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WAR DEPARTMENT

ARMY AIR FORCE FIELD MANUAL

*

TACTICS AND TECHNIQUE OF AIR FIGHTING

April 10, 1942

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ARMY AIR FORCE FIELD MANUAL

TACTICS AND TECHNIQUE OF AIR FIGHTING

(This manual supersedes FM 1–15, September 9, 1940.)

CHAPTER 1

OBJECTIVES OF AIR FIGHTING

SECTION I

GENERAL

■ 1. AIR FIGHTING.—An air fight is a combat between aircraft involving fire and movement by the opposing forces engaged. Fighting between aircraft in flight results from or grows out of the attempt to deny air attack and air observation. In air fighting there is no counterpart of the battle between ground forces. Air fighting is incidental to the carrying out of other and potentially decisive air operations. In itself, air fighting is indecisive, except as it affects the success or failure of other technical functions of aviation or ground forces. The permanent effects of air combat are measured in terms of attrition of the forces engaged and reduction in vigor of the enemy's air operations.

■ 2. DEFENSIVELY FIGHTING FORCES.—Air fighting is a hindrance to the performance of the potentially decisive functions of air attack on surface or subsurface objectives. Forces engaged in carrying out air attack functions seek to avoid combat and accept it only when it cannot be avoided. The object of such forces, even when air combat has been imposed upon them, is to persevere in their operations while avoiding losses. As a consequence, forces performing the functions of air attack and air observation only fight defensively in the air. Furthermore, forces designed primarily to

carry out these functions normally lack equipment possessing the necessary performance superiority to permit imposing combat on enemy aerial forces.

■ 3. OFFENSIVELY FIGHTING FORCES.—*a. Function.*—Pursuit aviation is designed primarily for the purpose of imposing air combat on enemy forces. The principal function of pursuit aviation is to offer resistance to enemy air attack and air reconnaissance. Pursuit must perform its role by fighting offensively in the air. To this end it must be equipped with aircraft of superior performance which can initiate and force combat upon the enemy. The primary object of the pursuit force in air combat is to deny or to limit enemy air attack or air reconnaissance. A secondary object may be the support of friendly air attack or air reconnaissance or under appropriate conditions the attack of ground forces.

b. Pursuit versus pursuit.—In situations where opposing pursuit forces are based within reach of each other, air fighting may take place between them. The sole purpose of such combat is as a means to the end of denying hostile air attack and air reconnaissance, or in aiding such friendly operations.

c. Escort fighters.—In situations where air attack is subjected to serious hostile fighter opposition and the range of available friendly pursuit or special fighter equipment permits, a fighter escort may be employed to assist in penetrating the defenses. The object of accompanying fighters in air combat is to insure the success of the forces they support. Their fire power may be considered as replacing or augmenting the defensive fire power of the supported force. Their mission precludes their seeking to impose combat on other forces except as necessary to carry out their defensive role.

■ 4. MEASUREMENT OF SUCCESS.—*a.* In air combat the success of the offensive fighting force is measured by the loss in efficiency suffered by the enemy force in the performance of its assigned task.

b. The success of the defensively fighting force in air combat is measured by the extent to which its efficiency is maintained in performance of its task of air attack or air reconnaissance.

SECTION II

PURSUIT AVIATION IN DEFENSE

■ 5. EFFECTIVENESS.—*a. General.*—A knowledge of the powers and limitations of pursuit aviation is a prerequisite of sound employment. Its capabilities as a means of defense will vary more with respect to the manner of employment than will those of any other defensive agency. Where pursuit aviation is used efficiently a small force may be expected to exert an extraordinary influence in the defense. On the other hand, large forces will accomplish little when they are employed for the defense of localities or sectors that are not susceptible to efficient defense by pursuit aviation.

b. Flexibility.—Pursuit defense is inherently more flexible than other means of antiaircraft defense due to its tactical mobility. It may be applied to some advantage in the defense of any area or objective whenever the other forms of defense are incapable of furnishing the desired degree of protection. The enemy will be able to determine the probable location of antiaircraft weapon defenses and will avoid them, or be prepared for their fire during the relatively brief periods of time that his forces may be exposed to such action. Pursuit, on the other hand, constitutes a threat which may materialize at any time against enemy forces within the pursuit zones of action.

c. Changing tactics.—Pursuit aviation cannot be employed effectively in active air defense by precisely following definite rules. The hostile air offensive that it opposes is extremely flexible, both in the tactical execution of offensive operations and in the readiness with which the general character of the offensive may be changed. Enemy tactics will vary constantly to meet operating conditions and to circumvent the resistance offered by the defense. The pursuit defense must respond rapidly to changes in the offensive. The action of the enemy must be anticipated and dispositions, methods of employment, and tactics varied accordingly.

d. Moral effect.—Pursuit aviation will have a greater moral effect than the other antiaircraft defenses inasmuch as it brings the threat of actual combat to the enemy. Although it will be impossible for the defender to determine the

strength of attacking forces that will be employed in specific operations, the enemy will also be unable to determine the strength of the pursuit forces that may be brought against him. Unless conditions permit the enemy to evade the defending pursuit, he must be prepared to accept combat during the entire time that he is exposed, under conditions wherein the defending force has the initiative.

e. Limitations.—In common with the other forms of antiaircraft defense, pursuit has limitations that seriously influence its capabilities for coping with the air offensive. Its flexibility is restricted by range and the availability and location of airdromes and facilities. These facilities are in themselves vulnerable to air attack. In general, pursuit operations are limited by darkness and inclement weather. Pursuit aircraft designed for daytime operation can operate effectively at night in conjunction with antiaircraft searchlights and ground control, and may even operate with effect on nights of particularly good visibility—bright moon, and in the light of conflagration on the ground. Special night fighters have been designed which can operate at night in almost any kind of weather.

f. Primary purpose.—Pursuit defense is organized primarily for defense against air attack. A defense against air attack will provide incidental defense against other enemy air operations. A pursuit defense for purely counterreconnaissance purposes is generally of insufficient strength to cope with hostile air attack forces.

■ 6. Basis for Effective Employment.—*a. Defense tasks.*—In considering employment of the defensive force, the force commander is confronted with the problem of selecting tasks to be performed in the conduct of the defense. He will be confronted with the allocation of defensive forces for the performance of those tasks. The selection of tasks to be performed by the defense is dependent upon the capabilities of the enemy striking force. Hence the initial problem involves a determination of the capabilities of the enemy striking force and his possible lines of action. The enemy may be expected to attack those physical installations which are immediately vital to us or those which, if destroyed or neutralized, will have the most widespread and lasting effect

on our own military operations. The first step, therefore, in establishing tasks for the defense is an analysis of our own situation with a view to determining the elements which are most important to us, and which are most likely to be attacked by the enemy, considering the location of enemy bases and the characteristics of enemy aircraft.

b. Influence of position on defense effectiveness.—The location of a vital element to be defended, relative to the outer limits of the aircraft warning service, has a profound influence upon the capability of the defensive force. Methods of operation of defensive pursuit forces are determined by relative performance of enemy and friendly airplanes and amount of warning time. This factor is in large measure determined by the depth of penetration of the enemy into the aircraft warning service area required to reach the objective. Since the efficiency of the pursuit force varies with the method of employment, and that method varies with depth of penetration into the aircraft warning service area, the efficacy of the pursuit defense will vary with the location of the objectives to be defended and the locations of the defending pursuit forces.

■ 7. SIZE OF PURSUIT COMBAT FORCES.—*a. Objective.*—The outcome of air combat, like other forms of combat, depends to a great extent upon the relative fire power of the opposing forces. From the standpoint of any particular combat, the larger the pursuit force that is brought against the enemy, the greater are its chances of success. In the defense of any considerable area, however, normally it will be impossible to dispose the defending pursuit in a manner that will insure the presence of a superior fire power in all air combat. The entire defense, however, must be organized on a basis that will provide pursuit combat commands that are strong enough to engage the enemy in air combat. The determination of the size of these air combat commands is a problem that is basic to the whole defense. If the combat commands are unnecessarily large the number of objectives that can be defended will be decreased, or the area over which resistance is offered must be reduced. On the other hand, if they are too small they will be unable to perform successfully their function of air combat.

b. Factors influencing.—The actual size of the combat commands will vary with the pursuit aviation available; the general character of the defense; the relative performance characteristics of friendly and enemy aviation; enemy tactics and defensive armament; and with weather and other conditions that influence the air operations of both forces. Under conditions that favor the employment of the pursuit defense, the enemy may be expected to operate with large attacking forces. Under conditions of low visibility enemy operations may be conducted with smaller combat commands or by individual airplanes. In general, it will be necessary to predict the size of the force that the enemy will probably use in accordance with the existing conditions in order that the defense may be properly prepared. If all the enemy striking force commands are to be opposed, the size of the pursuit combat forces must be reduced when the enemy operates with small combat commands.

c. Influence of armament characteristics.—Where the fire power of individual pursuit aircraft exceeds that of individual enemy aircraft, individual pursuit aircraft will be able to engage an attacking force with some degree of success, even though numerically inferior to that force.

■ 8. DISPOSITION OF DEFENSES.—The disposition of the pursuit defenses is governed by the enemy capabilities; the size of the pursuit force available; the character and extent of the aircraft warning service; and the number, character, and location of the objectives that cannot be provided adequate security by other means of defense.

SECTION III

PENETRATIONS OF PURSUIT DEFENSE

■ 9. AIR DEFENSE BY AIR ATTACK FORCES.—*a. General.*—Methods of operation employed by air attack forces in penetrating areas where pursuit opposition is present will vary greatly with the nature of the defense and the condition of the weather. In general, the fighter defense should be approached in a direction that the enemy least expects and in a manner he is least able to oppose. A course of action

that will result in the greatest surprise to the enemy aids in gaining security for the attacking force.

b. Formation strength.—For defense in air combat the primary reliance of an air attack command is placed upon its ability to defend itself. Where defensive fire power is an element of special importance in carrying out particular operations, this will be a controlling factor in determining the size of the command to be employed. The defensive strength must not be reduced below a point which will provide reasonable security against enemy fighters. Formation air attacks should always be employed when massed defensive fire power is necessary for security.

■ 10. METHODS OF OPERATION.—The higher commander will plan and direct operations so as to reduce the possible effectiveness of the enemy pursuit defense. These plans may include any or all of the following methods of operation:

a. Coordinated air attacks.—Coordinated air attacks are operations in which several attacking forces are employed to arrive simultaneously within an area defended by hostile fighter aviation. Such operations are designed to prevent the successive engagement of our forces by hostile fighters; to gain surprise; or to produce greater moral effect. Security from the hostile fighting force is also obtained by the mutual support that attacking forces can give one another. In such operations it is impossible for the defending forces to concentrate their full strength against the separate air attacking units.

b. Mass attacks.—Mass attacks delivered by a large concentration of aircraft, operating in suitable tactical formations and arriving over the objective at suitable intervals, will reduce the pursuit opposition that can be directed against successive assaulting waves and will be less costly in casualties than sustained attacks carried out by the small bombardment formations.

c. Repeated attacks.—Repeated air attacks may be made where it is desired to force the enemy to divert enemy fighter aircraft to the defense of the objectives attacked.

d. Secondary air attacks.—Secondary air attacks may be conducted for the purpose of drawing the defending fighters

away from a vital objective or for the purpose of causing the enemy to extend and disperse his defenses.

e. Night attacks.—Night attacks provide an effective means of minimizing enemy fighter opposition and are generally conducted against targets that can be effectively bombed by available equipment under the visibility limitations of night operations. It is becoming increasingly difficult for attack forces to evade the active air defense forces under cover of darkness due to increased effectiveness of searchlights, anti-aircraft artillery, and radio detectors.

CHAPTER 2

TACTICAL PLANS

■ 11. FORMULATION.—*a.* Success in air fighting depends upon—

(1) Simple tactical plans.

(2) Correct selection of the tactical plan best suited to the situation.

(3) Method of execution of the plan.

b. In formulating these tactical plans, consideration should be given in particular to concentration, the offensive, surprise, and security.

■ 12. SELECTION.—The correct selection of the tactical plan best suited to the situation is the special responsibility of the leader or commander of the forces concerned, and will depend upon the accuracy of his judgment and his faculty for quick and correct decision.

■ 13. EXECUTION.—*a.* The subsequent success of the tactical plan will depend mainly upon the—

(1) Skill and vigor of execution.

(2) Effective use of weapons.

(3) Power of maneuver.

Thorough familiarity with the plan by all members of the unit is necessary for its efficient execution.

b. The attack should be delivered with determination and pressed home to decisive ranges. Intensive drill in tactical maneuvers will increase the cohesion of the attacking formation and strengthen mutual understanding, rendering it possible to deliver sustained or repeated attacks with a minimum of confusion or loss of control and to produce the maximum concentration of fire at the decisive point.

■ 14. DEVELOPMENT OF METHODS.—*a.* The tactical methods to be adopted in air fighting must be evolved, developed, and perfected prior to war. These methods should be the product of experience confirmed by constant practice and experiment

in tactical exercises. They should be sufficiently flexible to facilitate rapid revisions necessitated by combat experience.

b. To be of any permanent and practical value in war, they should be few in number and simple of execution, so that the average pilot can become thoroughly familiar with them and efficient in their practice with the minimum amount of training.

c. The methods adopted should, therefore, be limited to those necessary to meet the varying conditions likely to be encountered in air fighting, and that suit the special tactical characteristics of the different types of aircraft which may be required to use them.

■ 15. EFFECT OF ARMAMENT AND DESIGN ON AIR TACTICS.—*a.* Development in armament and design will lead to changes in air tactics. The success of a particular method of attack may be countered by the provision of armor or by the elimination of blind spots due to improvements in design.

b. The development of suitable fire-control systems may render the fire of heavier caliber guns more effective at longer ranges. All-around fire may be improved by increasing the number of guns and gunners and reducing the interruptions of fire due to the structure of the aircraft. All these changes will tend to increase the offensive and defensive powers of aircraft and modify the tactical methods of attack and defense.

CHAPTER 3

FACTORS AFFECTING AIR FIGHTING

■ 16. AIRCRAFT PERFORMANCE.—*a. Speed factors.*—Superior rate of climb and airspeed are essential factors for the interception of hostile aircraft in order to impose air combat. The unit possessing equipment with superior climb and speed can, within limits, choose the time and place for initiating the fight. The ability to select a favorable time and place is a distinct advantage.

b. Maneuverability.—The relative maneuverability of aircraft will materially influence the tactics employed in air fighting. Maneuverability is of extreme importance in aircraft equipped only with fixed guns as it governs the ease and speed with which the guns can be alined and held on the target. Maneuverability facilitates the evasion of fire by defensively fighting aircraft.

■ 17. ARMAMENT.—*a. Fire effect.*—The outcome of an air combat will be dependent upon the relative fire effect obtained by the opposing forces. This fire effect may be either physical or moral or both. The destructive effect of fire against either force is determined by the destructive power of the projectiles used and the number of hits secured. Adverse moral effect influences the attacker to fire at ineffective ranges or to withdraw from attacks before the desired result is achieved. Adverse moral effect influences the defensive force by reducing the accuracy of its fire and demoralizing its system of supporting fire.

b. Accuracy of fire.—The accuracy of fire is dependent primarily on the following variables:

(1) *Range.*—The shorter the range, the more nearly will the projectiles conform to their mean trajectory and hit at the point indicated by direct sighting. If the target is maneuvering it may move out of the cone of fire while the projectiles are in flight; therefore, the shorter the range the greater the accuracy of fire.

(2) *Relative positions and motions.*—(a) Accuracy of fire is adversely affected when sighting lead must be applied in aiming. Sighting lead varies with the angularity of the line

of fire to the path of the target and with the rate of change of that angularity.

(b) Motion of the firing airplane about any of its three axes reduces accuracy of fire.

(3) *Accuracy of firing weapon.*—Projectiles from weapons with a high degree of inherent accuracy follow more closely and consistently the mean trajectory upon which sighting is based, thereby increasing fire power of individual weapons. In all weapons that accuracy will vary with range. Other factors being equal, each combatant endeavors to gain the range that will be most favorable to the accuracy of his own weapons and least favorable to the accuracy of his opponent's weapons.

(4) *Individual marksmanship.*—A high degree of individual skill is an essential requirement for successful air fighting. Correct estimation of the range; accurate aiming; and, for the fixed gun installation, skillful piloting of the airplane are the most important factors. Camera guns should be used in conjunction with firing weapons for the purpose of instruction and improvement of technique of attack; a check of the developed film will indicate the cause of errors, such as firing at ineffective ranges and improper approach.

(5) *Volume of fire.*—The rate of fire of each weapon and the total number of weapons available are factors beyond the tactical control of the combat commander in air combat. Volume of fire is tactically controlled by the proportion of the available weapons that are actually brought to bear upon the target. Every effort is made through maneuver and disposition to use the maximum number of weapons simultaneously.

■ 18. TRAINING.—Tactical situations which may confront combat aviation units are so numerous and varied that definite tactical rules of procedure cannot be set down to cover them. It is for this reason that they must depend to a high degree on training and indoctrination for the successful accomplishment of their missions. Drilled in fundamental principles of aerial combat, the pilots are trained to think and act as a unit. The ultimate aim of indoctrination is to enable the commander to exercise tactical control with the minimum of commands. Indoctrination develops its maxi-

mum effectiveness when the same personnel work together over relatively long periods of time. Frequent transfers of personnel from one organization to another reduce the effectiveness of teamplay.

■ 19. WEATHER CONDITIONS.—Weather conditions and the presence and location of the sun may have considerable influence on air fighting. These factors may affect both the ability to locate objectives and the possibilities for surprise. The principal advantages and disadvantages derived from these factors are as follows—

a. Sun.—Approach to the objective from the direction of the sun sometimes permits the launching of a surprise attack. Surprise can normally be achieved in this manner only by individuals or small units. Immediately after sunset and immediately before sunrise, surprise may sometimes be effected by approaching in such a manner that the objective is silhouetted against the lighted sky.

b. Visibility.—The factor of visibility is opposite in its effect on offensive and defensive air operations. High visibility favors pursuit forces in locating targets for attack. Low visibility aids defensive formations or individual planes to evade pursuit interception. If interception is effected, low visibility facilitates surprise in the attack by fighter aviation.

c. Clouds.—Clouds afford an excellent place for concealment from which surprise attacks may be launched against enemy aircraft beneath. They also provide effective cover for air attack forces en route to and from their attack objective. Clouds will generally increase the security of these forces.

■ 20. ALTITUDE.—The reduction in atmospheric pressure and oxygen with increase in elevation seriously affects the normal mental and physical efficiency of the individual at higher altitudes. Mental alertness is reduced; physical activity becomes sluggish and difficult. The danger to the individual lies in the fact that he does not immediately sense these effects. While these physical and mental reactions from high altitude flying cannot be entirely eliminated except in pressure cabins, they are materially reduced through the proper use of oxygen provided in all combat aircraft.

CHAPTER 4

ORGANIZATION OF PURSUIT AVIATION

SECTION I

GENERAL

■ 21. BASIC ORGANIZATION.—Pursuit aviation is so organized as to facilitate its effective tactical employment in any part of the world. The basic tactical and administrative unit is the squadron. Squadrons vary in kind according to the type of aircraft with which they are equipped and according to their functions.

SECTION II

COMPONENTS

■ 22. PURSUIT AIRPLANE.—The pursuit airplane and its crew comprise the smallest fighting unit in pursuit aviation. The crew may number one or more depending on the type of airplane. Special types of pursuit airplanes are required because no one type can excel in all the various kinds of employment and against all the different types of enemy aircraft which may be encountered. These special types may include—

a. Intercepter, low altitude, single-seater.
b. Interceptor, high altitude, single-seater.
c. Night interceptor, low altitude, multiseater.
d. Night interceptor, high altitude, multiseater.
e. Fighter, long range, single-seater.
f. Fighter, long range, multiseater.

■ 23. SQUADRON ORGANIZATION.—The squadron is the smallest unit organized for independent action. It has both administrative and tactical functions. The equipment generally includes 25 airplanes, all of the same type, organized in three or four flights of from 4 to 8 airplanes each. The operating

strength of a squadron is considered to be from 16 to 18 airplanes, the balance constituting a squadron reserve. For tactical control and to provide greater fighting power and security through mutual support and teamwork, each flight operates in "elements" of two or three airplanes each. Pursuit aircraft in daylight operations never operate singly if it can be avoided. The flight and element are purely tactical units. They are flexible and can be changed to meet requirements without disturbing seriously the squadron organization. For example, a squadron may operate 3 flights of two 3-plane elements each; 3 flights of three 2-plane elements each; or 4 flights of two 2-plane elements each.

■ 24. TYPES OF SQUADRONS.—Squadrons which are organized for the prime purpose of maintaining and operating tactical aircraft are known as tactical squadrons. The fighting strength of a pursuit force is measured in terms of its tactical squadrons. One pursuit squadron at full strength may have from 30 to 60 officers and from 200 to 400 enlisted men. Other types of squadrons include—

a. Headquarters squadron.

b. Interceptor control squadron.

c. Operational training squadron.

■ 25. PURSUIT GROUPS.—*a.* A pursuit group is an organization composed of two or more types of squadrons. These squadrons are grouped together to facilitate command and administration and to permit continuous effort over a period of many days. Present pursuit groups are classed as—

(1) Pursuit group (interceptor).

(2) Pursuit group (fighter).

(3) Pursuit group (composite).

b. The pursuit group, interceptor, is composed of—

(1) Headquarters and headquarters squadron, pursuit group.

(2) Air squadron, pursuit (I)—two or more.

(3) Air squadron, pursuit (night interceptor).*

(4) Air squadron, interceptor control.

c. The air squadron, interceptor control, is designed to install, maintain, and operate ground radio equipment for ground to air communication, with friendly pursuit units,

*Not yet authorized but under consideration for use in time of war.

by remote control; and to install, maintain, and operate direction finder equipment for tracking friendly pursuit units. The interceptor control squadron does not, as the name implies, exercise tactical control, but only provides the communication facilities on the ground through which tactical control in the air can be maintained by direction from a point on the ground. The maintenance of air-borne radio equipment is *not* a function of the interceptor control squadron, that being the function of the communication section of the squadron to which the airplanes are assigned. A flight of pursuit aircraft may be directed to an interception with an enemy formation by directions from an intercept officer located at the information center or control airdrome, using the communication network set up by the interceptor control squadron.

d. The pursuit group (fighter) is composed of—

(1) Headquarters and headquarters squadron, pursuit group.

(2) Air squadron, pursuit (fighter)—two or more.

(3) Air squadron, interceptor control.*

e. The pursuit group (composite) may be composed of a headquarters and headquarters squadron and any combination of other types of pursuit and interceptor squadrons including both interceptor and fighter units.

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*Not yet authorized but under consideration for use in time of war.

CHAPTER 5

EMPLOYMENT OF PURSUIT AVIATION

SECTION I

GENERAL

■ 26. MISSION OF PURSUIT.—The mission of pursuit aviation is to deny to the hostile air force freedom of action in the air.

■ 27. DENIAL OF FREEDOM OF ACTION.—The denial of freedom of action to enemy air forces is accomplished in three ways:

a. Destruction.—Total destruction of the enemy formations by offensive action in the air, thereby depriving the enemy of weapons with which to continue air warfare.

b. Attrition.—Reducing the enemy air forces by casualties in air combat to such an extent that—

(1) Their operations become expensive in personnel and matériel;

(2) Their morale is lowered; and

(3) Their will to continue air warfare is adversely affected.

c. Threat.—The mere fact that pursuit forces are present and are likely to attack at any time within their operating zones will limit the freedom of action of the enemy in those zones. This threat causes the enemy to carry defensive armament which reduces the load of offensive weapons or fuel, or both. Furthermore, it requires the enemy to fly in large formations for mutual support, thereby reducing their freedom to maneuver and restricting the number of targets that might otherwise be attacked.

■ 28. CONTROLLING FACTORS.—The conduct of the pursuit forces in the execution of their mission is predicated upon the operations of the hostile striking forces. The disposition and size of pursuit units within the limits of the capacity of the force are dependent on many factors, chief among which are—

a. Extent of the area over which operations are to be conducted.

b. Method of operation of hostile striking forces.

c. Strength of pursuit force available.

d. Nature, extent, and efficiency of the aircraft warning service.

■ 29. SPECIFIC MISSIONS.—Pursuit aviation may be employed in the execution of one or any combination of the following specific missions:

a. Defense of an area or installations.

b. Support of air attack.

c. Support of ground forces.

SECTION II

METHODS OF PURSUIT DEFENSE

■ 30. DEFENSE OF AREA OR INSTALLATIONS.—Pursuit aviation assigned to active air defense operates either in local defense of a single objective or in general defense of an area including many objectives. The type of defense to be provided will depend upon the nature and importance of the objectives requiring pursuit protection, the number of such objectives, their degree of geographic concentration, their locations with respect to frontiers, and the strength of the pursuit force available.

■ 31. LOCAL DEFENSE.—*a.* Local defense by pursuit aviation is a form of active air defense for a single objective in which the defending pursuit force is limited to operations against hostile penetrations that directly threaten that objective. It is appropriately employed for the protection of vital objectives that are vulnerable to air attack and that cannot be effectively defended by other means.

b. A local defense is the most effective defense for single objectives that are highly vulnerable to air attack.

c. The purpose of local defense is the provision of immediate protection for the defended objective, and the operations of the defensive pursuit are based upon this mission. The greatest disadvantage of such employment is that no objective other than that to which it is assigned is afforded direct protection by the pursuit force. It does, however, provide incidental protection to those installations that are in the immediate vicinity of the defended objective, because of manner of operations by defending pursuit.

■ 32. GENERAL DEFENSE.—*a.* A general defense by pursuit aviation is that which is provided for a specified area or defended sector. It differs from the pursuit employment in local defense in that special security is not provided any particular objective but, instead, some measure of security is provided for all installations and possible enemy objectives, including important troop concentrations or movements, that are distributed throughout the defended area or sector. A general defense is instituted primarily to protect an area containing many undefended or weakly defended objectives.

b. A defended area may contain many objectives well protected by the local defense of antiaircraft artillery, or pursuit aviation, or both. In such instances and when possible the pursuit aviation in general defense supports and cooperates with the local defense.

SECTION III

PURSUIT AVIATION IN LOCAL DEFENSE

■ 33. LOCAL DEFENSE.—*a Doctrine.*—Interceptor units, force, or aviation must be so located on the ground or in the air that immediate protection can be afforded the defended objective with the maximum of the available force. All enemy air attack forces must be opposed prior to their assault on the defended objective. No enemy airplane or formation is permitted to conduct an unopposed attack against the defended objective.

b. Aircraft warning service.—An aircraft warning service is essential for the employment of interceptor units, force, or aviation in local defense. The effectiveness of the defense

is vitally dependent upon the nature and extent of the information provided by the warning service and the rapidity with which it can be transmitted to the interceptor units, force, or aviation. To assure interceptions, an accurate, timely, and continuous flow of information of the approach of hostile air forces must be furnished to the pursuit commander both prior to and after the pursuit leaves the ground to effect interception.

■ 34. PURSUIT OBJECTIVES.—Pursuit aviation assigned to a local defense augments such other defenses as may be present. The pursuit force is employed only against forces that threaten the security of the defended objective.

■ 35. COORDINATION OF DEFENSE MEANS.—A local defense provides close protection for the objective with all available means. In all cases the defensive forces, air and ground, are disposed and employed in a manner that will give an all-around defense. All hostile air attack forces reaching the objective must be brought under maximum fire during the time of their sighting operations. The enemy force will not only be most vulnerable to antiaircraft artillery and pursuit during this period, but the maximum protection to the defended objective in such circumstances is assured by the influence of defensive fire upon enemy bombing accuracy. The tactical operations of pursuit are influenced by the character and strength of the antiaircraft artillery defenses. The interceptor command must have operational control over all antiaircraft artillery, searchlights, and barrage balloons in the defense area.

■ 36. EMPLOYMENT OF PURSUIT.—Pursuit operations based upon the use of information made available by the aircraft warning service are conducted by the ground alert or air alert methods. In the ground alert method, interceptor units, force, or aviation are alerted on their airdromes, taking off and effecting interception of the hostile attacking force upon instructions and through information transmitted to the air commander by radio. In the air alert method, the interceptor units, force, or aviation are alerted at a station in the air and effect interception of a target through instructions and information received by radio. (For interception procedure see pars. 49 to 55, incl.)

■ 37. GROUND ALERT DEFENSE.—The ground alert method of employing pursuit aviation should be used whenever the aircraft warning service is sufficiently extensive to permit the interception of the enemy force at a point that will allow time for effective air combat prior to the delivery of the enemy assault. In local defense no attempt is made to intercept the enemy at a considerable distance from the objective. The pursuit force maintains a position between the enemy and the defended objective during the approach to interception. Pursuit operating from an alert station on the ground is capable of utilizing all the available combat units against the enemy. For this reason it should always be employed when the warning service can provide information of the enemy approach in sufficient time to insure proper interception. Effectiveness of ground alert defense will vary with the distance between the pursuit alert stations and the objective.

■ 38. AIR ALERT DEFENSE.—In local defense by the air alert method, pursuit takes up an alert station in the air over the defended objective. This method of using pursuit is employed in the local defense of objectives where the extent of the aircraft warning service is less than that required for ground alert defense. This form of defense is exhausting and uneconomical; it should be used only when the area requiring protection is small and when the need for the utmost measure of direct air protection is sufficiently important to justify its use.

■ 39. COMBAT PATROLS.—*a.* An enemy air attacking force may be intercepted by using a pursuit force for conducting combat patrols over a particular objective or along a line on which it is desired to engage the enemy. The use of combat patrols ordinarily will be confined to the local defense of objectives where no aircraft warning service has been provided, or where the depth of the existing service is insufficient for other methods of employment. For air security the objectives that are located near front lines and frontiers must be defended by patrols.

b. Local defense by combat patrols requires the assignment of defense forces in excessive numbers if effective patrols are to be provided for prolonged periods of time. The method, therefore, should not be employed except in cases where a

definite threat to the defended objective is present, and the importance of that objective justifies the diversion of strong pursuit forces to its defense.

SECTION IV

PURSUIT AVIATION IN GENERAL DEFENSE

■ 40. GENERAL.—A general defense is provided for the purpose of defending a number of objectives that are located within a specified area or defensive sector. It gives security to objectives that have no active defenses, or that are weakly defended, and supports all local defenses within the defended area. Although not as effective as a local pursuit defense in providing security for particular objectives, a general defense can provide a measure of security for many more objectives within a given force than it would be possible to defend by local defense.

■ 41. CHARACTER OF DEFENSE.—*a.* A general defense is an extended defense, consequently the probability of making an interception without the assistance of an aircraft warning service is remote. The distance from the alert station at which pursuit aviation operating with an aircraft warning service is capable of engaging the enemy in combat is determined by the extent of the aircraft warning service, the course flown by the enemy force, the relative performance of enemy and friendly airplanes, the altitude of enemy penetration, and the effect of wind.

b. Pursuit operates in general defense by ground alert, air alert, or patrol methods. Ground alert should be used whenever time and space factors will permit. If the situation precludes the use of ground alert pursuit, air alert, or a combination of air alert and ground alert methods should be adopted. Pursuit patrols are relatively ineffective in establishing a screen to resist enemy penetrations, and are employed only when an aircraft warning service is lacking or is so limited in extent that it does not provide time for effective interception by the air alert method, and the importance of the target makes it imperative that the defended objective be provided pursuit defense.

■ 42. SCOPE OF DEFENSE.—The course taken by the enemy force to an objective may be that which requires him to remain within the limits of the aircraft warning service area the minimum length of time. Any other course will ordinarily result in an advantage to the defender, inasmuch as it will allow more time for the functioning of the defense, which may result in the enemy being intercepted farther from his objective and by a larger pursuit force than would otherwise be possible. The location of the line on which the enemy can be intercepted from an alert station will vary with the speeds of the opposing forces and the outer limits of the aircraft warning service.

■ 43. LINE OF RESISTANCE.—For a given set of operating conditions, a line of resistance is the outermost line on which the enemy can be intercepted in a general defense with a given disposition of the pursuit force. The distance to interception from a given alert station will vary inversely with the altitude at which the interception occurs, consequently a line of resistance will advance as the altitude at which the enemy conducts operations is decreased. For all practical purposes, a line of resistance must be established so that a defense can be provided against enemy operations at the highest altitudes from which he can deliver effective attacks. Lines of resistance are used by the pursuit commander in planning a general defense. By means of these lines, the locations of the pursuit forces and the methods of employment are determined.

■ 44. EFFECT OF LINES OF RESISTANCE.—The location of the line of resistance will determine the limits of the general defense. Defense, however, is not provided for objectives that are on this line, inasmuch as the pursuit forces will not have time to act against the enemy prior to the delivery of his attack. The distance, therefore, of a defended objective from the line of resistance governs the degree of defense that can be provided. A line of resistance does not constitute a barrier that exerts a continuing influence for the defense of all objectives within the line. The defending forces may be avoided by the enemy when he flies through clouds or above clouds or when he conducts operations in darkness. Thus objectives that are located a considerable distance away

from the defending pursuit forces may be attacked by the enemy under some conditions with little or no opposition from the general defense. The lines of resistance in a general defense must be located so that maximum defense is given the most important objectives.

■ 45. PLOTTING LINES OF RESISTANCE.—*a.* In order to plot a line of resistance it is necessary to plot the lines of interception from each alert station based on the maximum speeds of opposing aircraft and the depth of the aircraft warning service. Where several alert stations are used to establish a line of resistance, the line will consist of a series of intersecting curves.

(1) Figure 1 (see back of manual) shows a plot of lines of interception for an air alert pursuit force stationed at 10½, 20, 30, 40, and 50 miles within the outer limits of the aircraft warning service; and lines of interception for a ground alert pursuit force stationed at 52½, 60, 66½, 80, 100, and 150 miles within the outer limits of the warning service. The upper horizontal line of the chart represents the outer limits of the aircraft warning service. The points marked on the center line of the chart represent pursuit alert stations. The various curves indicate the limits at which interceptions may be expected with pursuit stationed at those alert stations under the conditions assumed.

(2) If figure 1 is drawn to the scale of a working map, it is possible to place the upper horizontal line on the general line representing the outer limits of the aircraft warning service, measure the distance from that outer limit to any alert station being considered, and determine how many places on the map can be afforded a defense from that alert station. The center line of the chart should be kept at right angles to the general line representing the outer limits of the aircraft warning service.

(3) If the outer limit of the aircraft warning service is not on a straight line but is, instead, in the form of a salient, then two curves should be drawn to indicate the line of interception. Place the proper point representing the alert station on the chart over that station on the map; swing the right-hand curve about that pivot until the center line is at right angles to the general line representing the outer limit

of the aircraft warning service to the right of the alert station. Draw an arc on the map showing the line of interception to the right of the alert station. Next swing the left-hand curve about the alert station as a pivot until the center line is at right angles to the general line representing the outer limit of the aircraft reporting net to the left of the alert station, and draw an arc on the map showing the line of interception to the left of the alert station.

b. By following a procedure similiar to that outlined above, the pursuit commander should be able to dispose his forces in a manner that will provide for the most effective general defense of that area.

■ 46. CONDUCT OF DEFENSE.—*a. Conduct of air striking forces.*—The enemy may be expected to concentrate his offensive operations in a manner that will prevent the use of the majority of the pursuit defenses at any one time. By attacking all of the objectives within one sector simultaneously he need be concerned only with the pursuit forces in that sector. Areas that are unlikely to be covered effectively with an aircraft warning service, such as large bodies of water, swamps, or other terrain unsuitable for such installations, will offer favorable avenues of approach.

b. Defending pursuit limitations.—Defending pursuit forces must be prepared to resist enemy air operations regardless of where or when they occur. However, the combat endurance of the pursuit forces that can be brought to bear on a line of resistance at any one point may soon be exhausted, and the delay occasioned by the necessity of refueling and rearming these forces may leave a temporary gap in the defenses. Thus the inherent inefficiency of the pursuit defenses as a whole is apparent in the application of the general defense.

c. Defense in depth.—It is unlikely that a general defense can be provided that is strong enough to oppose successfully an enemy penetration in force at the outer limits of the defended sector. When sufficient force is available, the defense must be organized so that increasing resistance becomes possible as the depth of the enemy penetration increases. Where successive penetrations are made at the same point in a line of resistance, alerted pursuit forces covering other

approaches may be employed to engage the enemy within the defended sector even at the expense of weakening the defense against penetrations at other points.

d. Necessity for defense mobility.—The pursuit forces available may be concentrated to cover the logical routes of enemy approach. Where the enemy is effectively opposed at these points he will undoubtedly select other routes of approach. A mobile general defense should be provided to meet such contingencies. Where satisfactory operating facilities are available, the mobility of pursuit will permit the character of the defense to change radically from day to day. A force that is concentrated and moved daily from point to point may result in the enemy receiving unexpected resistance, and thus cause him to resort to measures for security that he would not otherwise undertake.

■ 47. INFLUENCE OF LOCAL DEFENSES ON GENERAL DEFENSE.—Local pursuit defenses provide incidental defense to all objectives within the immediate vicinity of the defended objective. There is no certain method of determining which objective an enemy is about to attack. In local defense an enemy that threatens to attack is engaged at a limited distance from the defended objective. This distance will depend upon the depth of the aircraft warning service and the location of the alert stations. Within its zone of operations a local pursuit defense will reinforce the general defense by resisting enemy penetrations to the interior area. The enemy is unlikely to fly a course over objectives that may have local defenses when it is possible for him to avoid them. This fact should be considered in planning the general defense.

■ 48. DISPOSITION OF PURSUIT DEFENSES.—The disposition of the pursuit defenses within an area will vary with the enemy capabilities; the size of the area; the size of the pursuit force available; the relative location of the area with respect to other defensive areas; the character and extent of the aircraft warning service; the availability and location of operating airdromes; and the number, character, and location of the objectives within the sector that cannot be provided adequate security by other means of defense. If an adequate local defense could be furnished for all important objectives

there would be no need for general defense. Inasmuch as this condition probably will not be realized, a general pursuit defense usually will be necessary. With limited pursuit forces, the assignment of pursuit to local defenses, although greatly increasing the security of individual objectives, will decrease the security of other objectives within the sector.

SECTION V

INTERCEPTION

■ 49. GENERAL.—*a.* In order to alert pursuit defense units and effect interception of hostile aircraft penetrating a defended area, information of the approach and progress of the enemy is necessary. The technique of interception for either local or general defense is similar except that in general defense no restriction is placed on the allowable distance at which interceptions are made whereas, in local defense, operations are limited to the immediate vicinity of the defended objective. The technique of interception in local defense is described below.

b. Information required by the pursuit force commander in order to intercept and attack a hostile air force includes—

(1) *What.*—Type, strength, and disposition of hostile aircraft.

(2) *Where.*—Location, altitude, direction of flight, and speed of the enemy.

(3) *When.*—Time of the observation.

■ 50. OBSERVATION STATIONS.—A continuous watch must be kept in a large area surrounding the defended objectives. Such a watch performed by airplanes on patrol would require the use of an enormous number of aircraft which would consequently not be available for combat use. Therefore, a net of ground observation stations must be established about the defended objective.

■ 51. EXTENT OF WARNING SERVICE.—The distance to which the net of observation stations must extend outward from the airdromes of defending pursuit forces is governed by time and space factors. These in turn involve the time required for the transmission of information, operation and movement

of the defending pursuit forces, air combat, and for the movement of the hostile aviation force.

■ 52. DESIRED LINE OF INTERCEPTION.—*a.* The technique of interception is based upon the requirements that friendly aircraft intercept the enemy aircraft while the latter are still at a distance from the objective. In local defense the line connecting points at which interception is desired is called the "desired line of interception" and is abbreviated and referred to as the "desired L. I." A schematic presentation of a defended objective and the desired L. I. about that objective are shown in figure 2.

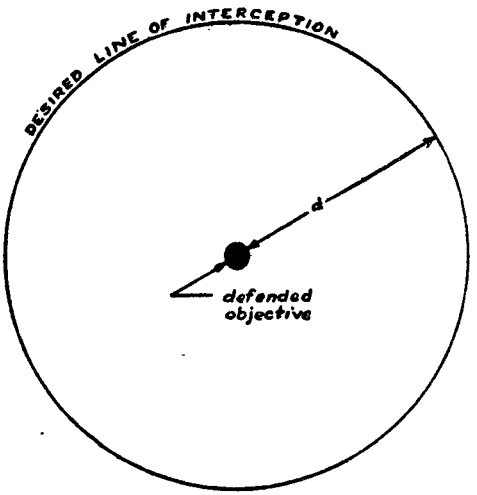


FIGURE 2.—Desired line of interception.

b. The distance (shown in fig. 2 as *d*) from the defended objective to the desired L. I. is governed by the desired "combat time" of the defending pursuit and by the speed of the enemy aircraft. The combat time is the period required for the effective delivery of fire by the intercepting aircraft and varies with aircraft of different characteristics and with different situations. For any particular aircraft the combat

time will not vary between wide limits, and an estimated average time for the effective delivery of the entire fire load carried constitutes a satisfactory basis for purposes of computation.

c. The distance from the defended objective to the desired L. I. is determined by computing the distance the enemy aircraft will travel during the combat time. Information of the performance of enemy aircraft will usually be available. By assuming the enemy speed to be the highest which can reasonably be expected, a safe basis for computation is assured. Assuming a situation in which the combat time is 10 minutes and the enemy speed is 240 miles per hour, the desired L. I. would be 40 miles from the defended objective. Under the conditions stated, *d* in figure 2 would be 40 miles.

■ 53. POSSIBLE LINE OF INTERCEPTION.—*a.* (1) The location of the base from which the defending pursuit operates is important in its relation to the location of the defended objective. Aviation forces may operate with equal facility in all directions from a base. The line to which an aviation force can go in a given length of time in still air will be a circle whose center is the base. This circle is called the "possible line of interception" and is abbreviated and referred to as the "possible L. I."

(2) When wind is present the possible line of interception will vary with directions of approach. In practical operations the presence of wind will be normal. For this reason solutions for the possible line of interception for specific operations will always require the application of wind speed and direction factors.

b. The relation between the base and the defended objective and the relation between the possible L. I. and the desired L. I. are shown in figure 3. The desired L. I. should lie on or in the possible L. I. The minimum requirement is met when the possible L. I. is tangent to the desired L. I. at a point in prolongation of the line: base–defended objective. The only condition under which the possible L. I. and the desired L. I. coincide occurs when the base is the defended objective, or when the base lies over or within the defended objective.

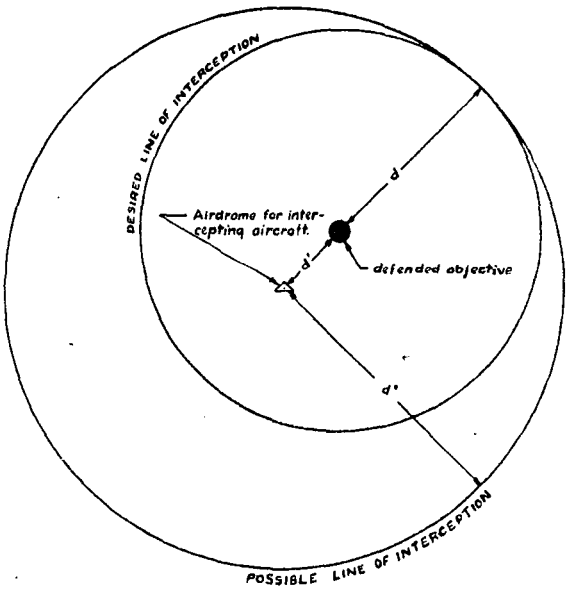
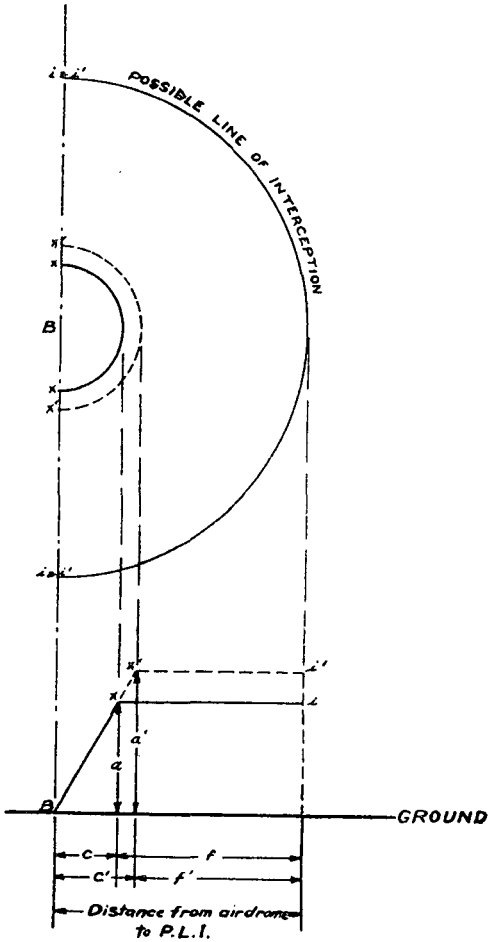


FIGURE 3.—Relation between possible and desired lines of interception.

■ 54. ALTITUDE OF INTERCEPTION.—*a.* (1) The defending pursuit force must not only move outward a considerable distance but must also move upward to an altitude at least as great, and preferably greater, than that of the approaching hostile aircraft. The movement outward may, therefore, consist of two components, the climb and level flight. The forward (horizontal) speed of an airplane is materially reduced during a climb. When climb is necessary, aircraft may proceed from the base to the possible L. I. at one rate of speed for a part of the distance and at another rate of speed for the remaining distance.



B=Airdrome.
c=Forward travel of interceptors during climb to altitude a.
c'=Forward travel of interceptors during climb to altitude a'.
f and f'=Forward travel in level flight.
$c+f=c'+f'$=Distance from airdrome to possible L. I.

FIGURE 4.—Effect of climb on airspeed.

(2) The distance which an airplane moves forward during a climb is a function of the time of climb and the rate of forward (horizontal) travel during the climb. Figure 4 shows the effect of differences in altitude on the forward distance traveled. The intercepting aircraft travel the distances *c* and *c'* at one speed and the distances *f* and *f'* at another and greater speed. The higher the altitude to which the aircraft climb, and the greater the time required to climb to that altitude, the greater will be the distance *c* or *c'*.

b. When the friendly aircraft utilize the ground alert method, the items of take-off and climb may be of considerable importance. The use of the air alert method serves to eliminate this delay and allows the friendly aircraft to reach the desired L. I. more quickly than can ground alert aircraft. When utilizing the air alert method, computations of time and space factors consider only the climb required to reach the desired altitude from the altitude at which the friendly aircraft are already flying.

■ 55. ENEMY MOVEMENT.—*a.* If the friendly aircraft are to arrive at the desired L. I. at the same time the enemy aircraft arrive there, the enemy aircraft must be at a distance outward from the desired L. I. which they can traverse in the time required for the friendly aircraft to move from the base to the desired L. I. It is essential, however, that the enemy aircraft be discovered and reported prior to their arrival at this point, to allow time for the transmission of the reporting message from the observer to the defending pursuit and for the necessary action to be taken prior to the starting of the movement from the base toward the desired L. I.

b. Ordinarily, it may be expected that messages reporting the presence and location of enemy aircraft will reach the information center a few minutes after the airplane has been observed. After the report reaches the information center, time is required for initial instructions to be issued to the aviation force before it can proceed to the proper point on the desired L. I. When the ground alert system is being used, additional time must be allowed for the starting of engines and the take-off of the unit.

c. Figure 5 is a schematic representation of the relative positions of the friendly and enemy aircraft at various stages

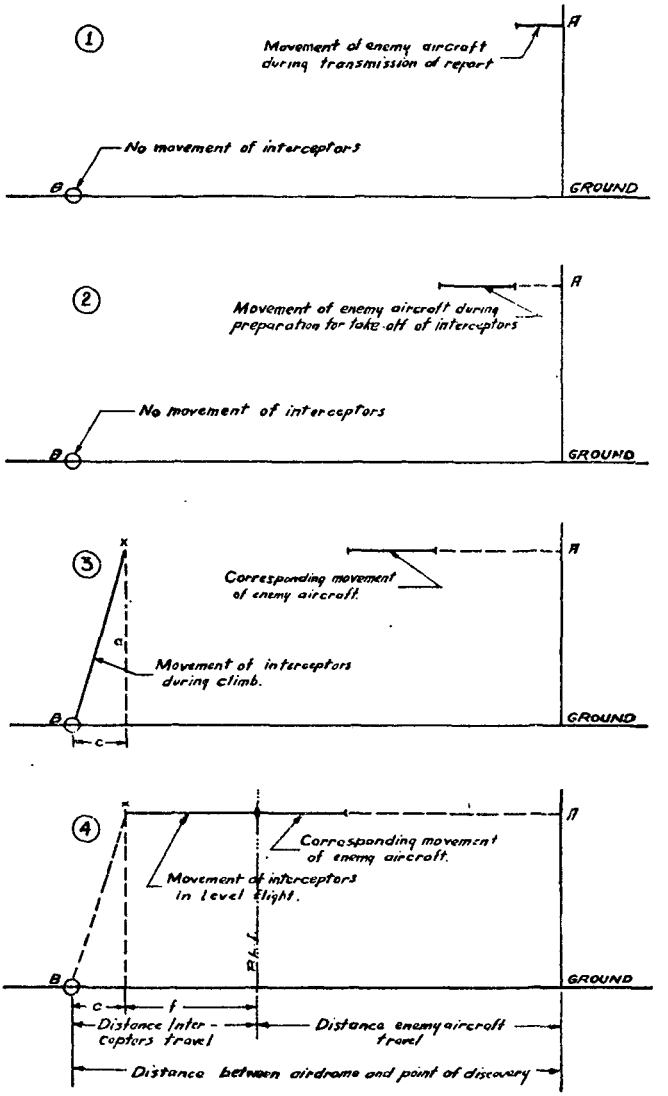


FIGURE 5.—Schematic diagram of interception.

of the operation, from discovery of the enemy aircraft to interception at the desired L. I.

SECTION VI

TECHNIQUE OF INTERCEPTION

■ 56. GENERAL.—Effective interception is dependent upon careful planning, rapid performance of all necessary functions, and accurate execution. The details of issuing orders, transmitting information, navigation, plotting, searching, and performing other essential functions will vary with different situations. In all situations, however, the critical factors are speed and accuracy. The time available in which to reach the desired line of interception is ordinarily very short, and all operations must be performed with the utmost rapidity but with accuracy.

■ 57. CONTROL.—*a.* Information and instructions are transmitted from the ground to aircraft in flight almost entirely by radiotelephony. A simple code system will serve to maintain secrecy and to decrease the length of messages. Routine messages, air-ground, or messages which are common should be listed and coded.

b. A grid system or a system of radial lines and concentric circles superimposed on a map of the area is a useful basis upon which to evolve the code for the transmission of navigation instructions and information of the enemy.

■ 58. NAVIGATION.—*a.* Either pilotage or dead reckoning is employed to navigate the force to the interception. Pilotage is ordinarily used for short distances; when operations are being conducted over an area with which the personnel are familiar; or over an area containing landmarks which can be identified readily. Over water areas, unfamiliar terrain, or terrain on which landmarks are few, and under conditions where contact flying is impracticable, dead reckoning navigation may be necessary. Dead reckoning navigation may be performed by personnel in the aircraft or by personnel on the ground.

b. Navigation of pursuit units by ground control necessitates a procedure differing from that followed when navigation is directed in the air, as drift and actual speed cannot

be determined by direct reading. Dead reckoning navigation from the ground must be based upon the wind data available and upon the known performance of the aircraft. The data required include—

(1) Wind direction and speed at all operating altitudes throughout the area over which operations may take place.

(2) Rate of climb used to all altitudes.

(3) Airspeed (horizontal) of the aircraft during the climb.

(4) Airspeed of the aircraft in level flight at all altitudes.

(5) Weather conditions throughout the area over which operations may take place.

c. The navigation can be done on the ground only when the aircraft movements conform to a known standard. Knowing this standard, personnel on the ground are prepared to determine with considerable accuracy the direction in which the aircraft should fly, and the time which they should fly in that direction to make good a desired distance. The ground control is able by this means to determine the location of the friendly aircraft at any instant, and to direct the movement of those aircraft rapidly and accurately to the proper place at the proper time to effect interception. The accuracy of navigation is increased by position reports from the pursuit leader and from the aircraft warning service.

■ 59. PLOTTING.—*a.* The information center receives information of the movements of enemy aircraft and relays this information to the unit in the air either in the form of navigation instructions or in the form of information of the enemy. The information center is equipped to receive and to evaluate information of the enemy, to make decisions as to the action to be taken, and to transmit information and instructions to the flying echelon. In order to accomplish these functions, it is necessary that the movements of the enemy be plotted and future positions estimated. When navigation problems are being solved on the ground, it is also necessary to plot the position of the friendly aircraft and to forecast their future positions, as the solution of any interception problem involves a knowledge of the relative positions and speeds of the two forces.

b. (1) A satisfactory technique for plotting the movements of enemy aircraft, for plotting the movements of friendly

aircraft, and for solving the interception problem has been evolved by the utilization of one large scale map of the area and a crew of four who work on the map. This crew is made up of the data keeper, target plotter, pursuit plotter, and intercept officer.

(2) The data keeper is charged with maintaining the latest available information on wind velocities, wind directions, weather conditions, and the performance of enemy aircraft. He is also responsible for the determination of the effect of wind on the movement of friendly aircraft.

(3) The target plotter is charged with the plotting of enemy movements and forecasting future enemy positions.

(4) The pursuit plotter is charged with the plotting of movements of the friendly aircraft and forecasting their future positions.

(5) The intercept officer is charged with the solution of the navigation features of the interception problem, and with directing the pursuit unit to a point in the air where interception with the enemy is assured.

c. When navigation is directed from the ground, an intercept officer of the unit usually directs the movements of the flying echelon. The flying echelon is retained under the tactical control of the commander on the ground until the enemy is sighted, at which time control passes to the formation commander. After the fight, the commander of the formation reports back to the commander on the ground, and again comes under the tactical control of the latter. When navigation is performed in the air, tactical control is vested in the formation commander throughout the entire operation.

NOTE.—Equipment has been developed for solving the interception problem by mechanical means that reduces the time involved in solutions and the number of operating personnel required at the control board. This reduction in time is of particular value when the hostile aircraft approach the defended objective on irregular courses. Under these conditions the saving in time should add to the probability of interception and reduce the time required. This will enable the defending pursuit to engage the enemy at a greater distance from the defended objective.

■ 60. SEARCH.—*a.* The technique of interception involves some search for the enemy regardless of the accuracy of the navigation. When contact with the enemy is imminent, the

formation commander disposes his force for search. This disposition normally involves the detaching of special components to take position below, in front, and on the flanks of the main body. The main body spreads out to intervals determined by the space to be searched, the size of the force, the nature of the enemy force, and time required to assemble for the attack.

b. It is especially important that detachments always be sent to an altitude at or below the reported altitude of the enemy aircraft, unless the latter are flying at minimum altitude. Aircraft are more easily located against the background of the sky than against average terrain, and the searching personnel have but one hemisphere to scan.

SECTION VII

SUPPORT OF AIR STRIKING FORCES

■ 61. GENERAL.—Support of air striking forces may be necessary when those operations are seriously threatened by hostile aviation forces. This support or security is accomplished by general or special support to those forces in flight and by protection of their ground bases.

■ 62. METHODS OF SUPPORT.—*a. General support.*—Pursuit forces provide general support by gaining temporary or permanent air superiority throughout the area or sector of air attack operations. Any friendly pursuit forces operating in an area or sector provide a degree of general support to friendly aircraft operating in that area. When hostile fighter operations are so extensive that security provided by pursuit forces operating in general support is not effective, special support forces should be employed.

b. Special support.—Pursuit provides special support by escorting the supported formation through part or all of its mission, furnishing a screen against surprise and augmenting the defensive fire power of the supported force. Multiseater fighter aircraft having strong defensive fire power are normally assigned for these missions. When this type aircraft is not available, single-seater pursuit may be employed.

(1) Multiseater fighter aircraft having all-around defen-

sive fire power take position relatively close to the supported force from which any hostile attack on the supported force may be met with maximum fire. Effectiveness of this support is dependent on the ability of the escorting force to concentrate fire in all vulnerable sectors.

(2) Single-seater pursuit forces furnish special support to friendly air attack formations by fire power controlled through maneuver. They normally operate above and to the rear of the defended formation from positions that guard vulnerable sectors and that facilitate immediate counterattack against any enemy force endeavoring to launch a direct attack on the defended formation. Distance from the supported force will be influenced by relative speeds, escort strength, and visibility conditions. Forces in special support counterattack immediately when hostile fighters make direct attacks on the defended formation. When possible, withdrawal from combat will be made when threat against the defended formation has been removed.

c. Protection of air striking force bases.—Support of the air force on the ground is accomplished by the same methods discussed in sections III and IV.

SECTION VIII

SUPPORT OF GROUND FORCES

■ 63. GENERAL.—Operations of pursuit aviation in support of ground forces are based upon the needs of the ground forces and their supporting aviation. The pursuit commander should be thoroughly familiar with the plan of operation of the ground forces, the terrain over which they are operating, and the strength, disposition, and method of employment of enemy antiaircraft artillery so far as they may affect the success of supporting operations.

■ 64. MISSIONS.—Pursuit forces operating in direct support of ground forces may be employed in the execution of all of the following missions:

a. Antiaircraft security.
b. Protection of air support forces and organic aviation.
c. Counterreconnaissance.
d. Air attacks on ground troops and light matériel.

■ 65. METHODS OF OPERATION.—Except for the attack of ground targets, pursuit executes its missions in direct support of ground forces by methods similar in character to operations previously treated in this manual. The specific application of these methods of operation is covered below.

a. (1) Pursuit provides antiaircraft security by operating in local or general defense. It operates by ground alert, air alert, or fighting patrol methods.

(2) When ground forces are in contact, antiaircraft security may best be obtained by offensive action, to gain temporary or permanent air superiority. This is accomplished by pursuit concentrations and/or offensively fighting patrols.

b. Pursuit aviation provides protection for air support forces by general or special support and by protection of their air bases as treated in section VII.

c. Pursuit aviation executes missions of counterreconnaissance by offensive or defensive fighting patrols. Counterreconnaissance is normally accomplished incident to other pursuit operations. Where enemy reconnaissance is extensive, special operations by fighting patrols may be necessary.

d. (1) Pursuit executes attacks on ground personnel and light matériel targets by employing light bombs and automatic weapons.

(2) So long as enemy air operations constitute a serious threat to successful ground operations, supporting pursuit forces will normally be employed against those forces and not diverted to attacks on ground objectives. However, in critical situations or when enemy air operations are relatively ineffective, pursuit aircraft can be employed effectively against ground personnel and light matériel, especially hostile antitank dispositions confronting friendly armored or mechanized forces.

■ 66. FIGHTING PATROLS.—Operations should be conducted to provide a screen of offensive patrols so disposed as to deny the enemy air reconnaissance and observation and to assure interception of hostile aircraft before they can interfere with friendly air operations or attack ground objectives.

a. For these patrols to reap the full advantages of the initiative in air fighting and also be able to make the utmost use of surprise, they should be given as much freedom of

action as is compatible with coordination of their operations with those of other patrols operating in adjacent areas.

b. It is inadvisable to restrict patrols more than is absolutely necessary in regard to the locality and altitude of operation. Orders should normally be confined to the definition of the task, leaving the patrol leader full latitude, within limits essential for coordination, in the execution of his task. The size of fighting patrols will be influenced by the methods employed by hostile aviation forces.

c. Owing to the ease of evasion in the air, it may often be necessary to augment these offensive patrols by establishing two or more lines at different altitudes. Even when large numbers of fighter aircraft are so employed, it may not be possible to prevent small enemy formations and single aircraft eluding the patrols or large formations forcing their way through them.

■ 67. CONCENTRATIONS.—Certain critical operations of the ground forces may require local air superiority over a limited area for a definite period of time. Within the capacity of the pursuit force, such superiority is achieved through concentration of operations over the designated area for the period required. The need for such special support should be anticipated and proper provision made in preceding pursuit operations to insure the availability for the operation of the force required. Where the pursuit force is limited this will usually require that an appropriate force be conserved to accomplish this particular task.

SECTION IX

PURSUIT IN NIGHT OPERATIONS

■ 68. GENERAL.—Pursuit operations at night will be limited by the availability of antiaircraft searchlights, suitable aircraft, and an effective aircraft warning service. There are two methods of making night interception:

a. By the combined use of pursuit and active searchlights.

b. By the joint use of air-borne and ground radio location devices.

■ 69. NIGHT USE OF AIRCRAFT WARNING SERVICE.—The aircraft warning service must function at night where pursuit conducts night operations.

■ 70. SEARCHLIGHT COOPERATION.—The target must be illuminated for pursuit aviation to locate the enemy and to attack. Searchlight illumination should be provided for pursuit operations beyond the operating range of antiaircraft guns and should provide for continuity of illumination for a sufficient time to permit pursuit to launch an assault.

■ 71. NIGHT PURSUIT TACTICS.—*a. Formations.*—Pursuit will normally use reference lights except for those airplanes that are actually detached for the attack. The number detached will depend on the width of the bombardment formation as well as its depth. In general, it will not detach more than three at one time. The two-plane element is the normal unit for attacking at night. The three-plane element may be used when the hostile formation has sufficient width to justify the force.

b. Alerting pursuit.—Pursuit operating at night will be alerted on reports from the aircraft warning service. The force employed will be dispatched to an air alert station sufficiently distant from sound locators to insure noninterference. This air alert station should be along the most probable line of enemy approach.

c. Pursuit's position after location of enemy.—When radio or prearranged searchlight signals indicate the location of the hostile aircraft, the pursuit formation will proceed immediately to the indicated location. It will take its position outside of effective fire range from the bombardment formation and detach elements to attack.

d. The assault.—(1) The detached airplanes will extinguish their lights and maneuver quickly to effective range in rear of the hostile target and deliver the assault. Pursuit airplanes engaged in the assault will deliver their fire in long bursts. When the attack is completed, individual airplanes proceed directly to their airdrome and land.

(2) In the attack by two-plane elements the leader will be indoctrinated to attack always the right rear of the hostile formation, and the remaining pursuit pilot will concentrate

simultaneously on the left rear of the formation. With three airplanes the leader will be indoctrinated to attack the rear center and the number two wingman the right rear, the number three, the left rear. Attacks are made simultaneously. The delivery of fire in one or two long bursts will insure that the attacking pursuit will finish at nearly the same time. In the event that several hostile formations or individual airplanes arrive at approximately the same time, the pursuit leader will detach the necessary units to attack according to his formation's strength. These detached elements will form small individual formations and proceed with the maneuvering and assault as described for the maneuver and assault of the parent formation.

e. Pursuit in artillery zone.—In night operations, which are coordinated with antiaircraft artillery, the pursuit personnel should know the limits of the zone of effective artillery fire. Normally the policy of the antiaircraft gun units will be to fire on unidentified airplanes within range. The interceptor commander of an area in which there are both pursuit aviation and antiaircraft artillery will prescribe instructions for the tactical coordination of pursuit and antiaircraft artillery fire.

CHAPTER 6

AIR TACTICS OF PURSUIT AVIATION

SECTION I

GENERAL

■ 72. TACTICAL FUNCTIONS.—Pursuit aviation is designed and created for the primary function of air fighting. It is, therefore, provided with aircraft characterized by high speed, maneuverability and rate of climb, and strong fire power.

■ 73. AIRPLANE TYPES.—*a.* Pursuit aviation is provided with special aircraft types for the execution of specific missions.

(1) *Interceptor.*—The essential performance characteristics of interceptor type airplanes are high rate of climb and speed. They carry armament capable of causing the destruction of bombardment aircraft. The fuel capacity is restricted to attain high rate of climb and speed, hence the radius of action is limited. Several subtypes may be required to insure maximum suitability of equipment for the various tasks of antiaircraft defense, such as local defense, general defense, pursuit versus pursuit action, and for special operations in direct support of ground forces.

(2) *Multiseater fighter.*—The essential military characteristics of the multiseater fighter type airplane are long range, high speed, and strong fire power. Its characteristics are governed by the requirements for long range patrol, interception and sustained air combat, and special support for bombardment formations. For the latter purpose it must possess strong defensive fire power. Subtypes may be re-

quired for the effective escort of the various types of bombers. The multiseater fighter will be generally inferior to single-seater pursuit in rate of climb, speed, and maneuverability.

(3) *Night interceptor.*—Aircraft are being produced to function solely as night interceptors. Combat tactics will be contingent on the type of aircraft produced.

b. The great difference in the military characteristics between the pursuit interceptor type airplane and the multiseater fighter type makes tactics and methods of operation peculiar to each type. The multiseater fighter is a newly created type for which combat tactics have not been evolved. The development of effective tactics for the operations of this type is contingent on their availability for tactical flying tests. For this reason where this type is treated in the following pages of this manual it will always be referred to as "multiseater" and will not be included in the generic term "pursuit."

SECTION II

PURSUIT FORMATIONS

■ 74. PURPOSE.—The purposes of the pursuit formations are—

a. To obtain a concentration of fire power.

b. To permit application of this concentration rapidly in any direction or manner.

c. To maintain tactical control in all situations.

■ 75. TACTICAL REQUIREMENTS.—In the arrangement of a pursuit formation, it is important that sound tactical principles be observed so that the formation may effectively serve its purpose.

a. The formation should possess a sufficient degree of flexibility to permit rapid change to meet varying conditions.

b. Simplicity of arrangement, signals, maneuver, and control is essential. It should be possible for each pilot to maintain his position by guiding on only one airplane so that he will be free to deliver individually aimed fire in an assault.

c. Pursuit formations must have sufficient maneuverability to enable them to gain and retain the advantage of position in offensive air fighting, and to interpose themselves between

an attacker and the formation they support in defensive fighting.

d. Pursuit formations must be readily controllable. This requirement is effected by indoctrination, visual signals, or radio. In elements, flights, and squadrons, control is further exercised by direct leadership. Control of the group formation is treated in paragraph 103.

■ 76. OFFENSIVE OR DEFENSIVE.—Pursuit formations may be either offensive or defensive. They may be echeloned either in depth, in altitude, or laterally, or in any combination of these.

a. Single-seater.—(1) The formations employed by single-seater pursuit are designed primarily for offensive air combat and for this reason are sufficiently extended to facilitate freedom of maneuver for all subordinate units of the formations.

(2) When a formation of single-seater pursuit is opposed by fighters superior in performance or numbers, it may sometimes be desirable to assume and maintain a compact formation as long as possible in order to avoid the risk of being broken up and attacked in detail.

b. Multiseater.—The multiseater formation operates both offensively and defensively. As with single-seater pursuit, the offensive formation is sufficiently extended to provide subordinate units the freedom of maneuver essential for the delivery of offensive fire. Defensive formations are sufficiently compact to provide for the requisite massing of defensive fire.

■ 77. COMPOSITION.—*a.* In organizations equipped with interceptor type aircraft, the element, consisting of two or three airplanes, is the basic air unit. The flight, consisting of two or three elements, is the largest unit that can operate efficiently under the direct leadership of an individual.

b. In organizations equipped with multiseater fighter type aircraft, the flight, consisting of two or more airplanes, is the basic air combat unit. The flight is the largest unit that can operate efficiently under the direct leadership of an individual.

c. The squadron formation, consisting of three flights, is the largest unit that can be directly controlled by an individ-

ual as a combat command. Control of the flights within the squadron formation is effected through the flight commanders by coordination and liaison.

d. Formations of groups, when required, are created by the coordinated employment of the requisite number of squadron formations.

■ 78. STRENGTH.—The strength of formation to be used depends upon—

a. Mission.
b. Strength of the enemy.
c. Type of airplane and armament available.
d. Character of the enemy (bombardment, pursuit).
e. Weather conditions.

■ 79. TYPES.—*a.* The element is the *basic* formation. The designation applied to the basic types of formations now in standard use by interceptor pursuit organizations derives from the disposition of individual airplanes within the element. The designations are—

(1) Three-ship V (fig. 6).
(2) Three-ship stagger (fig. 7).
(3) Two-ship element (fig. 8).
(4) String (fig. 9).

b. Close formations are those formations in which the airplanes are too close for tactical work. They are used primarily for drill.

c. Open formations are those in which the airplanes are spaced far enough apart to allow the pilots freedom of maneuver while remaining within close supporting distance of their element leaders. Elements and flights are within immediate supporting distance of the other elements and flights.

d. Extended formations are those in which the subunits are beyond support of each other but are still under tactical control. Adjacent units maintain visual contact at all times. This type of formation is used for combat patrols and for search.

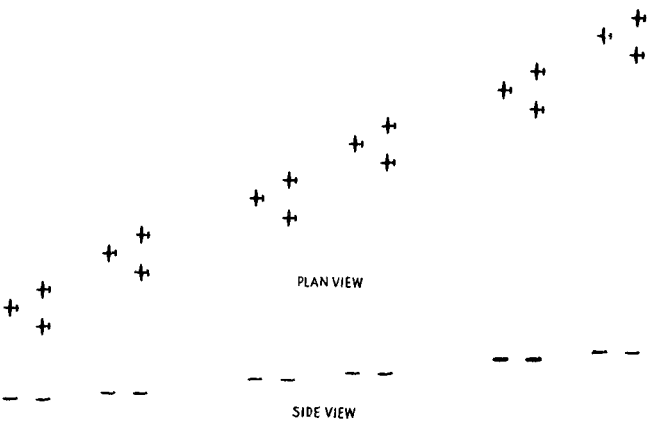


FIGURE 6.—Three-ship V.

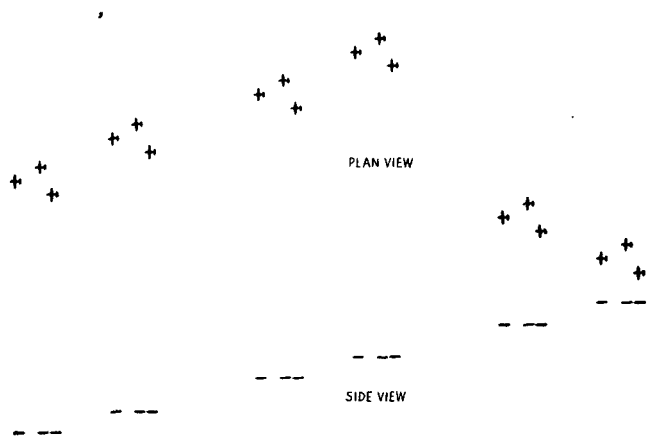


FIGURE 7.—Three-ship stagger.

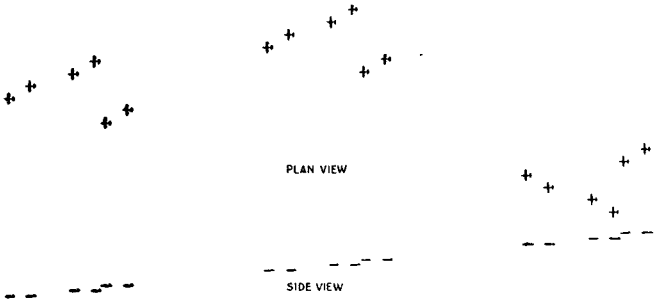
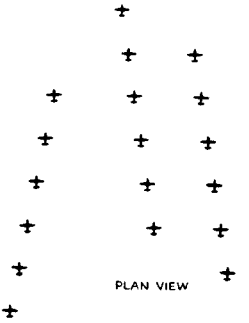


FIGURE 8.—Two-ship element.



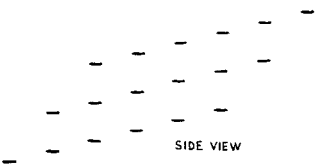


FIGURE 9.—String.

SECTION III

COMBAT TACTICS

■ 80. GENERAL.—*a.* In the performance of its defensive mission in antiaircraft security, pursuit aviation in all circumstances adopts the most strenuous tactical offensive. Combat tactics are based on the infliction of the maximum casualty effect upon the enemy forces with minimum losses to its own forces.

b. In the direct defense of other aviation forces, pursuit provides security by escort. Combat tactics are based on providing the freedom of action required by the escorted force in the execution of its mission.

■ 81. PHASES OF COMBAT.—*a. Approach to combat.*—The approach to combat has a greater influence on the result of the combat than any other phase of operations. Surprise affords a tremendous advantage. Approach to attack from the most vulnerable or blind sector of the hostile formation confuses the enemy as to the proper counteraction to be taken. Fighter pilots must be thoroughly familiar with the military characteristics and most vulnerable sectors of enemy aircraft and formations. When the enemy is sighted, the attack or the maneuver for attack position should be initiated without delay.

b. The combat.—The combat must be carried out with speed and determination. The first blow is very important. Sustained fire beginning at ranges where effective fire or hits may be reasonably scored and continued through to close ranges is most effective. Every effort is made to maintain the organization of the force and prevent the development of the engagement into a melee of individual combats.

c. Exploitation or withdrawal.—Determined effort is made to take advantage of any confusion and dispersion of the enemy force which may result from the initial assault. If the assault has been indecisive or unfavorable, a withdrawal is effected in such manner as to minimize losses while regaining the tactical advantage.

SECTION IV

INDIVIDUAL OFFENSIVE TACTICS

■ 82. GENERAL.—Thorough training of the pilot in the fundamentals of individual combat tactics is of vital importance. The pilot must be prepared to conduct individual air fighting missions under one or more of the following situations:

a. In pursuit versus pursuit action when the forces become temporarily disorganized and out of tactical control.

b. When tactical unity of a formation has been disrupted through adverse weather or visibility conditions.

c. As a result of dispersion caused by surprise attacks or an attack by overwhelming numbers.

d. When separated from his formation and a target of opportunity presents itself.

e. In night pursuit operations.

■ 83. FUNDAMENTALS OF COMBAT.—All successful pursuit combat is performed by the application of four fundamentals—

a. Surprise.—Strike the enemy first—

(1) By taking advantage of the sun's rays, clouds, and visibility conditions.

(2) By approaching the enemy's most vulnerable quarter.

(3) By taking advantage of enemy preoccupation.

b. Offensive.—The pursuit pilot must attack with energy and determination, pushing the attack until either the enemy is destroyed or his own ammunition exhausted. Should he be placed on the defensive, he must by his own skill strive to regain the offensive as soon as possible.

c. Concentration of fire.—Fire of all guns is directed at the most vulnerable parts of the airplane, that is, personnel, fuel tanks, controls, or other vital parts. In most airplanes these are all contained in a relatively small portion of the fuselage and may be protected by defensive armament. To deliver destructive fire on this target demands extreme accuracy. Successful attacks require concentration of fire at effective ranges.

d. Security.—For adequate security, compatible with his mission for himself and his equipment, the pursuit pilot must—

(1) Be always on the alert, watching especially the upper rear hemisphere. Observation of the air for enemy aircraft must be rapid, systematic, and thorough, always covering first the more dangerous regions above followed by the regions below.

(2) Never needlessly sacrifice the advantage of superior altitude in an attack.

(3) Never fly straight at any enemy when within effective range of his guns except when actually firing.

(4) Follow through in an attack beyond effective range of hostile defensive fire.

(5) Never lose sight of the opponent.

■ 84. ATTACK ON A SINGLE-SEATER.—*a.* The best position from which to attack a single-seater airplane is from above and to the rear of the target. In this position the attacker has the advantage of speed and power of maneuver gained from superior altitude.

b. In the execution of a surprise attack, care must be exercised to avoid overrunning the opponent, as this will result in placing him in a favorable position to fire on the attacker or to escape by quickly turning before the attack can be resumed.

■ 85. ATTACK ON A TWO-SEATER.—It is more difficult to gain surprise for attack on a two-seater than on a single-seater airplane. The best position for launching the attack will be dependent upon the blind angles of the two-seater, though the most vulnerable sector usually is found by approaching from the rear and below. Forcing the two-seater to execute rapid maneuvers to avoid the attacker's fire will greatly reduce the accuracy of defensive fire power of the rear seat gunner.

■ 86. ATTACK ON A MULTISEATER.—An attack on a multiseater by a single pursuit airplane will be hazardous if all possible approaches to it are effectively covered by defensive machine-gun fire. A determined following attack may be made from the rear at the same level or slightly below the target. The rear gunner in the multiseater is the initial target. Concentrated fire at close ranges may be necessary to destroy multi-

seater aircraft. Withdrawal from such attack should be made in a manner to avoid the defensive fire of the hostile aircraft, preferably to the rear.

■ 87. ATTACK ON FORMATIONS.—*a. Pursuit formation.*—Attacks on pursuit formations by individuals must usually be confined to the rearmost airplanes of the formation. Surprise attacks may occasionally be made with success if the formation is carelessly flown or if the attack is made suddenly. Such attacks are made by using the "dive and run" tactics, the attacker depending upon one or two bursts to deliver effective fire and relying on the speed gained in a steeply diving attack to carry him out of effective range of defense fire.

b. Multiseater formation.—The individual cannot effectively attack formations which possess a strong defensive fire to the rear. Consequently, the pursuit pilot operating alone should confine his efforts to stragglers that fall behind the main formation. Such opportunities will be rare, and the individuals should not make a general practice of operating against such formations.

■ 88. ATTACK ON CAPTIVE BALLOONS.—A special operation for pursuit aviation is the destruction of captive balloons. This work should be assigned to pilots who are specially adept at attacking stationary targets. The best results are obtained by diving into the wind or under cover of the sun and concentrating fire in the smallest possible space on the highest point of the balloon. Attacks on balloons can be made effectively with long range machine guns or cannon and by dive bombing.

SECTION V

FLIGHT OFFENSIVE TACTICS

■ 89. GENERAL.—*a. The flight.*—The flight is normally composed of six pursuit airplanes under the direct leadership and control of one individual. To enable it to have greater flexibility, maneuverability, and control, it is subdivided into elements of two or three airplanes each. The tactics of the element are fundamentally the same as those of the flight. The elements are a part of a closely coordinated combat team and are mutually supporting.

b. Tactical employment.—The flight is the principal tactical subunit of the squadron. It does not operate as an independent command except under unusual circumstances. It may then be detached temporarily from the squadron to perform certain tactical missions, such as combat patrols, or to attack small formations or other appropriate targets.

c. Fire unit.—The flight is the largest pursuit unit in which all airplanes while in formation can deliver effective fire simultaneously upon a single enemy airplane. For this reason the flight is the basic fire unit of the squadron and the basis for squadron tactics.

■ 90. COMBAT FORMATION.—Elements of the flight are so disposed as to furnish mutual support and to permit rapid concentration of fire power. The elements guiding on the leader may be echeloned in depth, altitude, or laterally, depending upon type, disposition, and tactics of the enemy.

■ 91. ATTACK ON A SINGLE-SEATER.—*a.* In launching an attack on one single-seater the whole flight formation does not ordinarily lose altitude to engage in combat. A three-plane element of the formation engages the hostile single-seater while the remainder of the flight acts as reserve.

b. On signal of the flight commander the designated element of the flight descends to attack. While one airplane closes in to fire, the others support the attack by closing in on the flanks to prevent the enemy from turning to escape or to engage in a close turning combat duel.

■ 92. ATTACK ON A MULTISEATER.—*a.* The method of attacking a multiseater is predicated upon the quantity of the defensive armament and its disposition. One element makes a direct attack through the most vulnerable sector while the remainder of the flight conducts harassing fire from the flanks in order to divert the enemy's fire from the attacking element, and also to take up the direct attack in case of maneuver by the multiseater. Normally one element is sufficient to destroy a two-seater. Against aircraft possessing heavy all-around defensive fire power a flight may be necessary.

b. The initial attack on a multiseater possessing heavy armament with all angles covered by fire normally should be

a massed fire attack. The flight in mass formation approaches the target from the rear and at the longest effective range initiates the assault, continuing to close on the target until destruction is accomplished.

■ 93. ATTACK ON FORMATIONS.—*a. Pursuit formations.*—(1) Attacks on pursuit formations must be launched from superior altitude. The approach must be direct and with full speed. The immediate objectives are the highest elements of the enemy formation. Every effort must be made to preserve the tactical integrity of the unit throughout the air fight. When close maneuver combat is forced, all individuals work inward and attempt to gain altitude during the fight. Individual pilots temporarily disengaged during an air fight should reenter combat only from superior altitude.

(2) If the hostile pursuit formation is very compact every effort must be made to disrupt its unity by the shock of the first fire attack. In every case it is imperative that all the hostile pursuit airplanes above and to the sides be engaged prior to or simultaneously with the attack on those at lower altitude.

(3) A flight attacking a numerically inferior force normally should send approximately an equal number of airplanes to the attack. The remaining airplanes of the flight should maintain their altitude over the combat as a reserve for the primary purpose of providing security for the attacking force. This reserve should be prepared to prevent unengaged hostile airplanes from gaining altitude on the attacking force. This reserve should also be prepared to prevent hostile airplanes from withdrawing from the combat when it is apparent that the enemy force is disorganized. The correct employment of the reserve insures minimum losses to the attacking force and maximum losses to the defending force. As long as the enemy fighting unit is conducting organized resistance every effort is made to effect his disorganization and defeat.

b. Defensive formations.—(1) The various types of defensive formations include those composed of two-seaters and multiseaters. A defensive formation of superior fire power should be subjected to harassing attacks at long range with guns and attacks from above with time-fuze bombs for the

purpose of breaking or temporarily disorganizing the formation. Fighter units should close without delay for the destruction of any hostile unit temporarily disorganized.

(2) Formations of reconnaissance aircraft are usually small and compact. Attacks on such formations will be a normal function of the pursuit flight. In making the attack, the pursuit flight will make converging attacks from the rear, bringing simultaneous fire to bear upon the target.

■ 94. THE RALLY.—The rally of a flight after combat is a matter of indoctrination and training. It may be necessary to select a predesignated point or to direct all members to return to the home airdrome after dispersal of the flight due to combat. Whenever practical the flight rallies upon the leader after termination of combat.

SECTION VI

SQUADRON OFFENSIVE TACTICS

■ 95. GENERAL.—*a.* The squadron consists of three flights and is both tactical and administrative. It is, therefore, capable of operating as an independent command. It is under the direct tactical control of the squadron commander, who exercises this control through his flight commanders.

b. The three-flight squadron provides a sound tactical unit for air fighting. It is especially suitable for covering a large area and providing small combat units capable of independent action under the control of the flight leaders. It is readily employed in situations where it is desirable to attack with three flights operating on different levels. It is readily adapted to screening and search missions, such as the mission of denying hostile reconnaissance in an area and the interception of hostile bombardment formations.

■ 96. COMBAT FORMATION.—*a.* The squadron operating independently when approaching a hostile formation whose location or flight path is known takes up a combat formation. All subunits will be in mutual supporting distance, and the individual airplanes are so spaced within elements as to permit ease in maintaining the formation and conducting aimed fire.

b. Echelonment of flights within the squadron in altitude, distance, and lateral interval is dependent upon the type.

strength, and disposition of the hostile air forces to be encountered.

c. Whenever pursuit opposition is expected the flights are echeloned in altitude. The three flights then have separate tactical responsibilities and are designated as follows:

(1) The leading flight is the assault echelon, is at the lowest altitude, and is normally led by the squadron commander.

(2) The intermediate flight is the support echelon.

(3) The highest flight is the reserve echelon.

(4) As their names indicate, the assault echelon will normally initiate the attack. The support echelon joins combat in support of the assault echelon, and the reserve echelon acts as a security detachment against other possible enemy pursuit until either it is assured no other enemy is present or that the situation demands its participation.

■ 97. SEARCH FORMATIONS.—*a. Disposition for search.*—If the exact position and path of approach of the enemy are in doubt, or if an area is to be examined, the squadron takes up a search formation. The leading flight takes the central position with its airplanes spread out in a line perpendicular to the path of flight and at a distance depending on the degree of visibility and the requirements for rapid concentration. The other two flights take positions with similar dispersion on the flanks and are echeloned in two higher altitudes, the altitude of each being dependent on visibility and desired rapidity of concentration.

b. Attack from search formation.—The normal method of concentration is for all flights to converge on the flight making contact with the enemy. The contacting flight immediately goes into the firing position in rear of the enemy formation and initiates the assault, while the other two flights assume positions on the flanks and above the enemy out of effective range of the defensive guns and then institute harassing flank attacks. If equipped with bombs, detachments are made from the flank units to bomb the enemy formation.

■ 98. ATTACK ON FORMATIONS.—*a. Attack on pursuit formations.*—(1) Normally a full squadron attack is made on a hostile fighter formation only when some other pursuit unit is acting as a security force. Otherwise only the assault and

support echelons initially engage in the attack. Squadron attacks on pursuit formations usually will be preceded by maneuver for advantage of altitude and position. The commander must exercise great care in maneuvering his unit to avoid dispersing the formation.

(2) The first object of the squadron attack is to break up the hostile fighter formation in order to permit attacks on dispersed units in detail. The assault echelon dives quickly to the attack and is followed immediately by the support, with the reserve echelon remaining unengaged as a security force until it is clear that no supporting hostile forces are in the vicinity. In the attack each pilot singles out an enemy airplane and delivers aimed fire upon it. After delivering their fire the attacking echelons pull up *as a unit* and regain altitude in order to resume the attack from a favorable position as soon as possible. Tactical unity is maintained throughout the assault, exploitation, or withdrawal.

b. Attack on defensive formations (bombardment and reconnaissance).—(1) The initial attack of a squadron upon a close defensive formation should, if possible, be a concerted surprise attack with the aim of causing casualties and the dispersal of the formation. If this result is gained the dispersed elements are destroyed in detail. If the defensive formation is already dispersed and a surprise attack can be made, attrition is best effected by attacking and destroying dispersed elements out of range of supporting fire. Disabled and straggler airplanes will be destroyed if and when they leave the support of the defensive formation.

(2) If hostile fighter aviation is present within supporting distance, it must be engaged and destroyed or drawn away beyond immediate supporting distance of the defensive formation by a part of the attacking pursuit force while the remainder of the force attacks the hostile formation.

■ 99. THE RALLY.—*a.* The plan for the rally should be made prior to combat and is a matter of training and indoctrination. The rally after combat may be effected in several ways:

(1) Upon the leader's airplane.

(2) By flights and then upon the leading flight.

(3) Upon the reserve echelon.

(4) Over a predesignated point at a specified altitude.

b. The ability to rally a squadron after combat is a measure of the training and tactical control of the commanders. A rally by flights is made after each engagement and contact between the flights reestablished as soon as possible.

SECTION VII

GROUP OFFENSIVE TACTICS

■ 100. ORGANIZATION.—The pursuit group is normally composed of three tactical squadrons. The group formation provides a strong fighting force with ample reserves for operations against large enemy aviation forces.

■ 101. PURPOSE.—*a.* The pursuit group provides a large concentration that has sufficient strength to—

(1) Force a favorable decision in the air against large enemy concentrations.

(2) Effect penetrations of enemy territory against strong hostile fighter resistance.

(3) Provide security and reserve detachments without unduly detracting from the effectiveness of the main force.

(4) Provide air security to an area by continuous patrols; by an alerted force; or by a combination of both without resulting in excessive fatigue to personnel.

b. The group is the largest tactical pursuit organization that can be controlled in the air by an individual. The group commander exercises this control through the squadron commanders. It is the largest pursuit command that can be maneuvered into position for a coordinated attack on an appropriate hostile formation.

■ 102. POSITION OF GROUP COMMANDER.—To exercise tactical control of a pursuit force during combat it is essential that the commander be able to observe directly the disposition and conduct of his command. The position of the group commander in a group formation will depend upon the situation and upon his own judgment. He may actually lead the group by attaching himself to the leading unit or by leading a command flight and requiring the group to conform to his movements. In actual combat he will place

himself above and toward a flank in such position that he can maintain tactical control of the group. The command flight will act as a security force for the group commander.

■ 103. METHODS OF CONTROL.—The group commander has three methods for the control of his group in the air:

a. Indoctrination.—The squadrons of the group should be so trained that in the normal methods of air attack the squadrons automatically take proper position to furnish appropriate assault, support, and reserve forces. Radio and visual signals are kept at a minimum. Indoctrination is the only dependable method of control in the heat of combat.

b. Radio.—Simple radio code signals, for types of formations, method of attack, the attack, and the rally, are a valuable aid to the group commander for control of the group in the air. Radio is extremely valuable for effecting quick concentration of forces when they are dispersed in search or in scattered patrols or when other means of control are ineffective.

c. Visual signals.—Visual signals, while valuable to squadron and flight commanders in controlling their units, should be kept to an absolute minimum by the group commander. Signals employed by him should apply only to the most important phases of the mission. All signals must be simple, clear, and instantly understandable.

■ 104. COMBAT DISPOSITION.—A combat disposition at or above the estimated altitude of the enemy is assumed when the probable scene of action is approached. The commander in disposing his forces bears in mind the altitude desired, distance for rapid concentration, and mutual support.

a. Pursuit versus pursuit operations.—(1) *Security detachments.*—In operations where pursuit opposition may be expected, the group places security detachments to the front, flanks, and above the main body. The relative position of these detachments depends on visibility conditions. They should be far enough out to prevent surprise attacks or an unexpected collision with the enemy. The duties of these detachments are to search for the enemy, prevent surprise attacks on the main body, and when contact is made to direct the main body to the enemy or, if contact is to be

avoided, draw the enemy away from the main body. For this reason it is essential that communication be maintained with the main body. The security detachments normally are flight elements dispatched from one squadron. After the main body is committed to the attack the security detachments assemble over the scene of combat and join the reserve.

(2) *The main body.*—The assault echelon is the guide for the entire formation. The support and reserve echelons, taking position above and slightly to the rear of the assault echelon, conform to its movements and remain in quick supporting distance at all times.

b. Pursuit versus bombardment.—In operations against bombardment formations, where normally no pursuit protection is expected, security detachments are not necessary. However, a part of the group is thrown out in front of the main body for conducting search. The strength of the search force is dependent upon the amount of information available as to the enemy location and movements. If little information is available, the entire group may assume the search formation with squadrons echeloned laterally and in altitude. The squadron making contact with the enemy reports, immediately reassembles, and takes up the main assault position from the rear. The remaining squadrons assemble and take up positions to the flanks. If equipped for bombing, one squadron takes a position above and initiates bombing attacks.

■ 105. ATTACK ON FORMATIONS.—*a. Pursuit formations.*—Surprise attacks by a group on a hostile fighter formation will seldom be effected. When the enemy fighter formation is contacted and combat is to be initiated the security detachments assemble with the reserve echelon while the main body maneuvers for position.

(1) Upon equal or inferior numbers the initial attack is made by the assault and support echelons in a rapid succession with the aim of causing the maximum casualties and disrupting the formation. If disruption of the enemy formation occurs, superior numbers are used to overwhelm the disrupted elements. The reserve, meanwhile, retains its altitude over the scene of combat under control of the group commander. It is not committed until needed to support

the assaulting units or cover their withdrawal. The reserve never sacrifices its tactical advantage of altitude until committed to action. When the enemy is completely demoralized and scattered the reserve is used to complete the destruction. If it is not committed it acts as the rally point for the units that have been in action.

(2) *Against superior numbers.*—The group will use "hit and run" or harassing tactics upon the rear from superior altitude, attacking by chain of squadrons. In using tactics of this nature the group must remain fairly compact and under complete control. Sustained combat should be avoided.

b. Bombardment formations.—Pursuit attacks on bombardment formations are predicated upon the type of defensive formation employed; that is, whether it is a compact formation employing supporting fires of all defensive armament or a loose formation in which all defensive fire is not supporting.

(1) *Compact defensive formations.*—This is the least maneuverable of all defensive formations. In this case the aim of pursuit is to cause as many casualties as possible with the initial assault and to disperse the formation. The four-squadron group disposes itself about the defensive formation in the following manner:

(*a*) The assault squadron takes up a position in rear, conforming closely to the speed of the hostile formation, and delivers concentrated fire from effective ranges either by waves of flights or by squadron concentration.

(*b*) One squadron, if equipped with time fuze or fragmentation bombs, may take a position well above and initiate time fuze or dive bombing attacks on the defensive formation.

(*c*) The remaining two squadrons take up flank positions out of effective range of the defensive guns and by flank attacks harass the enemy and draw some of the defensive fire. If the enemy maneuvers to evade fire, the flanking squadron from which the turn is made becomes the main asasult squadron, while the other flanking squadron and the former assault squadron take flanking positions. This attack is sustained, squadrons rotating in a prescribed order,

until the enemy is dispersed, destroyed, or the attackers' ammunition is exhausted.

(2) *Extended defensive formations.*—(*a*) Extended formations are those that have considerable interval between units but are not out of supporting range of the nearest units. Extended bombardment formations possess greater maneuverability for the individual units than does the compact defensive formation although the supporting fire is not so effective. Their main reliance for security in this case is maneuverability. The pursuit group concentrates its attack on the outermost unit or, in situations where they are relatively small, on the two outer units.

(*b*) The method of attack is similar to the attack on a compact formation except that the flanking unit toward the supporting fire takes position at an angle to the rear or stays out of combat in some convenient location ready to rotate with the assault unit. If the attacked units close in to a compact formation, the method of attack for that formation is adopted.

(3) *Dispersed defensive formations.*—Dispersed formations are those in which the subunits are out of supporting distance of each other. Dispersion may have been a result of an attack, weather and visibility conditions, or for some other reasons. This condition is ideal for a pursuit group and is one that it strives for in all attacks. The group commander in such situations directs sufficient force for the attack on each dispersed unit to insure its complete destruction in the shortest time. The attacks on dispersed units are sustained until complete destruction in detail is attained. In case the enemy closes up the formation for mutual protection, as he most assuredly will attempt to do, then concentrated attacks are again resorted to for attrition and dispersion.

■ 106. THE RALLY.—A pursuit group after combat may rally in the following ways:

a. Upon a disengaged unit.

b. Upon the group commander's element.

c. Over a point or locality and at a designated altitude.

d. To a flank or to the rear of the target.

SECTION VIII

PURSUIT DEFENSIVE TACTICS

■ 107. GENERAL.—Pursuit can be placed on the tactical defensive only by enemy pursuit. In air fights against all other types of combat aviation, pursuit possesses the inherent advantage of the initiative, that is, ability to fight or withdraw at will due to superior performance.

■ 108. AIM.—The aim of a pursuit force fighting on the defensive is to regain the offensive as soon as possible. All defensive formations and maneuvers are based on that aim.

■ 109. SINGLE AIRPLANE.—Every effort is made by the defending pilot to secure the advantage of altitude. In event of attack from the rear and above, a rapid change of direction toward a point beneath the attacking airplane is made and climb started. Each time the attacker turns, the defender turns in the opposite direction until equal altitude is attained. Careful flying of the airplane will materially aid in gaining altitude and outmaneuvering the opponent. The defending pilot should keep oriented with respect to friendly terrain and endeavor to maneuver toward friendly terrain and ground forces.

■ 110. FLIGHT.—*a.* The defense of any formation is based on maneuvering that brings effective fire to bear upon the attacking force. Every defensive maneuver must have as its objective the gaining of a position from which the offensive may be assumed.

b. The pursuit flight is forced on the defensive when attacked from above and the rear. It then has the choice of numerous defensive maneuvers, the selection of the most effective one depending upon such variable conditions as the time available before coming under effective fire, meteorological conditions, knowledge of hostile tactics, disposition, performance characteristics and size of the attacking force, and availability of friendly supporting forces. A very effective maneuver consists of reversing the direction of the flight so as to meet the attack head-on. As the hostile force passes overhead, another reverse is rapidly executed. By this

maneuver the enemy's initial advantage of position may be neutralized, and by carefully outflying the enemy the advantage of altitude may be attained.

c. When a flight is attacked by an inferior force, an effective series of defensive maneuvers consists of rapidly increasing the distance between elements. This maneuver deprives the enemy of the opportunity for attacking a concentrated target, forces him to select a definite target, and provides more maneuver room for the units of the defensive flight. Succeeding maneuvers of the defensive flight depend upon the enemy's choice of a target, but generally it will be found that at least one element will be in position to turn into and fire upon the attacking force.

d. When supporting forces are in the vicinity a defensive maneuver which may be used is the Lufberry circle. Each airplane covers the one directly ahead, making an attack by small forces extremely hazardous. This maneuver should be used only when supporting forces are in the vicinity, as it is difficult for the defensive force to assume the offensive from a Lufberry unless aided by supporting forces.

■ 111. SQUADRON.—*a.* In the presence of enemy pursuit the pursuit squadron uses a chain formation with the flights echeloned in altitude. If practicable, the reserve echelon flies at or above the altitude where hostile pursuit is expected. This disposition precludes the simultaneous surprise attack of more than one flight. The flight that is attacked rapidly maneuvers so that the remaining flights are placed in a position of tactical advantage and may assume the offensive.

b. The first consideration of the attacked unit is to avoid the enemy's fire. It may dive toward the other supporting units, it may turn rapidly into the attacker, or it may assume a Lufberry circle until the other units can arrive and give friendly support.

c. Each unit strives to retain its tactical unity and so maneuver that the most effective fire can eventually be turned toward the enemy.

d. When a superior hostile force is encountered, the commander will endeavor to avoid combat if the mission permits.

If the mission requires combat, an attack is launched regardless of inferiority of numbers.

■ 112. GROUP.—If for any reason the group should be placed at a tactical disadvantage, either by a superior force or by a surprise attack, immediate steps must be taken first to evade enemy fire and then to assume the offensive. The echelon(s) that receives the attack dives or maneuvers toward the disengaged units, evading the enemy fire meantime by flying an erratic course. This action is taken to permit one of the supporting echelons to gain a tactical advantage over the enemy and take up the offensive against him. The remainder of the squadron rapidly gains altitude and position to support the fighting echelons. If and when tactical equality or superiority is gained, the group commander has the choice of continuing the fight or withdrawing as the situation demands.

CHAPTER 7

TACTICS OF AIRCRAFT FIGHTING DEFENSIVELY

■ 113. GENERAL.—*a.* The air fighting tactics employed by bombardment and reconnaissance and observation aviation forces are based upon maintaining the integrity of command during the execution of their primary missions of air attack and air reconnaissance and observation.

b. The success of these forces in their operations is measured by the efficiency with which these missions are performed. For this reason they habitually avoid air fighting whenever it is possible to do so without jeopardizing the success of their missions.

■ 114. EVASION.—The ease of evasion in air operations serves as an advantage to the penetrating force in avoidance of the opposition of the enemy fighting force. Routes and the timing of operations will be planned to favor evading enemy pursuit aviation. Localities where the enemy fighting force is active, or that are likely to contain observation stations, are avoided so far as possible, and the mission is conducted so that the command is exposed to interception for a minimum period of time. Camouflage, darkness, cloud formations, poor visibility, altitude, circuitous routes, and speed are factors that may be utilized in various situations to favor evasion.

■ 115. SECURITY OF DEFENSIVELY FIGHTING FORMATIONS.—*a.* The fighting strength and security of a defensive formation are affected by—

(1) Quality of leadership.

(2) Discipline and cohesion of the formation.

(3) Skill, alertness, initiative, and indoctrination of the air gunners.

b. A bombardment formation can develop a formidable concentration of fire which, combined with effective tactics and a high standard of discipline, provides it with great

power of resistance to pursuit attack. Since the cohesion of a defensive formation is so essential to its protection, the enemy will endeavor to disorganize it in order that it may be defeated in detail. This must be strongly resisted.

c. Every effort must be made by the defensive formation to provide security against surprise. This is best achieved in the air by a proper disposition of aircraft and by the constant use of a well-planned system of protective observation covering all possible avenues of enemy approach.

d. Recognition by all individuals of the command of the futility of an attempt by individual airplanes to avoid the effect of fire by escape or by taking cover tends to preserve the integrity of the force.

■ 116. SINGLE AIRPLANE.—*a. Combat type.*—When a single combat type airplane is attacked by hostile pursuit it maneuvers in order to bring the greatest number of guns into play against the hostile unit. It operates at the maximum speed in order to reduce the speed margin available to the attacker.

b. Reconnaissance and observation type.—(1) Aircraft designed primarily for reconnaissance and observation with the ground forces are usually limited in performance because of the special characteristics required for the execution of their normal tasks. The armament generally comprises fixed forward firing guns and flexible guns in the observer's cockpit. This disposition of guns permits either offensive or defensive tactics in the conduct of air fighting. The object of such fighting is always the preservation of the aircraft and crew in the execution of missions. For this reason air combat is not initiated by this type of aircraft.

(2) If attacked by hostile aircraft during limited penetrations of enemy territory, every effort is made by maneuver to carry the fight to a position over friendly ground forces. When over friendly territory, maneuvers should be conducted that place the airplane at an altitude which denies attack from beneath and favors support from small arms ground fire.

■ 117. FORMATIONS.—When combat cannot be avoided, defensive forces seek to arrange their elements so as to concentrate maximum fire against successive threats in the order

of their immediate importance. The elements of the formation are so disposed or maneuvered as to prevent or minimize the possibility of enfilading fire being directed against two or more elements.

a. Speed and movement.—The defending command normally operates at maximum formation speed in order to reduce the speed margin available to the attacker. It may use turns or irregular movement to disrupt the simultaneous assaults of fighter aviation and to induce a series of attacks against which fire can be massed successively. Since movement will interfere with the stability of the gun platforms, the degree of such movement should be restricted during the times fire is being delivered.

b. Fire and vulnerability.—The commander endeavors to deliver the maximum fire while presenting minimum vulnerability. Maximum flexibility of massed defensive fire requires the close grouping of fire weapons with consequent reduction in ease of maneuver. The commander must adapt his tactics to meet immediate needs. When attacks at short ranges may be expected from several directions, the close grouping of defensive weapons is most effective. At long ranges the vulnerability of the massed formation exceeds the relative advantage of massed defensive fire. During long range attacks security may be improved by increased spacing and erratic maneuvering of units. The formation must be prepared to close rapidly in event the attacker closes in. Formations which offer the minimum target to the enemy while uncovering the maximum number of guns should be employed in defensive tactics.

c. Bombing attacks by hostile pursuit.—Time fuze bombing attacks launched by hostile fighters from a horizontal approach should be avoided by changing course, airspeed, and altitude as the attacking unit approaches a position for bomb release. Dive bombing attacks should be opposed by gun fire and maneuver.

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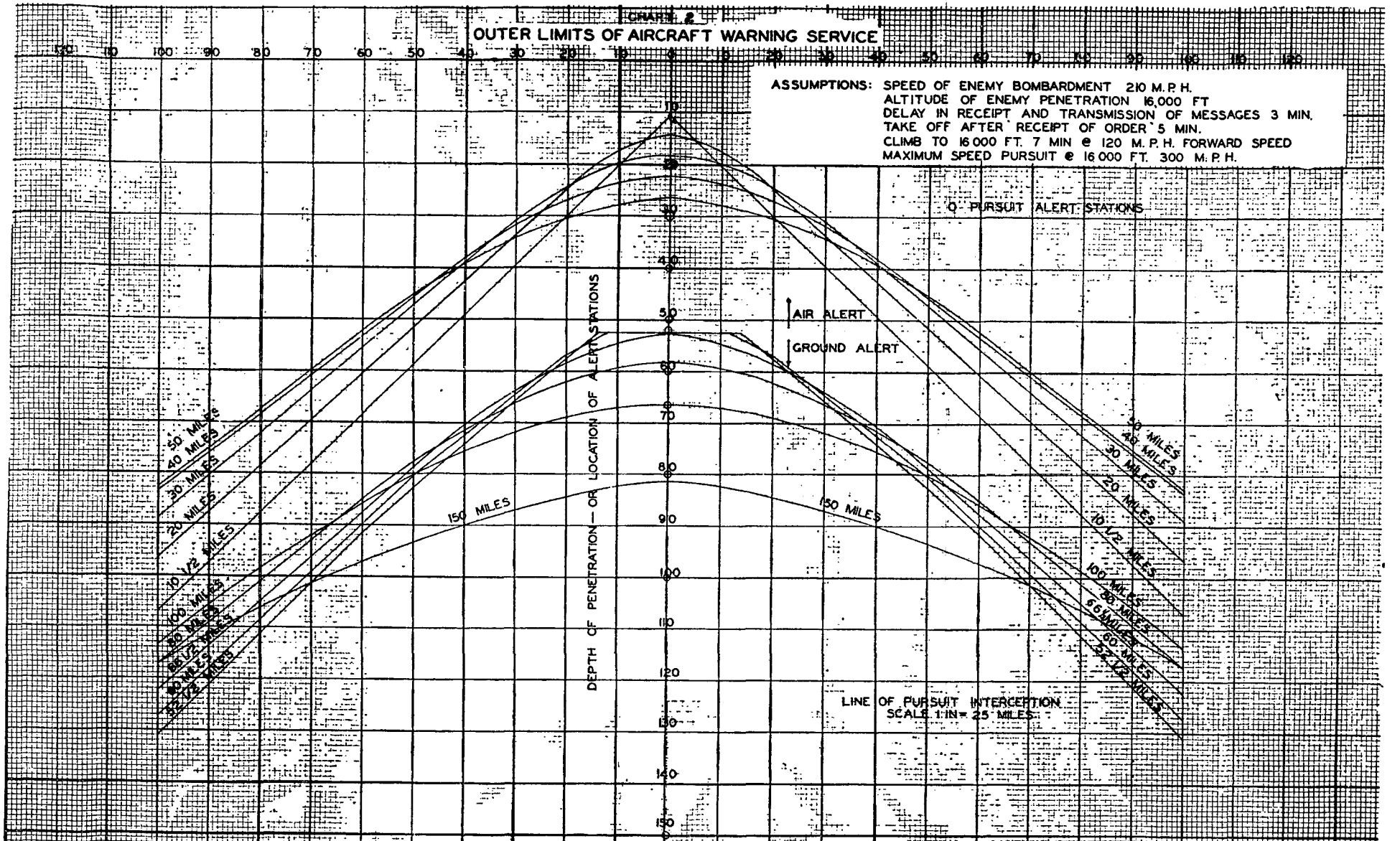

FIGURE 1.—Line of pursuit interception.