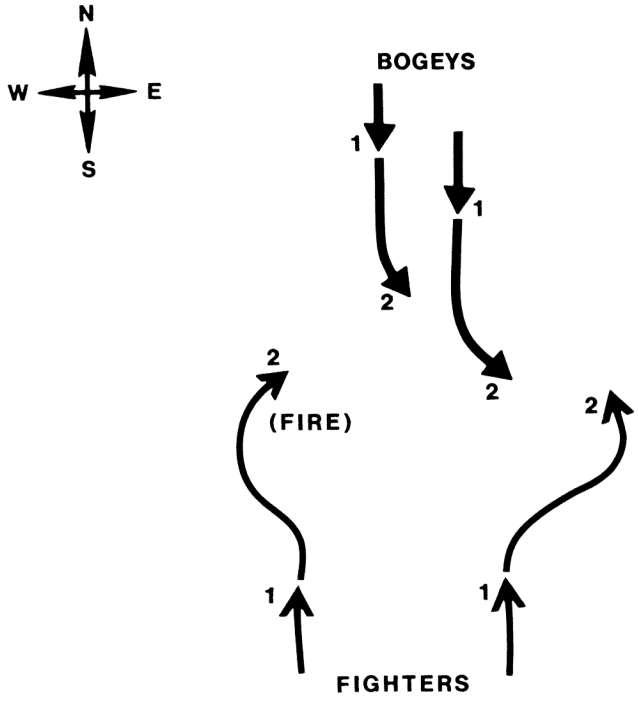

Figure 6-5. Two-versus-Two Engagement

the bogey leader spots the eastern fighter and turns toward it. As the bogey wingman begins to follow his leader, the pilot of the western fighter sees a shot opportunity coming, reverses hard, and fires a heat-seeking missile at the trailing bogey from its belly-side. The shot is unobserved, and the missile appears to begin tracking toward the target.

Figure 6-6 shows that, between the missile firing at time "2" and impact at time "3," the eastern fighter and the lead bogey approach a close head-on pass. The shooter is hypnotized by the sight of his missile's smoke, the fireball, and the subsequent ejection of the bogey pilot, and he temporarily loses track of the other aircraft. Meanwhile the pilot of the eastern fighter has to jink to avoid the debris, sees his wingman cross in front, and (after the shooter's victory whoop) calls him to come left to join in combat spread (time "4"). During all the excitement the pilots of both fighters lose sight of the bogey leader, and neither of them knows whether he disengaged or not.

In Figure 6-7 the victors close up their formation for a better defensive posture, make sure they have sight of each other, and quickly check the area visually. Having been successful to this point, the section is eager to return and engage the remaining bogey, so the leader calls a tac left at time "5," and then immediately calls another to complete the reversal at time "6." The bogey pilot, meanwhile, has both fighters in sight and, being somewhat annoyed, has been stalking the section from a distance. At time *"7"* he is able to convert to a rear-quarter firing position on the nearest fighter and cuts loose with a heat-seeking missile.

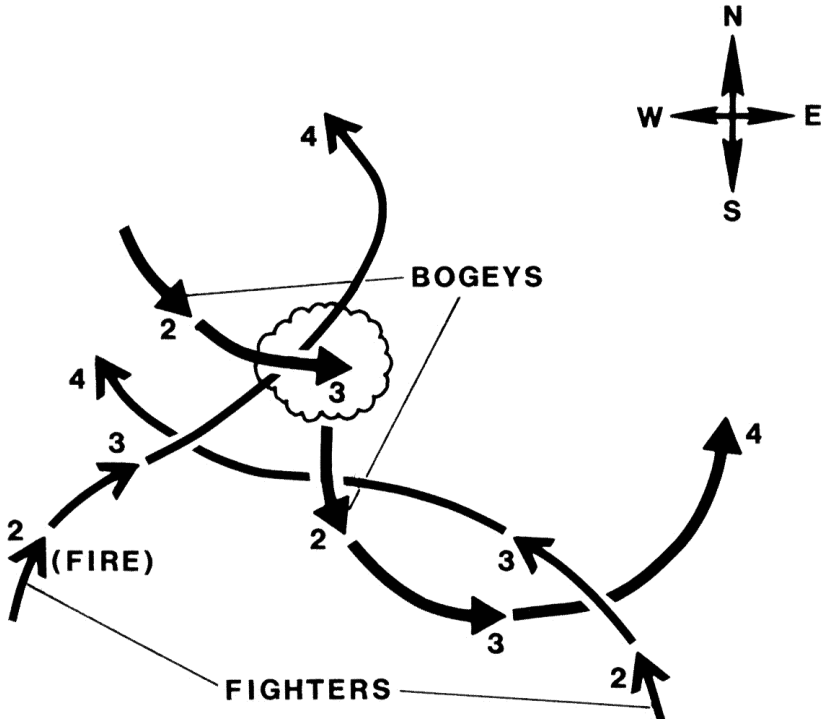

Figure 6-6. Two-versus-Two Engagement (Continued)

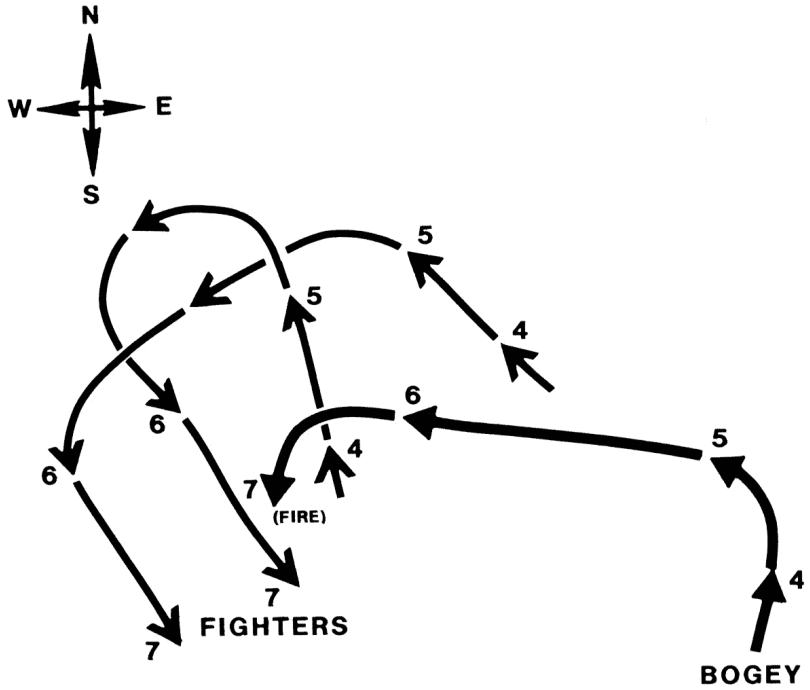

Figure 6-7. Two-versus-Two Engagement (Continued)

At that moment (Figure 6-8, time "7") the pilot of the western fighter sees the smoke as the missile leaves the rail and calls the target pilot to break left against the missile. Simultaneously the western fighter turns hard left toward the bogey to set up a sandwich. The wily bogey, however, has other ideas and switches to the western fighter (time "8"). Meanwhile the early warning has allowed the target fighter to defeat the missile through a combination of hard maneuvering, power reduction, and flares. The engaged pilot (in the western fighter) sees his wingman has survived the missile, calls the bogey switch, and directs the free-fighter pilot to reverse in order to get himself back into the fight as quickly as possible. As the bogey overshoots after time "8," the engaged-fighter pilot reverses nose-to-nose to keep it in sight and draw it away from the free fighter (for AOT and min-range considerations). At time "9" the bogey overshoots again, and the engaged fighter reverses, keeping the enemy interested but not allowing him to reach firing parameters. The bogey pilot continues to pursue his victim, unaware of the free fighter's position. By time "10" the bogey has been dragged in front of the free fighter, and its pilot launches an unobserved missile to end the engagement. The fighters then rejoin in defensive spread and head for the champagne.

> I always thought to go around in circles, slower and slower, was a ridiculous thing. . . . It's not the way to fight. The best tactic is to make a pass, then break off and come back. If you don't do this you'll lose people; one can't be greedy.
>
> Brigadier General Robin Olds, USAF

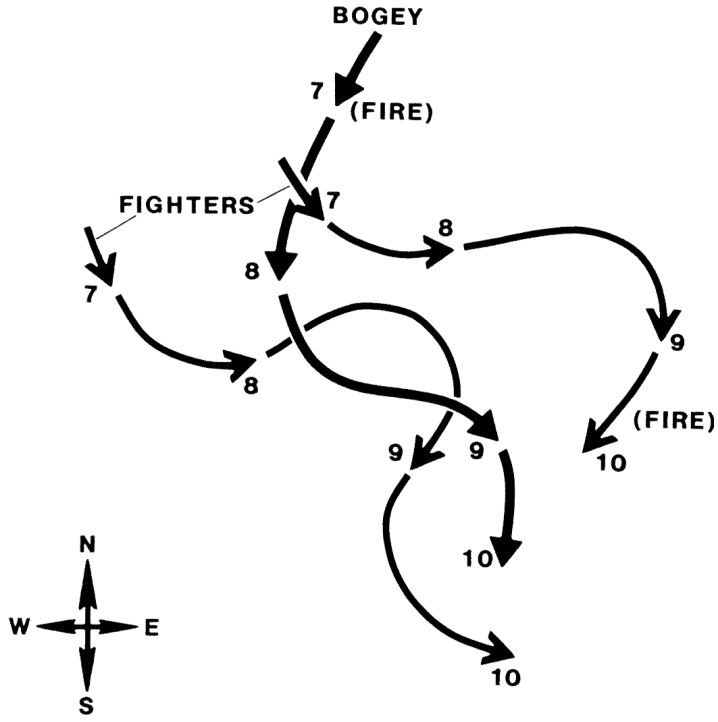

Figure 6-8. Two-versus-Two Engagement (Conclusion]

In analyzing this engagement, the value of the first visual contact with the enemy, which takes place in Figure 6-5, is evident. This early "tallyho" gave the friendly section the initiative to begin an offensive bracket of the hostile section before the reverse situation could occur. As discussed previously, the bracket attack, or offensive split, is one of the tactics associated with both double attack and loose deuce doctrines. The enemy section's response to this attack indicates that its leader probably has only one fighter in sight, and the fact that the wingman followed his leader with no apparent attempt to split or bracket the eastern attacker could mean that he does not have either fighter visually, or the bogey section might intend to employ fighting wing tactics.

Once the bogey section begins its turn to the east, the pilot of the western fighter must cut short his bracket maneuver and reverse quickly to avoid being placed outside missile range. Note that he fires at high angle-off on the target's belly-side, not waiting for the dead-six shot. As discussed previously, the belly-side shot can be deadly with a nominally rear-quarter AAM at medium range. Following the shot, the shooter makes a very common mistake in watching the weapon all the way to the target and then watching the bogey explode. This practice tends to give the shooter tunnel vision, leading to his loss of situational awareness. A better technique might be a quick unloaded roll to the left immediately following the shot to get a visual check of his own belly-side just in case a third, unobserved, bogey or a hostile missile is threatening. After this quick

"belly-check" the shooter can reverse back to the right to check on the fate of the target and locate the other aircraft.

> See, decide, attack, reverse.
>
> Major Erich "Bubi" Hartmann, Luftwaffe

Luckily the pilot of the eastern fighter has a little better handle on the situation and is able to talk the shooter off cloud nine and back into line-abreast formation in Figure 6-6. Reforming the section here is probeably a good move, since the eastern fighter had no advantage on the bogey leader at the pass, lost him completely soon after, and realized the section was operating in a hostile environment with poor defensive mutual support. Had either pilot maintained visual contact with the bogey leader, immediate re-engagement using two-versus-one techniques would probeably have been preferable.

> When the enemy starts to collapse you must pursue him without letting the chance go. If you fail to take advantage of your enemy's collapse, he may recover.
>
> Miyamoto Musashi

In Figure 6-7 the attackers close up into a good defensive spread formatin, take a couple of deep breaths, and execute a tac-turn reversal. Had they been trying an end-run around the bogey to disengage, they could have delayed the second turn, as shown in Figure 6-4. In this case, however, the pilots intend to re-engage, so they complete the reversal as quickly as possible. The tac turn was chosen here because it offers better protection against the remaining bogey, which is unseen, and also against wild cards in a hostile environment. This technique does, however, produce a large radius of turn for the section, which may allow a bogey originally located directly behind to gain greater angular advantage. Had the opponent been in sight directly astern in a relatively sterile situation, a cross turn or a split turn might have offered better offensive capabilities, provided the target range was sufficient to allow completion of the reversal before the adverb-say could close on one of the fighters. An in-place turn might be more effective against a bogey that is in sight in the rear hemisphere but is not directly astern. The object when the bogey is in visual contact is to reduce its flight-path separation with the center of the section to a minimum (i.e., meet it head-on) and generate a bracket if possible.

The section completes the reversal at time "6" in good defensive conditioning; but even with supposedly the optimum formation for visual coverage, the bogey remains undetected until it actually launches a missile. This is not an unusual occurrence, particularly when small, well-camouflaged bogeys and poor visibility conditions are involved, since the range from bogey to target fighter at time "7" might be well over a mile, and from the far fighter (the one whose pilot is more likely to see the attacker), several miles. The fact that visual detection of the missile launch itself enabled the target to avoid destruction highlights the value of defensive visual support. Undetected Amass are almost invariably fatal.

The decision of whether to return and engage an unseen adversary is

dependent on many factors. Among the most important of these is the opponent's weapons system. Under the conditions described here (i.e., with an unseen bogey) the section can expect to engage defensively, which may be unacceptable against an adversary equipped with all-aspect Amass, smokeless missiles, or an extremely lethal weapon (defined as one that probably cannot be evaded once it is fired) of any kind. Such weapons make re-engagement under defensive conditions a very risky proposition and call for a great deal of discretion.

On sighting the hostile missile, the pilot of the far fighter (the one to the southwest in Figure 6-8) calls his wingman to break, and he simulate-easily turns to engage the attacker. To this point in the scenario the section could have been employing either loose deuce or double attack doctrine, as all the tactics used so far (i.e., line-abreast formation, pincer attack, tac turns, sandwich) are elements of both tactical doctrines. At time "8," however, double attack would ordinarily call for the southwestern fighter (engaged fighter) to engage the bogey in one-on-one maneuvering while the free fighter (having defeated the missile attack) regains its energy and assumes a covering role. Loose deuce doctrine allows the engaged-fighter pilot to employ a drag technique, whereby he permits the attacker to gain a nonlethal offensive advantage in order to tie him up, giving the pilot of the free fighter time to position for a shot. While this method probably provides for a much quicker kill of the bogey, it is a calculated risk, particularly in a hostile environment. Any number of things could go wrong. For instance, the bogey might get off a lucky shot on the engaged fighter, or the pilot of the free fighter might lose sight of the fight or be jumped by a wild-card bogey (or even a SAM), which could result in both fighters being engaged defensively in separate one-versus-ones. In choosing their tactics here the pilots must weigh the odds and then throw the dice. Does the improved offensive efficiency and quicker kill provided by loose deuce offset the greater defensive vulnerability? If successful, the pilots are brilliant tacticians; if not, they are foolish and probably dead.

Prolonged Engagement. In the foregoing hypothetical engagement, the initial attack was successful, reducing the scenario to two-versus-one against an unseen adversary. The attackers chose to reform defensively before continuing the engagement, which provided some protection until they could regain the offensive. Had both bogeys survived the first attack and been lost from sight, disengagement might have been in order, at least until the opponents could be located and re-engaged on favorable terms.

Another likely possibility is the destruction of one bogey, with the other opponent remaining in sight of one or both of the friendly pilots. In this case immediate re-engagement is usually preferable to reforming defensively, except in very hostile environments. Immediate re-engagement keeps pressure on the bogey pilot and takes advantage of his temporary confusion and fright resulting from the loss of his wingman in the initial attack. Delaying the attack on the remaining bogey generally gives its pilot greater advantage, and it quite often results in loss of contact and subsequent bogey escape, or re-engagement on less than optimum terms for the fighters (as illustrated by the previous example). When both pilots have the

bogey in sight, both double attack and loose deuce doctrines provide for an immediate bracket attack if the fighters are positioned favorably. Otherwise the fighter with the greater offensive potential attacks while the wingman assumes the free-fighter role. When only one pilot has sight of the bogey, he may attack and engage the opponent under cover of his wingman until the free-fighter pilot can gain visual contact. At that point the free pilot can position for a shot (loose deuce) or continue his cover duties (double attack) and await his turn with the bogey.

In the event that both bogeys survive the first attack but are still in sight, the decision of whether to re-engage immediately depends on such factors as the hostility of the environment, whether both pilots have sight of the bogeys, and the confidence the pilots have in their ability to handle the threat. If any of these factors is negative, disengagement might be the prudent option. Otherwise a bracket or drag attack might be preferable. When the situation does not provide for such coordinated attacks, double attack doctrine calls for one fighter to attack the more vulnerable bogey while the wingman holds the free bogey at bay. This method can be quite effective if the fighters have significant performance and/or weapons advantages over the bogeys, or if the friendly pilots are better trained than the bogey pilots; otherwise loose deuce techniques are probably preferable.

Loose deuce doctrine in prolonged two-versus-two engagements calls for each fighter to operate semi-autonomously, much as in the one-versus-two engagements described in the previous chapter. The tactic involves neutralizing the more threatening bogey (by causing it to overshoot), then attacking the other bogey. The second bogey is likely to be involved with the other fighter and be vulnerable to attack. This attack cannot safely be prolonged, however, because of the threat of the free bogey. Each fighter switches from one bogey to the other in this manner until one opponent can be caught looking the wrong way.

This is a complex and difficult to master tactic, primarily because of the difficulties involved in keeping track of both opponents. The task is made easier when the adversary is flying larger and/or less maneuverable aircraft and when the fighters are equipped with all-aspect missiles while the bogeys are not. Larger bogeys are less difficult to see, and greater maneuverability makes neutralizing an attacker easier and reduces the time required to reach firing parameters against a target bogey. All-aspect AAMs provide many quick shot opportunities with a minimum of maneuvering. When bogeys cannot be eliminated quickly, the factors discussed earlier in this chapter concerning task overloading must be considered in making the decision between continuing and terminating the engagement. Disengagements are better begun too early than too late, when fuel considerations or critical defensive situations might complicate escape.

Defensive mutual support during prolonged loose deuce maneuvering is by chance and opportunity rather than by design. Each pilot is primarily responsible for keeping himself out of trouble by keeping track of both bogeys, maintaining high energy, and not getting tangled up with one bogey for any length of time. It is difficult enough to maintain visual

contact with two separate bogeys without also having to clear the wingman's six, but the fact that both fighters arc engaged in close proximity, and are trading bogeys back and forth, inevitably leads to chance sightings of the wingman. When these opportunities arise, the pilot should quickly check the airspace around the wingman visually, announce any bogeys in a threatening position, and attack them if possible. The mere presence of two fighters alternately threatening each opponent keeps an adversary from concentrating on either fighter for any length of time. Knowing that a second fighter is in the area also tends to make an individual bogey less aggressive against any one fighter. This condition is sometimes referred to as "mutual support by presence."

Again, a hypothetical sample engagement should serve to clarify some of the techniques involved in this method. Figure 6-9 depicts the same initial head-on approach situation shown in Figure 6-5, except that this time the bogey pilots see both fighters and split, denying the attackers a quick kill opportunity. Each friendly pilot continues his pincer maneuver in an attempt to get outside the hostile section and keep both bogeys in sight on the same side of the aircraft. This tends to draw the adversaries apart, making it unlikely they will be able to keep track of the other half of the fight.

Figure 6-10 shows that each pilot passes his bogey close aboard on the side away from the second bogey, and continues to turn in the same

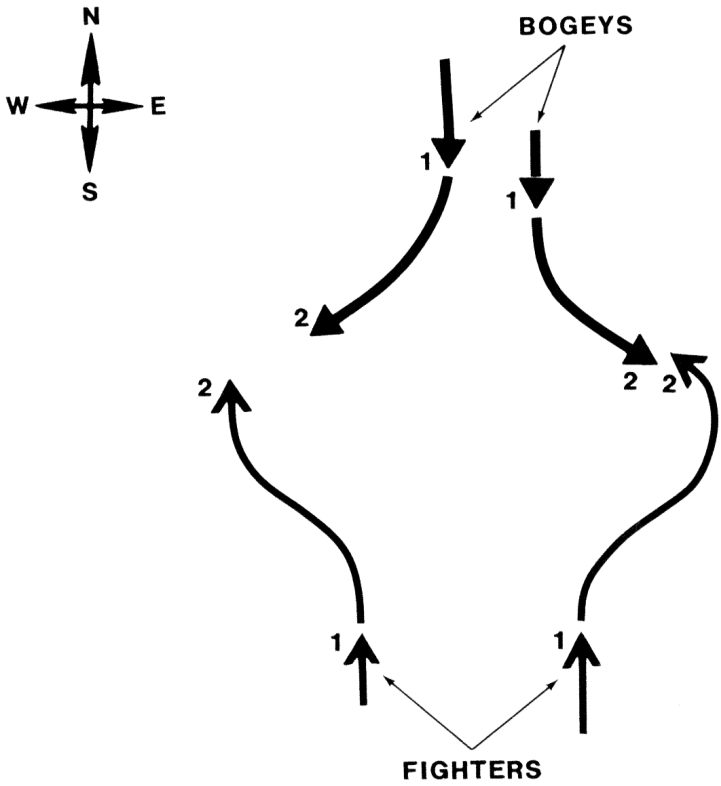

Figure 6-9. Loose Deuce Engagement, Two-vcrsus-Two

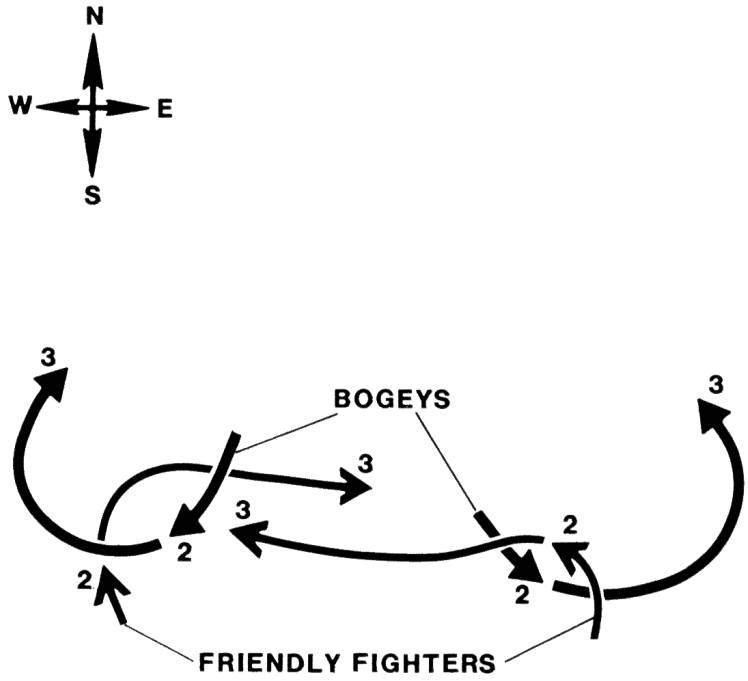

Figure 6-10. Loose Deuce Engagement, Two-versus-Two (Continued)

direction toward the second bogey. Immediately after the pass each pilot should watch his own bogey long enough to determine which direction it will turn before switching his attention to the next bogey. Observing the bogey's move at the pass is valuable in estimating the time available before it again could become a threat, in planning the attack on the second bogey, and in forming a "mental plot" of where the first bogey should reappear after the pilot concentrates on the other bogey for a few seconds. Approaching time "3" the fighters meet almost head-on and have a chance to clear each other's six as they press on toward bogeys on the opposite sides of the fight.

At time "3" the pilot of the eastern bogey sees the nearest fighter's attack and turns hard to negate it, as shown in Figure 6-11. The pilot of the eastern fighter saw the first bogey he passed turn to the north; therefore he plans to attack the eastern bogey from the south side to keep both opnets on the same side (north). After the pass at time "4" the pilot of the eastern fighter continues his left turn toward the perceived threat sector and observes that the bogey he just passed turned south. Then he begins to look for the other bogey again.

Meanwhile the pilot of the western fighter is pursuing the bogey to the north and has not yet been detected at time "4." He has a good offensive position at this point but is still outside RQ missile parameters. The pilot of the northern bogey has all along been watching the first fighter he passed (now the eastern fighter), and he pulls inside its turn for lateral separation at time "4." The pilot of the eastern fighter gets a "tally" on this bogey and

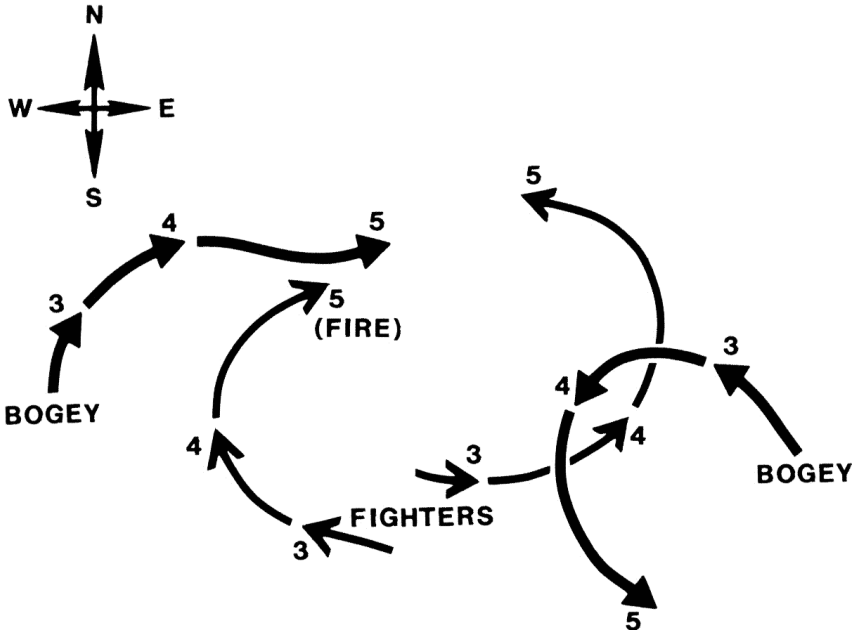

Figure 6-11. Loose Deuce Engagement, Two-vcrsus-Two (Conclusion)

maneuvers to negate its attack and keep it on the left side (i.e., to keep both bogeys to the south). Just as the bogey pilot reverses for a lead turn (time "5") he points his tail to the unseen western fighter, which obliges by blowing him away. Both pilots can then turn either north, to leave the area, or south, to find and engage the second bogey.

The techniques of loose deuce in two-versus-two engagements can be summarized this way: first each pilot negates any attack, keeping both bogeys on the same side of the aircraft if at all possible. Once the threat has been neutralized and the turn direction of the nearest bogey noted, an attack is made on the other bogey. This attack should be planned so that the final turn can be made in the direction of the first bogey, i.e., toward the anticipated threat sector. If an offensive advantage can be gained the target may be pursued, but only as long as both bogeys can be kept on one side of the aircraft or the free bogey is known to be no threat because of range, heading, etc. The attacking pilot should break off any attack and switch bogeys before allowing himself to be sandwiched.

In studying this sample engagement, it should be quite apparent that success hinges on having sight of both bogeys at critical times. In single-seat fighters this normally requires that the pilot shift attention from one bogey to the other as each becomes a threat or the object of pursuit. Multi-seat fighters have a distinct advantage in this environment since, with proper coordination, responsibility for watching each bogey can be shifted back and forth between crew members. This technique can reduce the chances of losing track of one opponent while concentrating on the other. The results of focusing full attention on one opponent to the excel-sin of all else (known as "padlocking") are demonstrated by the fate of the unlucky bogey in this example. Although more eyeballs can improve a

fighter's efficiency in a multi-bogey environment, this advantage is sometimes offset, and even reversed, if the additional crew members are gained at the expense of larger aircraft size and/or degraded maneuverability and performance. Field of view from each crew station is also critical.

The value of all-aspect Amass in this environment can be appreciated in Figure 6-10. With all-aspect missiles, both bogeys probably could be taken under fire at about time "3" in this example, thereby terminating the engagement much quicker and reducing the fighters' exposure in this hazardous environment. These weapons also have implications prior to the first merge (Figure 6-9) which are covered in a following chapter.

The defensive capabilities of fighters involved in protracted loose deuce maneuvering can be quite poor because of the inherent wide separations between fighters in both range and heading and the very high task loading placed on the pilots. Even with two-seater fighters, little time is available for purely defensive lockout duties, and advantage should be taken of any such opportunity presented. Defensive mutual support by presence can be effective, however, especially in low- to medium-threat environments. In such scenarios the quicker kill provided by greater offensive efficiency often compensates for a diminished defense. In very hostile scenarios the alternating offensive-defensive-offensive (i.e., strike-rejoin-strike) technice may be more effective.

Another problem inherent to prolonged loose deuce is the prospect that the engagement will break down into two separate one-versus-ones. Although this situation may be manageable by superior fighters, it does increase vulnerability to bogey loose deuce techniques and to additional wild-card attacks. One-versus-one engagements most often occur because of a lack of disciplined offensive switching or because a pilot loses sight of one bogey until he becomes critically defensive. Maintaining a good lookout and high energy reduce the chances of such a situation occurring.

Returning to the example illustrated by Figures 6-9 through 6-11 for a moment, note that the fighters made all turns in the nose-to-tail direction (i.e., turned across the bogey's tail) at each pass. This occurred because both bogeys were to one side of the fighter on each pass, so that by turning across the near bogey's tail the fighter was also turning toward the other bogey (i.e., toward the threat sector). Turning toward the threat sector is one of the keys to loose deuce maneuvering. After a head-on pass, a pilot is more likely to turn nose-to-tail because of greater ease in maintaining sight of the opponent he just met. By meeting each bogey on the side away from his wingman, the loose deuce pilot can turn nose-to-tail toward the threat sector while observing the near bogey's turn for future reference, and probably induce this bogey pilot into turning away from his own threat sector.

When a pilot is unable to pass a bogey on the desired side, he may have to execute a nose-to-nose turn to confront the threat sector. This situation is depicted in Figure 6-12, which is much the same as the scenario of Figure 6-10, except that in this case the western bogey has managed to get outside the western fighter at time "2." The pilot of the western fighter performs a nose-to-nose turn toward the eastern threat, while the bogey continues across the fighter's tail in a left turn. Since this bogey pilot has been

induced into turning back to the east (the direction of his threat sector), the possibility that the eastern fighter will be presented with an easy RQ kill is greatly reduced. Also, depending on the bogey's turn performance and weapons range, the pilot of the northern fighter (at time "3") may be forced to turn back south to defend against a missile launch by the western bogey. Such a defensive move may cause the northern fighter to turn in front of the eastern bogey and into a dangerous sandwich. This technique is therefore generally undesirable against bogeys that are more maneuverable and have long-range missiles. In this case, particularly against lower-energy bogeys, a vertical pull-up may be preferable at time "1," followed by a pitch-back toward the near bogey, a close pass (on the proper side this time), and another turn toward the threat sector. When the bogeys are equipped with all-aspect missiles, or when they have equal or better energy performance, however, vertical maneuvering can be quite dangerous and normally should be avoided.

In general, nose-to-nose maneuvering tends to keep aircraft closer together during an engagement, which is usually beneficial to the larger fighters. In addition, tight fights may limit the use of an enemy's all-aspect missiles because of minimum-range constraints. This is of particular value when only the enemy is so equipped.

Summary

The two-versus-two scenario can be very complex, and the outcomes of engagements often hinge more on such factors as section coordination, aircraft size, and number of crew members than on the more widely accepted measures of fighter performance. Aircraft performance and weapons-system performance remain as important players, but the impact

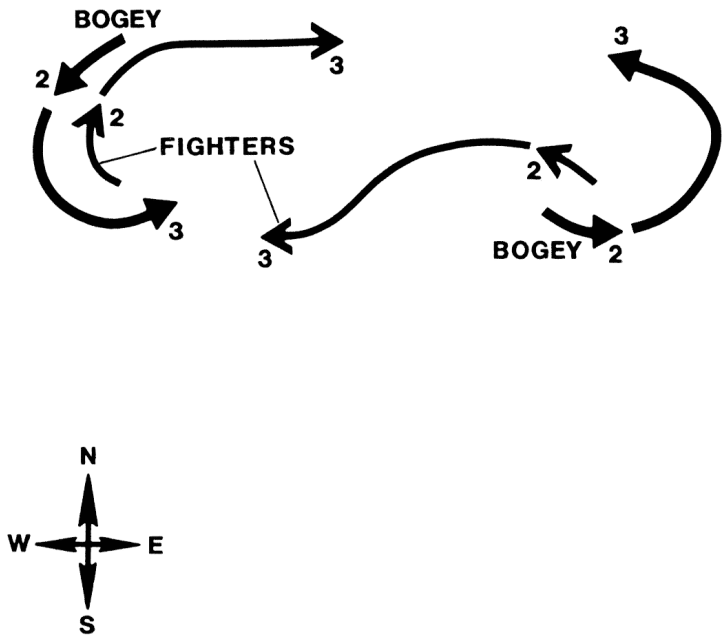

Figure 6-12. Nose-to-Nose Turns during Loose Deuce Maneuvering

of these factors may more easily be overshadowed by the more obscure parameters of fighter design, and by chance, in the multi-bogey environmet. Fighters, weapons systems, and tactics must be designed to reduce crew task loading. The vast majority of fighter pilots lost have been unaware of their attacker until it was too late. Reducing crew task loading, designing fighters for improved aircrew field of view and minimum detectability, and employing tactical doctrines that incorporate mutual support must, therefore, be of prime concern.

Four tactical doctrines have been examined so far: fighting wing, double attack, loose deuce, and one-versus-one engagement techniques. Fighting wing has been shown to be generally ineffective in the two-versus-two environment except against opponents with inferior pilot training, aircraft, or weapons. Engaging the bogey pair in two separate one-versus-one fights can be effective, provided the fighters have a weapons, pilot proficiency, or performance superiority. The lack of mutual support provided by this approach, however, may reduce offensive efficiency and leave the fighters vulnerable to coordinated bogey attacks as well as to attacks by additional wild-card enemy fighters.

Double attack and loose deuce doctrines employ essentially identical initial attacks (i.e., brackets and drags) in an attempt to eliminate one or both bogeys. If necessary, a single remaining opponent can be engaged with greater safety and effectiveness than an enemy pair can be engaged. (The comparative attributes of these two doctrines in two-versus-one situations were covered in the preceding chapter.)

The decision to re-engage or disengage is particularly critical if both opponents survive an initial attack, since prolonged two-versus-two maneuvering is a difficult and chancy undertaking. This decision can usually be made by the flight leader before the fighters ever take off; the decision is based on such considerations as mission objective, likely opponents, comparative pilot experience, relative aircraft and weapons-system design, and environmental conditions. Disengagements are most effective with minimum hesitation.

Once the fighters are committed to two-versus-two, double attack doctrine calls for the fighter with the greatest offensive potential to engage the more vulnerable adversary one-on-one (offensive), or to engage the greatest threat (defensive), while the free fighter protects the engaged fighter from attacks by the free bogey or by wild cards. If either fighter becomes defensive, the other comes immediately to its aid in any way possible. This method can be quite effective, particularly when the friendly fighters have superiority in pilot proficiency, performance, or weapons. Double attack can become easily saturated by additional bogeys (more than two), however, and mutual support between fighters can be effectively destroyed by determined attacks against the free fighter. In such situations the fight tends to divide into two separate engagements, often with undesirable results. The free fighter (and therefore the entire tactical doctrine) is especially vulnerable to hostile all-aspect missiles.

Loose deuce doctrine during prolonged two-versus-two engagements dictates that each fighter pilot operate semi-autonomously, alternately

countering and attacking each bogey in turn until one succumbs to an unseen attack. Defensive mutual support is generally by presence only, unless one fighter becomes defensive, at which time the wingman attempts to relieve the threat as quickly as possible. This method is potentially superior to double attack offensively, since both fighters are allowed to assume the offense at the same time. In addition, since it does not rely totally on the ability to outmaneuver the enemy aircraft, loose deuce can be successfully employed against superior enemy fighters and weapons.

The relative defensive merits of loose deuce and double attack are more open to question. The fact that the double attack free-fighter pilot is tasked only with defensive responsibility seems to argue for the superiority of this doctrine over the less structured mutual support "by presence" available during loose deuce maneuvering. The double attack free fighter, however, can effectively counter only one free bogey at a time, and even this ability is questionable when the friendlies are opposing superior fighters or all-aspect missiles. Once the free fighter is neutralized, double attack offers essentially no mutual support at all.

Loose deuce, on the other hand, because of its greater offensive efficiency, provides quicker kills and therefore subjects the section to less chance of interference by additional bogeys in a hostile environment. There is also less tendency for loose deuce fighters to become separated one-versus-one. These advantages, however, do not come cheaply. Loose deuce imposes an increased task loading on the aircrew which must be overcome by extensive training and the maintenance of high proficiency. Although pilot proficiency is of vital importance to any tactical doctrine, loose deuce is generally more sensitive to an incremental improvement in pilot performance than to a similar gain in aircraft performance. In addition, fighter design features such as aircraft size and pilot field of view may have greater impact than thrust-to-weight ratio or wing loading.

In conclusion, loose deuce appears to be the superior tactical doctrine in the two-versus-two scenario, provided aircrew proficiency is high. A notable exception to this generalization might be found when the friendly fighters have a significant performance or weapons advantage in a sterile environment against an enemy that is not equipped with all-aspect missiles. Caution, however, is necessary, because loose deuce is a relatively new tactical doctrine and has not been subjected to the test of time under actual combat conditions. Until they have been proven in many theaters of action under widely varying combat scenarios (and probably long afterward), the merits of this doctrine will remain hotly disputed.