

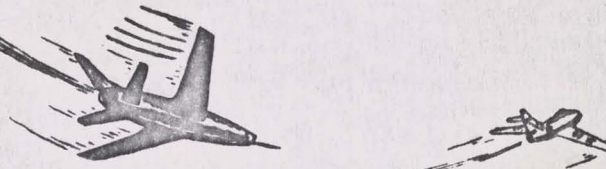
PART 1

AIR

Although present tactical commitments tend to relegate aerial tactics to secondary importance, it must be ever present in the fighter pilot's mind that he must be proficient in aerial combat maneuvering.

The series of articles which follow are designed to give the fighter pilot a basic concept of ACM. They are designed primarily for the F-100 but can be applied to almost any present day fighter.

COMBAT



MANEUVERING

Tactical offense and defense are so dependent on split-second timing, as well as the combat situation, that it is difficult to fully comprehend a discussion of these when studying them for the first time. It will take hours of practice in the aircraft and careful study on your part to become proficient in fighter tactics. To become expert is a full-time job.

Given an opportunity to engage the enemy, it may well be that the difference between those who become aces and those who are shot down will lie not only in the ability to handle the aircraft, but also in a complete visualization of the fighter tactics concept.

BASIC TACTICS

The fundamentals for fighter versus fighter tactics are very important to understand. Here the pilot picks up the building blocks on which must be based all the rest of his maneuvering. If he is limited in application of these fundamentals, so will he be in the rest of his training. It is imperative then that the pilot concentrate to fully understand and appreciate these fundamentals.

We have included the following elements in this section.

1. How to Perform a Hard Turn
2. How to Perform a Break
3. How to Recognize and Correct for Adverse Yaw
4. How to Recognize Favorable Yaw above Mach 1
5. How to Obtain the Best Results from your Afterburner

One can easily see that items 3 and 5 might not apply to every aircraft, but the rest can be included for nearly every present day fighter. The approach may also appear to be defensive in nature. However, we feel this is necessary, as any offensive action is directly dependent on the precise maneuver the defender chooses to execute. If the defender's knowledge is limited in scope, the attacker's corresponding maneuvers will reflect this limitation.

Therefore, to fully understand what the attacker may have to do, we first analyze the defender's possibilities.

The hard turn and break are considered basic maneuvers. The difference between the two lies in application. The hard turn is gradually and steadily increased to maximum performance to keep the attacker at high enough an angle-off to prevent a tracking solution. At the same time it is an attempt to gain an overshoot for lateral separation. The break accomplishes the same purpose, but maximum performance must be reached instantly as the attacker is within firing range. Now why not

use a break for every situation? Because a break, if done correctly, diminishes air speed very rapidly. This reduces future maneuvering potential and can possibly prevent a pilot from achieving an advantageous position if the turn has to be prolonged for too long a time. If a break is attempted in a situation demanding a hard turn, the turn would be extended for too long a time, and the airspeed loss would be great. Therefore, even though the defender frustrated the immediate attack, he will have placed himself in a more vulnerable situation.

An understanding of adverse and favorable yaw is necessary in the F-100 because they have a strong influence on the turning rate of the aircraft. Adverse yaw is the tendency of the aircraft to yaw or roll away from the intended turn. This influence is present in the subsonic range, but is especially noticeable at lower indicated speed ranges when a high relative G condition is present. Favorable yaw is the tendency of the aircraft to yaw in the direction of the intended turn. We recommend that the pilot pay particular attention to these items in the manual, as they will exert a tremendous influence on how well he can fly in a tactical maneuvering situation.

The afterburner is nothing more than an additional throttle increment. However, there are times and places where the afterburner is effective. Since it is essentially a ram-jet mounted tandem to a turbojet engine, its efficiency, like a ram-air jet, multiplies enormously as the speed increases. Therefore, the afterburner is most effective when used at higher mach numbers. It is effective also in a low-G nose-down condition to gain acceleration. However, very little advantage is gained when the afterburner is used in low-speed, high-G conditions. With the aircraft in a high angle of attack, the resultant drag is extremely high; therefore, the afterburner, if used, is in its least efficient speed range and provides poor acceleration characteristics.

How to Perform a Hard Turn

1. Estimate range and angle-off of the attacking aircraft.

2. Make a hard turn if the attacker is at a range greater than 2,500' or more angle-off. This is a planned maneuver in which you are trying to achieve lateral separation from the attacker.

3. Do not make an instantaneous maximum performance turn. This will kill off your airspeed very rapidly and will reduce your future maneuvering potential.

4. Play the turn to maintain your attacker at a high enough angle-off to force him out of your turn radius.

5. Increase rate of turn steadily but quickly to maximum performance. The F-100, in many cases, requires extreme rudder control to obtain maximum performance.

How to Perform a Break

1. Estimate range and angle-off of the attacking aircraft.

2. Call a break only if the attacker is closer than 2,500' and at a low angle-off in a tracking curve. This is an emergency maneuver designed to ruin your attacker's tracking solution.

3. Make an instantaneous maximum performance turn into the attack.

4. Use hard rudder momentarily (top or bottom) if necessary to change flightpath and get out of the impact area. This is necessary, if the attacker has already opened fire, to make his tracking more difficult and to prevent you from presenting a plan view as a target.

How to Recognize and Correct for Adverse Yaw

1. Notice the tendency in the F-100 for the nose to move in a direction opposite the turn. The F-100 is designed with large inboard ailerons to aid control through all flight conditions. In a turn, the low wing aileron is de-

flected up and the high wing aileron is deflected down. This condition imposes a greater amount of drag upon the high wing or in the direction opposite the turn. This will be more noticeable at airspeeds below 250 knots in a high-G condition; however, it occurs at all subsonic speeds.

2. Add rudder, as necessary, in the direction of the turn to counteract this condition. Rudder pressures should be increased as the rate of turn increases because of a steady increase in adverse yaw.

3. Do not add aileron in the direction of the turn. This will produce additional adverse yaw.

4. Neutralize aileron control and continue the turn. This will reduce the adverse yaw component and result in a maximum performance turn.

5. Do not arbitrarily use full rudder and opposite aileron to achieve a maximum performance turn. This may inadvertently place your aircraft in an uncontrollable condition.

How to Recognize Favorable Yaw above Mach 1

1. Notice the tendency, in the F-100, for the nose to move in the direction of the turn. This occurs, in the F-100, at speeds above Mach 1. Due to the formation of the shock wave upon the wings, with ailerons deflected for a turn, a favorable yaw is induced.

2. Do not use extreme rudder pressures. Excessive rudder may cause an uncontrollable rate of turn. It may become necessary to use slight opposite rudder pressure to perform a coordinated turn.

How to Obtain the Best Results from your Afterburner

1. Anticipate need for afterburner and try to use it before your airspeed dissipates and

your angle of attack or G-load becomes too high. Because of a very rapid increase in angle of attack below 250 knots, at lower altitudes, or below Mach .8, at high altitude, you will not gain optimum afterburner efficiency.

2. Do not use afterburner in a low-speed, nose-high condition. You will be at such a high angle of attack that your aircraft will be on or near the low side of the power curve. In this situation, the afterburner will not increase your acceleration appreciably.

3. Use the afterburner to gain acceleration in a nose-low, low-speed, low-G condition. (See low-speed yo-yo) Since you have a reduced angle of attack, you will obtain good acceleration characteristics. (See How to Maneuver for Airspeed and Lateral Separation.)

4. Use afterburner in short bursts or as necessary to maintain a high position on an opponent. (See high-speed yo-yo.)

5. Do not use afterburner if a surprise attack can be completed with normal engine power. The afterburner will leave a short smoke trail prior to ignition. This may compromise any surprise by advertising your position.

TACTICS INVOLVING A HIGH RATE OF CLOSURE

When a high speed attack is made against aircraft, the defender will maneuver generally as outlined in basic tactics and specifically as stated in "How to Defend Against a High Side Attack." The purpose of the resulting turn or break is an attempt to force the attacker into an overshoot condition and destroy his tracking solution. Furthermore, it is the first step in an attempt to attain offensive capability. All you need to know is how to make use of this overshoot or lateral separation. The scissor maneuver will provide just that. It forces the attacker, with his higher airspeed, into an ever increasing higher angle-off until he is forced completely out front and onto the defensive. The only prerequisite for this maneuver is a

definite overshoot and enough lateral separation to prevent the attacker from sliding into the 6 o'clock position when the reversal is attempted.

It is not hard to see, if you are on the attack with overtaking speed, that being caught in a scissor-type maneuver could be disastrous. How, then, is the attacker going to prevent such a catastrophe? Simple. Instead of overshooting the attacker, he will yo-yo high the moment he realizes he cannot stay inside the defender's turn. This will position the attacker at 6 o'clock high and still in an offensive position. However, just because the attacker is able to perform this maneuver does not mean that he has the situation completely at his command. The defender, upon recognizing the yo-yo, has a few alternatives. If the attacker yo-yo's too far behind or too high, the defender can use the maneuver for airspeed and lateral separation in an attempt to seek more favorable position. If the attacker yo-yo's high and maintains very little nose-tail separation, the defender can pull up into the attack by using the defense against a yo-yo. Of course this can be carried on and on by having the attacker use the proper procedures in the yo-yo if a defender pulls up into the attack.

In a head-on attack both individuals begin with the same potential. The objective here is not one of turning the aircraft the tightest to achieve a favorable position. Instead, it is to use your airspeed to turn in a 3-dimensional sense, instead of losing it and reducing maneuvering potential by turning in a level plane. The individual who knows the procedures required to trade airspeed for altitude (and vice versa), correct throttle technique, etc., will find himself gaining more turn and advantage, without the tremendous loss of airspeed and altitude usually associated with this maneuver.

Maneuvering in a turn overshoot presupposes an error in judgement. How to maneuver after a turn overshoot is designed to help erase the uncertainty and lack of action that normally results in a situation where such an error occurs. Also, it will help prevent the

possibility of being forced into a vulnerable position. Of course other actions may be employed, but this would depend upon the exact situation.

How to Defend Against a High Side Attack

1. Make an immediate nose-high 180° turn (lazy-eight type) and attempt to maneuver into a head-on pass if the attacker is at a range beyond 6,000'.

2. Begin a planned level turn into the attack if the attacker is inside 6,000' range. This will cause the attacker to increase G loading to continue tracking and position him farther inside your turn at a higher angle-off. This will force the attacker into a nose-low overshoot situation.

4. Pull the nose up hard and begin a turn reversal as the attacker passes behind your tail.

5. Continue the hard turn reversal and attempt a scissor if the attacker overshoots. You should not make a turn reversal until a positive overshoot is accomplished.

How to Perform a Scissors Maneuver

1. Increase your rate of turn into the attack until the attacker overshoots or moves outside your turn radius.

2. Reduce throttle and/or use the speed brake initially if necessary to increase the attacker's closure rate. The higher the rate of closure, the faster the attacker will be forced outside your radius of turn. Remember, speed brakes may advertise your subsequent maneuvers.

3. Pull the nose up hard and execute a turn reversal as the attacker passes your tail. The decision on when to reverse your turn will depend upon how rapidly the attacker is sliding to the outside of the turn and how far behind he is as he slides through your flight path. A good rule of thumb - rapid turn over-

shoot, early reversal, slow turn overshoot, late reversal. However, a reverse too early will be to the attacker's advantage.

4. Retract speed brake and advance power to gain and hold a high position behind the attacker.

5. Hold the nose up and slow your aircraft (without reducing power) as necessary to place you at your attacker's 6 o'clock position. Maximum attainable power reduces the stalling speed of your aircraft to the lowest possible increment. Therefore, the pilot able to reduce his airspeed most rapidly, as well as to the lowest increment, will end up with an advantage over his opponent.

6. Repeat a hard turn reversal each time your opponent slides through your flight path and to the outside of your turn.

7. Use rudder to obtain maximum performance on each turn reversal. If the initial reversal is misjudged and an extremely slow speed scissors results, rudder must be used smoothly or a snap or stall will occur.

8. Use speed brake to S down to six o'clock position or perform a top quarter roll-off to prevent over-running if you obtain a position above and behind your opponent.

9. Attempt to place yourself in phase with your opponent if you find yourself below and behind or under him. This forces your opponent into a visual disadvantage with the subsequent possibility that he may mis-manuever and help you to attain offensive potential.

How to Make a High Speed Attack

1. Stalk your target in an attempt to complete the attack at 800' range and in the 6 o'clock position.

2. Keep the aircraft you are attacking in sight. One glance away and you may not see him again.

3. Depress the gunsight electrical cage button to hold the sight reticle image on the reflector glass in a high G condition.

4. Position the gunsight reticle ahead of your target.

5. Check that your fuselage is pointing in the same relative direction as the target's fuselage. This will help prevent an overshoot.

6. Close on the target and get a radar lock-on.

7. Release the electrical cage button and place the pipper on the target within 2,500' range.

8. Begin to track the target as you close range and slow your aircraft to enable you to track smoothly. You may use the speed brake, abrupt elevator movement, or hard rudder to help slow down, but remember to maintain enough airspeed to give you an advantage in case you should miss the attack. However, too much airspeed may allow the defender to dive away, i.e., if the attacker is forced to zoom or yo-yo off in order to prevent an overshoot, the defender may use the maneuver for airspeed in order to gain separation.

9. Make a positive identification of the target. You should know it is an enemy before you squeeze the trigger. If you are unsure, you are out of range and should not fire.

10. Check range dial and open fire within 2,000' range. A 1/2-second burst will normally insure a kill if the pipper is held on the target while firing. For film assessing purposes, this is 16 frames of tracking time.

11. Maintain some closing speed and continue tracking the target. You should slow down to approximately a 50-knot closing speed to enable you to fire a lethal burst; however, all airspeed advantage should not be sacrificed.

12. Fire to a minimum range of 800' (training minimum).

13. Use afterburner if all closure speed is lost during any part of the attack.

14. Zoom or yo-yo off the target if you are unable to stay inside your opponent's turn radius.

How to Perform a High Speed Yo-Yo

1. Attempt to track the target as you close range.

2. Roll away from the turn and pull the nose up hard when you can no longer hold the pipper on the target. (This will prevent overshoot, loss of offensive, and subsequent defensive scissor). When the pipper begins to slide behind the target, you are no longer in the target's turning radius, and you must break off to prevent overshooting. This maneuver should be begun before reaching 2,000' range, or it will be difficult to maintain an advantage. At any time that it becomes impossible to maintain parallel fuselage direction with the target, your angle-off will be too high to complete an attack and you must yo-yo your target.

3. Slide high and to the rear of your opponent. You are now trading airspeed for altitude in order to prevent an overshoot on your opponent with the subsequent possibility of being caught in a scissors.

4. Push the throttle into afterburner range to gain a higher rate of climb, increase your turn capability, maintain a high airspeed, and gain a decisive altitude advantage. Use of the afterburner after initial pull-up will be determined by the target's evasive action and your rate of closure.

5. Do not use afterburner if it becomes apparent that your yo-yo apex will provide too much altitude separation. If your altitude separation is too great, your opponent may spiral or dive away and reduce your offensive potential.

6. Roll in on the target for another pass. Proper use of the speed brake and afterburner

will help cut your turn radius and speed your entry into the target's radius of turn. Rudder control must be used to obtain a maximum performance turn-in.

7. Do not lose your airspeed advantage until the kill is assured.

8. Perform this maneuver as many times as necessary until you are able to maneuver into a firing range and position. Mis-judgement is the original cause for an overshoot, and any well executed yo-yo maneuver should not require more than two pull-ups and subsequent attacks to insure a kill.

9. Use caution to prevent a nose-low attitude when attempting to slide down toward your opponent's 6 o'clock position. A steep nose-down attitude is difficult to recover from and may force you into a defensive situation if your opponent reverses up into the attack. Use the following procedures if this should occur.

10. Roll one-quarter turn away from your opponent's line of flight the instant your opponent begins pullup and you recognize a steep nose-low attitude as you approach tracking range.

11. Keep your opponent in sight and at the same time maintain nose-tail separation. (If you fail to take immediate action, your opponent will gain an advantage, and a dive for airspeed and lateral separation is recommended.)

12. Begin a smooth pullup without burbling the aircraft as you reach your opponent's original altitude. You will have a greater airspeed at that level than your opponent. This will allow you to maintain an airspeed or altitude advantage.

13. Continue the pullup and maneuver toward your opponent's 6 o'clock position as you gain advantage.

14. Continue maneuvering until you achieve a firing position. (Refer to sections concerning scissors and yo-yo maneuvers).

How to Maneuver for Airspeed and Lateral Separation

1. Play the attack in an attempt to force an overshoot. Your opponent will probably counter with a yo-yo maneuver in order to maintain his offensive advantage.

2. Wait until your opponent has his nose pointed well up. Any attempts to maneuver before your opponent has definitely committed himself to a nose-high attitude will destroy the effect of this maneuver. You are attempting to take advantage of the attacker's altitude separation to open the distance and obtain greater separation.

3. Reduce your G loading as much as possible and spiral 180° away from your opponent with maximum attainable thrust. The F-100 accelerates very slowly at high G-loads even in extremely nose-low attitudes. This maneuver will provide maximum acceleration and increase the rate of separation.

4. Relax more and more G's as the distance opens up to further increase acceleration and rate of separation.

5. Begin a maximum performance turn into the attack when maximum lateral distance is obtained (approximately 6,000' or more). (See section describing defense against a high side attack).

6. Attempt to maneuver to a still higher angle-off or a head-on pass.

7. Attempt to hold an airspeed advantage or gain an altitude advantage, then maneuver into an attack of your own.

How to Defend Against a Yo-Yo

1. Play the attack in an attempt to force an overshoot. Your opponent will probably counter with a yo-yo maneuver in order to maintain his offensive advantage.

2. Determine whether or not the attacker is going high and to the rear. If the attacker has an extremely high rate of closure, he will be forced into extreme altitude separation. Use the maneuver for airspeed as a defense. If the attacker slides high and maintains very little nose-tail separation, follow the procedures as outlined below.

3. Maintain a level to slight nose-down turn, relaxing G's as your opponent slides high. This will allow you to maintain airspeed for future maneuvering potential. Your opponent will probably not be able to recognize the decreased G loading.

4. Wait until your opponent has committed himself to a nose-low attack.

5. Make a hard rolling reversal up into the attack. This will force your opponent into a high angle, nose-low attack below and forward of your line of flight. This is caused by a rapid change in relative airspeeds - your opponent's airspeed increasing and your airspeed decreasing.

6. Maintain a nose-high attitude if your opponent attempts to pull up with you, and use speed brakes and power as necessary to slide into his 6 o'clock position.

7. Use hard rudder and maximum attainable power to turn behind your opponent if he dives away.

How to Maneuver after a Head-On Attack

1. Make a coordinated rolling pullup and a descending turn back down into the attack to decrease your turn radius after passing your opponent. This closely parallels the first half of a lazy eight maneuver and will allow you to cut off in the turn in both climbing and descending attitudes. If your opponent makes a level turn, his turn radius will be larger than yours, and you will gain some advantage by maneuvering toward his 6 o'clock position.

2. Use afterburner as you begin your pullup to minimize airspeed loss.

3. Do not attempt to hold maximum G-loading or burble the aircraft, as this will nullify the advantages of this maneuver.

4. Use afterburner throughout the descending part of the turn until a pullup is begun. If afterburner is used during the pullup, it will act in the direction of gravitational force and will impose an apparent higher wing loading and increase your radius of turn at pullup.

5. Shut off afterburner, begin easing the nose up, and maintain a slight nose-low attitude as you approach the target from the front quarter.

6. Initiate a rolling pullup as you pass the target and move throttle outboard to afterburner range as your nose passes through the horizon. This will prevent your opponent from obtaining separation.

7. Continue making dives and climbs until you are inside your opponent's turn radius. (See "How to Perform a Yo-yo").

How to Maneuver after a Turn Overshoot

1. Realize you are overshooting inside 2000 foot range when you can no longer track the target.

2. Do not attempt to pull into the target's radius of turn. This will impose high G loads, and possible buffet or stall will occur. All airspeed advantage will be lost.

3. Relax G-s, slide around the outside of the turn, and thereby maintain airspeed advantage.

4. Roll level and zoom up (wings level) as your opponent reverses into you. When your opponent reverses, he will be unable to match your zoom because he will have killed some of his airspeed on the reversal, besides having less airspeed to begin with.

5. Continue to pull up, wings level, and force your opponent forward and below your line of flight. If your opponent pulls up into a banked attitude, he cannot counter your maneuver if he has equal airspeed, since -

a. His stall speed is higher.

b. His pullup is only a component of a straight pullup.

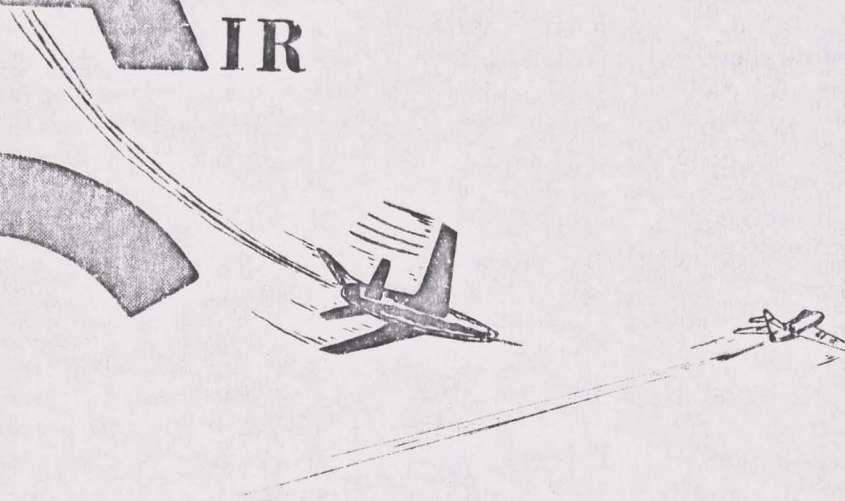
If your opponent pulls up wings level, he cannot counter because of your airspeed advantage.

6. Roll or slide down into your opponent's six o'clock position.

PART 2

This is the second in a series of articles on Air Combat Maneuvering. These articles are designed to give the fighter pilot a basic concept of ACM. It must be ever present in the pilot's mind that it is his job to make himself familiar with the contents of these articles.

AIR COMBAT MANEUVERING



TACTICS INVOLVING A LOW RATE OF CLOSURE

Positioning in situations involving low rates of closure is much more critical for the defender. By contrast, other than trying to close the distance, the attacker has a somewhat easier time getting into and maintaining a lethal position upon his opponent. It is not hard to see that the pressure is on the defender. Because of this, he is more apt to make errors when the demand for good judge-

ment is at its greatest. To a great extent, defenders and attackers will not be able to use the maneuvers available in attacks with a high rate of closure, as they will not give the necessary lateral separation or closing rates.

The problem in an attack, whether it is a high-angle or stern-quarter attack, is rate of closure. In a high-angle attack, if the attacker yo-yo's high off the defender in an attempt to achieve position, the defender can easily use the maneuver for airspeed and lateral separation to get out of danger. Therefore, the attacker must use the inside procedures as described in the low speed yo-yo where altitude is sacrificed for airspeed in a cutoff below and inside the defender. The same holds true in the stern-quarter attack except another factor enters in. The defender cannot see at 6 o'clock low. Therefore, the element of surprise may be coupled with the low speed yo-yo to gain a favorable position.

In defending against this type of attack, the conventional hard turn or break is performed. The problem, if the attack comes from the stern quarter, is that of achieving the necessary lateral separation for subsequent maneuvering. If the defender is able to achieve a reasonable overshoot, he may effect a scissors upon his opponent. (Assuming he may use power reduction and/or speed brakes in an effort to obtain the initial overshoot.) However, such a maneuver, in this instance, may cause an extremely slow-speed fight. This will result in both the original attacker's and the defender's maneuvering potential being reduced to such a low state that nothing more than a dangerous standoff will occur.

If you should approach such a low-speed condition that your opponent fails to overshoot properly, use the defensive spiral in an attempt to obtain the necessary lateral separation. It is easily seen that this is not an ideal maneuver and should only be used if absolutely necessary to extricate one's self from a vulnerable situation.

The defender should not use the scissors if he believes the overshoot or lateral separation is not enough to obtain offensive potential.

He may only solve the attacker's problem (if not in the defensive spiral) on the initial reversal, so the attacker can cut off and get the required lead for a lethal firing burst.

The vector roll may be used when little overshoot or lateral separation is achieved and the attacker is close at 6 o'clock (around 1,500' or less, 300 knot minimum airspeed). It is designed to take care of the attacker's aggressiveness in visualizing a kill he is about to claim. The attacker is forced to overshoot on the rolling pullup, but discounts it as he will be holding a high position when inverted and on top of the roll. However, he is "hooked" once he starts down the opposite side - if he attempts to maintain a lethal position - because of the resulting steep nose-low attitude relative to the defender. The attacker is then forced from the direction of the roll below and to the opposite side in an obvious overshoot.

A vector roll underneath may be used if your airspeed has dropped below the 300 knots needed for a roll over the top. The maneuver should be initiated when your airspeed is 250 knots or less. (If airspeed exceeds 250 knots, this presents no problem since your airspeed will bleed off rapidly with G applied.) Although more difficult to perform than the roll over the top, with practice, the vector roll underneath is a better maneuver than the defensive spiral and should be used once a high level of proficiency has been attained. The defender should not use either vector roll if he is able to achieve the necessary overshoot or lateral separation for a scissors. This maneuver imposes an extreme visual disadvantage, besides allowing the attacker to slide to a more favorable position without being able to counter. The attacker, in all probability, will not be enticed to follow the maneuver, as too much lateral separation is achieved. He will just pull high and wait until the maneuver is completed, then drive in again for the attack.

At high altitude, when the defender has a high mach number but a low indicated airspeed, the defender may be forced to perform a descending hard turn and break to maintain fu-

ture maneuvering potential. The attacker may be induced to press the attack, thinking his opponent is attempting to gain separation. This can easily result in a substantial overshoot. If so, the defender should take full advantage by executing a vertical rolling scissors. Caution should be exercised in employing this maneuver. The defender should be sure he has substantial overshoot and is able to anticipate power and speed brake along with skillful stick and rudder control. Otherwise the defender may be worse off than prior to executing the maneuver.

In a Lufbery a stalemate generally results. The reason this occurs is because the adversaries try to see who can turn the tightest without any understanding of the 3-dimensional sphere. If one of them would only exchange altitude for airspeed (low speed yo-yo) he would be effecting a cut off and maneuvering inside of the turn toward his opponent's 6 o'clock position. Quite naturally, if both fighters do the same thing, a stalemate results. If this should occur, a breakout must be made for airspeed and lateral separation to leave the fight or to develop a new set of conditions favorable to the defender. (See "How to Maneuver for Airspeed and Lateral Separation.")

How to Make a High-Angle Quartering Attack with a Low-Speed Yo-yo

1. Stalk your target and plan your attack so as to achieve as near a 6 o'clock position as possible when you arrive at 800' range by using the following technique.

2. Lower the nose and move throttle into afterburner range. This will increase your rate of closure, provide optimum engine performance, hasten your entry into the opponent's turn radius, and allow you to keep your opponent in sight during the attack.

3. Continue a rolling descent and play your opponent's defensive action. If opponent continues straightaway, steepen descent immediately and set up an underside attack or six o'clock low attack.

4. Cut off as much as necessary to close upon the target; however, attempt to gradually reduce your angle-off as range diminishes. This will enable you to arrive inside the cone of maximum performance at firing range. If you are unable to reduce the angle-off, maneuver as outlined below.

5. Press the attack until you realize it will be impossible to stay inside your opponent's turn radius.

6. Release back pressure and steepen descent immediately and at sufficient range to prevent subsequent overshoot and loss of offensive potential. This will enable you to stay inside your opponent's turn and keep him in sight. Your opponent, being in a maximum performance turn, is in a minimum radius turn for his airspeed condition and will be unable to further tighten his turn. Since your aircraft is no longer in the same plane as that of your opponent, you will gain airspeed, cut off your opponent to the inside, and slide below him with increased offensive potential (low speed yo-yo).

7. Shut off your afterburner and increase back pressure, as you slide below and inside your opponent, to initiate a zoom toward his 6 o'clock position. This technique will diminish your horizontal turning component and allow you to describe an arc inside your opponent's turn.

8. Relight your afterburner (if necessary) as your nose comes through the horizon to accelerate toward your opponent's 6 o'clock position. You may also have to relight your afterburner if you slide slightly to the outside to maintain zoom capability and subsequent offensive advantage.

9. Pull up toward your opponent's 6 o'clock position and maneuver as necessary to complete the destruction. Since you are maneuvering inside your opponent's turn at all times, you will be able to pull up into or slightly above his 6 o'clock position without being forced to the outside.

10. Attempt to maintain altitude above your opponent if your rate of closure is high and insufficient range remains to maneuver inside and below your opponent's turn radius. (See High Speed Yo-yo).

How to Make a Stern or Quartering-Stern Attack

1. Set up a rate of closure and maneuver to 6 o'clock low. This is the most valuable position behind all later model aircraft, as rear visibility is extremely poor in this area, and it is considered one of the best attacks with this type aircraft.

2. Dive to increase airspeed and rate of closure. The element of surprise is one of the most important principles of warfare, and you should attempt to move into the target's area of minimum visibility before lighting afterburner.

3. Use afterburner to maintain a rate of closure. The use of afterburner may compromise your position. However, if you are unable to close upon your target, you should disregard the element of surprise and use afterburner in an attempt to obtain a positive intercept.

4. Continue closing with a slight nose-low attitude until you reach a position where you can exercise a pullup and remain in firing range.

5. Initiate a smooth pullup into firing position and use afterburner as necessary. Any abrupt control movements will cause you to lose any closing advantage you might have had.

6. Zoom above your opponent if you have critically misjudged your rate of closure and position yourself for another attack.

How to Defend Against a Stern or Quartering-Stern Attack

1. Estimate the attacker's range and rate of closure.

2. Make an immediate planned level turn into the attack. This will force your opponent to cut off and result in a subsequent high angle-off. Since the rate of closure is low, any delay will place the attacker in a more advantageous position.

3. Increase rate of turn steadily until maximum performance is attained. This will prevent your attacker from reducing his angle-off as range diminishes.

4. Begin a climb into the attack, if the attacker is high, as he approaches 2,000' range.

5. Begin a shallow dive into the attack, if the attacker is low or level, as he approaches 2,000' range.

6. Increase the dive or climb steadily as range decreases. This will help further increase your opponent's angle-off.

7. Attempt to maneuver into a scissor to gain offensive advantage. If it is impossible to force your attacker into an overshoot for a scissor maneuver, you should begin a defensive spiral, or use the vector roll.

How to Maneuver into a Defensive Spiral

1. Lower the nose to maintain maneuvering airspeed and continue a maximum performance descending spiral into the attack. This is to prevent your opponent from tracking you and at the same time maintain some degree of lateral separation. You should attempt all other possible maneuvers before being forced into this situation.

2. Avoid an excessive nose-low attitude. By reducing your turn radius you will prevent your opponent from obtaining the required lead and tracking time necessary for destruction. You should retain a steep enough dive to maintain maneuvering airspeed.

3. Retard throttle rapidly after you have forced your opponent into a nose-low spiral

at or near your 6 o'clock position. This will tend to decrease and flatten out your rate of descent. It will also cause a slow bleeding off of airspeed and force an overshoot upon your opponent. This is an insidious maneuver, as it is extremely difficult for your opponent to notice the throttle reduction and subsequent loss of airspeed.

4. Extend speed brake and make a hard rolling reversal and pullup as your opponent slides through your line of flight. This will further increase your opponent's rate of overshoot and destroy his offensive advantage.

5. Continue hard nose-high reversal. (Refer to section describing a scissor). If, after initiating a nose-high reversal, you do not have the necessary lateral separation, perform a vector roll.

How to Perform a Vector Roll

1. Perform a hard turn or break to achieve lateral separation. If you do not receive the separation necessary to perform a scissors maneuver against your opponent, and he is in close (about 1,500' or less) toward the six o'clock position, use the following procedures.

2. Reverse and barrel roll without releasing any G forces. This requires extreme rudder control and very little aileron movement. (See section describing adverse yaw). This maneuver will give you a deceleration advantage, because your line of flight will describe an arc above the horizon prior to your opponent. This will result in a subsequent overshoot by your opponent. You should have 300 knots or more, on initiating the reversal, to successfully accomplish the maneuver.

3. Hold top rudder when coming down the opposite side of the roll if your opponent is well committed. This will prevent dish-out and tend to flatten out your roll.

4. Look for your opponent high and from the direction of the roll. He will slide below

and forward from that position, providing you hold top rudder after your opponent has committed himself to follow you.

5. Continue rolling and increase nose-up attitude to force your opponent to slide below and in front of you.

6. Continue maneuvering as necessary to complete the destruction. If your opponent slides well below and forward, complete another roll in the same direction or opposite direction and drop into a 6 o'clock position, keeping your opponent in sight at all times. If your opponent does not slide forward, use a scissor maneuver to achieve the offensive.

7. Try to keep your opponent in sight at all times, as he can pull high and out of the roll and wait for you to complete it before coming in again. If he should pull high, maneuver as outlined below.

8. Check the attitude of your opponent's aircraft relative to the horizon.

9. Relax your G's and spiral or dive for airspeed if your opponent has an extremely nose-high attitude. You should use afterburner to obtain maximum separation.

10. Continue your roll if your opponent has a level or slightly nose-high attitude. Since your opponent's line of flight is now a straight line and your aircraft is describing an arc, you will tend to slide to the rear and below your opponent.

11. Maneuver and use power as necessary to achieve a firing position.

How to Perform the Vector Roll Underneath

1. Perform a level hard turn or break to achieve lateral separation.

2. Continue the roll underneath without releasing G forces. This is to prevent subsequent increase in airspeed and make it extremely difficult for the attacker to solve his

tracking problem. Use this maneuver when your airspeed is below 250 knots.

3. Hold rudder in the direction of the roll all the way around the roll, reduce power, and extend speed brakes as necessary. By holding the rudder you will prevent a steep nose-low spiral and a subsequent easy tracking solution. Your opponent will probably attempt to follow but will not be concentrating on the rudder and stick pressures such as you have employed. Consequently, his aircraft will be cleaner aerodynamically, and an overshoot will most likely occur. If this situation arises, maneuver as outlined below.

4. Continue rolling in an attempt to increase the attacker's overshoot and at the same time slide behind his line of flight. Since the attacker, in a relatively coordinated condition has been concentrating on the gunsight, an overshoot underneath will be effected before he can counter with the same stick and rudder technique.

5. Continue maneuvering as necessary to achieve a firing position.

6. Do not use this maneuver as a crutch when in doubt as to what to do. Visibility is extremely limited. The attacker may delay while you are well committed, then follow through to set up a tracking situation in your blind spot, or he may follow immediately, using the same technique as you have employed. This is unusual, however, since he does not suspect what is happening until the overshoot has been accomplished.

How to Perform the Vertical Scissors

1. Make a hard descending turn or break. This is to help prevent an opponent from tracking you and at the same time prevent too great an airspeed reduction with subsequent loss of maneuverability. You will generally run across the condition at higher altitudes at relatively low indicated airspeeds, but at fairly high mach numbers.

2. Roll and reverse in the opposite direction after achieving the necessary lateral separation. This will be the only true reversal. The rest of the maneuver is a vector roll.

3. Reduce power and open the speed brake to slow rate of descent.

4. Continue rolling toward opponent's flight path with hard back pressure and rudder control. This will result in a wider descending roll-spiral arc and in addition tend to slow your rate of descent relative to your opponent's. (See section on Roll Underneath.)

5. Apply power and speed brake as necessary after reaching the 6 o'clock position.

How to Gain an Advantage in a Lufbery

1. Lower the nose of your aircraft to the inside of the turn. Since there is very little rate of closure in a Lufbery, it becomes necessary to slide low (low speed yo-yo) to the inside in order to cut off and maneuver inside your opponent's turn radius.

2. Use afterburner in the descent until a pullup is begun. By staying in afterburner range during the pullup, you will describe a wider arc and ruin the effectiveness of this maneuver.

3. Do not burble the aircraft. You may have to ease off on the G-load slightly; however, this will result in an increase in airspeed and subsequent zoom capability.

4. Shallow out your turn and begin a pull-up toward your opponent's 6 o'clock position. This should be accomplished as you approach a position low and approximately 30° behind your opponent.

5. Employ afterburner as your nose comes through the horizon to accelerate toward your opponent's 6 o'clock position.

6. Repeat this maneuver to the inside until a firing position is attained.

TACTICAL FORMATION

Tactical formation of fighters and fighter bombers must possess the characteristics of maneuverability, mutual support, and ease of control and still maintain a high offensive potential with the ability to become defensive if the situation demands.

The purest form of defensive formation occurs when all units of the flight fly as close to line abreast as possible. This type formation is best for providing cover for the flight, but maneuverability of the flight is highly reduced. This formation could be used when returning from a target, when on the defensive, or to control a large group of fighter bombers to a target.

In-trail formation is the best for pure maneuverability, but flight coverage is at a complete minimum. A compromise, utilizing the most desired features of both, is known as "fluid element" and is flown because of its maneuverability and flexibility at all altitudes.

Fluid element in the F-100 is flown with the wingman approximately 1000/1500 feet out and approximately 20° to 35° back. This position allows the wingman to fall into the fighting position immediately when called upon to do so. The fighting position is an approximate 60° cone back of the leader and out about 600/1000'. From this position, the wingman can also provide coverage for the entire flight. The element is flown about 5,000' out, approximately 2,000' above and 10° to 35° back. This gives the element a position that affords it an advantage on any aircraft trying to attack the lead element.

How to Fly the Fluid Element Formation

How to Fly the Position of the Wingman in Patrol

1. Hold position by flying off the leader's wing approximately 20° to 35° back and 1000/1500' out, on the side opposite the element. If you fly in closer, too much time is spent

in flying and not enough looking around. Flying too far out allows the wingman to become separated from the leader during hard maneuvers, (especially high altitude) and mutual support becomes extremely difficult.

2. Play the outside as well as the inside of the turn for mutual coverage. If the wingman attempts to stay on the inside of the turn, at high altitudes, by varying power he will only fall back.

3. Fly a partial extended low position on the inside of the turn and an extended high position on the outside of the turn.

4. Lower your nose and cross to the inside if you are on the outside of the turn. If you are on the inside of the turn and sliding forward, cross to the outside, then slide high and fly in the plane of the leader. This technique provides mutual coverage at almost all times during the turn and is actually easier, once it is mastered.

5. Do not cross in front of your leader. Always maintain nosetail separation.

How to Fly Position of Element in Fluid Four Patrol

1. Position the element leader approximately 5,000' out, approximately 2,000' above and 10° to 35° back of the lead element.

2. Maintain a relative position with your leader in turns. If you are on the outside of the turn, lower your nose and cross to the other side of the leader when you find yourself out-turned and pulling back. When you are being turned into and find yourself creeping forward, slide high and/or cross to the outside of the turn to maintain position. In other words, play the vertical as well as the horizontal plane in order to maintain supporting position.

3. Lower your nose to gain airspeed and position when you find yourself too far back

after rolling out of a turn. When you regain your forward position, you may pull back to the original fluid position.

4. Pull your nose up and kill off airspeed if you find yourself too far forward after rolling out of a turn. You may also retard throttle; however, this is not advised when at altitude. When you regain your correct relative position, lower the nose to maintain proper vertical separation. All maneuvers must be smooth to prevent over-correction.

5. Bank from side to side and look below when crossing forward and high on the lead element. This will prevent you from losing the lead element during crossovers.

6. Think in terms of a relative position to the lead element at all times. In theory you are matching your lead element's airspeed and rate of turn.

7. Cover the leader at all times, particularly when he is maneuvering to make a kill. Your primary purpose is to cause an attacker on the lead element to break off, thus allowing your leader enough time to destroy the enemy aircraft.

How to Fly as a Wingman in the Fighting Position

1. Decrease lateral distance perpendicular to the leader's flight path.

2. Keep your fuselage aligned with your leader's at all times.

3. Fly in a 60° cone in fighting position about 600/1000' back (see figure 1). This is along a line that splits the angle formed by the trailing edge of the wing and the fuselage of the leader's aircraft.

4. Stack down slightly and avoid flying in the same geometric plane with the leader's wings on the inside of the turn.

5. Maneuver through both the horizontal and vertical planes to maintain position. Slide

high when overshooting and drop low to the inside when falling back in order to maintain position on the leader.

6. Attempt to stay out of the in-trail position as much as possible.

FLIGHT TACTICS

The present concept of tactical employment is fluid four formation. The fluid element is seen as an important asset to a well trained offensive unit. However, after the initial intercept, in ACM it is extremely difficult for the fluid element to achieve a favorable tactical position and at the same time provide supporting cover for the lead element. Why, then, do we utilize this as our basic maneuvering formation? In the past, and to a great extent at the present, too few fighter pilots have a working concept of Air Combat Maneuvering. Instead they substitute numbers for skill. If the day is reached where every fighter pilot can be trained to be a qualified tactician, this strength-in-numbers routine might not be necessary.

In flight tactics, other than employment of cross cover and mutual support, only a few new basic maneuvers must be mastered.

The defensive split is employed when an element has been unable to force an overshoot or gain separation upon an attacker. Since this maneuver requires excellent judgement to execute properly, and places the defenders in an extremely vulnerable position if used at the wrong time, do not use the defensive split as a standard for evasive action.

The vertical split is nothing more than a fluid separation in the vertical plane. The maneuver is employed when an attacking element appears to make an overshoot that could easily result in a slow-speed scissors. Rather than have a dangerous stand-off, a fluid separation is performed in the vertical plane in an attempt to achieve a tactical advantage and reduce the possibility of a mid-air collision between elements. It is effective since the attacking ele-

ment made an error in judgement and overshoot the turn. It is doubtful if he will correct this error by countering with similar action. (How to Maneuver as an Element after a Turn Overshoot with a Slow Rate of Closure.)

When operating as a flight of four on the defensive the basic consideration in any supporting action against an attack is the idea of keeping both elements' line of flight parallel. This allows the defenders in a fluid separation, whether near vertical or horizontal, to set up effective supporting action in an effort to achieve an offensive advantage. By contrast, when making an attack with a flight of four, a separation of the defending elements will be necessary in an effort to prevent them from setting up effective mutual support. An attack in train will provide this separation. It frustrates the defenders' initial efforts to set up mutual support and it allows each attacking element to position itself behind each of the defending elements. Therefore, each defending element is on its own. As a result, a permanent separation is achieved and mutual support is impossible.

How to Operate as an Element Team

1. Maneuver on offense or defense as described in the preceding sections, flying as a single unit until an advantage is gained by one side or the other.

2. Maintain element integrity while on the offense if the enemy splits and there is danger from other enemy flights.

3. Perform a defensive split if unsuccessful in eluding an opponent by all other maneuvers. Since this maneuver requires split second timing and judgment, a permanent separation may be achieved to the defender's disadvantage.

How to Perform a Defensive Split

1. Call the wingman to continue the turn into the attack. The decision should be made

before the attacker reaches firing range and with enough altitude remaining to complete the maneuver.

2. Slide high and to the outside when maneuvering as the leader. You should play the pullup to maintain a supporting position upon the wingman.

3. Do not kill off airspeed by abrupt or violent maneuvers. You are attempting to force the attackers to concentrate their efforts on one man, and you must maintain sufficient airspeed for future maneuvering.

How to Continue the Defensive Split when the Attacker Selects the Low Man

1. Continue a level or slightly nose-low maximum turn when maneuvering as a wingman. The wingman shouldn't lower his nose excessively, as the attackers are trying to force him down and out of the fight.

2. Attempt to sandwich the attacker when maneuvering as the leader. In performing this maneuver the wingman will attempt to maneuver as necessary to gain lateral separation and subsequent offensive potential.

3. Play your wingman's evasive maneuvering to achieve a firing position. If your wingman maneuvers onto the offense, you should support the attack. He should use any of the applicable preceding maneuvers in an attempt to throw his attackers on the defensive.

4. Rejoin the element as soon as possible to obtain maximum mutual support.

How to Continue the Defensive Split when the Attacker Selects the High Man

1. Make a high-G reversal or vector roll underneath when maneuvering as the leader. By doing this the attacker will be unable to track.

2. Call the wingman to reverse and pull up into the attack. The wingman should be

alert and execute the reversal the instant the attackers select the leader. This will force the attackers into a sandwich.

3. Pull down into the attack and continue evasive action as necessary when maneuvering as the leader. The leader may be able to achieve offensive advantage. If this occurs, the wingman should support the attack.

4. Play the leader's evasive action to achieve a firing position. Once again the leader should fly as above, i.e. he should attempt to gain the offensive by use of the applicable previous maneuvers.

How to Continue the Defensive Split when the Attack Switches from Low to High

1. Maneuver initially as outlined in the section describing the attack on the low man.

2. Determine the attacker's relative airspeed. If the attacker attempts to stay with the wingman too long he will lose airspeed very rapidly. The leader should pull the nose up rapidly to gain maximum altitude if the attacker stays with the wingman too long prior to the switch. Since the attacker's airspeed is less than the leader's, he will be unable to execute a successful attack. The wingman should make an immediate nose-high reversal and force the attacker into a sandwich. Allow your opponent to slide ahead and then ma-

neuver offensively or in support of your wingman to complete the attack.

3. Break down into the attack when maneuvering as the leader if your attacker does not decrease his airspeed in maneuvering with the wingman.

4. Make an immediate roll-out and pullup when maneuvering as the wingman. This maneuver should be initiated the instant the attackers switch to the leader in order to develop a sandwich.

5. Play the leader's subsequent evasive action in order to achieve a firing position or to support any offensive action by your leader.

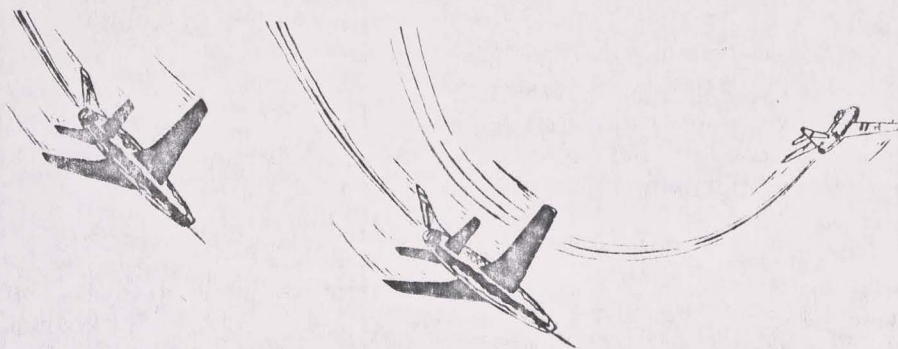
How to Continue the Defensive Split when the Attackers Split

1. Split into a 1 versus 1 situation.

2. Maneuver as necessary to elude your opponent. (See section covering individual maneuvers.)

3. Disregard your teammate's actions until you are able to successfully evade your opponent. By doing this, you will not compromise your defensive position.

4. Attempt to rejoin and support one another as soon as possible. You may be forced to destroy your opponent before effecting a rejoin.



PART 3

AIR

This is the last in the series of articles on Air Combat Maneuvering. We sincerely hope that this series has given the fighter pilot a basic concept of how to perform ACM. However, since it is still each Tactical Fighter Pilot's job to "Fly and Fight", it is with him that the individual responsibility lies to STUDY and PRACTICE!!

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OMBAT

How to Maneuver Against a Defensive Split

1. Attempt to force the low man down and out of the fight. You are trying to force the weakest man out of the fight to give you a two to one advantage. Normally the wingman will be the least experienced.

2. Do not prolong your attack on the low man. This may kill off too much airspeed and result in a loss of offensive advantage. (See section covering defensive split when the attacker switches from low to high.)

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3. Switch the attack to the high man. This maneuver should be performed before the high man reaches your line-abreast position.

4. Perform a fluid separation and allow your wingman to force the low man down and out of the fight. This maneuver should be performed only if the wingman is fairly experienced. He should not attempt to destroy the low man, but force him down and out of the fight as quickly as possible, while maintaining visual positioning on the leader. If your wingman is relatively inexperienced, you should maintain close element integrity.

5. Rejoin the leader as soon as the low man has been definitely committed out of the fight. Do not follow the low man too far or element integrity and all mutual support will be sacrificed.

6. Complete the attack with a two-against-one advantage. The wingman should continue to closely observe the low man to prevent any counter-attack.

How to Perform the Vertical Split

1. Determine the attacker's rate of overshoot. If the rate of overshoot is relatively slow it would still be advantageous to begin a scissor. You should maneuver as outlined below.

2. Begin a scissor and allow your wingman to perform an extremely nose-high pullup on the initial reverse. This will give you vertical separation and provide the wingman ample clearance if a tight scissor develops. This maneuver must be accomplished on the initial reversal to retain enough airspeed to gain a decisive altitude advantage. If this maneuver is attempted later, it is doubtful if any separation can be attained, as both elements will be performing nose-high reversals.

3. Pull up behind the attacker if he attempts to switch to the wingman. If the attack switches to the wingman, the wingman should break down and into the attack to maintain a high angle-off and force the attackers into a

sandwich. Generally the attack will continue on the leader, because the attackers are already committed in a hard turn and are unable to execute an extremely nose-high pullup.

4. Play your leader's maneuvering in an attempt to support or sandwich the attack when the attack remains with the leader.

How to Maneuver as an Element after a Turn Overshoot

1. Recognize an obvious overshoot developing.

2. Roll wings level and zoom up as the element reverses into you.

3. Force the defending element forward and below your line of flight. The enemy element will be unable to counter because of his airspeed disadvantage.

4. Roll or slide down to the defender's six o'clock position.

How to Attack a Flight of Four with an Element

1. Begin your attack on the high element, if possible, at 6 o'clock low. This will position you in your opponent's blind area.

2. Switch your attack to the lead element after the high element is well committed in a defensive maneuver. If the high element should reverse, pull high and position yourself behind the trailing element while you still have an airspeed advantage.

3. Drive in again and attack the trailing element. If the defenders attempt (or are able) to provide mutual support, slide high once again behind the trailing element.

4. Continue this procedure until the defenders are unable to provide mutual support. Then drive in and attain a firing position behind the trailing element. Your wingman should

keep you informed on the whereabouts of the free element to prevent any possible counter-attack.

How to Attack a Flight of Four with Four

1. Begin your attack on the high element. Attack the high element from the lead element side.

2. Perform the attack in staggered train (element behind element). This makes it difficult for the defense to observe the fluid element. Therefore, they are more apt to mis-manuever and set up the fluid element for a successful attack.

3. Switch your attack to the lead element after the high element is well committed in a defensive maneuver. At the same instant, switch your fluid element behind the defenders' free element. This double switch counters the defenders' possibility of setting up an effective sandwich on the lead element. Also, it will position both attacking elements at the defenders' 6 o'clock position.

4. Press the attack as separate elements. This allows each element to take advantage of its superior position. Also, it prevents the defenders from effecting a rejoin and subsequent mutual support.

5. Maneuver behind the trailing element if you have the whole flight breaking in the same direction.

How to Defend Four when Attacked by Two

1. Check to be sure there is only one element performing the attack.

2. Turn the high element away from the lead if possible. Here assume the attackers have committed themselves to the high element.

3. Turn the lead element in on the attackers. You then have them sandwiched and on the defensive if they press their attack on the high element.

4. Call the fluid element to reverse onto the attackers if the attack switches to the lead element. Here we still have them in a sandwich but in reverse order.

5. Press the attack and force the defenders to break off the lead element.

How to Defend Four when Attacked by Four

1. Turn the high element away from the lead if possible. Here assume the attackers have committed themselves to the high element. As lead element, check the position of the attacking fluid element.

2. If the attacking fluid element stays with his lead element, sandwich the flight of four in the same manner as you would an element.

3. If the attacking lead element switches the attack to the defending lead element and the attacking fluid element switches the attack to the defending fluid element, maneuver as separate elements.

4. Disregard your friendly element's actions until you are able to successfully evade your opponent. By doing this, you will not compromise your defensive position.

5. Attempt to rejoin and support one another as soon as possible. You may be forced to destroy your opponent before effecting a rejoin.

6. Do not operate as a single aircraft in a combat area if you become separated from your element or flight. A surprise attack is easily accomplished against a single aircraft. When flying as an element, it is not advisable to use vector rolls prior to executing the defensive split.

We sincerely hope that the foregoing has aided you, the fighter pilot, in a better understanding of aerial combat maneuvering. Remember the key to success is knowledge and knowledge is gained only through ardent study. It is true that practice makes perfect, but you can not practice what you do not thoroughly understand.