CTAF MANUAL 51-1

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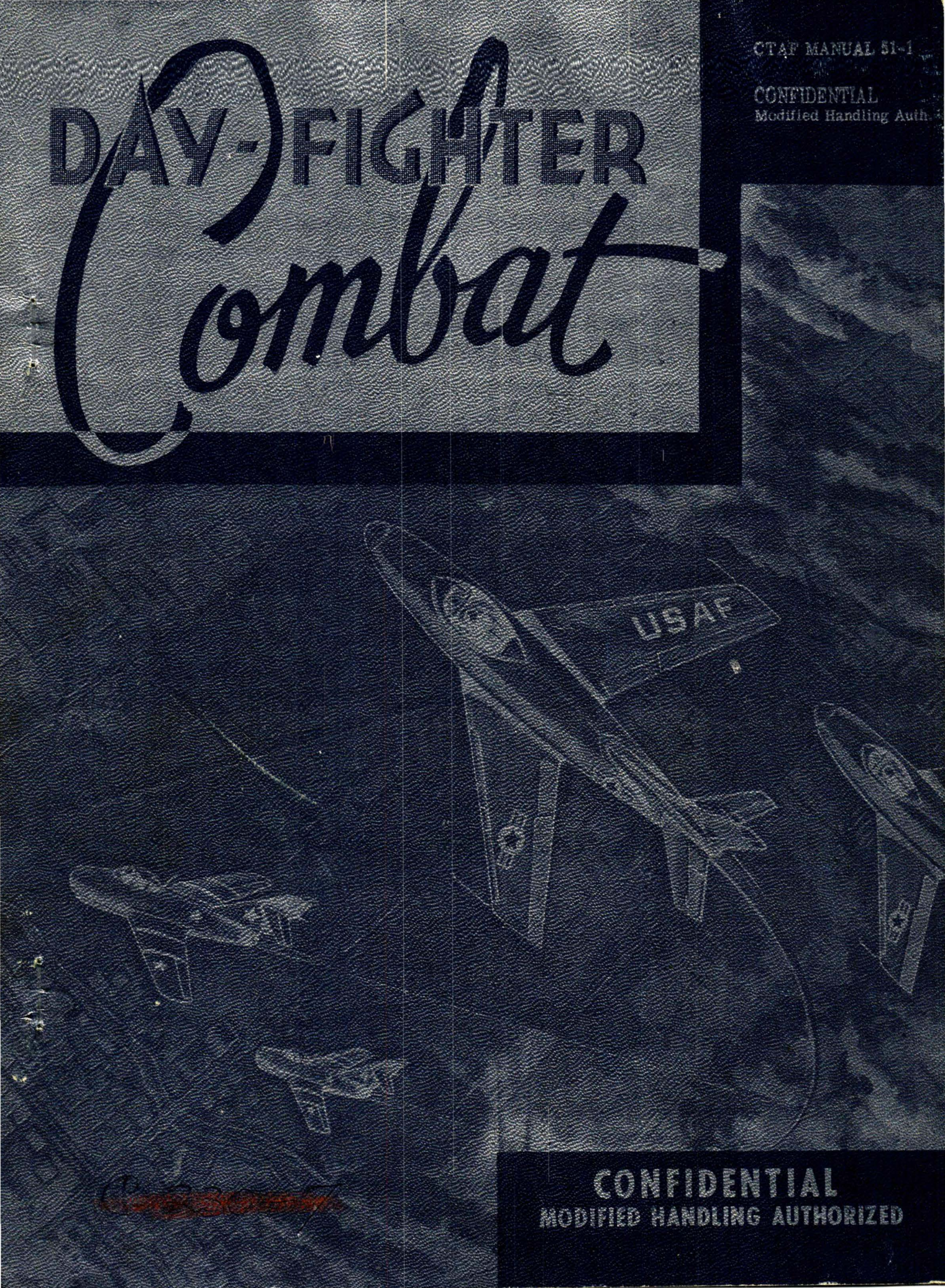
DAY-FIGHTER Combat



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CTAF MANUAL

NUMBER 51-1

HEADQUARTERS
CREW TRAINING AIR FORCE
UNITED STATES AIR FORCE
RANDOLPH AIR FORCE BASE, TEXAS
26 November 1956

FOREWORD

1. Purpose. The purpose of this manual is twofold:

a. To provide CTAF fighter instructors and students with a source of information concerning the operation of fighter aircraft in aerial combat.

b. To outline the methods and procedures to be used in the conduct of Air Combat Maneuvering Training within Crew Training Air Force.

2. Scope. This manual presents background information on day fighter operations required by the Crew Training Air Force instructor in the intelligent performance of his duties.

3. Recommendations. Recommendations for improvement of this manual should be forwarded through channels to DCS/P&O, Fighter Division, Crew Training Air Force, Randolph Air Force Base, Texas.

BY ORDER OF THE COMMANDER:

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Downgraded

KEEPING TACTICS CURRENT

The question will inevitably arise in a manual of this kind as to when this type information becomes outdated. To answer this it might be wise to consider this manual as a bag of tricks. No one aircraft will give the capability to profitably use all the tricks in this bag. Each aircraft, because of its wingloading, weight, power, after-burner, visibility or some other characteristic will make certain things useful and certain things foolhardy. The responsibility lies with each fighter pilot to become familiar with all the contents of the bag and then choose only those things applicable to his particular aircraft. The contents in this bag we believe will prove useful as long as opposing fighters have weapons that are most effective when delivered from near the six o'clock position of the aircraft being attacked.

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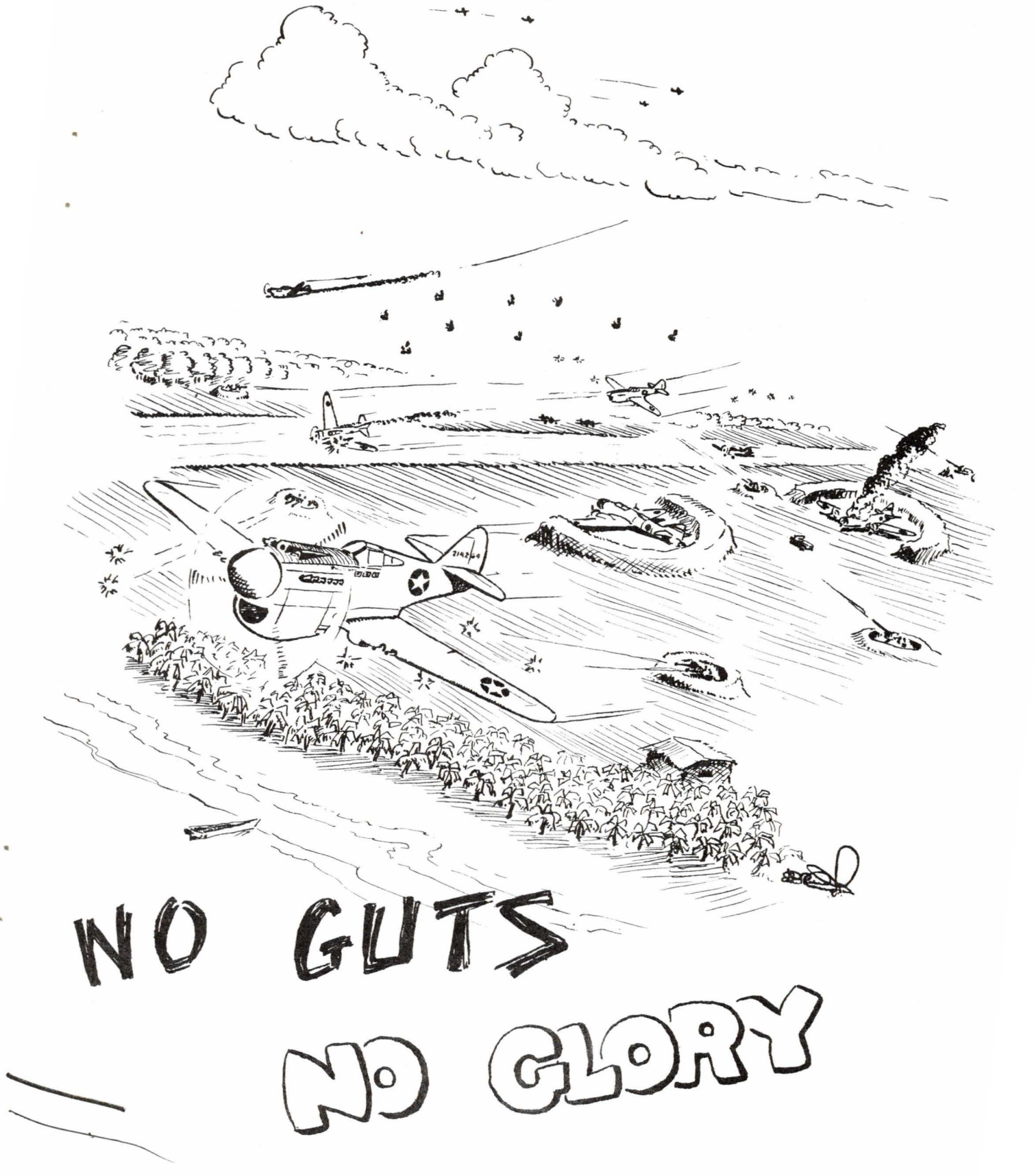

NO GUTS
NO GLORY

AIR COMBAT MANEUVERING

This entire manual is devoted to the methods and principles involved in acquiring skill in air combat maneuvering. In order to understand why so much time and effort have been expended on such a project, let us look at the Aerial Combat Training program and the relative position of air combat maneuvering in this program.

Aerial Combat Training in Crew Training Air Force is accomplished in two phases:

1. Air-to-Air Gunnery

2. Air Combat Maneuvering

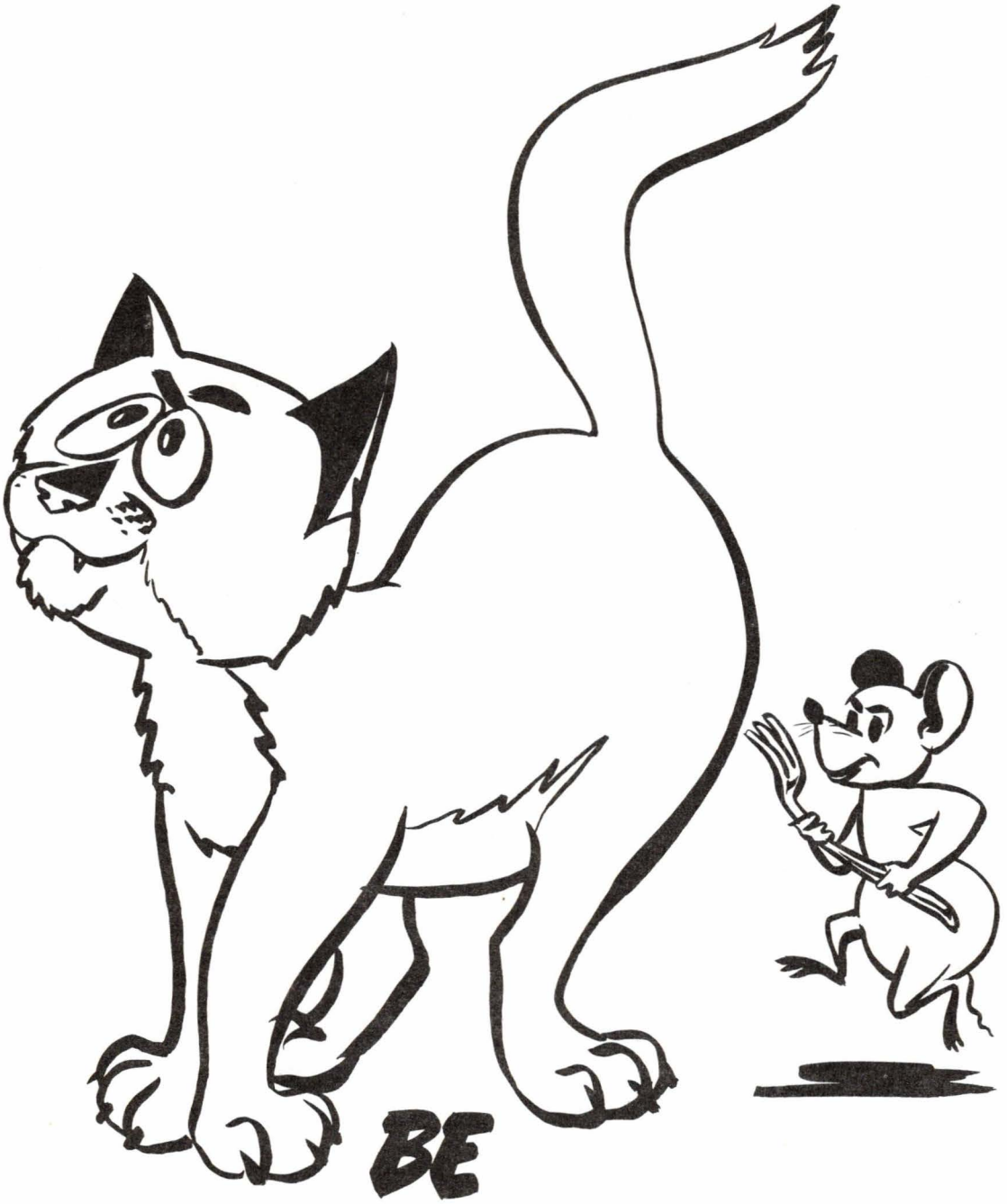
It must be recognized that firing on a banner target produces for the pilot the ability to track a target with the gunsight and nothing more. Realizing this, it becomes quite evident that the ability to hit this towed target is, in itself, no guarantee of the pilot's ability to handle himself capably in combat. The need for further training in how to get into a position from which the developed tracking and firing ability can be used has always been recognized to some degree at least, but formal, organized instruction has not been attempted.

Buzzing, over-stressing of the aircraft, mid-air collisions and the like, most of which have been the result of trying to learn this air combat maneuvering the hard way, have all done their part in keeping commanders from accepting any course of training on this subject. A good air combat maneuvering phase, coupled with plenty of air-to-air firing, is a definite requirement if properly trained pilots are to be available to fight the enemy under visual flight conditions.

It should be obvious that this Aerial Combat Training is vital to the pilot who is likely to become engaged in air-to-air combat. The inevitable question as to whether it is worthwhile on a large scale training basis, since many of our pilots never get a chance to use the knowledge, is bound to be presented. This fact is acknowledged, but a strong program of Aerial Combat Training for all fighter and fighter-bomber pilots is a necessity if our Air Force is to remain the most aggressive air arm in the world. Here is the reason.

Although a major accomplishment and a necessity in aerial combat, the ability to fly on another man's wing through any kind of maneuver he attempts is insignificant when compared to the value derived from the mental attitude developed in the individual concerned. The greatest reward and basis for all that is to follow in his flying career, regardless of the type aircraft he flies, is the self-confidence the pilot feels in himself. As this confidence grows, so does his enthusiasm. Enthusiasm increases interest, which in turn pays dividends in overall accomplishment. All of these qualities together add up to the one thing a training program must produce if the graduate pilots are to be successful in combat -- aggressiveness.

It is this pilot aggressiveness which we seek. Without it all training is useless, for the individual pilot must have the desire to put into effect that which he has been taught. Amazing results have been achieved in combat through aggressiveness alone, but it has been proven time and again that all the training in the world is insufficient when the individual does not have it in his heart to engage the enemy or destroy the target. Certainly then, the goal which we seek, or should be seeking in the training of any pilot, is to produce a pilot who is aggressive because he is well trained. The methods described herein are intended to contribute to the safety of this training and help the pilot to acquire, through his self-confidence, this golden quality of aggressiveness.



BE
AGGRESSIVE

GENERAL *Combat* INFORMATION

Section 1

SELECTION OF FLIGHT AND ELEMENT LEADERS IN COMBAT

At first glance this may appear an odd subject to discuss initially in a manual of this type, but aerial combat, good government, a successful business, or any large undertaking with a specific purpose, all have one important thing in common -- they all require good leadership.

The selection of flight and element leaders is actually more important to the average squadron in combat than the type tactics they decide to use. The importance of the selection of flight and element leaders cannot be overemphasized. When a man's life depends on the brand of leadership displayed in the combat area, he has a right to expect his commander to furnish him with the best leaders available in the organization. The average commander, unless he is extremely fortunate, cannot do this and still have all his personnel lined up by date of rank. Here are a few guides recommended for use in a Fighter Squadron already operating in combat.

1. Assuming he meets a minimum standard of experience and leadership, give the first opportunity to the ranking man.

2. If one must choose between leadership ability and date of rank, or leadership ability and flying time, by all means select the man who has demonstrated the leadership ability.

3. Advise every man that gets a new job that it is a temporary or trial selection, then let him demonstrate by his actions whether or not the selection is really temporary. (Three weeks to a month should be plenty of time for a man to show his true colors).

4. Give a man who is not measuring up ample warning, but be honest enough with the rest of the squadron to remove him if he does not produce the desired result in a reasonable length of time.

5. For determining whether a leader is measuring up, judge him on these things in this order:

a. Leadership ability and results in combat.

b. Aggressiveness.

c. Flying ability.

d. Cooperation.

e. Administrative ability.

All these things obviously would produce an ideal officer in combat. A commander may not get them all in one man, but if he observes his pilots closely and utilizes the quality traits discovered, he will be ahead of most other organizations when evaluating combat results, morale and operating efficiency.

We may as well face the fact that all our people will not be as aggressive as we would like them to be. A commander can count on about three pilots in the squadron to possess those traits necessary to be exceptional leaders and produce more than an occasional kill or two. There will be a secondary group, both wingmen and element leaders, that want to do the job but still lack the experience to do it.

There is a third group, relatively few in number, that will not do the job regardless of the instruction offered them. These, unfortunately, are frequently highly experienced personnel and have the capacity to poison the young pilots just beginning their tour of combat. These "pseudo leaders" are the people that must be weeded out. To "tide" these along is the greatest mistake a commander can make. They must be dealt with just like any other individual doing a below average job in peace time. Warn them, remove them, note it on their effectiveness report, and get a man who wants to do the job. A commander owes that much to the people in his unit who are willing to fight.

"HOPE THEY'RE NOT MIGS

EMPLOYMENT OF FIGHTERS

Training is an invaluable asset, but nothing takes the place of firing and being fired at in actual combat. The finest thing a training program can provide is the teaching of procedures that have been learned the hard way. The following seven subjects, although not easily recognizable as purely offensive or defensive in nature, certainly come under the heading of background information that was learned the hard way. The first of these is the employment of our fighters in the aerial combat role.

There are two general methods used to employ jet air-to-air fighters on fighter sweep missions:

1. Mass formations.

2. Area saturation.

Each method has advantages and disadvantages, but either may be needed from one day to the next depending on several factors:

1. Formation the enemy is using.

2. Size of the area you are attempting to control.

3. Performance characteristics and number of enemy aircraft opposing you.

4. Quality of enemy pilots.

5. Mission.

6. Supply support available.

7. Evaluation of past tactics in that area.

The Area Saturation Method has been used very effectively in areas where the enemy had to be sought out. Four ship flights are used at varied altitudes in predesignated areas. Aircraft maintain a vigil until a call is received that enemy aircraft are sighted. At this time, those flights that are able to converge on the "hot" area, allowing maximum fighting strength for each fight.

Mass formations are conducted by massing two or three squadrons all under on group leader. In general they:

1. Require too much formation flying. Potential leaders use valuable time flying formation that could be devoted to looking offensively.

2. Lose the value of surprise. A large formation can be tracked easily by radar.

3. Cut down time in the combat area. Too much fuel wasted joining up, flying formation, etc.

4. Do not allow our pilots to properly use the "aggressiveness" advantage.

5. Allow a large number of aircraft to be brought to bear on a chosen area at a chosen time.


"Break Right!

Here is a subject, one could assume, would be second nature. Consider the results of one simple radio transmission in an area with 50 or 75 other fighters -- "Break right!" Properly used with a call sign, a life may be saved. Improperly used, 75 friendly aircraft are almost obligated to stop what they are doing to "Break right." You simply can't afford not to!

Proper voice technique is mandatory and has a very definite part in the overall training. Obviously, a wingman who sees what he should, but is too excited to get the information quickly and clearly to his flight leader, is of questionable value. Wingmen should be trained to put out a call to their leaders about every 20 seconds once enemy aircraft are sighted and it is evident that leader's attention is required offensively.

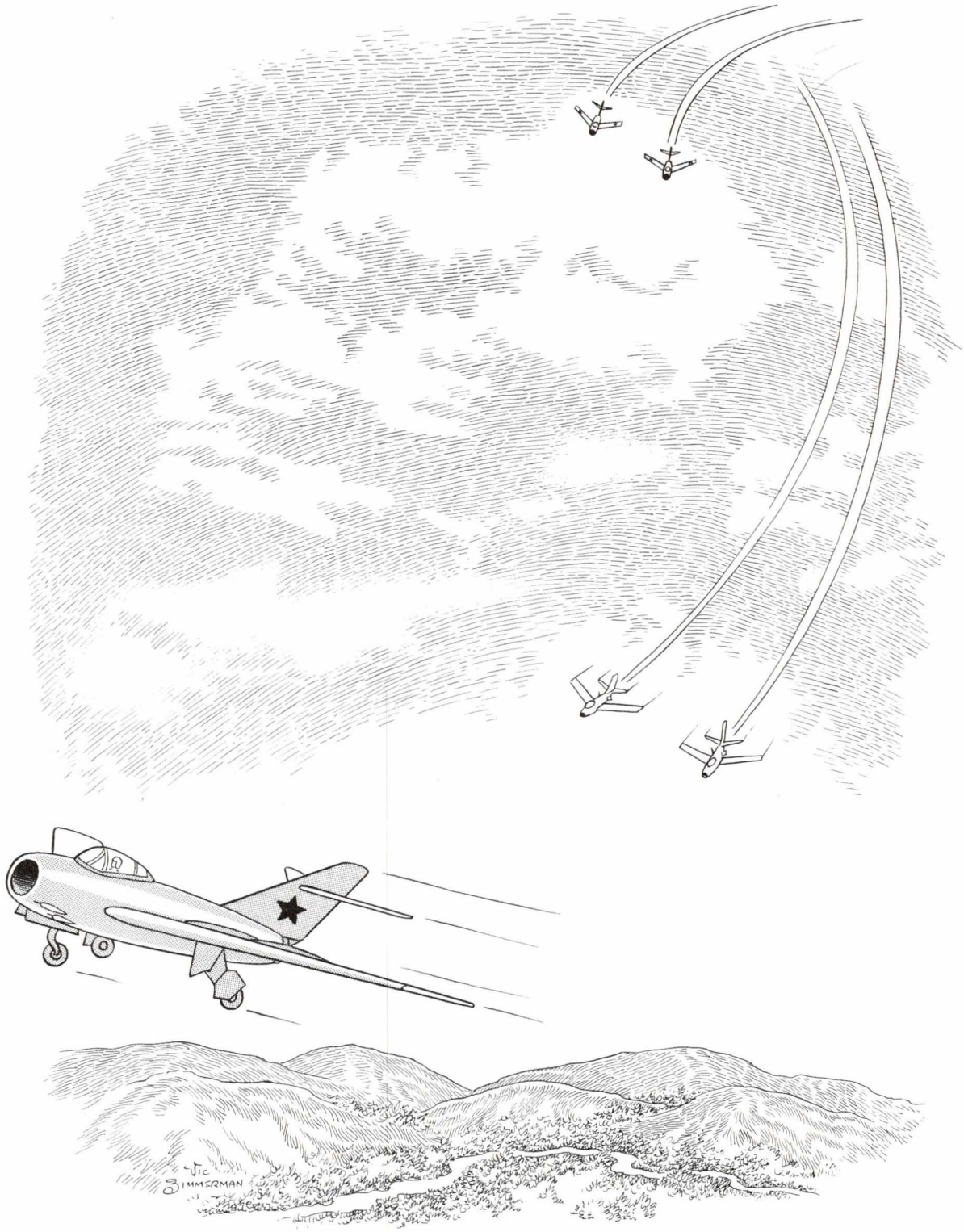
Here is another little thing that will make your flight more effective. Some method should be devised to indicate to other members of the flight that the leader has his eye on a possible enemy aircraft. A code word is necessary to indicate to other flight members that the leader is glued on an aircraft and isn't going to look away until he is close enough to identify or attack. It means that other members have to redouble their efforts in looking around when offensive action is imminent. A procedure such as this is necessary, for even one look away is enough to lose a possible kill.

One more item: Get your flight in the habit of flying formation without radio calls of any kind (turns included) except for calling in bogies. The radio must be held clear in order that those who are in actual contact with the enemy may properly coordinate their actions.

SPEED BRAKE UTILIZATION

The use of speed brakes in combat is a mandatory requirement. During an attack, airspeeds generally have to be cut down to within 150 or 200 knots of the aircraft being attacked if anything other then a few sporadic hits are to be the result. An element slowing down to any extent should have another element high and fast for top cover. Speed brakes may be used anytime the immediate result could be a kill. Never use them headon -- trade your airspeed for altitude in case of this kind. Never use them to tighten up your turn unless, as you use them, you are sliding high and to the rear of the aircraft being attacked. Practice coming up behind another aircraft that is straight and level. If you have a neutral position on your speed brake switch, use your speed brakes in increments (out and back to neutral immediately, thus obtaining quarter or half brakes as desired). To use speed brakes only full out or full in is to waste what can be a valuable asset.

IF YOU SLOW DOWN, HAVE AN ELEMENT HIGH TO COVER YOU



HIGH ALTITUDE FORMATION FLYING

High altitude means that altitude where you have lost enough of the effect of your thrust and turning ability to make maneuverability a serious problem.

You can get away with the technique of throttle changing on the inside of turns at low altitudes. At low altitudes your throttle gives you quick reaction; at high altitudes, however, you will be left behind after your leader rolls out of a turn that is in your direction. For this reason, a little different technique is required when flying at very high altitudes.

As you increase altitude, the common conception is that you must spread further out. Such an idea is without basis. The higher you go the less effect your thrust has on the aircraft, thus the time to move from one relative position to another on your leader is greatly increased. If it takes longer to get from patrol position to the fighting position at altitude, then the logical answer certainly is not to move further out and exaggerate your problem. Actually the same formation you have used at lower altitudes will hold you in good stead, but even then your time to get to a fighting position will be increased. To cut this down you would have to be so close to your leader that you would spend too much time actually flying formation. Besides this, you can afford this extra time required because your attacker will be longer in his curve of pursuit or attack; his performance is also cut.

Some things that will help the wingman maintain his position on his leader are:

1. Fly about the same distance from your leader that you did at low altitude.

2. As a wingman, do not attempt to stay on the inside of the turn the way you did at low altitudes. Concentrate on keeping your airspeed the same as your leader's.

3. This means when turned into ease across from inside to outside behind your leader. Change gradually as you gain. Once on the outside, slowly change sides again as he pulls away from you.

4. As an element leader using fluid element, gain a little altitude as you are turned into, and rarely get more than a hair to the outside of the turn. As the turn is completed, drop on down to your normal high element position, trading the altitude you gained for airspeed.

5. As a wingman, make all your stick movements gentle pressures or you will lose valuable airspeed by buffeting or stalling the aircraft.

6. As a flight leader, make gentle turns with your flight to preserve the mach you have.

7. Watch tailpipe temperature. In some aircraft it increases quickly and will even go above limits at extreme altitudes and decreased machs.

8. Use your oxygen system properly and get to lower altitudes if you have any reason to suspect trouble.

9. Be more attentive to keeping your approximate position while you are flying wing. Once you get out of position at high altitude it's going to take you a long time to get back.

10. Cruising at high mach is imperative for high altitude work. Low airspeed at low altitude is a bad practice, but at least the aircraft will turn and maneuver. This is not true at high altitude.

11. The percentage of kills per sighting will drop off at high altitudes. Everything is too critical - no room for misjudgement.

12. Be familiar with all aspects of your pressure suit. There isn't a fighter pilot alive who likes it any better than you do, but there are quite a few dead ones who would like a chance to reconsider its importance.

MINIMUM FUEL RETURNS

Any combat experienced group or wing commander, with an ounce of leadership ability, knows that a large percentage of his total kills were made by a relatively few number of pilots. These same people are getting most of the kills because they are more highly motivated, luckier, and just plain working harder at it. Any fighter pilot who has shot down more than five or six enemy aircraft, learned the hard way that you will not always be engaged by the enemy at the most convenient time. If enemy aircraft choose to engage you when you have just enough fuel to get home, you may need some special technique to get home with an even smaller amount.

Before going into combat in an aircraft you should gather the following information to help you solve this problem of fuel shortage:

1. Best glide speed at idle rpm.

2. Best glide speed dead stick.

3. Best altitude from which to begin idle rpm glide back to base. Distance covered and fuel consumed during this idle rpm glide.

4. Best altitude from which to begin dead stick glide back to base and distance covered during this dead stick glide.

5. Air start procedures.

With this amount of information at your fingertips, it is possible to get home with little more fuel than it takes to climb to the best altitude for glide. Once you reach the desired altitude you have two courses of action:

1. Glide at idle back to the base. (Choose this course of action only if enough fuel remains to have power in the traffic pattern.) If you only have a little fuel left, don't waste it gliding.

2. Shut the engine off and glide dead stick to an altitude over the base that will allow one 360° turn before landing. During this 360° turn, attempt an air start. If the air start is successful, widen your pattern and land normally; if unsuccessful, abandon all thought of an air start and concentrate on your dead stick landing.

We have been discussing some major facts others have learned the hard way. Nothing in this world will keep you awake more nights than the mental picture of an enemy aircraft in front of you at about 1200' -- and guns that won't give more than a few sporadic hits. When you have maneuvered into the firing position and don't get that kill, you will remember it a long time. A few things to help you avoid this happening to you are:

1. Know your harmonization procedures and be present when they harmonize your aircraft.

2. Know your firing techniques. Be able to do the job with radar, pegged range, and the fixed sight.

3. Don't Fire when you should still be maneuvering. Get in range first.

4. Know your gunsight like the back of your hand. If you can't tell when the sight is operating improperly, you can hardly expect the maintenance personnel to have it in tip-top shape for you when your big chance comes.


COOK OFF "

BINOCULARS

For both offensive and defensive reasons, pilots must not only be able to look around, but they must be able to recognize and interpret what they see. Aircraft recognition for air-to-air work and target identification on air-ground work are vital factors in effective offensive or defensive action.

To help improve tactical effectiveness take along a better set of eyes. As flight leader, keep a monocular or a pair of binoculars with you at all times. They will save you precious time and fuel when you are able to distinguish the aircraft type that is 10,000 or 15,000 feet above you in the "cons." They are also useful in watching airfields for activity while you circle above the heavy flak altitude. They are helpful when doing fighter-bomber work for a closer look at haystacks, trees, nets and other things used to camouflage weapons, aircraft, supplies, vehicles, troop concentrations and the like.

The OFFENSE

Section 2

There are several fundamental reasons for the existance of tactical formation, which should be constantly kept in mind and repeatedly emphasized to the pilots during instruction. A thorough understanding of the reasons for the employment of tactical formation is necessary before a pilot can attain any degree of proficiency. Short sighted or misplaced objectives must be replaced, in his mind, by realistic objectives and by sensible approaches to the means of realizing these objectives. Tactical formation is employed to achieve the following broad objectives:

1. To achieve maximum maneuverability for offensive air-to-air operations.

2. To achieve maximum mutual support and visual cross-cover for defensive air-to-air operations.

3. To deliver with control, maximum fire power on a chosen objective, either on the ground or in the air.

4. To enable each member of the flight to accomplish his own navigation in addition to fulfilling the duties required from all members of an effective combat team.

All tactical formations are a compromise between maximum maneuverability and maximum mutual support, and the extent of the compromise depends upon the requirements of the mission to be flown. A pilot who has these objectives firmly fixed in his mind, and who governs his tactical formation flying with a constant awareness of these broad objectives, will be able to master tactical formation much sooner. If a pilot gains proficiency in a basic form of tactical formation, which incorporates all the important principles involved, it is then a relatively simple matter for him later to convert to a more specialized variation designed to meet the particular need of some Theater, Air Force, Wing or Group Commander. Since we shall always be on the offensive when flying tactical formation, unless forced to be otherwise, let us consider the jobs of the wingman, element leader and flight leader in the offensive tactical formation.

THE WINGMAN

In any discussion of the air tactics problem one must, of necessity, deal with a fairly experienced fighter pilot. It takes a good bit of experience to be able to interpret and absorb information of this kind. We must start somewhere to give the inexperienced pilot some instruction if we wish him to become a good combat leader, capable of carrying the fight aggressively to the enemy. To accomplish this ultimate aim, a thorough understanding of certain responsibilities is mandatory.

Let us start with the most elementary of the basic problems -- the position of the wingman on a typical mission where enemy fighter opposition is expected. There are just about as many positions taught in our Air Force as there are fighter pilots. Despite this, it should be evident that some one position must offer more advantages than the others. What is it we want from the wingman? We want him to do two things; (1) Fly his aircraft in such a way that, regardless of the leader's manuevers, he will not become separated. (2) Look around. If item (1) is not put first in his duties, he obviously will not perform his primary purpose in being there; that of supplying the eyes to the rear for the lead aircraft. We see then that, unless the wingman can get flexibility and maneuverability in the position he flies, he is in constant danger of being separated, especially when the element or flight is attacking or being attacked. He must be able to look around.

Through extensive experience in aerial combat in two wars, we have found the position best adapted to meet these two important requirements is:

1. For normal tactical formation, such as patrolling, have the wingman fly about 35 degrees back, and out only as far as he can still read the large numbers on the side of his leader's aircraft. This is as far forward and as far out as the wingman should ever get, unless lack of fuel or some other circumstance renders the element useless offensively.

2. When enemy aircraft are sighted, the wingman moves into a fighting position. (he does not move in along the 35 degree angle line, but along a line perpendicular to the flight path of his leader's aircraft.)

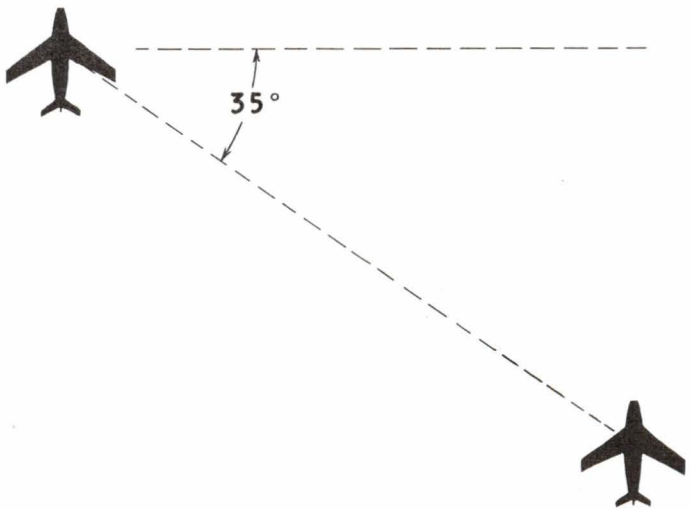
In the fighting position, the wingman will probably be able to read the small numbers on the vertical stabilizer and will be back from his leader about 55 degrees. These are only crutches for the beginner to use. He flys actually, not in a position but in an area; cutting off, crossing, sliding to trail, doing what is necessary to stay with his leader. It takes only a moment for one to realize this is pretty close to the leader, but that is what is needed in an aerial fight. The wingman must be close enough to his leader to make it necessary for an enemy aircraft to actually out-perform and out-maneuver the leader himself in order to shoot down the wingman. Just one ride in this proper position will be a little discouraging to the average pilot, for during the early stages of training, not much time can be spared for looking around.

When one first learns to drive a car, it is safer to be taught outside the city. It takes all of one's concentration just to coordinate the functions of the clutch, gearshift, accelerator and brake. Later though, we find the driver downtown doing these things and in addition, watching traffic signals, persons crossing the street, street cars and other driving hazards. He has become so familiar with the car that its mere operation is second nature, and most of the time formerly spent shifting gears is now devoted to "looking around."

This same transition takes place with the wingman. He must be required at first to learn where to put his aircraft during maximum performance in order to stay with his leader, whether he can look around or not. All the performance the aircraft has in it is not enough if the wingman does not put his aircraft in a position to utilize this performance. Later, as the job becomes progressively easier, the wingman will find more time left, which he naturally devotes to "looking around."

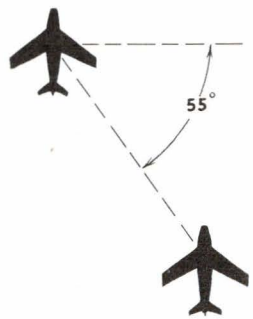
A few tips for the wingman, now, before we leave this subject. Consider your fuselage in relation to your leader's fuselage when maintaining position. Keep your fuselage stacked just slightly down at all times on your leader. When turned into, resist the temptation to drop way down with your wings in the same plane as your leader's. Drop down a few feet, perhaps, but then hold what you have and see what happens. If you have trouble seeing the leader, or if you begin creeping forward (as you may when he tightens up his turn), ease off your bank and slide toward the trail position. Since you have no idea (and neither does the leader, actually) just how far around the leader

NORMAL

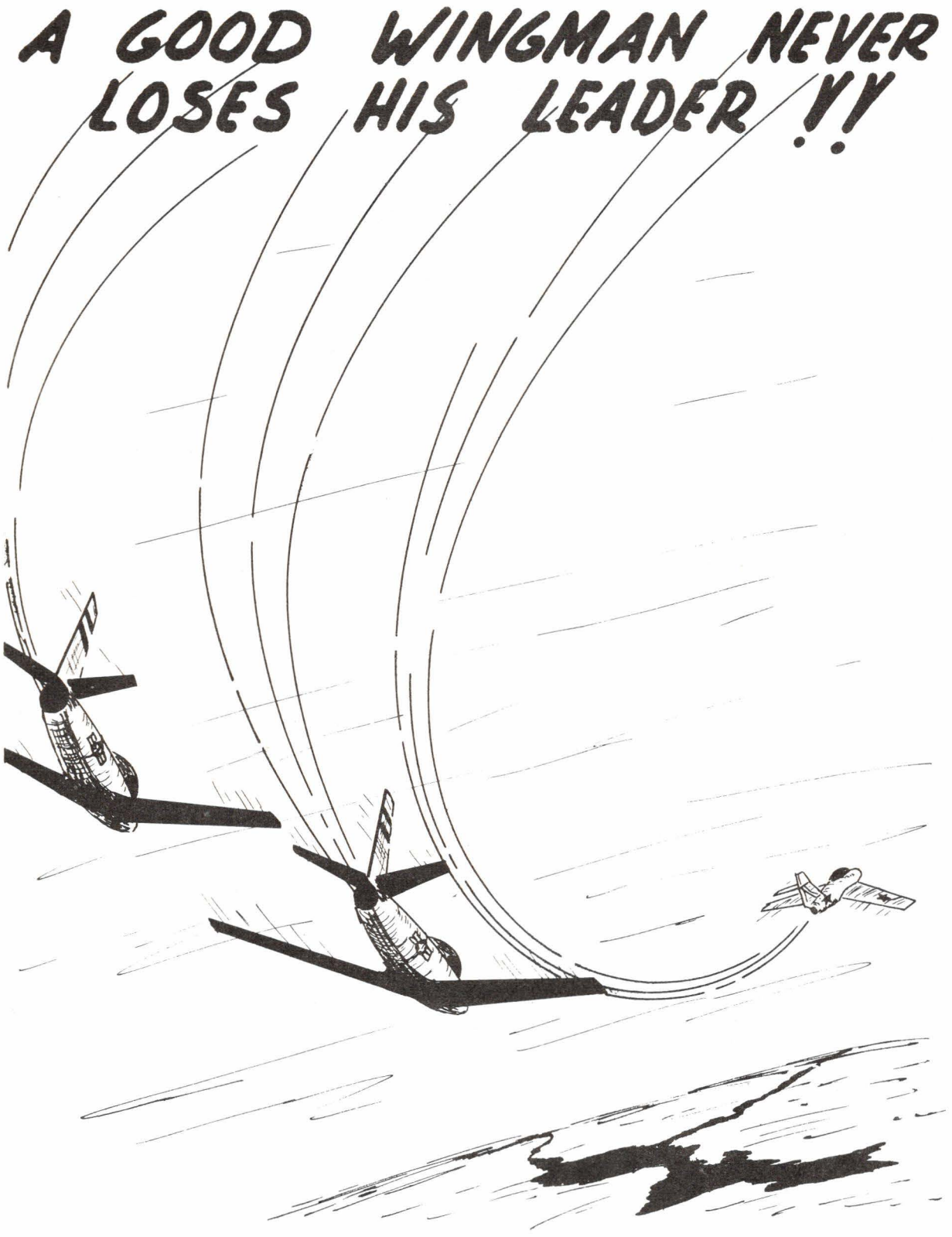


THE DISTANCE BETWEEN AIRCRAFT IS SUCH THAT THE WINGMAN CAN JUST BARELY READ THE LARGE NUMBERS ON THE FUSELAGE OF THE LEADERS AIRCRAFT.

FIGHTING



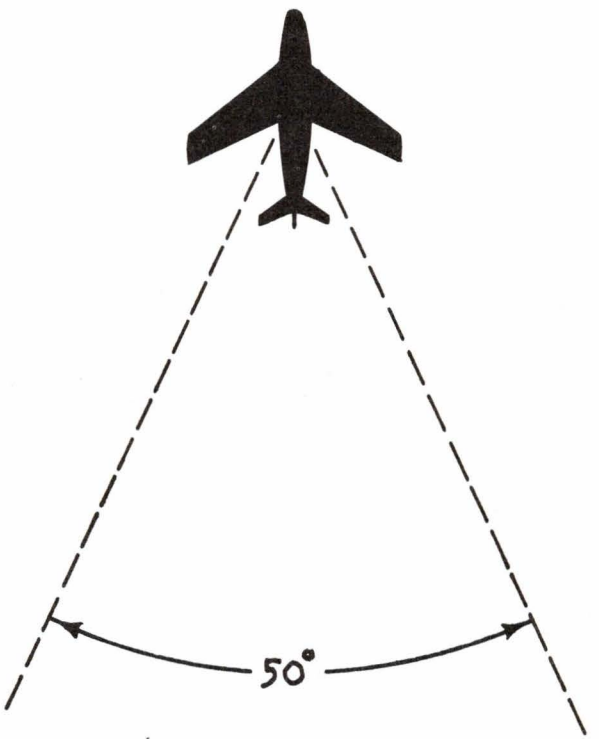
THE DISTANCE BETWEEN AIRCRAFT IS SUCH THAT THE WINGMAN CAN PLAINLY READ THE SMALL NUMBERS ON THE VERTICAL STABILIZER OF THE LEADERS AIRCRAFT.


A GOOD WINGMAN NEVER LOSES HIS LEADER!!

is going, stay five or six ship lengths from him in trail, if necessary, and hang on 'til he eases off on the G's. At low altitudes, stay on the inside of the turn whenever possible. Cross or slide toward trail position when G forces make it necessary - but, not until. You'll know when it's time to go to trail because you can't go anywhere else. There will be too many G's and no visibility on the inside of the turn, and you will immediately be left behind on the outside. That only leaves this "maximum performance cone" to slide to.

During the initial encounter, when the leader is maneuvering with an aggressive enemy pilot, it will be difficult for the wingman to do anything but hang on. During the maximum performance stage, as previously stated, hang on until the leader is no longer pulling maximum G's, then immediately get to the inside of the turn and begin looking around again. Tell the leader what you see every time you are able to take a look. If you should become separated from your leader, give him a call immediately after being separated. If you are unsure of your location, tell him so immediately. Head for the prearranged rendezvous point, keeping Mach high and clearing yourself constantly.

While you are a wingman, think as a wingman and play on the team. In a Tactical Organization, you will find that being the best wingman in the squadron is the quickest way to become an element leader!



MAXIMUM PERFORMANCE CONE

While you are striving to be the best wingman in your squadron, keep one eye on the element leader for you will soon be faced with his problems. Know the job ahead whenever possible; it will pay big dividends. In that regard, here are a few things about the second element that may help you to better understand your objectives as the element leader. The second element may be flown (1) slightly lower or (2) considerably higher than the lead element, depending on the individual likes and dislikes of the unit commander. The fluid four (high element) is suggested as the better of the two because of its maneuverability and flexibility at all altitudes.

Low Element:

The use of the element low is acceptable at low altitudes where you have lots of thrust and performance, so let's see what we have when the element is down on a level with, or slightly below, the lead element. With the element low it will have to be back about 35° to 45°, at least, to allow the lead element the maneuverability necessary for maximum performance in offensive action. Even though it is back that far, mutual support from the lead element can be obtained easily, regardless of the type of turn the element leader uses when turning into his attackers.

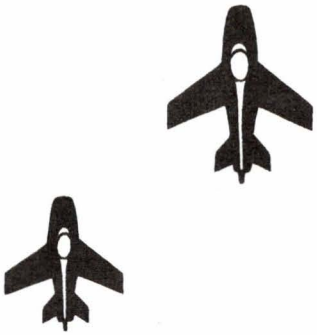
The lead element is equally effective defensively with the second breaking away and down, away and level or away and up. However, if the lead element is attacked with the second element low, the situation is not so clear-cut nor is mutual support so easily accomplished. The elements are about the same airspeed, with no possibility of a material change. (Even if after-burner were available, the lead element would probably cut it in when attack was discovered and cut down any possible chance for the second element too close for mutual support.) Thus we see that the lead element, although out in front, is not as well protected as the second element unless, of course, he chooses to break off his own attack. Obviously, this is undesirable. This is why, for any altitude, the "fluid four" or high position for the second element is recommended. Here the element can dive to overtake any attacker of the lead element, and can furnish support in such a manner that it allows the lead element to complete any attack begun. This is felt to be the primary mission of the second element. From a low position the element cannot accomplish this purpose. One must keep in mind that the entire purpose behind air superiority aircraft is attack; therefor, you should use a formation that best suits this purpose. If your primary concern is defense, don't go on the mission.

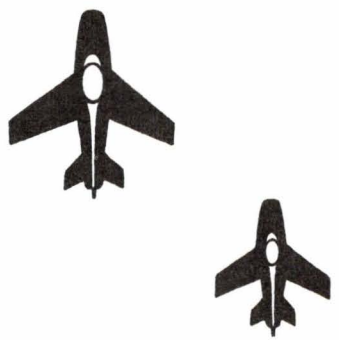
The mere fact that we do not choose to use the element low for offensive action does not necessarily mean that the element will never be used in the low position. One primary use for the low element in tactical formation in combat is to allow large numbers of aircraft, fighter-bombers for example, to proceed in as restricted an air space as possible to ground objectives, maintaining maximum visual coverage and mutual support as they do so. In this type formation the element leader flies slightly low and about 20° back from the leader. These formations usually have air cover and are not designed for maximum maneuverability. When attacked by more enemy aircraft than the fighter escort can engage, external loads are dropped and the element leaders, either before or during the attack, move to the fluid element position for the maximum maneuverability that will be needed.

It must be clearly understood that maximum performance maneuvers, with the element leader only 20° behind the leader, would occur only during the initial break or hard turn into the attack, and any subsequent maneuvering would be performed with the element back about 35° to 45° or up in the fluid element position. It is not considered a profitable utilization of time to continuously practice hard turns, breaks or other high performance maneuvers with the element in the low forward position. To ignore the importance of this statement is to invite accidents in both training and combat.

The High Element or Fluid Four:

The element leader in this type formation is invaluable to the flight commander. He must take a position on the lead element that affords him an advantage on any aircraft trying to attack the lead element. His primary purpose is to cause the attacker of the lead element to break off, thus allowing the lead element that period of time necessary for destruction of the aircraft he is attacking. The element obviously performs other defensive and offensive functions; but with the four ship flight on the offensive, it must be kept in mind that the primary function of the element is that of allowing the lead element to successfully complete any attack begun. Any split of elements before this func-





TOP

LOW ELEMENT

FRONT

LOW ELEMENT


TOP
FLUID ELEMENT

FRONT

FLUID ELEMENT

tion has been performed, unless the second element is attacked, should not be condoned. A good element leader may perform as indicated several times on the mission before getting a kill himself, or only once before a physical split of the elements is necessary. The tactical situation will determine when the split is to be made.

The element leader should be encouraged to press his attack if he has a substantial advantage on the attacker of the lead element even though it may require leaving the lead element permanently. Either element may be the lead element, depending on experience level in the flight, direction of attack, position of enemy aircraft, and who sees the enemy first. If time permits, however, the lead element should be directed until visual contact is made, thus allowing the flight to begin the fight with the element properly positioned and with each man performing the job for which he is best trained.

If the high element is attacked, the element leader merely turns into the attack. If he should break up and away from the lead element, mutual support will be a little difficult. If he breaks down and away, the lead element can reach him easily and mutual support becomes quite simple. Thus we see that here the first element is well protected and, although the second element is not as well protected as if he were low, he is certainly adequately protected if he uses the correct evasive defensive maneuvers.

This slight defensive sacrifice for the tremendous offensive cabability of having the second element always able to reach the first element quickly, is deemed more than a fair exchange. If you doubt it, which flight would you rather attack -- one with both elements at the same level where you can keep track of them easily, or a flight of four where only two can be seen at one time? For the fluid four, element leaders should fly back about 10 to 20 degrees and out about 5,000' to 8,000'. (Laterally you should be a little closer to your leader than you are to the tow ship when firing air-to-air gunnery). Be above your leader 2,500' to 3,500'. These are estimates. To find the correct position, place the element up there so he can make a good high side pass on the leader or on someone up to 2,000' behind the leader. In a shallow turn, if you can't tell immediately whether the leader is turning away from you or into you, you are too far away from him.

IF YOUR PRIMARY MISSION IS DEFENSE, DON'T GO !

THE FLIGHT LEADER

We have discussed both the wingman and the element leader of our highly specialized team. Here are a few things for flight leaders to think about. Whether in training or combat, the flight leader has a vast amount of responsibility. In training he must guide a new pilot gently but firmly, never exceeding the inexperienced pilot's capabilities, yet reaching as quickly as possible that stage where the wingman may be expected to do the right thing instinctively in combat. In combat, the leader must be able to maneuver one of his two elements into the firing position on enemy aircraft without unduly jeopardizing other members of the flight. The word "unduly" can and will be interpreted differently by all flight commanders. Some, because of their ability, may attack twice or three times their number with no more risk involved than another flight commander attacking a single element.

A good flight commander must have a complete mastery of his aircraft and must be an accomplished navigator and instrument pilot. He must be able to think alone, possessing the essential ability of being able to assess a combat situation quickly and accurately. He must be aggressive or all his other capabilities are wasted. He must know the capabilities of enemy aircraft to be encountered in relation to the performance of his own aircraft. A few things that might help the leader, both in training himself and his flight for combat, are listed below:

1. Before Takeoff: Be certain every man knows his job before he gets in his aircraft. Make your briefings thorough. Brief so you cannot be misunderstood.

2. Takeoff and Joinup: If you have a man taking off on your wing, don't use more than 98% for takeoff. For a straight away climb out, begin your climb at a fairly high airspeed and climb normally from that time on. Have the element begin a climb about 30 knots above your speed, then judge the rate of climb on the lead element. He will soon overtake you even though you have not throttled back below 98% since takeoff. The second element should not attempt to join up in close formation; instead, use the overtaking speed to get into the "fluid four" element position.

3. Climb Out: If there is any possibility of meeting enemy aircraft during climb out, climb at higher than Tech Order Airspeeds. Increase your climbing Mach as altitude increases. If you are climbing straight out, the element leader should be looking into the sun and so the number 2 and number 4 man would naturally be on the outside of the formation. During climb out, ease your power up and try to get some idea about the speed of all the aircraft in your flight. As you increase power, note the percent at which the slowest first begins dropping behind and then give him about 2% to play with for the rest of the mission. You'll find having him with you when the fight starts will more than make up for that 2% of the power.

4. Cruise:

a. Cruise at a high Mach and you'll find you will have an advantage on most enemy aircraft engaged.

b. Steep turns, when you are merely patrolling, only force the members of your flight to use excessive power after a new course has been established. During a good, smooth, gentle turn, airspeeds will stay up and flight members can look around.

c. Find the con level. When possible, cruise with your high element just below con level and you'll quickly see any attack made on your flight from above.

d. Don't call turns of any kind unless you actually have enemy aircraft in sight.

e. Most of the looking to the rear will be taken care of by the wingman, but remember both of them are usually inexperienced. Double check them occasionally.

5. Afterburner Use:

For the day fighter pilot in the USAF the afterburner is a relatively new toy. Most of our new Century Series aircraft are equipped with afterburners, therefore, a few thoughts in this direction might prove advantageous.

a. Afterburner use for takeoff is usually a must even if the aircraft will get off without it.

b. Afterburner for climb all the way to 40,000' or 50,000' is not recommended unless the situation requires it. It takes more time but less fuel to get to altitude by using afterburner to best climb speed and then cutting it off.

CRUISE AT A HIGH MACH!

c. Afterburner operation is improving, but in the early Century models, "light ups" fail quite often above 35,000 feet or so. Know the characteristics of your afterburner system.

d. Generally speaking, you will encounter difficulty getting a light in a tight turn.

e. The afterburner is not effective when turning and maneuvering at speeds below about 225 kts. Just above this airspeed it helps some, but generally speaking, the higher the airspeed the more effective the afterburner.

6. Fighting Enemy Aircraft:

a. Never use more than 98% and you'll always have a wingman.

b. Keep your voice calm when you transmit. They are looking to you for leadership.

c. Always turn into the attack.

d. When you first sight a possible enemy aircraft, don't take your eyes from him until you are close enough to identify. Train your flight to look around carefully during these moments.

e. Except under unusual circumstances don't allow wingmen to initiate attacks. Usually this brings grief because the average wingman is not experienced enough to attack properly and the average leader hasn't been flying wing recently.

f. When you are told to break -- do it!

g. Get rid of your tanks as soon as you are sure enemy aircraft are in the area. If you wait until you see them, it is usually too late.

h. Know how and when to use speed brakes.

i. If you slow down be sure you have an element high to cover you.

j. If you cannot turn with the aircraft you are attacking, pull up and to the rear, drifting back down on him as your airspeed drops off.

k. Attack from low and behind when possible.

l. Don't shoot unless you are positive it is an enemy aircraft.

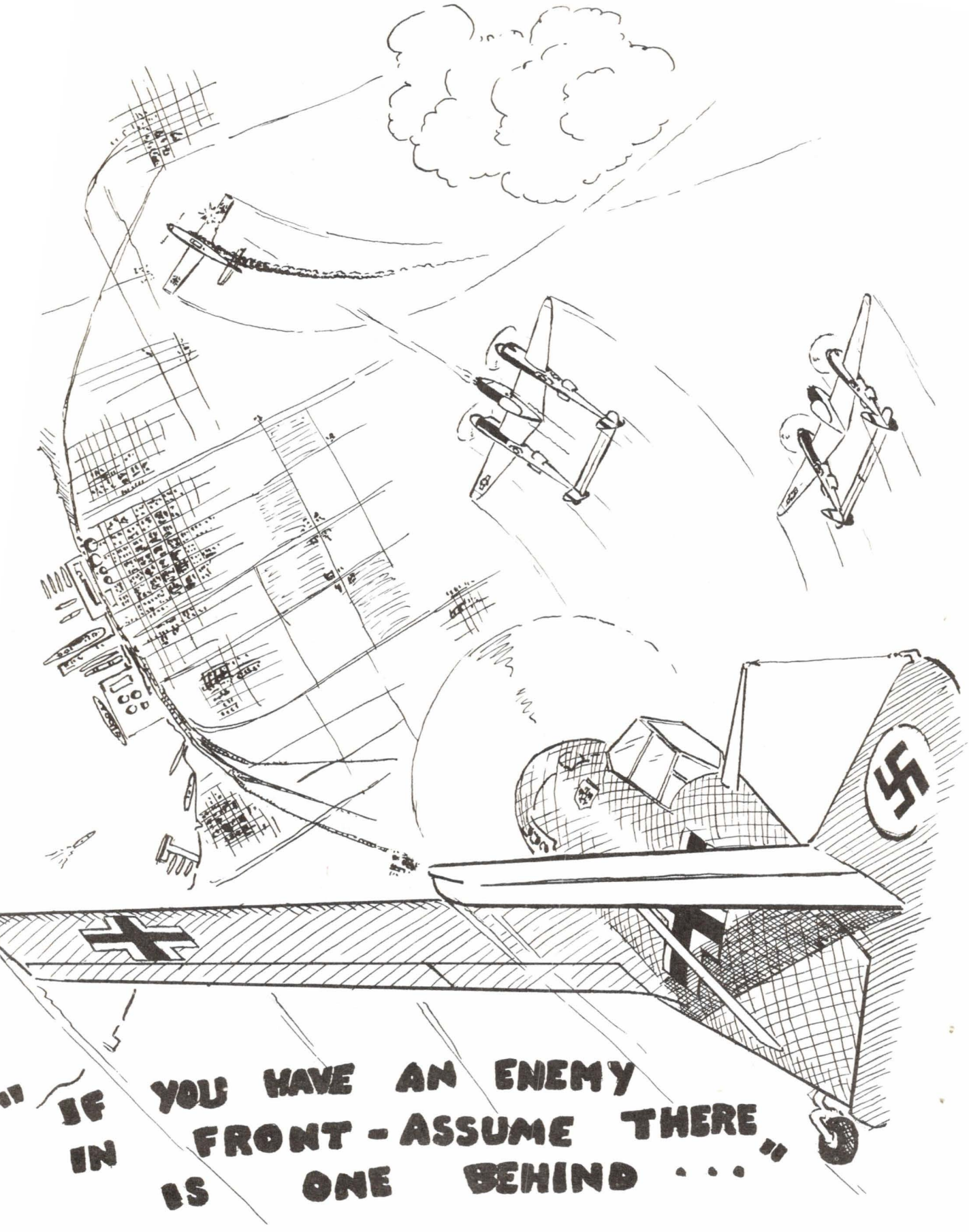
m. Proceed as though the enemy pilot you contact is as good as you until he proves otherwise.

n. Look behind you before you shoot.

o. When in doubt -- attack!

p. One last word to flight commanders -- don't think you can disguise your intentions. If you want to fight, it will be obvious; if you would just as soon not, that will also be obvious. The only one you are fooling is yourself.

Always Turn Into The Attack


"IF YOU HAVE AN ENEMY IN FRONT - ASSUME THERE IS ONE BEHIND ..."

We have seen the problems involved in actually flying the individual positions. Now let's take a look at the four pilots working as a team. What they do as a Unit is generally classified under the heading of tactics. No one can tell what to do in a future air-to-air fight. We can only relate what we have done that worked effectively a good percentage of the time in the past. We can hope that these basic sets of circumstances aid by forming a general background of knowledge from which you can draw instinctively when the chips are down. In this game, there is a great demand for the individual who can "play it by ear."

In the following cases, let us assume we can attack; i.e., have airspeed or altitude and are the aggressors.

1. One Attacking Two:

Ordinarily, you don't stay around without a wingman, but you can always expect the unusual in combat. You may be a single through no desire of your own on your next mission. A single aircraft with a pilot who is aggressive and well trained can tear a two or four ship flight to shreds unless every man in the four ship flight knows his job backward -- a thing rarely seen. When attacking two aircraft, determine the feasibility of dropping unseen below them and gradually slipping into firing range from low and behind. Assuming this is impossible, begin a normal pass from any angle possible and note closely your overtaking speed. If the two aircraft stay together, drive on in using speed brakes occasionally to cut closing speed so that you can expect to fire a burst of reasonable length. If they break into you, turn with them as long as possible. If you begin to overshoot, slide high and to the rear, still using speed brakes to cut speed. Then, depending on your desires, slide back down at six o'clock or stay high and reconsider. You must decide on the way in, whether you are going to slow down and attempt to get at six o'clock at their airspeed or just bounce and pull up.

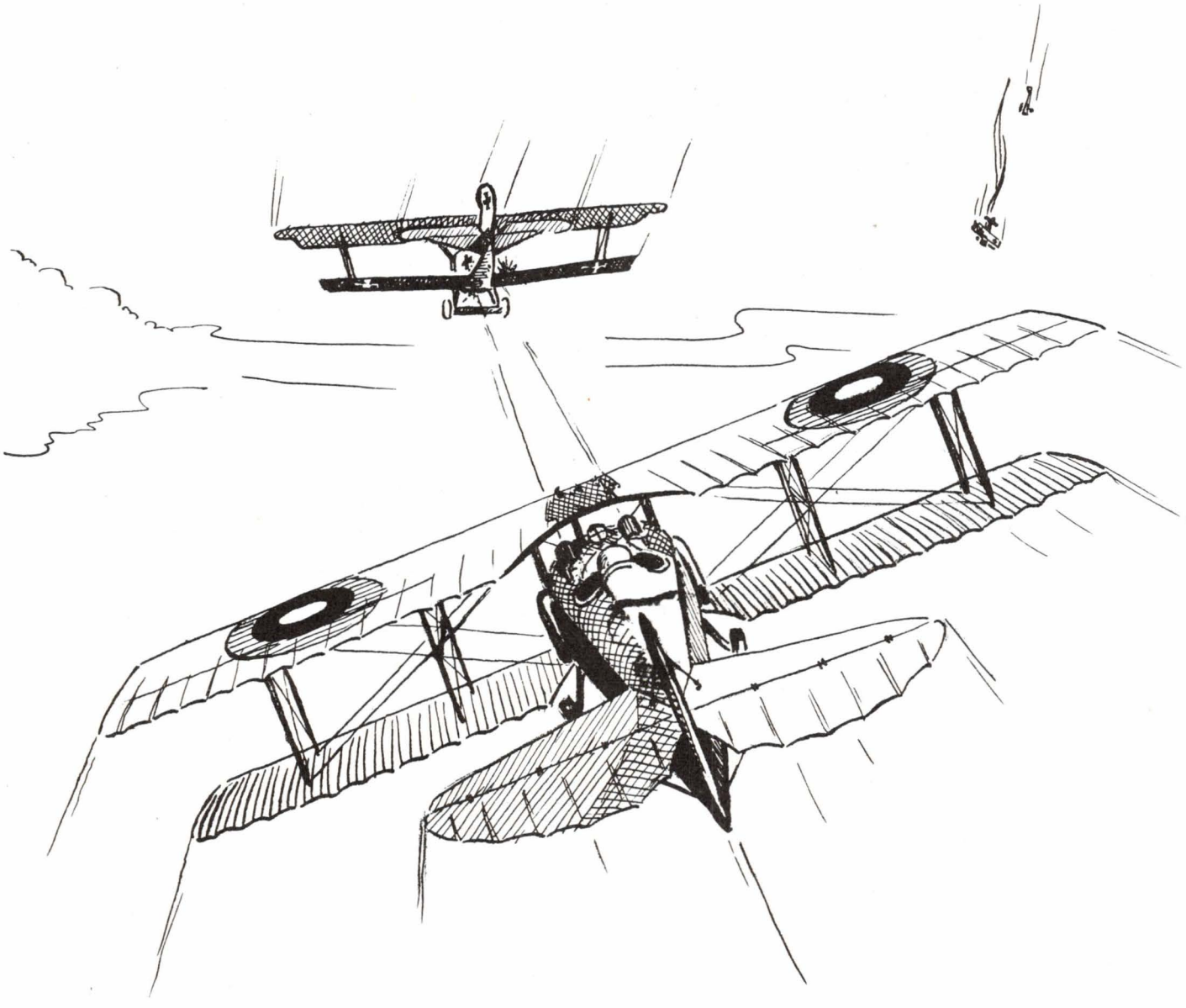
How well they are flying, how many enemy aircraft have been sighted in the area, whether you could be picked up if you had to bail out, how much fuel you have in case you make a mistake and have to hit the deck, are just a few of the major considerations before making this decision. If you slow down, you may get them both; if you YO-YO, you stand a good chance of getting only a few sporadic hits. If you slow down and stay, get the wingman first. If you hit him and for any reason he breaks off, leaving his leader, watch him but let him go and switch to get the leader. The wingman probably will be too excited, especially if he is hit, to think of mutual support and the leader will be easy to get since you are already at six o'clock to him. After you nail the leader, then look again for the crippled wingman. Get him too, if you can. If not, get out, keeping your airspeed up.

Remember, if properly trained, the one left free will turn back into you so take one and follow him as long as possible; then, at the last moment change. Many times the one supposedly attacked will commit himself to evasive maneuvers too early, leaving the other an unprotected target. If this happens, you are fortunate. Let's see what happens if you aren't so fortunate. As you commit yourself to one, he begins a turn into you, possibly a diving spiral immediately; this, generally, is a turn away from the other aircraft. Begin the turn with him but watch the other aircraft carefully just as you did before. If the free aircraft turns toward you and has timed it properly, he will drop in range behind you. Your only move then is to reverse into him to meet his attack. This can easily end in a scissors maneuver if he is a good, aggressive pilot so be alert for a possible decrease of throttle and use of speed brakes. He may go right on by since he has accomplished his purpose of making you leave his partner alone, in which case another reversal to chase him will put you to the rear of both aircraft once again. Now press your attack on the most likely of the two, for they will probably be separated. Before you fire at one, look behind you for the other.

2. One Attacking Four:

Note carefully the position of the second element. Whether they are high or low, attack the second element first. Keep your airspeed up as you close, for you can be sure when he turns into you that his turn will be away from the other element if he can arrange it. Your best chance, therefore, if the element is on the right of the leader, is to attack from the left side. If the element is on the left, attack from the right. This makes it necessary for the second element to break toward the lead element. This will increase your chances of success, for it makes it more difficult for the leader to see what is going on when you are all directly behind and above him. Also, it brings the two elements closer to-

ATTACK FROM LOW AND BEHIND WHEN POSSIBLE



gether during the initial phase of your attack; which means you can delay a little longer before committing yourself completely to one element and force them into a defensive maneuver.

When they are out of mutual support position, shift your attack to the lead element and press this attack to the hilt, just as is indicated in the previous discussion of one aircraft attacking two. Look around: After a turn or two, the second element leader may work himself back so that he and his wingman can again help the lead element. If you overshoot, don't commit the foolhardy error of sliding level to the outside of the turn. When you can't hack the turn, trade airspeed for altitude and try to keep your aircraft behind his as you are pulling up.

3. Two Attacking Two:

Look around carefully to make sure you are not attacking one of two elements. When you are sure you have really contacted a two ship flight and not one element of a four ship flight, begin your attack. You may be high, low or level, but regardless of what you have that enables you to attack, begin the maneuvering phase to put your two to the rear of the two you are attacking. If they don't see you, your job is simple. If they do see you, they will resist your effort to get behind them by a turn into you. This is the beginning of your dogfight.

If their turn is maximum performance you will probably not be able to turn tight enough to continue closing and tracking at the same time. When you can't track, stop trying and either disengage or pull your nose up and to the rear of the two you are attacking. If the situation is such that you cannot slow down to their airspeed, then fire anytime you are in range and can track; if not, disengage by breaking down and away opposite their direction of turn. Disengage only if you are in imminent danger of being attacked by slowing down; otherwise, trade airspeed for altitude, keeping to their rear and using throttle and speed brakes as necessary to slide back in at six o'clock. Now watch yourself, for if the two are sharp, they will spread apart causing you to again make an important decision. Your best move is to do one of two things; (a) Separate with them, each of you taking one aircraft; or (b) Stay together and attempt to make one pilot commit himself defensively to the point where he cannot help the other pilot. At this time, switch your attack and have the wingman watch carefully for the other enemy pilot.

4. Two Attacking Four:

Begin your attack on the second element and, if possible, from the lead element side. This will cause the element to break behind the leader and make mutual support more difficult between elements. It will also bring the elements closer together and allow you to switch your attack later in your initial pass. To be effective, you must make the second element believe you are really after them; believing this, they will be thinking very little of the lead element. When you switch attacks at the last moment to the lead element, you will generally find the second element is no problem, having gone into a defensive spiral or some such maneuver and become separated from their lead element. If they should come back into you, turn into their attack and disengage before you become entangled with two to one odds and everyone at the same airspeed. If things go right, you'll be two behind two and can continue your attack as described in Section 3. But look around!

5. Four Attacking Four:

In a situation such as this, the lead friendly element should attack from the inside of the high enemy second element, or the enemy element farthest back. This is another of the many cases that must be played by ear. As the second enemy element breaks into the attack they will probably go down so they can get help from the lead enemy element. The lead friendly element switches the attack, if possible, to the lead enemy element in which case the friendly second element stays high and fast and watches for the possible return of the enemy second element. The second friendly element stays as cover until he is needed to run off an attacker or until he becomes the object of an attack himself. If it is not possible to switch elements when the initial bounce is made, then the lead friendly element will have to decide whether or not he can safely press his attack on the second enemy element. His decision will depend on the position and action of the first enemy element.

The second friendly element serves as cover for the first, countering any action taken by the free enemy element. At any time the lead friendly element is attacked and the second friendly element has a substantial advantage over the attacker, the second friendly element should be encouraged to exploit this advantage even though it requires a permanent separation from the friendly lead element. Sometimes committing


USAF
LOOK AROUND

both elements to the offensive immediately by putting an interval of 7 to 10 seconds between attacking elements will be productive. The second element is frequently in a position to engage the enemy element attacked as it makes its initial defensive maneuver. By having both enemy elements engaged, you almost cut out the possibility of mutual support between enemy elements.


DON'T SHOOT
UNLESS YOURE POSITIVE IT'S
AN ENEMY AIRCRAFT

BASIC PRINCIPLES OF THE OFFENSE

1. The element of two aircraft is your most effective basic fighting unit. When the fight is over, you will be coming home in two's about 90% of the time.

2. Two elements represent your most effective fighting team -- the flight.

3. If enemy aircraft are anywhere in the area, get rid of the external tanks as soon as empty.

4. When in doubt in a dogfight, trade airspeed for altitude as you turn into the attack.

5. Two good aerial training fights a week are the minimum number necessary to stay in practice. If you aren't fighting the enemy, practice among yourselves.

6. Never continue turning with another aircraft after you are unable to track him with your sight. Pull up, keeping your nose high and to the rear. You'll always end up on top because of your attacking airspeed.

7. If, by using speed brakes, you can drift into the radius of turn of the aircraft you are attacking, do it in preference to the YO-YO maneuver. It takes less time to get your kill and you don't run the risk of being out-maneuvered by the aircraft you are attacking. What you are leary about is slowing down and thus subjecting yourself to attack. You are at your opponent's airspeed either way and for less time if you use your speed brakes properly. Obviously, the combat area is no place to experiment with this theory. Don't waste your flying time - practice!

8. Cruise at a high Mach.

9. Look around; you can't shoot anything until you see it.

10. Keep the aircraft you are attacking in sight. One glance away is enough to make you kick yourself for ten years.

11. Generally speaking, have an element high and fast when you slow down to maneuver. If you are trying to snip one up in the traffic pattern, you'll find it difficult at best with all the flak. Don't make the job harder by leaving yourself open for a bounce by the always present enemy CAP flights.

12. Attack from low and behind whenever possible. That's a fighter's poorest visibility area.

13. If you have an enemy aircraft in front, assume there is one behind, there usually is.

14. Know the performance data on all aircraft you are apt to be fighting.

15. Know your "Big Three". Be familiar with glide characteristics (dead stick and at idle RPM), air start procedures and fuel consumption at altitude at idle RPM. If you are attacked on the way home, you may need all three to make it back safely.

16. Assume every pilot you meet is the world's best (you can swallow your pride that long) and maneuver your aircraft accordingly until he shows you he is not.

17. Don't shoot unless you're positive it's an enemy aircraft. When it's time to fire, you'll know if it's an enemy aircraft or not. If you can't tell, you are out of range.

18. There are three distinct phases in destroying another aircraft in the air:

    a. Maneuvering - 85%

    b. Positioning the pipper - 10%

    c. Firing and adjusting the burst - 5%

    75% of all the lost kills are the result of attempting phase (b) and phase (c) before phase (a) has been adequately solved.

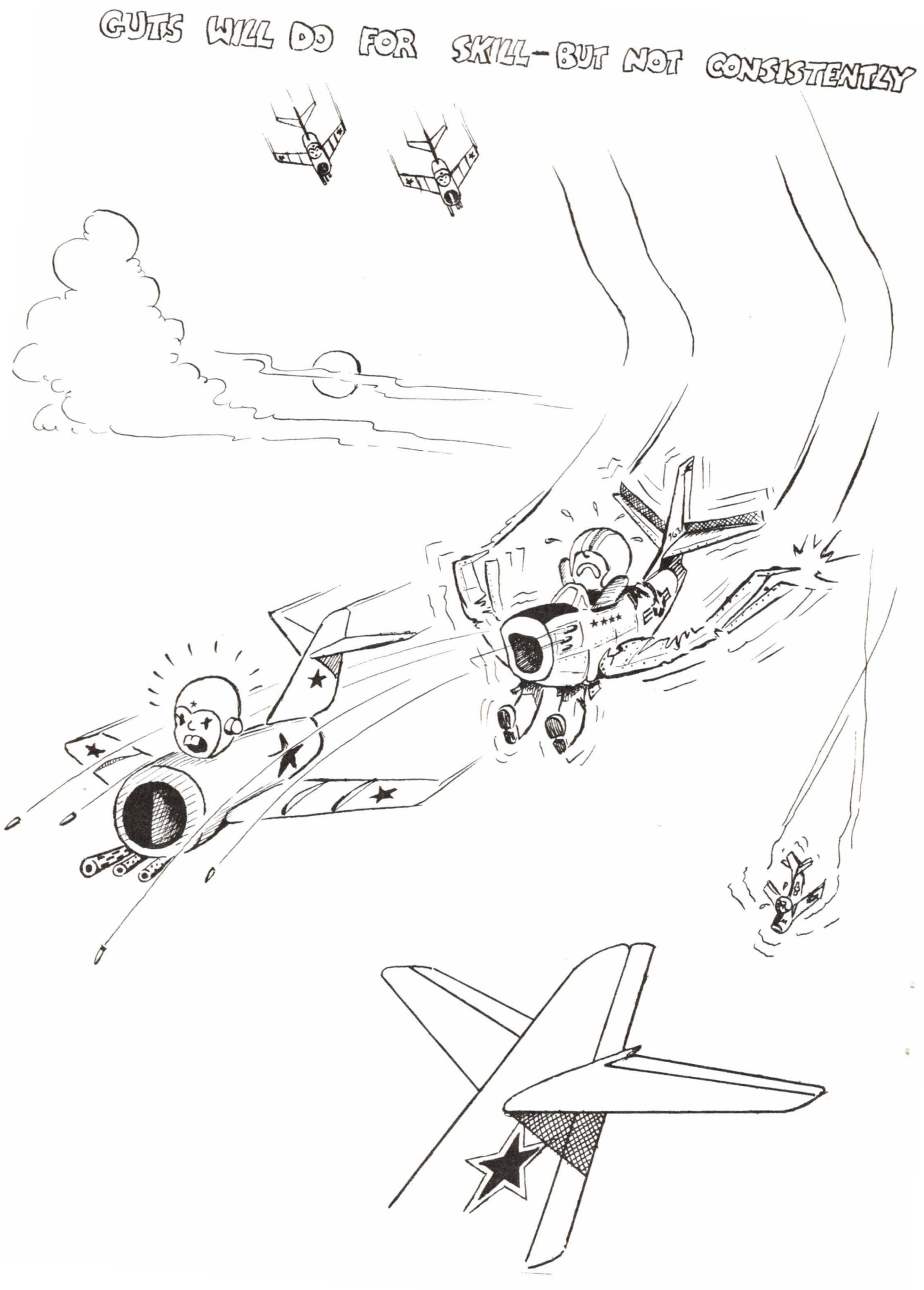
19. Guts will do for skill but not consistently. Know your job in combat or someone else will be flying in your place.

20. Shut up on the radio; if it doesn't concern everyone, get on another channel.

21. Play on the team -- no individualists. The quickest way to be an element leader is to be the best wingman in the squadron.

22. When in doubt -- attack!

23. Learn the value and proper procedure for harmonization.


GUTS WILL DO FOR SKILL - BUT NOT CONSISTENTLY

24. Divide the enemy and conquer. It is very difficult, even for the best pilots, to work mutual support tactics in high speed jet aircraft. If you can split the tactical formation of the enemy, more often than not his mutual support efforts against you will be ineffective.

25. One last word -- No guts, No glory! If you are going to shoot him down, you have to get in there and mix it up with him.

The DEFENSE

Section 3

We have been discussing the Offense almost exclusively. We wish we could tell you that "a good defense will come naturally," or "a good offense is your best defense." Unfortunately this is not exactly the case, for no matter how good you are, there are going to be times when Lady Luck if no one else, catches up with you. There probably is not a single Ace from World War I, World War II or Korea, who can honestly say that on at least one mission he wasn't just plain lucky to get back. "My wingman lost me and didn't say a damn word"; "there were two other 109's I didn't see"; "My wingman and I transmitted at the same time and I didn't know they were back there"; "I heard him call 'Break', but I just had to get him"; "I thought the MIG couldn't turn at low altitude"; "For some reason I thought I was Black Leader and didn't break"; "I saw the long string of Zero's, but thought I had the last two of the string"; these are just a few of the typical comments heard during every de-briefing. The line between Ace and PW is a damn thin one at times, not because you aren't good or aren't smart, but because you can't control circumstances. One other reason -- let's face it -- the enemy has good pilots, too.

From this we see that in combat there are going to be times when we want maneuverability and flexibility, and other times when mutual support is of primary concern. In the instruction of Tactical Formation, therefore, we must consider the probability that both offensive and defensive action will be a necessity and teach our fighter pilots how to handle themselves under either situation.

It seems logical that, when maximum maneuverability is desired, the wingman should be well back and not too wide. By the same token, when mutual support is required, the wingman should get himself well forward and wide enough so that any attacker would have to select either the wingman or the leader as his target, but not be able to switch his attack once within firing range. This will leave the other aircraft free for mutual support.

It is not meant that this defensive formation be a particularly maneuverable one, except during the first turn. This first turn is the key and should immediately place the attacker between the two he is attacking if he presses on in. If the attacker pulls off and climbs, the two merely reverse their turn, turning back to the homeward heading. The entire objective is to keep heading home and, of course, not lose any aircraft. This is the basic defensive plan. Some stereotyped situations are covered in this section later in a discussion of actual Defensive Tactics, but all these mutual support maneuvers are ramifications of the one basic situation.

The position just discussed is one adopted generally on the way home before contact is made with the enemy. The position was assumed because the flight leader knew beforehand he had no offensive capability. When the flight is on the offensive but out-maneuvered, it will be necessary to use almost the same defensive tactics. The principles are identical, but the course of events leading up to their use will differ. On the offense, the wingman could be flying in the fighting position, in close, until the last moment. Going on the defensive he would slide out just before an attacker is close enough to fire, causing him to select one for attack, leaving one free. The free one comes back in on the attacker. This is merely practical application of the basic defensive set-up.

Remember, the Basic Defensive set-up as described below would be used when aircraft are too low on fuel to fight, have no ammunition, or are damaged to the extent they have lost all their offensive capability. Any other time the wingman would remain in the maneuverable fighting position until just before the enemy aircraft reached the firing range.

1. Move your wingman well forward, nearly line abreast and out so as to present two targets instead of one.

2. The aircraft attacked turns away from the other when possible, and must then concentrate on the attacker, taking every opportunity to return to homeward heading.

3. The aircraft not attacked watches the attacker and turns so as to position himself at 6 o'clock to him, thus driving him off or shooting him down.

"My wingman lost me and didn't say a damn word!"

4. If the attack is not pressed, aircraft involved reverse and head for home.

5. If attack is pressed, everything possible should be done by the free aircraft to provide mutual support to break up the attack.

6. The aircraft attacked turns hard into the attack causing attacker to over-shoot; if he does not over-shoot, there is no choice but to use the diving spiral maneuver hoping the other aircraft will help out. Watch yourself, for you may need a "Last Ditch Maneuver" to get out of this one.

THE "BREAK" MANEUVER

The necessity to "break" one way or the other will present itself early as something of a problem. If everyone of your team uses this term under the same circumstances and properly distinguishes it from a "hard turn," it will certainly reduce the trouble you have.

"Break" is an emergency maneuver, and the word "break", when used properly, is an admission that someone has failed to do his job of looking around. In a "break," the two aircraft of an element begin a maximum performance turn in the direction called. It should be called only when enemy aircraft are discovered in range and about to fire. If the wingman is holding anywhere near the correct fighting position as must be expected 99% of the time, he will find it is very easy to fly the leader's wing during the turn even when turned into. If he should be too far forward and must make an in-place turn immediately (as would be the case if you were already being fired at, then the leader will see this and should continue around about 130 degrees until the wingman calls that he has the leader in sight again. He flys wing again immediately upon picking up the leader. A reverse maneuver after a break into a wingman who is making an in-place turn is risky; the wingman can't see the leader the first 90 degrees or so and you can't be sure he'll pick up a radio call to reverse.

These "breaks" and turns discussed, cover about 1% of all turns into enemy aircraft. The other 99% of the time you are expected to be looking around properly, in which case a simple call such as "Let's go hard right, Baker lead, two coming in from five o'clock high" will do nicely. A good wingman, then, should be flying the leader's wing during a "break" into the enemy aircraft. It will seldom be necessary for all four aircraft in the flight to break; however, if both elements are attacked simultaneously and required to break, each element will have to turn into its attacker making mutual support all but impossible. If attacked separately, as is generally the case, the "break" would be executed by the element attacked with the free element striving for mutual support.

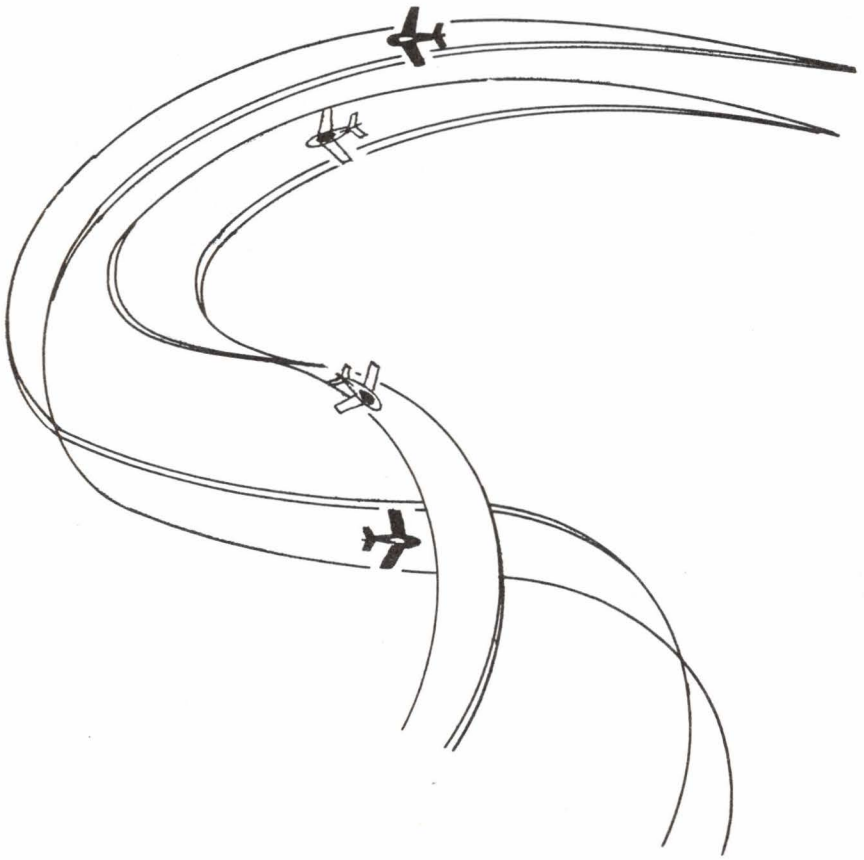
WHEN TOLD TO BREAK

DO IT!

REVERSING A TURN

Reversing a turn is the quickest way to get from the defense to the offense. It can also be the quickest way to get shot down if used at the wrong time. Never try to reverse your turn if you have aircraft behind you at your airspeed. Lateral separation is the determining factor in using this maneuver and can be recognized easily by merely tightening up your turn into the attack and watching closely the attacking aircraft. If he slides outside your radius of turn, reverse into him for he has created that lateral separation which you are always seeking in any defensive maneuver.

Your best chance of getting this lateral separation usually will come when the attacker is faster than you or coming in with a high angle off. Keep turning into him until he slides past you to the rear, then reverse. From then on, as he slides out in front, he is on the defensive and you are on the offensive. More than one turn reversal constitutes a scissor maneuver. One precaution: before reversing, make sure that the element you are engaging is not followed closely by another. A reversal in this situation could make you a sitting duck for the second enemy element.

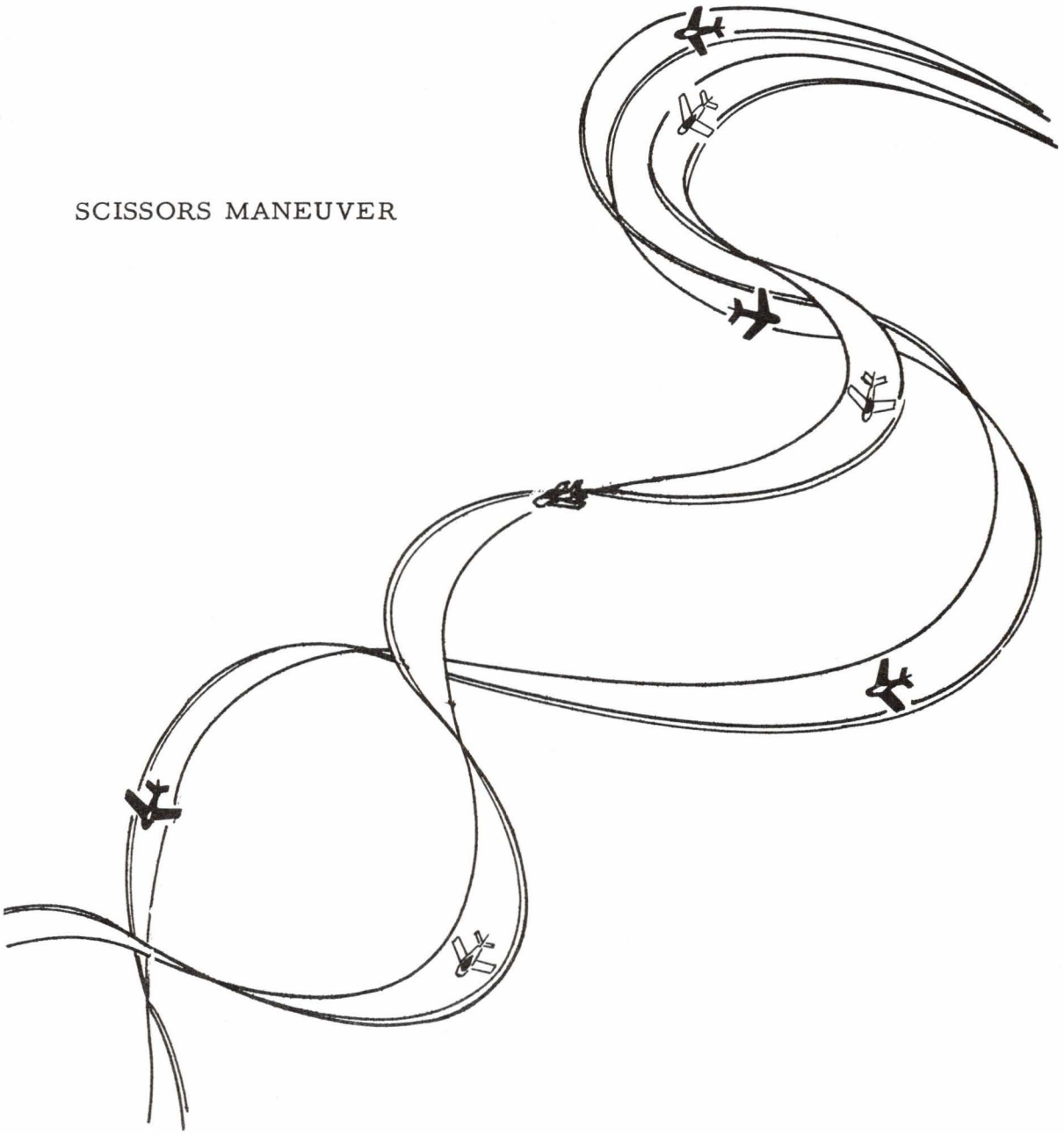


THE SCISSORS MANEUVER

A simple turn reversal that throws the enemy wide of you, but not out in front, will call for another turn reversal. A series of reversals of this kind is commonly termed a scissors.

This scissors maneuver is one with which you must become familiar. Any time two aggressive pilots meet in comparable fighters, the eventual result will be a series of maneuvering turns for advantage. These turns kill airspeed, and the pilot who is most familiar with the low speed maximum performance of his aircraft will come out the winner. These fights many times wind up at low speeds. The maneuver, if properly executed, is probably the fastest method known of getting from the depths of despair to the victory roll.

SCISSORS MANEUVER



As you are being attacked, turn into your attacker until he can no longer stay in your radius of turn. When this happens, you will see him begin drifting to the rear of you quite rapidly. The more rapidly he approaches your six o'clock position, the earlier you can chance a turn reversal. You know he has more airspeed or he wouldn't be there, so as he drifts through the five to six o'clock position, hesitate about 2 seconds then pull up and reverse your turn. If he is closing slowly, reduce throttle and the use of speed brakes will not be necessary. After you reverse, you will observe him still turning hard toward you - canopy to canopy. From this point, the two of you will conduct a series of turn reversals, each pilot endeavoring to get rid of his airspeed by pulling up, using speed brakes, maybe even using a few degrees of flaps.

The attacker, if foolish enough to go this far, after one or two more reversals ends up sliding in front of the one he was attacking. This series of close-in, continuous turn reversals is called a scissors maneuver. Obviously, the pilot who is able to decrease airspeed the quickest, once these reversals start, will end up in the firing position on his opponent. The trick, if you are being attacked, is to be able to recognize the instant to reverse. If you are the attacker, you must realize that a smart fighter pilot is going to have you in serious trouble very quickly unless you pull up, trading airspeed for altitude, the instant you are unable to track him with your sight.

When attacking, don't have too much overtaking speed. It merely cuts down firing time, makes tracking more difficult, and often can be the difference between a kill and a damage. If you have an element to stay high and fast to cover you, your best bet, if you know your aircraft, is to use a few inches of speed brakes and attempt to get at six o'clock very close to his airspeed. If he out-turns you, slide high but in his orbit, gradually cutting down airspeed until you can be directly at six o'clock and at his airspeed. This procedure must be played by ear. What gave a kill yesterday may make a PW today. You are burning the candle at both ends if you slow down without your element there to cover you. This is especially true if very many enemy aircraft are being sighted on that mission.

Wingmen must be indoctrinated to the scissors so as to be able to fly wing properly, staying behind the leader, or choose the right time to pull to the outside and high, thus allowing the leader complete freedom of action. If your wingman can't stay with you during a scissors he has more practicing to do before you can expect good results against an aggressive enemy.

If you end up in front, after one of these scissors maneuvers, your only salvation may lie in how quickly you get your nose down and get into a diving spiral. Maybe you can get some airspeed before you get hit too badly. Become familiar with this maneuver for it is useful, regardless of type aircraft being flown. Your best protector with an aircraft at six o'clock is G force. You need speed to get G's - thus, the diving spiral. Keep the G's on and keep the nose down so you can keep enough airspeed to make it rough for the shooter. Try to watch the aircraft behind you. If you can see the belly of his aircraft, he's beginning to pull lead and may be about to fire. Tighten up your turn immediately.

THE DIVING SPIRAL

SANDWICH THE ATTACKER IN BETWEEN THE DEFENDING AIRCRAFT!

THE DEFENSIVE SPLIT

Occasionally, and perhaps through no fault of your own, you and your wingman will be faced with the problem of what to do after an enemy element has worked its way to your six o'clock position and is almost in range at your airspeed. This can be the result of excellent enemy pilot technique, better enemy fighters, negligence, your own poor pilot technique, or any other of a number of factors which have worked to your disadvantage. This situation calls for a deadly kind of move and countermove game played step by step, hoping to find the attackers wanting in some basic knowledge of tactics. The defensive split represents your best opportunity to equalize conditions, or at least extricate yourself with a one for one trade.

Here is the way the action will develop in performing this maneuver. Having been outmaneuvered, you will logically be taking your element into some variation of a diving spiral to continue your attempt to keep the attackers on the outside of your turn. As it becomes evident that your attackers are close enough to begin firing, usually upon a call from the flight commander, the leader and wingman spread apart wide enough to present two targets instead of one. It is suggested the wingman cut down and inside the leader's turn, for he will want to be as nearly abreast as he can get. The leader can just about hold what he has and the split will take place normally. This split offers the attackers three logical courses of action:

1. Stay together and attack the high aircraft.

2. Stay together and attack the low aircraft.

3. Split with you and place both of you under attack.

Now let's see what action will be required on your part for each possible course of action for the enemy aircraft.

1. If the enemy element stays together and attacks the leader, who is the high aircraft, making certain such a move is not merely a feint, the leader rolls under or over, down and away from the low aircraft. The wingman then turns in the direction of his leader, forcing the attackers to either break off the attack or be sandwiched between the defending aircraft.

2. If the enemy element stays together and attacks the low aircraft, the pilot in that aircraft should roll down and away from the leader. The leader in the high aircraft rolls down in the direction of his wingman, forcing the enemy element to break off their attack or be sandwiched between the two defending aircraft. The basic thing to remember is that mutual support, whether in a flight of two elements or in a single element executing a defensive split, is most easily accomplished when the aircraft under attack turns away from his supporting unit.

3. If the enemy element splits when you split, each taking one of you, your best and only move is to split up, each doing his best to dislodge the enemy aircraft at his 6 o'clock position. The first pilot to extricate himself helps the other if circumstances permit. A last ditch maneuver may be necessary here, depending on enemy pilot ability. This situation is the only one which calls for an intentional split of the element, but is necessary to keep from needlessly losing both aircraft. Initial efforts usually show poor timing and judgment, but this can be easily remedied with a little practice and is well worth the effort involved.

A LAST DITCH MANEUVER

When the diving spiral won't do the trick, your last hope is in a "last ditch" maneuver. A good pilot should have one good "last ditch" maneuver and practice it frequently. Keep in mind, though, that it is a "last ditch" maneuver, and not one to be used merely because enemy aircraft are somewhere behind you. This type maneuver would be used only if an enemy aircraft were at six o'clock to you, in range and firing, or about to fire, and at your airspeed. If he is faster or slower than you, there are obviously other more productive methods of dislodging him from the six o'clock position. If, however, through your own carelessness or inability, you find yourself with an aggressive enemy fighter pilot at six o'clock and close to your airspeed, you are going to have a good one to tell the boys at the bar that night -- if you get back.

Whether you do get back or not will depend a great deal on how much thought and practice you have done on this last ditch maneuver; also, on how well you fight off the tendency to panic in such a situation. There are other ways to dislodge an aircraft from the six o'clock position, but the one described here is as good as any when he is in range and at your airspeed at six o'clock.

1. Get your aircraft into a 5 or 6 G turn as quickly as possible.

2. As your airspeed drops off, lower the nose so you can continue to pull the high G's.

3. Five or ten thousand feet of this may be enough to lose a pilot who is unsure of himself, or half-hearted in his attempt to destroy your aircraft. If he is a good, aggressive pilot, however, the fight has just begun.

4. At about 15,000' you are going to have to decide on a "do or die" effort to shake him. Increase your G forces to 6 or 7 G's if you can, and slowly reduce throttle to idle.

5. As you reach idle, throw out speed brakes and reverse your direction of turn without easing up on the G forces. (You can do this easily merely by pulling the nose up and over into high G barrel roll opposite your original direction of turn.)

6. After about 30 degrees of this turn, reverse your turn again. This should not prove too hazardous, for by now you should have your attacker in a full scissors maneuver.

7. As he sees your speed brakes go out, he probably will instinctively throw his out, but he has not yet noticed the decreased throttle setting. Even a good pilot usually will not recognize the initial decrease in throttle, because the increase in G forces keeps the two aircraft about the same distance apart. By doing this, you have created the one thing always sought by the defender in any dogfight -- lateral separation.

8. After your first turn reversal, just play the situation by ear. Keep turning into him and you will find his slightly excessive airspeed will carry him out in front of you. As this happens, he will be forced to break out into some maneuver of his own.

9. Speed brakes "in" and throttle forward immediately as he slides by, and you will find yourself in perfect offensive position for a kill.

10. If, for any reason, you don't manage to scissor him through the use of this maneuver, and end up still in front with speed brakes out and throttle back, the pilot behind you will solve any other problems you might have.

HAVE A "LAST DITCH" MANEUVER

Let us combine all our defensive knowledge now and see what action would be required for the standard circumstances outlined below. Knowledge dispels fear -- know your job and coolly do what is required according to the circumstances.

1. One Attacked by Two:

Don't panic, no matter how many aircraft are attacking. Panic is your most formidable enemy. As the two come in on you, as soon as possible, break sharply into the attack making sure you offer no less than a 50 or 60 degree angle off shot. At this stage of the attack you should see both leader and wingman sliding to the outside of the turn or, if they choose to YOYO, climbing steeply to your rear. Your best move, if they are attempting to turn with you, is to wait until they slide through the trail position then reverse, possibly chopping power and using speed brakes, if required, to get to the rear of the enemy number two man.

Base all your maneuvers on the wingman as long as he is still attempting to fly wing. Don't get yourself sandwiched in between the two of them accidently. If they decide to YOYO and pull up as you begin out-turning them, put your aircraft into a diving turn and keep going 180 degrees away from them. With them going up initially and you going down, you'll probably get enough of a range spread to keep you out of trouble. Don't try to pull up with them if they stop tracking and begin an early pullup. You haven't as much airspeed and consequently will end up either low or stalled out. Either way, you are in worse shape than if you break away and down, and do barrel rolls toward the ground while you are picking up speed.

2. One Attacked by Four:

You have a real problem here if the four have any idea about what they are doing. Your procedure is to turn into all attacks and to be sure you don't get cocky and try a turn reversal with the other element spaced about 10 seconds behind. Keep both pairs in sight at all times. You'll notice after the first attack or two that the attacking elements are not evenly spaced. Watch for this and, just after turning into the last element, continue your turn and go away at 180 degrees and with all the airspeed you can pick up. Get your nose down quickly for the gap you are trying to create will depend on your picking up maximum speed as quickly as possible. After each turn into an attacker, lower the nose to keep airspeed up. This will keep you ready for an immediate turn reversal if you should need it. Remember -- airspeed is your salvation. Keep your attackers at high angles off, and DON'T PANIC. Watch for your chance to break away and down, then get out. Come back tomorrow with a full flight.

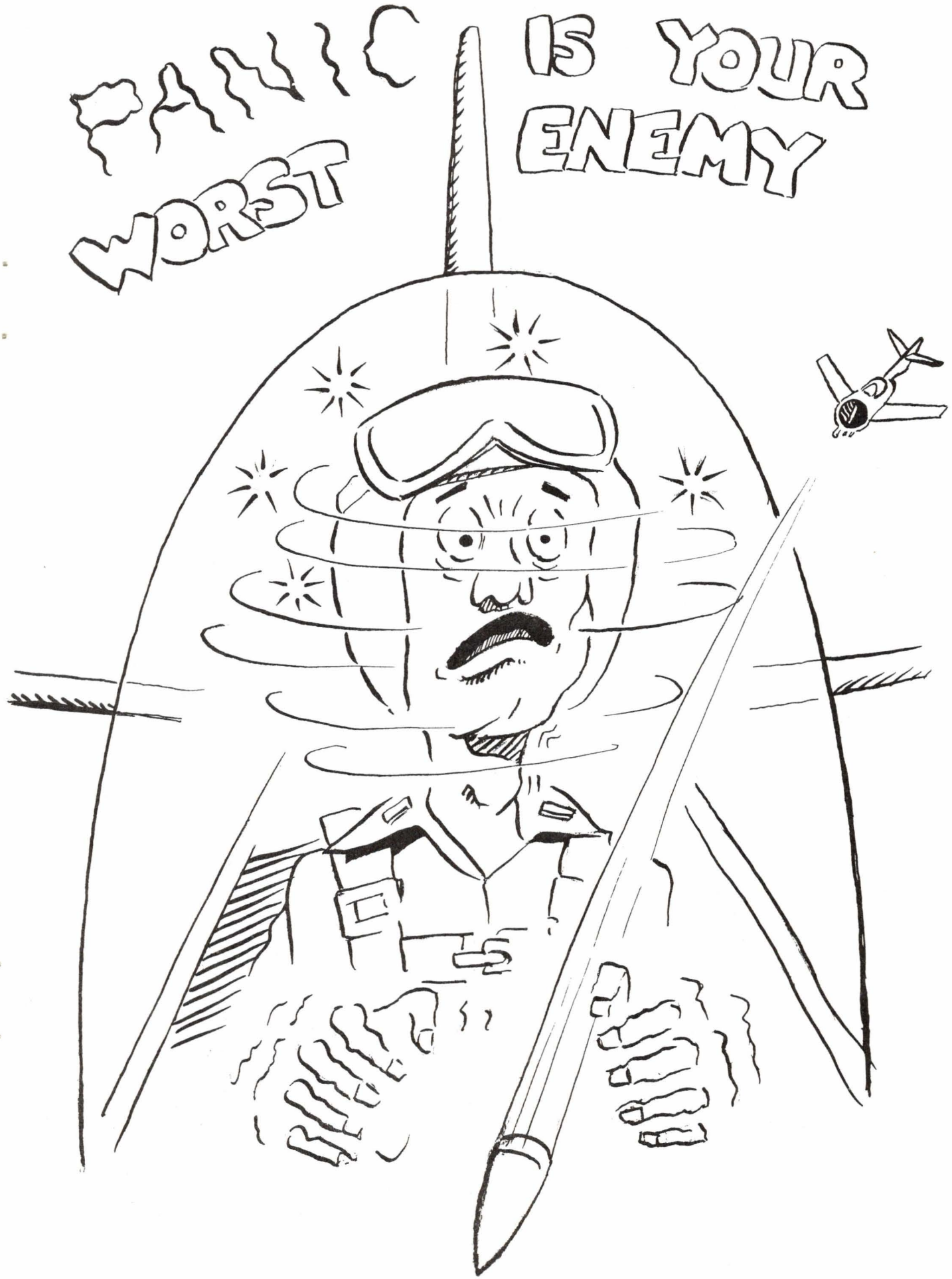
3. Two Attacked by One:

If you have a good wingman, this should prove no more difficult than if you were a single. Turn into the attack and attempt to swing him outside your turn. Reverse and scissors until you get him to break away and down. If he is extremely sharp and gets behind you at six o'clock, and at your airspeed during the initial maneuvering phase, try a defensive split and force him to pick one or the other of you. The free pilot helps the other one. A tip for the pilot who is attacked - forget about everything but shaking the man behind you. Just hope for help from other members of the element, but make no turns to get it. Keep your eyes on that attacker; keep him at a high angle off, and keep 5 or 6 G's on the aircraft. Be prepared, if he follows you all the way down, to use your "last ditch" maneuver.

If the leader and the attacker become entangled in a low scissors maneuver, the wingman may find an opportunity to slide out and away from them both. If so, he should do it, then get his airspeed up and circle the fight, ready to jump the enemy in case he should get an advantage on the leader.

4. Two Attacked by Two:

Turn into the attackers as soon as possible. Fight as though you were a single until you either get an advantage or until they get one on you. Handle the reverse the same as in other cases; if they are down on your level trying to turn, reverse and scissor them as they slide past the trail position. If they pull up early, as they will in most cases, they probably won't drift out of your radius of turn far enough to make a reverse anything but dangerous. As they go up, do wide barrel rolls going down, to be sure a lucky hit doesn't get you or your wingman before you can get some distance between yourself and the attackers. If the two of them do make the turn and you end up with them at your airspeed at six o'clock, spread out in a diving spiral (defensive split) and see what they do. If


PANIC IS YOUR
WORST ENEMY

"Beats me!
Didn't you
see 'em?"

they stay together and attack one of you, the other can swing back in, sandwiching them between you and your wingman. The one attacked, again is on his own, while the free one does his best to help. If, as you spread out, one of them slides out so each of you has an attacker, you are in a bad way. This situation calls for about the only advisable intentional split of your element. Each of you must forget the other and do whatever is necessary to shake your attacker. If one gets free he attempts to help the other. This one's a rough go.

5. Two Attacked by Four:

Turn into the attacking lead element keeping them, as in other attacks, at a high angle off. Even if they stay low and try to turn with you, be careful about reversing unless you are sure the second element is still high above. Frequently the second element will come in at about a seven second interval, in which case a reverse on the lead element could be disastrous. Keep your airspeed up by diving as you turn into each attack, and attempt to catch one element in a reverse when the other is too poorly positioned to help out. If they work their way behind you at your airspeed, you may have to try to spread out, hoping that the attacking element will remain intact. If so, the free pilot helps the other. Here he must be particularly careful, for there is the other element to reckon with. In addition to the attackers, he is fighting at close range. He must know the whereabouts of the extra element. This is a dangerous situation, especially if attackers know what they are doing. Watch for your chance -- it comes with unequal spacing between attacks. Turn into attack and go away and down at 180 degrees to your attacker.

6. Four Attacked by One:

By now we begin to see the patterns of defense repeat themselves. The element attacked quickly turns into the attack. The free element plays his supporting action trying to sandwich the attacker between elements. This forces a trade of aircraft or causes attacker to reverse into the supporting element, thus freeing the one originally attacked.

Be careful not to commit yourself too quickly or too completely. Don't turn too early and find you have allowed the attacker to switch targets. If the top friendly element is attacked, he will have better luck turning down and away from the lead friendly element, calling him and advising him of this as he does it. The leader can delay momentarily, then wheel about, sandwiching the attacker in between. If the lead friendly element is attacked, the second friendly element should arrive for support at such time as to parry the attack just before maximum firing range is reached. If an advantage is gained on the attacker, the second friendly element should continue to press the attack, even if it means separating from the lead element. If it looks questionable, the second element repositions itself as cover for the lead element.

7. Four Attacked by Two:

The defense here is exactly as it would be if attacked by a single. If the attacker's wingman is separated for any reason, the free friendly element should attempt to engage him immediately, keeping him from lucking into a position of advantage as the friendly element maneuvers with the leader of the attack.

8. Four Attacked by Four:

This represents quite a problem for both attacker and the flight being attacked. Assuming the attack is on the high element and is discovered normally, the friendly second element should turn hard into the attack. The second friendly element should, if at all possible, turn away from the lead element as long as doing so does not give the attackers any advantage. If in doubt, however, always turn into the attack. At extreme ranges the entire four ship flight should wheel into the attack.

If the attacker can make the second friendly element think he is going to take them to the deck and make them dive away, he will switch his attack to the lead element who will then have no chance for help. Should the attack be on the high element and from the side the lead element is on, the same early turn into the attack is suggested so that the mutual support can be accomplished easier. With this procedure it will be a simple matter for the lead element to sandwich the attacker in between. At this stage the lead friendly element must watch carefully the second enemy element. They may commit themselves with a 7 or 10 second interval behind the lead element, or they may still be high above waiting for an opportune time to drop in at 6 o'clock to another element or single aircraft. Either way, much emphasis must be placed on looking around, for the attackers will have the trump card.

"There were two other 109's I didn't see!"

If the initial attack is on the lead element, the second element should come down immediately and attempt to parry the attack. If the attack is broken up, the second friendly element should continue to follow up any advantages gained by pressing home the attack on the first enemy element. Look around! Don't let the other element surprise you. A call will be necessary to advise the lead element they are clear at present, but on their own from here on. The fight must be "played by ear" from this point, utilizing the basic principles of offense as the situation may dictate.

COULD HE HAVE SAID,

BLACK LEADER,

BREAK RIGHT???

BASIC PRINCIPLES OF DEFENSE

1. If you slow down, have an element high and fast for support.

2. Always turn into the attack.

3. If there are enemy aircraft anywhere in the area, get rid of external tanks and get your Mach up. It's too late after you spot him.

4. Keep your attacker at a high angle off.

5. Keep airspeeds up when patrolling.

6. Don't ever reverse a turn unless you have your attacker sliding to the outside of the radius of your turn.

7. If you have a "hung" external tank, leave the combat area.

8. If you lose your wingman, both of you should leave the combat area.

9. Know the low speed characteristics of your aircraft. If you are fighting aggressive pilots you'll need all the know-how you can lay your hands on.

10. Have a "last ditch" maneuver and practice it.

11. Keep a close check on your fuel.

12. "A good offense is your best defense" -applies most of the time - but know your defensive tactics.

13. Don't play Russian Roulette! When you're told to Break - DO IT!

14. Avoid staring at contrails or the only aircraft in sight. There are a dozen around for every one you can see.

15. Watch the sun - a well planned attack will come out of the sun when possible.

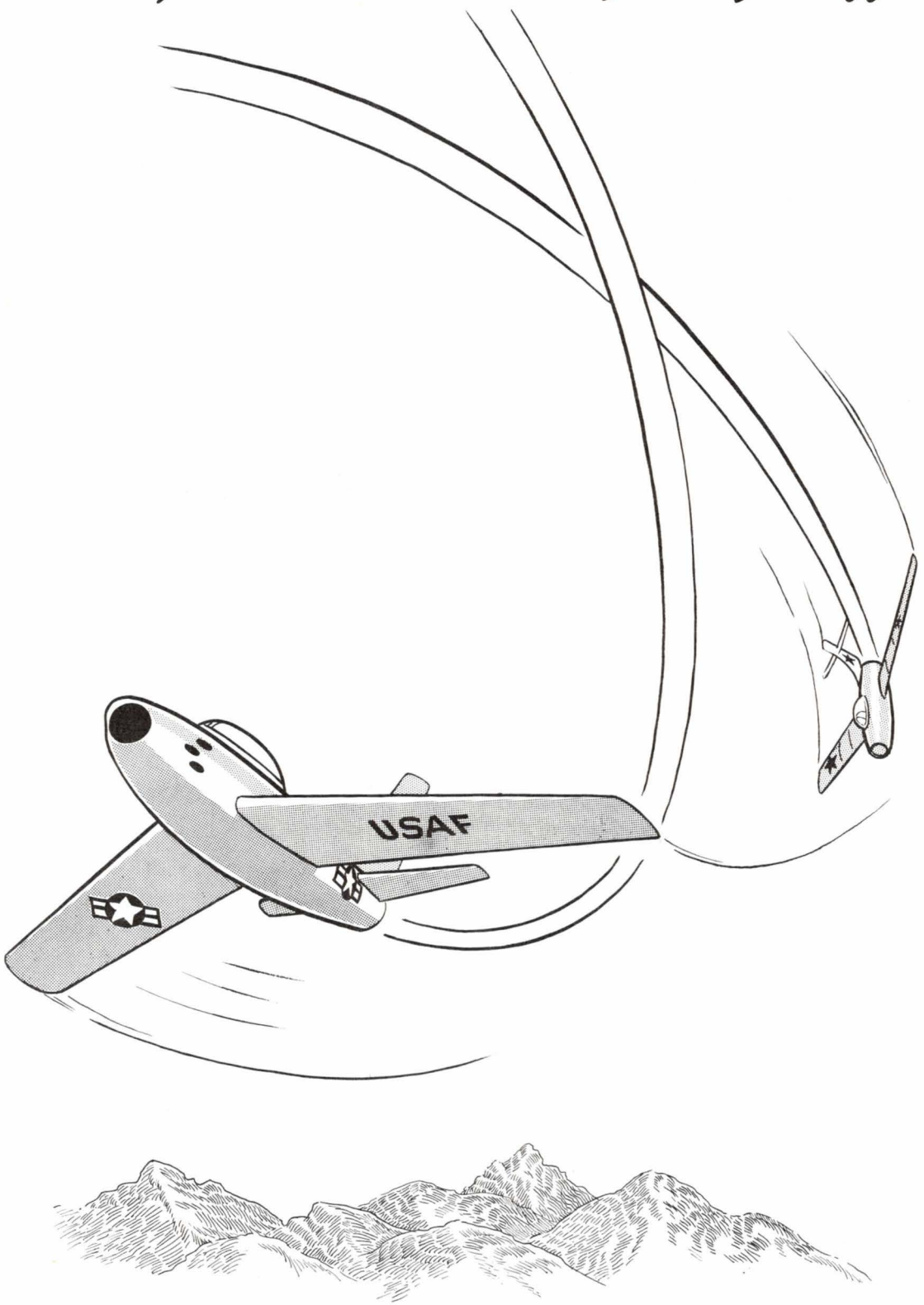
16. The object of any mutual support maneuver is to sandwich the attacker between the defending aircraft.

17. In any dogfight, the objective for the defender should be lateral separation. When this is achieved, a reverse and a series of scissors will, if properly executed, put your attacker out in front. The rest is up to you.

18. Place yourself in your attacker's shoes. How would you like to find an enemy flight positioned? Be smart and avoid this formation for your flight.

19. Don't panic - panic is your most formidable enemy!

Keep Your Attacker at a High Angle Off !



LOOK AROUND!

THE Supervisory ROLE

Section 4

The time and effort expended to prepare the information contained in Section I, II and III of this manual is wasted unless some program for logically and safely presenting it to the new pilot exists. The purpose of this section is to discuss the difficulties encountered from a supervisory standpoint, and to outline procedures for this type of training which are considered adequate, as long as the proper calibre of supervision is being administered.

COMMON MISCONCEPTIONS

Many commanders of both tactical and training units feel, when considering Air Tactics Training, they are undertaking a phase of training which is beyond the capability of student and instructor alike. There are two general areas of misunderstanding responsible for this idea.

1. The false assumption that no simulated aerial combat is currently being done by members of their unit or command and,

2. The preconceived idea that air combat maneuvering training is all maximum speed, maximum "G" force, hell-for-leather flying.

Let us analyze the truth in the first of these problems. As long as our Air Force continues to have in its tactical units aircraft that are even somewhat maneuverable and fighter pilots who are worth keeping in the service, simulated aerial combat will be going on. In teaching air combat maneuvering, we are not attempting to teach something our fighter pilots are incapable of; we are only organizing the instruction so that they may acquire this information in a safe, orderly manner.

A careful check into the second problem clearly discloses that the actual conduct of the training itself is such, that maximum performance until the final few missions, is not a signigicant factor even ten percent of the time. As in other activities, there is first a period of instruction in basic fundamentals, then the practicing of these fundamentals, and finally the fuzing of all knowledge by a practical application phase. The entire program is closely monitored and controlled, which results in a logical schedule of learning. The student is required to undertake only that of which he is capable, commensurate with his skill level at that time.


PROPOSED PROGRAM for FIGHTER TACTICS
COL. I. AM
NONE OF THIS STUFF
ON MY BASE
IT'S TOO DANGEROUS!

A good, safe, productive air combat maneuvering phase of instruction obviously requires good instructors and eager students. These we can train. A successful course of this type also requires mature, thorough supervisors at every level -- from the assistant flight leader through the group commander.

It is not inconceivable that an occasional accident may occur in this type of training. When it does, it is generally apparent that someone failed to exercise the proper common sense and supervision in the planning and conduct of the mission. If commanders AT ALL LEVELS will condemn this type of training only after all supervisory personnel have been exonerated, then this type of training will be with us as long as we have fighter aircraft.

In cases such as these, the weak links must be removed and stronger ones put in their place. One removed for improper supervision will frequently improve the brand of leadership to the point of virtually eliminating this problem entirely. THIS IS THE COMMANDER'S RESPONSIBILITY.

There are rules to be followed when playing this "game," just as in any sporting contest. Any infraction of these rules can have the same serious effect as a violation during other phases of training. This means the individual instructor must be given enough information on this phase of training to fully understand how much responsibility he has, and the consequences of any failure on his part to accept this responsibility.

A few rules of instructor conduct follow, which proved stumbling blocks to certain instructors in the past. With a little common sense and good mature judgment, these stumbling blocks can be made stepping stones to a successful program.

1. The instructor must avoid the childlike action of attempting to impress his students. This same requirement exists in all phases of training.

2. He must avoid any maneuver not feasible in combat.

3. He must observe designated minimum altitudes, realizing they exist for the benefit of the student and instructor alike.

4. When attacking, he must never cut in between a wingman and his leader. Most accidents in this phase of training happen as a result of a violation of this procedure. It's a disastrous mistake in combat as well as in training.

5. An instructor must never lead a flight in this type training without first checking the previous grade slips of the students.

6. He must never underestimate the value of the briefing and the de-briefing.

7. He generally must avoid encounters that are head-on, especially at the same altitude. The desired encounter will be with one flight having a 3000 to 4000 foot advantage and the two flights meeting any way other than head-on. This gives each flight the opportunity to practice pure offensive or defensive work, avoiding the indecisive, altitude consuming action which usually results from head-on encounters.

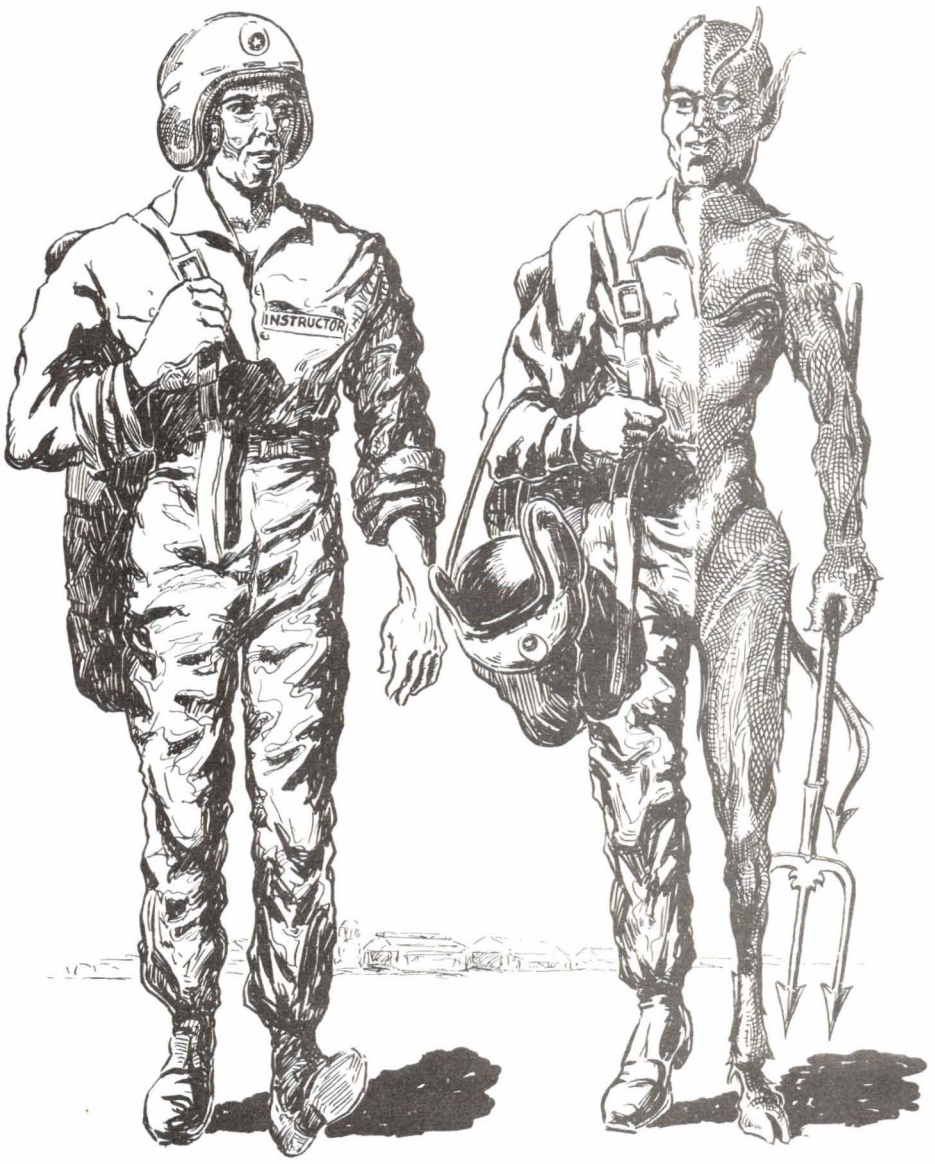
8. He must study the provided reference material. It's like money in the bank for himself as well as his students.

9. He must never exceed the capabilities of his poorest student.

10. He must not allow pride to affect his good judgment. No matter what the conditions are in training, the leader must cease fighting when the wingman becomes separated. When he violates this, he has forgotten why he was sent on the mission.

By applying these common sense procedures to the outline of training presented in the next few pages, the instructors very soon will become as effective when teaching air combat maneuvering as they already are teaching the other phases of fighter operation.

NEVER CUT IN BETWEEN A WINGMAN AND HIS LEADER.



KNOW *The Past Performance*
of THE STUDENT YOU ARE
SCHEDULED TO FLY WITH

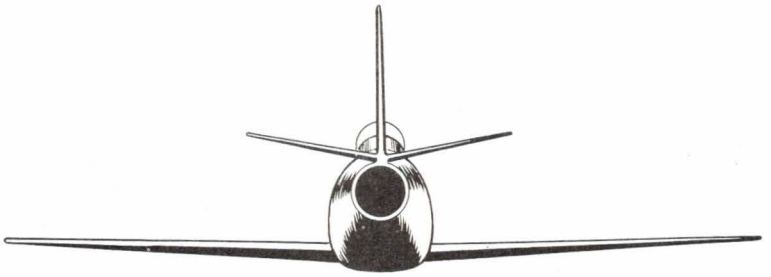
IN-TRAIL WORK

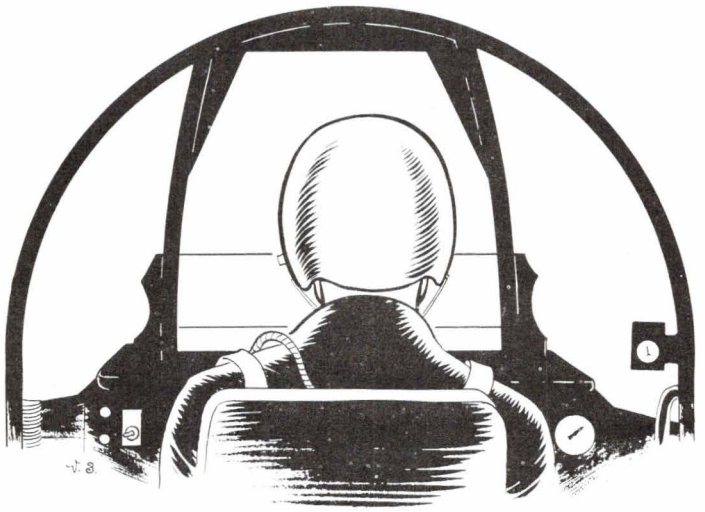
All through this type training the instructor will be flying with students in-trail. Because of this, it is a vital necessity when signaling the flight to "trail" to indicate what type maneuvers are to be flown. Certainly one does not want all four aircraft jammed up close behind when trying to initiate some high "G" turns and reversals. Nor does one wish to see the flight with 500 or 1,000 feet between aircraft when doing the lazy maneuvers of precision trail flying. To eliminate any misunderstanding, two types of trail flying are designated -- close and extended.

Close Trail - When the instructor tells his flight to drop into close trail, each student is depending on him to do only what is intended in close trail. Up to about two ship lengths, the closer the students are to the one in front of them the easier this type flying becomes. The instructor should put the student through easy barrel rools, lazy eights, and steep turns, avoiding excessive periods of straight climbs or dives since this causes aircraft to gain and lose rapidly in relation to one another. When climbing or diving, the instructor should turn to allow for proper spacing behind. No over the top maneuvers in close trail with more than one student in the flight. After some precision work, he can motion the flight to drop back to extended trail for some of the more difficult maneuvers.

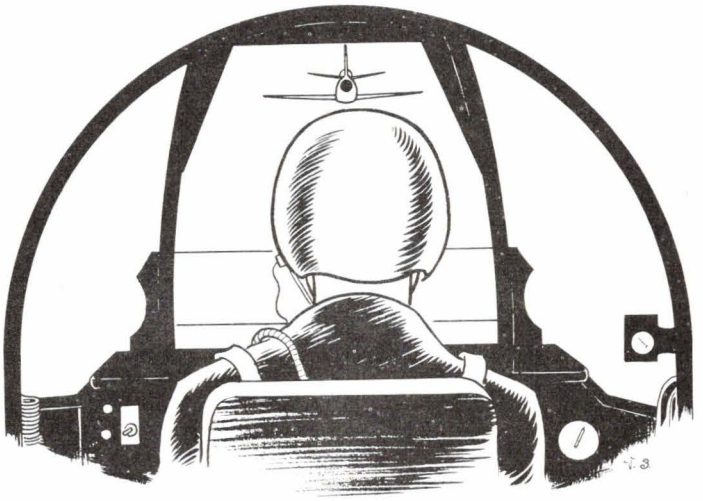
Extended Trail - This type trail formation is used to teach the students how to get maximum performance with the aircraft. Aircraft are flown about 300 to 500 feet apart and each pilot endeavors to maintain his position in the string. Every pilot follows the pilot in front, even though that pilot is not getting the desired performance in relation to his leader. There can be no cutting anyone out of the string. Instructors must teach their students to get the aircraft ahead in their windshield and keep it there; crossing, sliding, cutting to the inside or outside as necessary, to stay with the leader. The instructor must realize this is maximum performance work only for the poorest student in the flight - very seldom for the leader, unless he feels all his students are as good as he is. Over the top maneuvers such as loops, Cuban eights, cloverleafs, etc., are fine in this type formation, but it must be kept in mind that the last student will have about twenty knots less than the leader on the top. In hard turns the last student will be pulling about one and a half to two "G's" more than the leader. Turn reversals with more than one student in trail can be extremely dangerous depending on airspeed and student proficiency. Turn reversals, scissors maneuvers and the like should be accomplished in a two ship flight only when training students.

Close Trail





Extended Trail



In the conduct of our training program, just as in combat, there is a preferred position for the element leader to fly when the intent of the flight concerned is offensive air-to-air combat. This position is termed the "fluid element position" and should be used during the air combat maneuvering phase. It is possible, though generally undesirable in combat, to have the element in the low position for offensive air-to-air combat. In cases such as these the element leader flies a normal position about 20° back of the leader until such a time as high performance is anticipated or required. As the wingmen assume their fighting positions the element leader also assumes his, which will be, if he chooses to stay low, approximately 35° - 40° behind the leader and out about twice as far as the wingmen. There are serious disadvantages to this position and consequently, the fluid element is considered a far superior method of utilizing the four-ship flight in combat.

The important thing is to understand that maximum performance maneuvers, with the element leader only 20° behind the leader, would occur only during the initial break or hard turn into the attack. Any subsequent maneuvering would be performed with the element back about 35°-40° or up in the fluid element position. It is not considered a profitable utilization of time, therefore, to practice hard turns, breaks and other high performance maneuvers with the element in the low forward position. It is interesting to note that practically every accident in CTAF that has occurred during a break maneuver, was the result of conducting maximum performance maneuvers with the element in this untenable position.

In summary, and to preclude any further misunderstanding on this subject, the following procedures will be followed in utilizing the element leader in the fluid and low element positions in tactical formation:

1. The fluid element will be flown as indicated in CTAF Regulation 60-7. This position may be used during the formation phase and will be used during the air combat maneuvering phase of training.

2. The low element will be flown as indicated in CTAF Regulation 60-7. The position of the element leader, about 20° behind the leader and stacked slightly down, will be used whenever the course and destination of the flight are clearly outlined. Any time the objective of the flight requires maneuverability and performance, such as would be required during "breaks and hard turns" in aerial combat, the element leader, if unable to move to the fluid element position, will move from the 20° position to about 35° - 45° behind the leader. This position is designated the fighting position for the element leader in the low element tactical formation.

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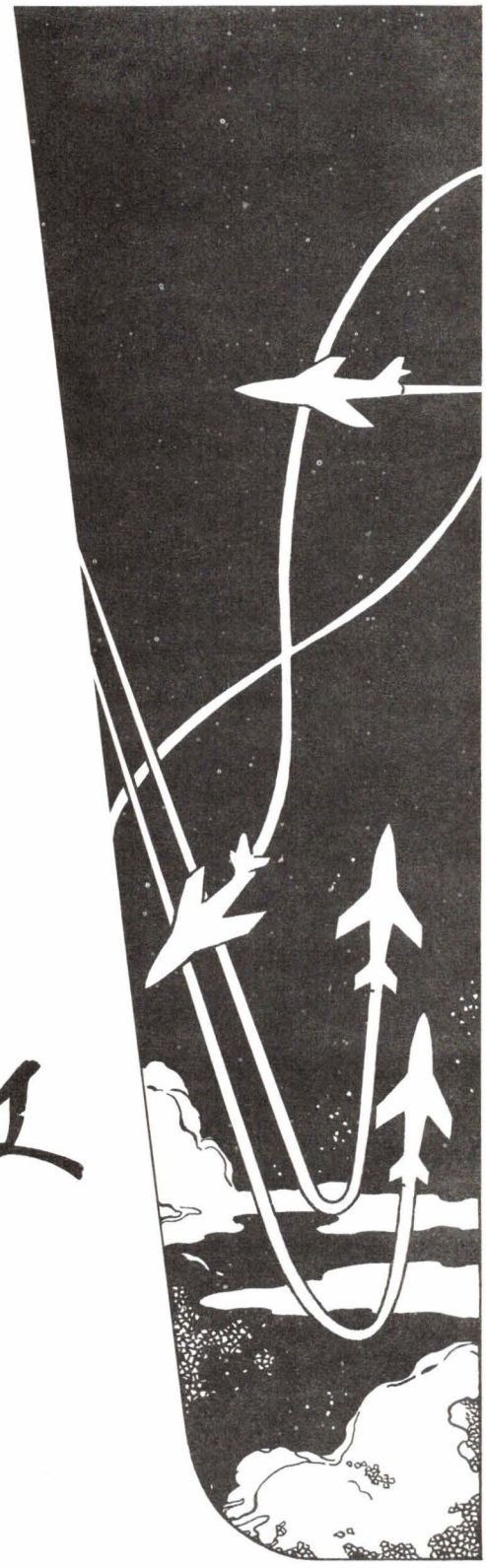
TRAINING

Procedures



Section 5

To provide the student with the best possible opportunity to learn, an organized schedule of instruction must be adhered to. This schedule of learning falls conveniently into three distinct phases:

Phase 1. Individual instruction in basic fundamentals (missions one through six.)

Phase 2. Practicing the fundamentals by element (missions seven through eleven).

Phase 3. Combat application of the four-ship flight (missions twelve through fifteen).

PHASE ONE

(Air Combat Maneuvering Training)

During the first six missions an instructor should accompany each student. The instructor should be responsible to see that the student demonstrates proficiency, in this order, in the following specific skills prior to engaging in simulated combat:

1. Maintaining normal position in tactical formation.

2. Maintaining fighting position in tactical formation.

3. Maintaining proper position in steep and shallow turns at low and high altitude.

4. Maintaining position during precision maneuvers in close trail.

5. Maintaining position during maximum performance maneuvers in extended trail.

6. Causing an attacking fighter to overshoot.

7. Preventing an overshoot when attacking.

8. Maintaining wing position during a diving spiral.

9. Describing in detail the "Break" maneuver and performing breaks as a wingman.

10. Maintaining proper position during scissors maneuver.

11. Describing in detail the "defensive split" and performing same as a wingman.

The best average mission duration is 1:15 to 1:30 for maximum learning with this type instruction.

A card should be kept on each student indicating how far along he is on the necessary required items. It should also show trouble areas to the instructor not familiar with the individual's progress.

Mission Nr. 1. Brief as a four-ship flight. Taxi, takeoff, and initial climb to altitude are routine. As soon as possible after takeoff the elements split, each leader undertaking the instruction of his student. Considering now only one element, since both will be doing the same thing, the leader checks student position in normal and fighting position straight and level. The leader turns left and right, shallow and steep, during climb out from low to higher altitudes, checking student position as he does so. This continues until drop tanks (if carried) are empty or until adequate practice has been obtained at higher altitudes. At this point, both the normal and fighting positions have been demonstrated. Some students, not many, need to be told when to use each position. Generally speaking, the normal position will be used until such time as the leader's maneuvers indicate a change is in order. It is easier for the wingman to stay with the leader from the fighting position, so the wingman should go immediately to the fighting position any time he feels he will benefit by this action.

This type work is quite simple and, except for steep turns at low and high altitudes, the student should have made few mistakes up to this point. An instructor can usually get the student through this phase in about thirty to forty minutes. At the appropriate fuel load, precision maneuvers may be accomplished in close trail. After a little close trail work, the instructor signals the wingman to extended trail and gingerly tests the student pilot for ability to get performance out of the aircraft. He begins easily with gentle turns, lazy eights, and an occasional barrel roll to see how well the student controls his aircraft. If the student is in good position, he will increase his "G's" in the turns, doing the same maneuvers and always being alert for a sign of weakness in the wingman.

While extended trail is described as being for

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2nd LT. U.S.A.F.


PLAY ON THE TEAM-
NO INDIVIDUALISTS!

maximum performance work, it should be stipulated "student maximum performance." For this reason an instructor seldom needs to pull even four "G's" during a training mission. He must always figure a student wingman to pull an additional "G" and a half in-trail, for he frequently will. An instructor does not need to pull seven "G's" in order to teach proper position on the inside or outside of a turn. During the final phase of instruction, with clean aircraft which have a seven "G" limit, the student's maximum progress may be checked, but during the initial phase of training, four "G's" is sufficient to accomplish the job of instruction. After some extended trail, the instructor goes back to the type work most difficult for the student during the turns at low and high altitude. If time permits, he breaks up the monotony again with more in-trail work (close and extended). He should plan his mission to be on initial with appropriate fuel remaining.

Mission Nr. 2. The first half of this mission will be a review of Mission Nr. 1. In order to demonstrate the advantage gained by creating lateral separation from an attacker, the student will climb to the line abreast position for a high side pass on the leader. He will be instructed on the first pass to attempt to turn with the leader at the leader's altitude. As the student passes the leader's six o'clock position at a high angle off, the leader will reverse his turn demonstrating to the student, who is now drifting in front and wide of the leader, the disadvantage of staying low when overshooting. The procedure will be repeated except the student now will apply the correct action of pulling up and behind when turned into. The instructor repeats the procedure until the student is thoroughly familiar with the desired action in preventing an overshoot. The leader now climbs to the line abreast position and attacks the student, coaching him as to when to turn and reverse. He should repeat this process until the wingman learns when to turn and how tight, when to reverse, and how to exploit the advantage gained by the reverse.

The instructor must not get into an individual fight with the wingman. He must keep in mind what he is attempting to teach and stop the maneuvering when he has accomplished his purpose. If he has any time left over, he brings the wingman into the fighting position and takes him through several diving spirals. The student should note how he must range from inside to outside the turn while flying wing on his leader. Any additional time should be spent doing close and extended trail work.

Mission Nr. 3. The first part of the mission will be a review of the student's weak points. Generally speaking, the instructor should avoid aerobatics (other than slow, smooth barrel rolls) or high "G" maneuvers until external tanks are empty.

After a quick review, the student will be given instruction concerning the "Break" maneuver. At first the break will be accomplished with the wingman in the fighting position and flying the leader's wing all the way around the turn. Next the wingman will be given practice flying the leader's wing around the turn starting from the normal position. Finally, the wingman will intentionally place himself too wide and too far forward and accomplish the break with an in-place turn, blanking out the leader during the first 90 to 100 degrees of turn. When the wingman has been forced to make an in-place turn on the break, the leader should continue his turn for about 130 degrees or until the wingman is again flying wing. Turn reversals are risky here, for the wingman cannot see the leader and may not hear a radio call to reverse.

In-place breaks will not be practiced with a four-ship flight. The slim chance that an entire flight would have to break does not warrant the time spent accomplishing the training. Care must be taken that the student does not confuse a break and a hard turn. The instructor must fully explain that a break is an emergency maneuver used when someone is about to get shot down. The fact it has to be used is an indication that the flight was not covering itself porperly. A hard turn is merely a maximum performance turn into enemy aircraft that were seen at the proper time. After practicing breaks, the instructor puts the student on the perch for a high side pass. As the student reverses the turn, the instructor draws him to the six o'clock position by adding power and diving slightly. With the student coming in directly at six o'clock, the instructor calls "hard turns" and "breaks" to demonstrate the approximate range at which each should be called. He must not fight with the student - just get his point across and go on to his next objective.

The time remaining should be spent in close trail for some precision flying and extended trail for some more work that is maximum performance for the student - not for the instructor.

Mission Nr. 4. Take off and climb to altitude as before, with the student making turns of all kinds as the flight climbs to the operating altitude. The first twenty or thirty minutes is spent reviewing the items listed as weak on the

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student's grade card. When this work has been completed, the instructor begins teaching the student how to stay with the leader during a scissors maneuver. We cannot shy away from this type training by saying we keep airspeeds up in jet combat. We keep a high mach until enemy aircraft are sighted, but after that time all performance is relative. If both flights choose to fight, maneuvering will take place. As one flight or element begins to gain an advantage, turns will tighten and airspeeds will drop. The result -- lower speed flying and maneuvering. This we must live with until we no longer have fixed forward firing guns. When they are replaced, our tactics will very likely change. The instructor cannot go into this phase halfheartedly for this training is every bit as important for both leader and wingman as any yet encountered.

The student begins from the fighting position. The instructor makes a few gentle turns and then, without any previous radio call, begins a turn into the student. This initial turn into the student should be moderate, but gradually, as the student becomes more proficient, it will be increased to maximum performance. The initial turn is continued into the wingman for about 50 degrees and then, noting his position to be sure he is not too far forward, the instructor reverses his turn.

Two serious mistakes are usually made by the student during this phase. One, he will drop too low when turned into, causing his aircraft to high-speed stall when the initial turn is maximum performance. Two, he will allow himself to get too far forward on the leader and, when the leader reverses the turn, he will be almost line abreast of him. Serious consequences can result, since the leader must immediately lessen his performance to avoid his wingman, and offers an adversary the change he is waiting for. This training must be continued until such time as the student can be depended upon to keep himself close enough to the leader to stay with him, yet far enough back to afford the leader individual action. He must be able to do this 100 percent of the time before going any further. Any violation of this principle could have serious results during the combat application of the four-ship flight in Phase III.

This particular ability will not only be needed when involved in a scissors maneuver itself, it could be used any time an aircraft makes a simple pass at the leader and his wingman. When the attacker is turned into at a high angle off, the next desire would be to pull the attacker through the 6 o'clock position at this high angle off and then reverse the turn. If the wingman can handle himself, the leader is in good shape. If he meets the wingman canopy to canopy after the reverse, the biggest problem may not be the attacker. This training cannot be over emphasized. The wingman must perform properly in a scissors maneuver and during turn reversals in order to safely continue his training. After about twenty-five or thirty minutes of practice on the scissors maneuver, the leader breaks the monotony with five or ten minutes of close trail and extended trail. The student is signaled to rejoin and, with him holding the fighting position, the rest of the period is spent practicing turns into simulated enemy aircraft, placing emphasis on turn reversals and the scissors maneuver. It is work, but it is this type work that makes good fighter pilots.

Mission Nr. 5. Taxi and take off are as on other missions. The elements split as usual but have an appointed time, altitude and IP to get together for work on the defensive split. During the first twenty-five minutes, the instructor works on the student's weak areas as indicated by his grade sheets. The leader proceeds to the IP at the proper altitude and rendezvous with the other element. One element goes high to the perch position, while the other maneuvers so as to be easily attacked from 6 o'clock. As the attacking element reaches a fairly close range, the leader of the defending element begins a moderate turn allowing the attackers to get still closer.

At a range of about 1,500 feet, the defending element will tighten up their turn in an attempt to out-turn their attackers. It will be impossible to do this unless airspeeds vary excessively, so the defending element will find it necessary to attempt a defensive split. Let's assume they are in a left turn. The wingman may be either high or low in relation to the leader, but he will certainly be behind him. As the leader calls for a "split", the wingman comes down and inside his leader, approaching aline abreast position in a tight, slightly diving turn. If the attackers take the leader, and before they can begin firing, the leader makes a hard turn over or under and away from the wingman, and the wingman reverses his turn. This sandwiches the attackers in between. If the attackers take the wingman, he continues to tighten his turn and spiral down while the leader comes after him. Again this sandwiches the attackers between the two defending aircraft.

If the attackers split as the defenders split, each defender is on his own to get free. The one getting free naturally helps the other. The leader alternates the attackers and defenders and


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BE AGGRESSIVE
OR ALL YOUR OTHER CAPABILITIES WILL BE WASTED . . . . .

they continue practicing until the student is able to time his turns and work the "split" properly. Again high "G's" are not necessary. The student gets the idea and timing down first, then the instructor adds the higher "G" forces to the problem when everyone knows exactly what to do.

Mission Nr. 6. This is a duplication of Mission Nr. 5, except less time should be needed on the "split". The instructor breaks the monotony with five or ten minutes of close and extended trail, then goes back to work. He reviews turn reversals, diving spirals, "breaks", hard turns, and all other maneuvers so he can evaluate the student's performance. After this mission, the student goes on his own unless recommended for further work with an instructor.

PHASE TWO

Mission Nr. 7, 8 and 9. The four-ship flight is briefed with a student leading the second element. Taxi, takeoff, and climb out are as a four ship flight. When reaching medium altitude, the second element will climb to the perch position and drift away from the leader until visual contact is difficult. At a given signal the leader and element leader turn 45° into each other and maneuver for position. As the attack begins, Number Two should call out the attack. The leader should watch Number Three for errors in leadership and Number Four for his ability to hold proper position as they come in. At the appropriate time, Number Two should call the necessary turn into the attack. The leader should turn into the attack and then stop the engagement. The procedure is repeated until every man is doing his job properly including the element leader. He adds to the next few engagements a turn reversal after the initial turn into the attack. Depending on how well the students are doing, the leader continues maneuvering until a full-fledged fight is the result of the perch attack. Both elements should try diving spirals and defensive splits when pushed into situations that call for them.

Missions Nr. 10 and 11. The four-ship flight briefs together choosing an IP, rendezvous time, and rendezvous altitude. One element should take at least a three or four thousand foot advantage to keep from having engagements that end in indecisive Lufberry turns. The engagement will be even more satisfactory if the elements will approach the IP and, using a known point for a radius, circle the same direction around the IP. On a given signal both elements turn in for the IP and continue until a sighting is effected. This assures an encounter and means one element should be able to do offensive work and the other defensive. Remember, an instructor never cuts between a wingman and his leader, and always stops the fight when he loses his wingman or reaches minimum altitude.

When one element has gained an advantage over the other, the attacking leader stops the fight and climbs up for another engagement. He stops fighting in time to proceed to the base for a simulated weather penetration and ADF letdown if it is scheduled. This will be necessary in combat and has excellent training value. The leader proceeds to the cone with a four-ship flight. The leader begins the letdown while the element leader makes a 360 degree turn and then begins a letdown of his own. Students should lead both elements and log pilot hood time for the procedure.

PHASE THREE

Mission Nr. 12 through 15. Two four-ship flights should plan their encounters giving an advantage of 3,000 to 4,000 feet to one flight. The instructors should plan not to meet head-on more than is necessary to learn how to handle this situation. When peak proficiency has been attained, the participating flights should be on different channels. If no other flights are available to fight with during this phase of training, and providing students are briefed accordingly, engagements of opportunity are excellent training and come as close to real combat as any simulated combat we can devise. If no other aircraft are in the area, the instructor can continue the element fighting as in Missions Nr. 10 and 11.

If the instructors observe the previously mentioned pitfall markers pointed out for their benefit, this training will be the safest and most valuable in the course.

CONCLUSION

Although we know you will feel like this on the way into enemy territory the first time, (we know, 'cause the rest of us did) there is little provocation for you to feel that way; for when you have digested the contents of this manual and can put the information to use, you will be better trained than the fighter pilots of any other nation in the world.

Air Force-James Connally AFB, Tex/JC7-4389

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