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# Fighter Missions

To use a fighter as a fighter-bomber when the strength of the fighter arm is inadequate to achieve air superiority is putting the cart before the horse.

Lt. General Adolph Galland, Luftwaffe

The primary mission of fighters is air superiority; that is, ensuring use by friendly aircraft of the airspace over critical surface areas, and denying use of that airspace to the enemy. Control of the high ground has always been one of the fundamentals of warfare. Airspace control allows strategic and tactical bombing, close air support of troops and armor, airborne or surface reinforcement and supply, reconnaissance, and other missions vital to the success of any military operation. Although no war so far has been won solely on the basis of air power, the advent of nuclear weapons certainly lends credence to this possibility for future conflicts.

The value of air power became evident in World War I, when airplanes were in their infancy. The airplane did not play a pivotal role in the outcome of that conflict, but by the early days of World War II it was inconceivable that any major military operation could succeed without first achieving air superiority. This evolution was brought about primarily by the quantum increases in firepower and destructive capabilities of the aircraft that were developed between the wars.

The most important branch of aviation is pursuit, which fights for and gains control of the air.

Brig. General William "Billy" Mitchell, USAS

During World War II, the devastating tactical bombing and close air support by the German Luftwaffe during the blitzkrieg attacks on Poland, the Low Countries, and France provided early evidence of the effectiveness of air power. The importance placed on air superiority is obvious in the German decision to cancel the invasion of England after the RAF could not be defeated during the Battle of Britain. The value of air superiority was shown again by the ability of the American bombers to prosecute daylight strategic bombardment of Germany and Japan late in the war. Since that

conflict, air superiority has continued to play the decisive role in conventional warfare. Only guerilla conflicts seem to be resistant to the crushing weight of air power, which may be one of the primary reasons behind the recent popularity of guerilla strategies.

A soldier who is familiar with his weapon can only achieve a maximum effect with it when he believes in the way it is tactically employed.

Lt. General Adolph Calland, Luftwaffe

The major military attributes of the airplane, namely, speed and freedom of movement, are best suited to offensive action, as it is very difficult to defend against an attack that can come at any time, with very little warning, from essentially any direction. These same attributes, however, make the airplane one of the most effective defensive weapons against airborne attack. Paradoxically, the fighter is an offensive weapon used primarily for defensive missions. Regardless of how offensive the fighter pilot may feel when he is attacking another aircraft, his role in the final analysis is usually defensive. He is defending a target against enemy attack or defending friendly bombers from hostile fighters. Only once in a great while is he assigned the tasks of interdicting enemy airborne supply and transport aircraft not directly involved in hostile action or simply ranging over hostile territory in search of targets of opportunity. Missions such as these, however, are best suited to the military advantages of the fighter, and they are covered first in this chapter.

### **The Fighter Sweep**

The fighter pilots have to rove in the area allotted to them in any way they like, and when they spot an enemy they attack and shoot him down; anything else is rubbish.

Baron Manfred von Richthofen

A fighter sweep is a mission flown generally over hostile or contested territory for the purpose of engaging and destroying enemy fighters or other airborne targets of opportunity. The fighter sweep is designed to establish air superiority by denying the enemy use of the airspace for his purposes, and to make the airspace safer for use by friendly forces. Thus, the fighter sweep can be carried out for either offensive or defensive purposes, but because the conduct of this mission allows the fighter pilot to seek out and attack other aircraft from a position of advantage, it is offensive in nature and is well suited to the inherent offensive character of the fighter. The sweep, therefore, is the preferred fighter mission, and fighter tacticians should employ sweep techniques whenever possible in conjunction with other missions. This concept is explored in greater depth throughout this chapter.

An air force is, according to its intrinsic laws, by nature an offensive weapon. Air supremacy is of course essential for this. If this has been lost then the fighter force has to be strengthened first of all. Because only the fighter force can achieve this essential supremacy so that the bomber and with it the entire air force can go over to the offensive once more.

Lt. General Adolph Galland, Luftwaffe

*Scenarios*

Since the usual objective of the fighter sweep is to engage enemy fighters, it is logical for such sweeps to be conducted in areas expected to have a high concentration of hostile aircraft. From World War I to the latest conflicts, the favorite target for fighter sweeps has probably been enemy fighter bases. A surprise fighter attack on an unsuspecting airfield conducting routine flight operations can be utterly devastating. Some aircraft are taking off, often in tight formations, and are climbing at low altitudes and slow speeds; others are circling to land, in dirty configuration, low on fuel and ammo, with exhausted pilots. The enemy pilots are over friendly, familiar ground, and they are generally less vigilant.

An airplane on the ground, full of fuel and ammunition and unable to evade or shoot back, was a sitting duck and one of the most vulnerable of all military targets, and . . . most of its life was spent in this position.

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

In addition, aircraft are quite often caught on the ground, where they are "sitting ducks," taxiing or being refueled and rearmed between missions. Undoubtedly it is best to attack an enemy aircraft when it is on the ground. Unfortunately, many modern air-to-air weapons are ineffective against surface targets. For this type of mission, therefore, even the true fighter pilot might consider hauling some token air-to-ground ordnance. (If everybody does it, it doesn't look so bad.) An alternative is to take along some fighter-bombers, which can concentrate on the surface targets but have the ability to defend themselves credibly or even to join in the air-to-air fun after unloading their other baggage. This is not the time, however, to saddle the fighters with escort duty.

Ability to attack surface targets is an essential element of a fighter sweep against an enemy airfield. Otherwise any aircraft on the ground, and those that can get there quickly, have an effective sanctuary. Recognizing their disadvantage in the air, the enemy pilots have little inducement to come out and play, but for some reason, fighter pilots seem to prefer even the short end of a one-sided air battle to eating mud with bombs falling around their ears. A single bomb on the local pub often turns the trick. The fighter pilots who survive this attack should be blinded by rage and make for easy airborne targets.

Aircraft on the ground are not always easy scores, however, as they can be dispersed, camouflaged, and stored in hardened bunkers. In addition, because of the value of airfields and the likelihood that they will be attacked, these installations are often among the most heavily defended by surface-to-air weapons. Against such defenses, fighter sweeps are best limited to one quick pass with the intent of taking out easy targets and retiring before the ground defenses have time to react. Hit-and-run attacks can be repeated often, generally with better results than are obtained by a smaller number of sustained attacks.

A squadron commander who sits in his tent and gives orders and does not fly, though he may have the brains of Solomon, will never get the results that a

man will, who, day in and day out, leads his patrols over the line and infuses into his pilots the "esprit de corps."

Brig. General William "Billy" Mitchell, USAS

Another likely opportunity for a Fighter sweep is over a surface battle, which is often accompanied by ground-attack aircraft that make tasty targets as they go about their revolting chores. Enemy transport, reconnaissance, and liaison aircraft can also be expected to be in this area. These are all very lucrative targets because of their vulnerability and their direct participation in a surface battle. Under such circumstances enemy fighters should be avoided as long as more favorable targets are available, unless these fighters are a menace to friendly aircraft.

Enemy fighter sweeps can be expected in these areas for the same reasons. It is usually good policy, whenever hostile fighters may be encountered, to split the friendly forces into low- and high-level elements. The majority can work at a low level, where more of the high-value targets are likely to be found. Low-altitude flight often makes these targets easier to see, as they are silhouetted against a light-colored horizon.

The duties of the high-level element in this scenario are largely defensive. These aircraft should remain in a comfortable supporting cover position, guarding against attack by enemy fighters on the low-level element or on other friendly aircraft in the area. In general, they should avoid contact with nonthreatening aircraft. A radio warning should be issued to any threatened friendly; this may suffice, and it is generally preferable to actual engagement with the hostile fighters. If it is required to leave its defensive station, the covering element should notify the low element of the situation and solicit help if necessary.

The greater altitude of the high element may allow it to serve as a radio relay from friendly GCI or command-and-control centers. This element can also usually make better use of on-board radar equipment. These advantages, plus a better overall view of the battlefield, may allow the high element to direct the low element to target opportunities. Because of these factors, when more than one type of fighter is available, the type with the more sophisticated radar and communications equipment is normally assigned high-cover duties. This aircraft should, however, have good air combat capabilities, since it is more likely to engage hostile fighters. These two qualities may call for a mixture of fighter types to be employed on high-cover assignment.

In general in this scenario, as in many others, either very high or very low is the place to be, although the high element may be limited in altitude if it is to provide effective visual support for the low element. Low, middle, and high elements might be preferable in this case, depending on available numbers and surface defenses. Aircraft at medium altitudes are usually very easily detected and engaged by both surface-to-air and air-to-air weapons. Battlefields are notorious for heavy low-altitude air defense. Aircraft recognition has never been one of the soldier's strong suits, and low-flying aircraft are regularly fired on by both sides. It may be more practical under these conditions to keep the entire fighter force at high

altitude, detaching small elements as necessary to descend for slashing attacks on low-level targets and then return to the fold.

The purpose of some fighter sweeps is simply to find and engage enemy fighters in a given airspace. Generally these missions are conducted over hostile or contested territory, so the tactics developed for the few-versus-many and many-versus-many scenarios are usually applicable. Quite often the enemy's GCI and command-and-control networks will be superior to friendly capabilities in these areas, so the unexpected attack should be guarded against. The basics include high speeds and very high or very low altitudes, depending on surface defenses, environmental conditions, and relative aircraft and weapons-system performance. Friendly fighter pilots must use every means at their disposal to achieve surprise, and they must approach an engagement with the intent of attaining the first shot opportunity. Whether engaging in sustained maneuvering or employing hit-and-run tactics is called for depends on the factors discussed in the previous chapter. "Slash-and-dash" methods are often preferable when friendlies are facing enemy forces superior in number or quality. The size of the friendly force should be tailored, when possible, to be equivalent to or larger than the expected hostile formations. Dividing the force into engaged and covering elements is usually most efficient when the enemy is greatly outnumbered in any engagement. If friendlies are forced to engage against superior numbers, loose deuce or gaggle tactics tend to even the odds.

Fuel state is often a critical factor in a fighter sweep. The aircraft are often deep into hostile airspace, and they can be very vulnerable if the pilots are unable to avoid extended engagement or if the aircraft are attacked on the way home. One effective technique used to alleviate this problem is multiple, independent sweeps in the same area, with entry into the combat zone staggered by several minutes. This ensures a supply of fresh fighters in the area to assist in the retreat of other friendlies and to take advantage of retiring enemy forces. The last flight to enter the arena in this scheme is devoted to defense. These aircraft should make one pass through the area, avoiding contact with the enemy if possible, make sure that all friendlies are headed for home, and then depart as rear guard at a high fuel state.

One notable example of the use of this tactic was the staggered (usually every five minutes) fighter sweeps by U.S. F-86s to the Yalu River area during the Korean conflict. These missions stretched the range of these aircraft to the limit, and dead-stick, flamed-out approaches were almost routine on return to base.

A possible complication with the use of this tactic arises when the friendly fighters have beyond-visual-range weapons capability. In order to make full use of this capability, and possibly to avoid allowing the enemy to achieve the first shot should they be similarly equipped, it is necessary to identify BVR targets as hostile at the maximum range of the available weapons. If targets cannot be reliably identified at such ranges, either visually or electronically, then it may be necessary to "sanitize" the combat arena of all friendly forces. This means making sure that no other

friendly aircraft can be in the combat zone during the sweep, so that any target detected can be assumed to be hostile. Sanitizing can be very difficult in practice, requiring coordination not only within the friendlies' own air forces, but also, possibly, with other combatant forces and neutrals. Such coordination may be impractical from a time or a security standpoint. Even if this ideal condition can be achieved, only the first wave of attacking fighters can take advantage of it, limiting the desirability of multiple, staggered waves in a fighter sweep.

Two of *Kitty Hawk's* [U.S. Navy carrier] fighters were making a sweep somewhere out there and the Air Force had fighters just north striking Yen Bai. We were obliged to see the bogey aircraft before shooting, virtually eliminating the head-on potential of the *Sparrow* missile system.

Commander Randy "Duke" Cunningham, USN

One of the most effective fighter-sweep tactics involves staging a simulated air strike against a high-value surface target. Fighters armed strictly for air-to-air engagement can imitate bombers by employing typical bomber formations, altitudes, and airspeeds while following expected attack routes toward an enemy target. The ruse can be as simple or as elaborate as necessary, even including deceptive communications, EW, and supporting aircraft. Once the enemy fighters have been confirmed (usually by a supporting source) to be airborne in defense against the false strike, the friendly forces can redeploy for more aggressive, offensive capability and spring the nasty surprise. Good electronic surveillance of the combat arena and adequate command-and-control are desirable, if not required, for this tactic, however, to avoid an equally nasty surprise by the enemy prior to redeployment.

### *Control of Fighter Sweeps*

Command, control, and communications (C<sup>3</sup>) are critical elements in the success of a fighter sweep. Often the combat arena is very large and contains many aircraft, both hostile and friendly. The ability of friendly fighter pilots to find, identify, and engage high-value hostile targets while avoiding potential threats, or at least engaging these threats from a position of advantage, rests in great measure on relative C<sup>3</sup> capabilities.

Now [in the Battle of Britain] fighter squadrons could be used economically, so that the cathode tube [radar] had the effect of multiplying the fighter strength several times.

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

Supporting radar surveillance may be provided by surface-based GCI or airborne AIC controllers. Depending on tactical philosophy, these "controlling" agencies may have absolute authority to dictate every action of friendly fighters, including headings, altitudes, speeds, attack and firing clearances, and bugouts, or they may act merely as an advisory service, passing along real-time intelligence information and monitoring the progress of the battle. Something of a middle-ground approach seems to be more successful, depending on the relative capabilities of the controlling

agency and the fighters themselves. It should be kept in mind that the "controllers" support the fighters, and not vice versa. All parties should recognize that, although the controllers often have a better grasp of the big picture, overall success and failure are decided by many small engagements. Generally the fighter crews themselves are in the best position to judge the critical factors and rapidly changing events in close proximity to the enemy.

There are essentially only two types of radar control: close and broadcast. Under close control the duty of the controller usually is to direct the pilots into a tactically advantageous position to attack or identify a target. In order to accomplish this task, the controller generally must monitor the positions of the fighters and the target. He then transmits relative range and bearing of the target to the fighters, and he may dictate or recommend (depending on philosophy) intercept headings, speeds, altitudes, etc. The primary purpose of the controller in this scenario is to position the fighters favorably so that the pilots can acquire the target, either visually or with their own self-contained sensors, facilitating identification or attack. If identification of an unknown contact is the purpose, the pilots may be required to perform either a visual identification or an electronic identification (EID), using onboard equipment. Depending on the outcome of the identification, the fighters may then be cleared by the controller (or by prearrangement) to attack a hostile target, but final attack procedures should be left to the pilots. During the close-control intercept process, the controller is also responsible for advising the pilots of any additional contacts that might pose a threat or that might be of higher attack priority than the original target.

In broadcast control the controller generally gives the position, and other relevant information as available, of any hostile or unknown targets in a given area, relative to one or more geographical or navigational fixes within that area. The reference point is known to the friendlies, as is their own position relative to that point. As the controller calls target positions and movement relative to the reference, the pilots can calculate their own position relative to the target, and they may be assigned by the controller to conduct their own intercepts based on this information. Unlike with close control, no group of fighters gets individual attention, but all pilots in the area get the same information and can react to it offensively or defensively. Specific fighter formations are generally assigned by the controller in real time to investigate a given contact, or each fighter element may be briefed to prosecute any contact in a given region.

Close control is usually preferable for fighter-sweep operations, since it offers the fighters the greatest offensive capability. Once the pilots have their own visual or radar contacts, the close controller should generally revert to providing an advisory service. His function then is to monitor the progress of the intercept and the ensuing engagement, warn of additional hostile or unknown contacts that may be a factor, give rejoin assistance to pilots who become separated from their wingmen, recommend egress headings, etc. During this period it is critical that only essential or re-

requested information be passed over voice radio frequencies; the pilots must have those limited frequencies for their coordination purposes.

Regardless of its advantages, close control may not always be possible or practical. Limitations on controllers or control frequencies may lead to saturation of a close-control system with large numbers of separate enemy and friendly formations. Broadcast control may be better suited to such situations. A combination of these two systems may also be useful. For instance, broadcast control can be given over a common fighter frequency, while selected fighter formations may be switched to a separate close-control frequency during intercepts and engagements as controllers and frequencies become available.

Because of their dependence on communications, command and control are very vulnerable to comm-jamming. Aircrews and controllers should both practice communications brevity, and they should be briefed on alternate control frequencies. Data link and jam-resistant radios can be very valuable. In addition, the tactics employed must not be so dependent on external control that pilots are helpless without it. Just such a condition contributed greatly to the Syrian debacle over Lebanon's Bekaa Valley in 1982. "Spoofing," or intrusion, is another C<sup>3</sup> consideration. This is the tactic by which an enemy controller operates on friendly control frequencies and attempts to "steal," divert, or confuse pilots by issuing false instructions. Coded authentication procedures offer some protection against this trick, but they can be cumbersome and are not foolproof. A better defense against intrusions, when practical, is for the fighter crews to be intimately familiar with the controller's voice.

For fighter aircrews and controllers to work most effectively together as a team, each must know the tasks, problems, and limitations of the other. When this is not the case, friction is likely to develop when aircrews do not receive the information they believe is necessary and controllers believe their instructions are not properly followed. Probably the only solution to this problem is for aircrews and controllers to work, live, eat, and play together, so that they know each other well enough to work out these inevitable differences. Even better, fighter crews should be cross-trained as controllers, and each crewman should take his turn in the barrel on a periodic basis, maybe daily or weekly. Unfortunately, most fighter pilots will resist this idea, even with their last breath, whispering something about the high wing loading of a radar console! Threat of transfer to a bomber outfit will usually induce compliance, however.

### **Point/Area Defense**

Orders to protect fixed objects are very much disliked by fighter pilots. Their element is to attack, to track, to hunt, and to destroy the enemy. Only in this way can the eager and skillful fighter pilot display his abilities to the full. Tie him to a narrow and confined task, rob him of his initiative, and you take away from him the best and most valuable qualities he possesses: aggressive spirit, joy of action, and the passion of the hunter.

Lt. General Adolph Galland, Luftwaffe



As previously discussed, the aircraft is primarily an offensive weapon. Its speed and freedom of movement make defense against airborne attack a very difficult task, and these qualities of an airplane usually confer advantage to the offensive forces. The same qualities, however, make the fighter one of the most effective defensive systems for countering airborne strikes. In conjunction with high-quality C<sup>3</sup> networks and strong surface defenses, fighter/interceptors can make life very difficult for attacking aircraft; but it is not possible, in general, to seal the airspace around a given point completely. Skilled, determined attack by state-of-the-art equipment will normally succeed in penetrating even the most ardent defense.

Space in which to maneuver in the air, unlike fighting on land or sea, is practically unlimited, and . . . any number of airplanes operating defensively would seldom stop a determined enemy from getting through. Therefore the airplane was, and is, essentially an instrument of attack, not defense.

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

When faced with attack by conventional (i.e., non-nuclear) forces, the goal of the defenders is usually to make an attack so costly for the enemy that he is either unable or unwilling to strike again. Although some attackers may get through, the assumption is that target damage will not justify the heavy loss rate of enemy aircraft and crews. Obviously, if the one that gets in is armed with a "silver bullet," this strategy may not be effective. Fortunately, as the weapons become more lethal, they and the aircraft that deliver them become more complex and expensive, so that the number of attackers involved in a nuclear strike is likely to be reduced. This factor gives the defense a better chance to stop all the attackers, but it would still be poor headwork to pitch one's tent on ground zero.

"He who wants to protect everything, protects nothing," is one of the fundamental rules of defense.

Lt. General Adolph Galland, Luftwaffe

Two distinct types of air attack are considered here: the penetration strike and the massed attack. The penetration strike involves one or more attacking aircraft which normally fly singly or in small formations and attempt to penetrate the defense network undetected, strike the target, and depart from hostile airspace before they can be caught. Quite often many penetrators will follow individual tracks to the same target, maintaining very rigid time schedules so as to arrive on target nearly simultaneously from different directions to saturate the defenses, and then retire again by separate routes. Normally the penetrating aircraft are small fighter-bombers, which fly at very high speeds at low altitudes to avoid radar detection. Conventional strikes of this type may involve large numbers of penetrators, while nuclear attacks are generally limited to one bomber per target. In either case this can be a very difficult tactic to defend against.

It is not possible to seal an air space hermetically by defensive tactics.

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

The massed attack is much more straightforward, usually comprising a formation of bombers flying close together, World War II-style. The attackers' intent is usually not to evade detection, but to rely on high speed and/or high altitude to limit their exposure to defensive weapons. Quite often they plan to fight their way to the target and back home with the aid of ECM, the concentrated power of their own defensive armament, and possibly heavy fighter escort. This is a brute-force attack and is almost invariably conventional.

Defending fighters, in general, can employ one of two concepts: the combat air patrol (CAP) or the ground-alert interceptor (GAI). The CAP is an airborne standing patrol positioned so as to facilitate interception of possible inbound or outbound raids; the GAI waits on the ground until attackers are detected and reported by the C<sup>3</sup> network, then "scrambles" to intercept. A third concept is actually an offensive approach to a defensive problem: the defenders make-a fighter sweep of the enemy's airfield which is timed to coincide with the departure or the return of his strike force. Any of these three concepts can be employed singly or in conjunction to form the fighter defenses. Together with the surface defenses and the C<sup>3</sup> network, the defensive fighters form what is termed an integrated air-defense system (IADS).

It has been demonstrated recently beyond a doubt that the best antiaircraft defense is pursuit aviation.

General H. H. "Hap" Arnold, USAAF

The fighter's primary assets in air defense are its range and flexibility. Fighters can usually engage the enemy farther from the target than the surface defenses can—the fighter sweep is the extreme example of this capability. Fighter defenses, unlike fixed surface weapons, can also be shifted from one sector to another very rapidly as needed. This flexibility is invaluable when the defenders are faced with an attacking force that has the speed and freedom of movement inherent to aircraft.

Only air power can defeat air power. The actual elimination or even stalemating of an attacking air force can be achieved only by a superior air force.

Major Alexander P. de Seversky, USAAF

### *Combat Air Patrol*

Whether the CAP or the GAI is preferable in a given situation depends on many factors, including the type of raid expected, the number of targets that must be protected, the degree of certainty as to the attacker's approach route, the amount of warning anticipated, and the numbers and capabilities of the defending fighters. One advantage of a CAP is the probability of interception at greater distances from the target, with presumably more time to inflict damage before the raiders reach their objective. This defensive concept may be necessary if the warning of an attack is expected to be insufficient to allow GAI launch and interception at useful ranges. A prime example of this can be found in attacks by aircraft armed with long-range, stand-off weapons that can be launched many miles from their targets (e.g.,

cruise missiles). It is usually preferable in such cases to engage the attacking aircraft before it reaches launch range, rather than to attempt to find and destroy multiple weapons inbound to the target.

Aside from the time factor, the CAP is best suited to situations when the direction of approach or the route of the attackers is known with some degree of certainty. The volume of airspace which must be covered by one CAP increases exponentially with the distance it is stationed from the target. Since it is unlikely that there will be enough defending fighters to guard all the approaches to a target at a reasonable range, CAPs must be positioned strategically to make the most efficient use of available assets. Likely stations are located directly between enemy bases and anticipated targets; near natural "choke points," such as mountain passes or restricted passages between heavily defended surface points; along likely ingress and egress routes for low-level penetrators, such as in valleys and along mountain ridgelines, coastlines, and rivers; and over natural low-level navigation landmarks, such as coastal inlets and points, lakes, river bends, crossroads, towns, or the end of a ridgeline.

The practical distance from target to CAP station depends largely on the number of defending fighters and the area that must be covered. As the possible threat sector expands, and as the enemy's speed and stand-off weapons range increase, greater numbers of fighters are required to defend a target adequately. Near-, medium-, and long-range CAPs are usually optimum if the numbers of defending fighters are adequate, as this gives depth to the defenses. Surface defenses or GAI often can be substituted for near- and medium-range CAP. Defense is generally more effective when the CAP stations are compressed enough to allow each CAP to cover its entire assigned area reasonably; this is preferable to overextending the defenses just to reach greater distance. The luxury of compressing CAP stations may not be available, however, depending on fighter assets, the extent of the threat sector, and the possibility of stand-off weapons. The effectiveness of the C<sup>3</sup> system and the fighter's own sensors and weapons, as well as environmental conditions, affect the size of the area that can be defended practically by any one CAP.

I was of the opinion that with the existing shortage of fighter aircraft only a central defense rather than an outer defense ring could promise any success. Squadrons and wings of fighter planes in the inner circle was my idea, rather than a few flights in the outer circle.

Lt. General Adolph Calland, Luftwaffe

The practical range of a far CAP is also affected by the aircraft's useful time on station. As distance from base to CAP station increases, station time decreases because of fuel considerations. Airborne refueling capability can be critical to the ability to maintain a CAP at useful distances. Much valuable time is lost when the CAP must return to base for refueling. A refueling requirement also greatly increases the number of fighters necessary to maintain a constant defensive posture.

CAP requirements can be supplemented by the coordinated use of surface defenses. The necessity for near-CAP stations may be eliminated

by installation of heavy surface-to-air defenses around the high-value targets. When they are available, surface defenses can also replace the CAP at likely ingress and egress points. Close coordination is essential between such surface defenses and the fighters, however. "Free-fire zones," in which anything that moves is fair game for surface-to-air weapons, are popular around the surface defenses. The fighters must know where these areas are and avoid them. Another possibility is the use of altitude blocks; in this system, the fighters are free to operate above a given level, and surface-to-air defenses are responsible for low-altitude coverage.

Another consideration for the CAP is altitude. This is usually chosen according to the expected altitude of the threat, but weapons and environmental conditions also play important roles. An altitude advantage over the enemy provides for the diving attack most useful with short-range weapons, while look-up is usually best for all-aspect AAMs and for target detection with most radars. Very low altitude penetrators are often best spotted visually at equally low levels, where they can be highlighted against the light background of the horizon. Fighter endurance performance, which can be critical to maintaining a continuous defensive presence, can also be a factor. In general, prop-driven aircraft achieve maximum endurance at low altitudes, while jets perform better at high levels. Communications and tracking may also be factors in the determination of the cap's altitude. Controllers must maintain radar contact with the fighters if close control is to be provided, and very low altitudes for the CAP may hamper both controller tracking and communications ability.

The most important factor in selecting the cap's altitude is usually the optimization of target detection, without which the other tasks of the CAP are meaningless. This objective is usually best achieved by optimizing  $C^3$ , onboard sensors, or visual factors, depending on the methods considered to be most effective in detecting the enemy under the prevailing conditions.

Once the cap's position and altitude have been selected, there remains the question of patrol technique. It is usually necessary for the CAP to stay in a fairly small area and guard against intruders. The considerations involved here include endurance, optimization of sensor and visual coverage, and defense against attack by enemy fighter sweeps or fighter escort.

Conventional aircraft cannot remain motionless over one point, so they must constantly move around in some manner. Remaining in the same general area normally means turning regularly, which complicates employment of directional on-board sensor systems, as these should ideally be continuously pointed in the direction of the threat sector. Fighters with hover capability may be able to accomplish this, but the penalty is greatly reduced endurance. An orbit around the CAP station is the usual compromise. Two fighters on the opposite sides of a race-track-shaped pattern, oriented as shown in Figure 9-1, can provide almost continuous radar coverage of any threat axis. With greater numbers of fighters on a given CAP station, a Lufbery circle, with fighters spaced about equally around the circle, can provide good sensor coverage in any direction as well as visual defensive mutual support. A single fighter on a CAP station has a difficult problem with a directional sensor system. Usually the race-track

pattern gives the best sensor coverage of the threat sector, but coverage in this pattern generally averages less than 50 percent of total station time. Coverage may be increased somewhat by flying more slowly on the out-bound leg and faster on the inbound leg, but endurance will suffer with this technique. The lengths of the straight-line segments should be maximized and turning minimized in the pattern, as hard or frequent turns reduce endurance. Probably a better technique, when the enemy must be detected visually, is to fly a "figure-8" pattern oriented perpendicular to the threat axis. If all turns are made toward the threat, the defending fighter can stay in one area and never have its tail turned directly toward the enemy. This technique should provide the pilot with continuous visual coverage in the threat direction.

Patrol speed for fighters on CAP station is optimally near max-endurance speed for the given conditions of weight, configuration, etc. This guideline may have to be modified, however, if surprise enemy fighter attack is a probability. Higher airspeeds may be prudent, even with reduced endurance, for defensive maneuvering potential. It is also advisable under these conditions to vary the pattern regularly so that enemy fighter attacks are not aided by the predictability of the CAP.

There are seldom enough aircraft to maintain what the defense would consider an adequate number of CAPs. In order to stretch the available assets as far as possible, the number of fighters assigned to any CAP station is usually small. Two per station, however, should be considered minimal if enemy fighter resistance is expected. The numbers factor is one of the weak points in the CAP defense concept, as small isolated CAPs can easily be neutralized or destroyed by more powerful enemy fighter sweeps or fighter escort. Small CAPs are also usually inadequate to oppose strong massed attacks. Greater numbers are normally required to spread the

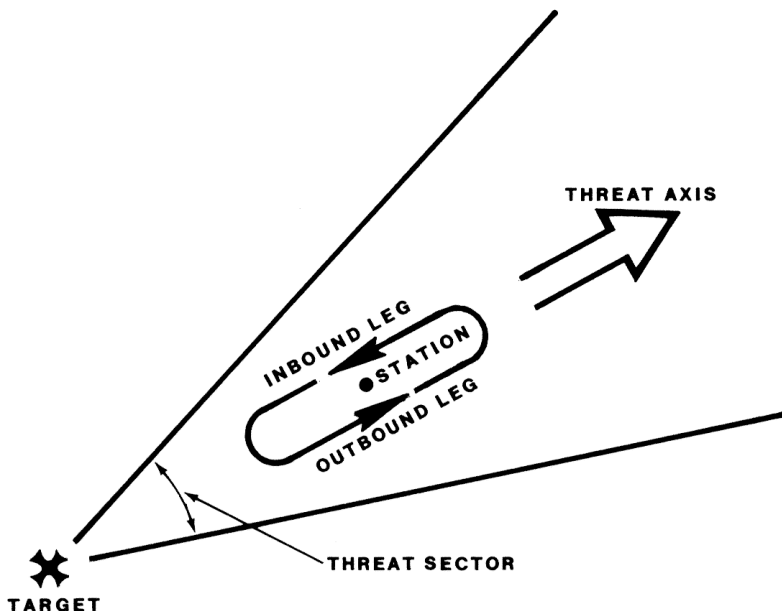


Figure 9-1. Race-Track CAP Pattern

bombers' defensive fire and to deal effectively with the often heavy force of escorting fighters. CAPs are better suited to defending against penetration raids, which are generally composed of small attacking elements that are not accompanied by fighters.

The C<sup>3</sup> network for a CAP defense system can be very complex. Its duties normally include long-range target detection, target identification assistance, assignment of individual CAPs to each raid, long-range intercept control, obtaining from higher authority the clearance to fire on a given target (if clearance is required), and keeping all participants apprised of the current overall defensive situation. When CAPs are committed to various targets, the C<sup>3</sup> system has the responsibility of shifting CAPs from one place to another, committing GAIs, etc., to maintain the integrity of the system and to ensure coverage of the most critical CAP stations. More mundane C<sup>3</sup> tasks include tracking fighter fuel states, allocating airborne tanker assets, and even assisting CAPs in maintaining their assigned stations. When stations are over open ocean or large expanses of trackless desert, etc., the fighters may not have the navigational capability to maintain the prescribed stations, as electronic aids to navigation may be beyond useful range, or they may be jammed, destroyed, or silenced to deny their use to the enemy. A self-contained, jam-resistant navigation capability for each fighter, such as that provided by inertial navigation systems (INS), is invaluable under these circumstances for reduction of C<sup>3</sup> workload. Data-link capability between fighters and controllers provides further workload reduction and increased resistance to enemy jamming. Multiple fighter radios can also aid in reducing frequency congestion.

The best control techniques vary greatly with the defensive situation, but quite often a combination of broadcast and close control provides good results. Broadcast control can be issued on a continuous basis to keep all CAPs updated on the big picture. This information aids the pilots in obtaining their own target contacts, maintaining their defensive posture, and planning for necessary gaps in coverage, such as for refueling. Controllers usually have a better picture of the overall defensive situation than do individual pilots; therefore, under ideal circumstances, pilots should not initiate their own intercepts on contacts which will cause them to leave their assigned station unguarded. When the defense coordinator decides to assign a CAP to a particular target, he should, when it is practical, pass the CAP to another controller and control frequency for close control. It is the coordinator's responsibility to allocate his defensive assets (i.e., CAP, GAI, SAMs, etc.) most efficiently to counter each target track. Individual initiative on the part of the pilots can make this task much more difficult or impossible. Pilots should, however, retain the authority to attack any hostile aircraft penetrating their assigned airspace and to report any sightings or contacts which are apparently unknown to the C<sup>3</sup> system, as determined from monitoring the broadcast-control transmissions.

Contingency plans are necessary for situations in which the C<sup>3</sup> network becomes saturated or communications are jammed. Quite often under jamming conditions the defending pilots can communicate with nearby CAPs, but not with central control. Under these conditions the pilots may

have to coordinate among themselves or even operate independently. To be successful under such conditions, the pilots must be prebriefed and have intimate understanding of the rules of engagement, return-to-base procedures, and the total defensive structure and philosophy.

One of the most important requirements for an active air defense is air intelligence.

Lt. General Adolph Galland, Luftwaffe

The C<sup>3</sup> network is a critical, and often the weakest, link in air defense. As such, its problems are under constant intense study by all major air powers. Some of the more recent advances are effective airborne C<sup>3</sup> platforms and the integration of satellites into the system as communications relay and sensor platforms. C<sup>3</sup> aircraft and AIC have the advantages of flexibility, extended radar horizons, and longer line-of-sight communications capability. They can be deployed quickly to remote battle sites, and they usually can operate well outside the actual combat arena, making them less susceptible to attack.

In general, the CAP concept of air defense is complex and inefficient, and quite often it is ineffective. In some cases, however, there is no viable alternative, and CAPs can be very effective under the right conditions. These conditions are a reasonably sized defended area for the number and capabilities of the fighters available, a limited threat sector, and small penetration raids without fighter escort. CAPs may be required when raids must be countered at long distances from the operating bases of defending fighters or when warning of an attack is insufficient to allow for GAI defense.

### *Ground-Alert Interceptors*

Under other conditions the GAI usually provides much more efficient and flexible air defense. When interceptors can be based close to the high-value targets, they are capable of countering attacks from any direction with equal ease. More fighters can be kept armed, fueled, and ready for action on the ground. Communications and control are much more reliable, and the formation of large fighter forces to oppose massed attacks is more practical. The fighters required to perform the GAI mission can be less sophisticated. Whereas the ideal fighter for the CAP needs long range and endurance; sophisticated sensor, communications, and navigation equipment; and air-refueling capability, the GAIs can be simple, small, and cheap, further increasing the numbers of aircraft likely to be available and serviceable. High speed and climb rate (to oppose high-altitude attacks) are important attributes for GAI fighters.

You never make a big truck and tomorrow make it a race car. And you never can make a big bomber and the next day a ... fighter. The physical law means that you need another airplane. . . . You should do one job and should do this job good.

Colonel Erich "Bubi" Hartmann, CAF

The GAI concept is not without its limitations, however. The defense

must be assured of its ability to detect incoming raids at sufficient range to allow for launch, formation, intercept, and attack by GAIs on favorable terms. If defending fighters are caught on the ground, surprise attacks can be disastrous, not only for the high-value targets, but for the fighters themselves, which qualify as valuable targets in their own right. The fighter bases must also be located very near the defended targets to be effective in countering attacks from any direction. This basing requirement can greatly degrade the flexibility of the GAI system. A further limitation is the speed at which GAI can be launched. The number of available runways and their vulnerability to battle damage can limit the capacity of the system. A system of many dispersed bases, located throughout the defended area, is ideal for this concept.

Again, close control from GCI or AIC is advantageous for the employment of GAI; but once the system becomes saturated, effective close control of multiple intercepts becomes impossible, and broadcast control can be an effective alternative.

### *Attack Considerations*

The primary mission of either CAP or GAI is protection of the target. Although destruction of incoming enemy bombers is ideal, this is certainly not the only way to accomplish the goal. Merely threatening a bomber or bomber formation is often sufficient to cause it to jettison ordnance off-target in order to increase maneuverability and speed for defensive purposes. Once a bomber has been forced to drop its weapons off-target, the fighters have achieved a "mission kill." Even forcing the pilot of a penetrating aircraft into an extended defensive maneuver is often sufficient to foul up his timing over the target, resulting in an aborted mission (mission kill) or increased vulnerability in the target area. Unfortunately, if the bomber pilot escapes, he can return again the next day, smarter, when the defending pilots may not be so lucky. It may take much less time to achieve a mission kill than an aircraft kill, however, allowing the fighter to intercept more bombers on a given raid. This tradeoff should be considered.

What does not destroy me makes me stronger.

Prussian Military Axiom

An attack on an individual bomber or on small formations of unescorted low-level penetrators is much like any of the other attacks already described, with a few exceptions. Low-altitude flying and navigation take a good deal of concentration on the part of the bomber pilot, leaving little time for effective defensive lockout. In addition, most low-level penetrators are small fighter-bombers without rear-hemisphere defensive ordnance, and they are designed with limited field of view in the rear quarter. Surprise attacks from the rear quarter can, therefore, be very effective, time and weapons capabilities permitting. Once he has sighted a target visually, the fighter pilot should consider turning off any radar transmitters to avoid being detected by the enemy's RWR equipment while he conducts the actual attack. If they are required for attack, these transmitters possibly



can be turned back on just prior to weapons firing. The advantages and limitations of various weapons in the low-altitude environment were discussed in previous chapters.

We carried out many trials to try to find the answer to the fast, low-level intruder, but there is no adequate defense.

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

A fighter pilot attacking a low-level penetrator from the rear hemisphere should be especially cautious of a particularly nasty countertactic. Bomber pilots, when they are threatened from the rear, will often drop a retarded bomb that is intended to explode right in the face of the pursuing fighter. A retarded bomb is fitted with a high-drag device that slows its forward speed after release, allowing the bomber to gain safe separation before weapon impact. A pursuing aircraft, however, may well be caught in the weapon's fragmentation pattern. At the first hint of something falling off a bomber ahead, the attacker should break as hard as possible left or right to avoid the frag pattern. A quick pull-up may also work, but it usually provides less separation than a hard turn and makes rejoining the chase more difficult.

If at all possible the enemy fighters should be avoided completely and strict attention given to attacking the enemy bombers. With a high-speed airplane of the P-38 type this is entirely possible. ... If the attack is delivered swiftly and the breakaway completed the enemy fighters can be avoided easily. The initial attack should be designed to break up the bomber formation. If this plan is successful the squadron can then break down to flights and proceed to pick off stray bombers. If the formation is not broken the squadron attack should be delivered a second time.<sup>1</sup>

Captain Thomas J. "Tommy" Lynch, USAAF  
20 Victories, WW-II

Low-level penetrators are usually not escorted closely by defending fighters, since their presence is more likely to give away the position of the penetrator. Massed attacks, however, are a different matter, and fighter escort is a probability. One of the first considerations when attacking massed bombers, therefore, is how to deal with the escort. If the escort is poorly positioned and can be avoided, it is generally best to do so and make hit-and-run attacks on the bombers, then separate before the escort can react. Otherwise the escort usually must be neutralized if the fighters are to stand much chance of inflicting serious losses on the bombers without incurring heavy attrition themselves.

The first and most important requisite for the destruction of the bombers was the achievement of air superiority against the American escort fighters.

Lt. General Adolph Galland, Luftwaffe

One of the most effective means of neutralizing the fighter escort is to devote some defending fighters to the task of attacking and engaging the escort. When forced to defend themselves, the escorts quickly become separated from their strike group. Fighters are typically much more short-legged than bombers, and they often must carry external fuel "drop-tanks" to provide the necessary escort range. Because of this the escort should be

attacked just as early in the mission as possible. If the escort is forced to jettison its partially used drop-tanks and use extra fuel (such as by lighting afterburners) to defend against an early attack, its bombers may be required to abort their mission or to complete much of it unescorted and vulnerable to attack by other defenders. Even a feint attack or a "gun and run" by a very few fighters may effectively "strip the escort" from the strike package.

To fight the bombers before the escort fighters would mean in the long run to take the second step before the first. But if instead of fighters, the bombers got the priority in combat, then the peripheral defense . . . was absolutely wrong. The continuous demand to attack the bombers as soon as possible could only be successfully fulfilled if the attacks were made in groups. This meant that each of our fighter groups . . . would attack a greatly superior enemy force. In an action like this the results were naturally small, our own losses on the other hand considerable. Instead of attacking the bombers when they were as far as possible out of range of their fighter escort, our fighters had to attack the enemy just when he was strongest.<sup>2</sup>

If the defense is unable to strip the escort at long range, some of the fighters of the main assault force should be assigned to engage and occupy the escort while the remaining interceptors concentrate on the bombers. When different types of fighters are involved, the best dogfighters are generally assigned to the escort while the less maneuverable, but, hopefully, heavier-armed, aircraft attack the bombers. When practical, the number of interceptors assigned to engage the escort should be roughly equivalent to the number of fighters in the escort, and the remaining interceptors will tackle the bombers.

In air fights it is absolutely essential to fly in such a way that your adversary cannot shoot at you, if you can manage it.

Captain Oswald Boelcke, German Air Service

Attacking heavy bombers can be a tricky proposition, as they are often well protected by defensive armament, particularly in the rear hemisphere, and usually are well equipped with electronic- and infrared-countermeasures gear. In a heavy ECM/IRCM environment, guns and unguided rockets are often the most effective weapons, but since these have fairly short ranges, the direction of approach to a heavy bomber must be carefully calculated to minimize exposure to defensive fire. Saddling-up at close range on a bomber with rear-firing weapons, particularly in a large enemy formation, is a very unhealthy approach. Bombers are almost always less well defended in some directions than in others, and these weak points should be found and exploited. Often head-on or forward-quarter passes through an enemy formation, using gun or rocket snapshots, prove to be the best tactics. In general, just as with most other military strategies, the approach is to concentrate the greatest offensive firepower against the enemy's most weakly defended point. Few bombers can match a fighter's forward-firing weapons from all directions.

If you see enemy aircraft, it is not necessary for you to go straight to them and attack. Wait and look and use your reason. See what kind of formation and tactics they are using. See if there is a straggler or an uncertain pilot among

the enemy. Such a pilot will always stand out. Shoot *him* down. It is more important to send one down in flames—so that all the enemy pilots can see the loss and experience its psychological effect—than to wade into a twenty-minute dogfight in which nothing happens.

Colonel Erich "Bubi" Hartmann, CAF

Generally speaking, a massed attack should be met as far from the target as possible. Long-range CAPs are often in position for first intercept, but unfortunately its strength is seldom sufficient for a CAP to have great success in destroying large numbers of enemy aircraft or in breaking up a large massed attack, particularly if fighter escort is present. A long-range CAP, therefore, might best be used in an attempt to strip the formation of its escort.

There are several advantages of early interception of massed attacks. Obviously, the longer the fighters can maintain contact, the more damage can be done to the attackers. Quite often determined attacks will result in damaged bombers and stragglers which provide easy pickings later in the battle. Early attacks may also slow the progress of a massed attack, allowing more defending fighters to make an intercept. In many cases fighter-bombers planning low-level penetration attacks will proceed in massed formation, possibly with fighter escort, to some point short of the target, and then split up for individual penetrations by different routes. These raids are usually more vulnerable to serious damage if they are intercepted before the break-up point.

The demand of the hour was quantity against quantity. The massing of our fighters was impossible at the periphery and could only be done in the center.

Lt. General Adolph Galland, Luftwaffe

Regardless of its advantages, however, early interception of a massed attack is not always possible; attack may have to be delayed to provide for greater numbers in the attacking force. Multiple small, uncoordinated attacks are more easily defended against by the bombers and fighter escorts than are larger, more concentrated assaults. Depending on the number of escorts, distance remaining to the target, and the likelihood of reinforcements, the first interceptors to arrive on scene might best "shadow" the formation from a good attack position and call for help. Once the fighter force is as large as it is likely to get, or is considered strong enough to take on the escorts on roughly equal terms, the attack can begin.

The ballistic rocket struck the death knell of the fighter-interceptor.

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

### *Integrated Air Defense*

A fact that brings the air defense picture into perspective is that, in nearly all conflicts since and including World War I, more aircraft have been lost as a result of surface-to-air defenses than have been victims of fighter action. This is primarily because of the sheer volume of AAA, SAMs, etc., and the great number of firing opportunities encountered. Surface defenses alone, however, have rarely been sufficient to prevent destruction or heavy damage to high-value targets. Only determined fighter defenses have

proven consistently capable of inflicting enough casualties on any single raid to turn back the attack or to prevent repeated assaults. Surface defenses are, however, an important component of any IADS. High-value targets particularly should be heavily fortified by surface weapons for terminal defense. Accurate air-to-ground ordnance delivery requires extreme concentration on the part of the bomber crew, even with the aid of the most sophisticated weapons systems. In addition, most air-to-ground deliveries require the bomber to fly a fairly predictable flight path for at least a few seconds prior to weapons release. This predictability and crew preoccupation make the bomber most vulnerable during the weapons-delivery phase of its attack. Simply causing the bomber pilot to break concentration or to maneuver to avoid ground fire may contribute to the defense by reducing the pilot's weapons accuracy.

As mentioned previously, when surface defenses and fighters are integrated into the IADS, there should be a free-fire zone established for surface-to-air weapons which should be known and avoided by the defending fighters. When adequate surface defenses are not available for a high-value target, a CAP orbiting overhead or near the point might substitute for terminal defense. The fighters in this CAP can be very unsophisticated, since their station-keeping is usually visual and they are not required to intercept targets at long range. Their pilots can simply monitor broadcast control and wait for the enemy to come to them. Great speed is not required for this mission, but exceptional maneuverability and having all-aspect weapons that are effective at low altitude are great aids (assuming low-altitude penetrators) in providing quick shot opportunities on short-range contacts. Good endurance and airborne refueling capability are also important attributes for such aircraft.

Offensive fighter sweeps against enemy airfields and rendezvous areas can be extremely effective defensive tactics. The timing of these sweeps is critical if the enemy is to be caught when he is most vulnerable. One ploy which has been used very successfully is following the bombers back to their base and striking during their landing approaches.

### **Strike Escort**

The fighter, even when tackling a purely defensive task, must never lose the initiative to his opponent.

Lt. General Adolph Calland, Luftwaffe

Escort has historically been one of the most difficult and most frustrating missions assigned to fighters. The escort is often cast in a defensive role, which tends to place it at a disadvantage with respect to enemy fighters. Once a strike has been discovered and intercepted by defending fighters, they enjoy the offensive advantage of the aircraft. History has shown that it is effectively impossible to seal completely the airspace around a strike group, and casualties can be expected when the strike group is opposed by determined fighter attack. It has also been shown, however, that fighter escort holds the greatest hope for limiting losses to acceptable levels during massed attacks in the face of such opposition. Of course "acceptable" losses are zero for fighter crews charged with the protection of strike

aircraft, and the unrealistic nature of this goal adds to the frustration of the mission.

Bomber air power cannot develop where enemy fighters have an air superiority.

Air Vice-Marshal Raymond Collishaw, RAF  
62 Victories, WW-I and Bolshevik Revolution

One bright spot in this picture is that the days of massed-formation attacks appear to be numbered. Many factors have contributed to this trend, including the reduced size of bomber fleets (making any losses more significant), the advent of more lethal surface-to-air weapons (especially SAMs), increased bomber speed, and greatly increased lethality of air-to-ground ordnance (requiring fewer bombers to destroy a given target). These trends have led to a preference for low-level penetration raids, for which close fighter escort may be more a liability (because of greater detection probability) than an asset.

A fighter can only carry out this purely defensive task by taking the initiative in the offensive. He must never wait until he is attacked because he then loses the chance of acting. The fighter must seek battle in the air, must find his opponent, attack him, and shoot him down.

Lt. General Adolph Galland, Luftwaffe

The fighter sweep provides probably the most effective means of participation for fighter aircraft in a penetration attack. A sweep before the strike, closely timed with the penetration attacks, can be conducted to hinder or prevent launch and formation of GAIs. Sweeps can also assist by engaging and occupying CAP fighters (particularly those near the target area) to prevent them from harassing the bombers during the actual attack or along the bombers' ingress and egress routes. Much of the success of such fighter sweeps depends heavily on the relative capabilities of friendly and enemy C<sup>3</sup> networks in the battle arena. Often the defenders have an advantage here which can be exploited to avoid contact with the sweeps and allow concentration on the bomber aircraft.

Sometimes, however, even penetration strikes proceed as massed formations until they approach the target area. This fact, and the possible necessity of protecting other types of aircraft, such as transports, in a hostile environment, require that the principles of escort be understood.

Fighter escort is essentially point defense of a moving target, so many of the principles already discussed are applicable with certain modifications. Since air strikes are presumably conducted over hostile territory at some distance from friendly airfields, the GAI concept is generally not applicable. An analogous concept, that of the "parasite fighter," has been the subject of some experimentation since World War I. This idea involved carrying a small fighter aboard a large bomber; the fighter could be released for defense if the bomber came under air attack, and then it could be recovered aboard the bomber again after the fight. Probably because of the payload penalties and operational complexities, however, this concept has never been put into practice.

The use of independent fighter sweeps for defensive purposes has

already been considered; this discussion focuses on other fighter-escort concepts. In general, there are four types of escorts which have evolved and been proven useful for the strike-escort mission. Here they are called reception escort, remote escort, detached escort, and close escort. The reception escort has the task of meeting the strike force as it returns from the target and guarding its retreat from pursuing enemy fighters. The remote escort may take the form of a fighter sweep ahead of, or along the flanks of, the strike group, proceeding along with the main body, but generally not within visual range. Remote escorts may also be stationed over a fixed geographical point along a line between the strike group and enemy airfields, or between the intended target and enemy bases, in the more conventional CAP role. The detached escort is positioned closer to the main body, normally within visual range. Its duty is to intercept and engage hostile fighters at the most likely points of attack. The close escort, as the name implies, is tied closely to the strike force for terminal defense, analogous to the overhead CAP in point defense. Any or all these concepts of escort, as well as independent fighter sweeps, may be employed, depending on the available assets and the expected opposition.

### *Reception Escort*

The reception escort is intended to provide defensive reinforcements at a time when they are likely to be needed badly. Heavy opposition tends to deplete and scatter escorting fighters, reducing their effectiveness. The main body is also likely to be more spread out because of damaged aircraft and stragglers, making it more difficult to defend. In addition, many of the original escorts may be low on fuel or ammo, or they may be damaged themselves, resulting in reduced effectiveness. A reception escort can also furnish protection for penetration bombers on their withdrawal, often by conducting a sweep of the egress corridors. Even though the strike mission is essentially complete at this point, the enemy may still achieve his objective if he can inflict severe enough casualties during this vulnerable period to prevent further strikes. The reception escort provides a fresh defense, added protection for damaged and straggling aircraft, and discouragement for enemy intruders that may be shadowing the returning strike force. This mission is often assigned to GAIs that have been retained during the strike as part of the home-field defenses. The range and sophistication of these aircraft can be considerably inferior to those of the primary escort fighters.

We introduced "Fighter reception": fighter squadrons or wings were sometimes sent right up to the English coast to meet the often broken-up and battered formations on their return journey, to protect them from pursuing enemy fighters.

Lt. General Adolph Galland, Luftwaffe

### *Remote Escort*

The remote escort quite often begins as a fighter sweep that is timed to proceed some distance in advance of the main body. Its route of flight generally follows that of the strike group, but it may be diverted at some

point for a diversionary attack on another target. (This type of feint attack was discussed in some detail earlier in this chapter in conjunction with fighter-sweep tactics.) The usual mission of the remote escort is to clear the intended strike route of enemy fighters, generally all the way to the target. This escort is usually positioned directly ahead of or on the forward quarters of the main body, and it is intended to surprise hostile interceptors in transit to, or forming up for, an attack on the strike group. Because their intention is to surprise, these escorts often ingress at low altitude to avoid detection by enemy radar, but their altitude should be consistent with the expected threat. If it is assigned the duty of engaging enemy air defense in the target area, the remote escort should plan to reach the target near enough to the intended strike time so that combat endurance will allow it to remain engaged until the strike is complete and the bombers have withdrawn.

Another likely mission of the remote escort is to establish a CAP to block the probable intercept route of enemy fighters launching from hostile airfields. Often the remote escort will proceed along the intended strike route for some time as a sweep, then depart from the primary ingress route to set up a blocking position. This break-away is often a good opportunity to make a feint attack on the enemy airfield to confuse the defense network.

We fighter pilots certainly preferred the "free chase during the approach and over the target area." This in fact gives the greatest relief and the best protection for the bomber force, although not perhaps a direct sense of security.

Lt. General Adolph Galland, Luftwaffe

### *Detached Escort*

Next in the defensive screen come the detached escorts, which are positioned strategically around the main body to engage enemy interceptors early in their approach for attack. The optimum positions for detached escorts are dependent on the capabilities of both friendly and hostile weapons and on the nature of the anticipated attacks. Ideally a detached escort is located where it can detect and engage any hostile fighter before it can fire at the aircraft of the strike force. Considerations include the enemy's probable intercept geometry and maximum effective firing range, and escort maneuverability, reaction time, and weapons limitations.

Figure 9-2, which depicts a strike-force formation with various friendly and enemy weapons envelopes superimposed, illustrates how some of these factors interrelate. The figure also shows likely enemy attack geometry and representative detached-escort positions to counter these attacks. To oppose a forward-quarter (FQ) missile attack, escorts are stationed on the left and right forward quarters of the strike force, far enough ahead of the bombers so that hostile interceptors can be engaged by the escorts' FQ weapons before the enemy reaches firing range against the bombers. The forward escorts' lateral separation on the strike force also allows maneuvering room to engage interceptors making head-on or FQ attacks with short-range weapons. For this purpose lateral separation

between the two forward escorts should be on the order of two to four fighter turn radii, but this distance may need to be modified for visibility considerations. They should be positioned ahead of the lead bomber at least as far as the enemy's short-range weapons-firing distance. This distance may have to be increased to provide coverage of threat FQ long-range missiles, as shown. Obviously the strike force will be extremely vulnerable to FQ missile attack if the escort is not similarly equipped. Denying such a threat would probably be the responsibility of remote escorts. Altitude for the forward escort is typically close to that of the strike force, maybe a little higher to give quicker response to short-range gun or rocket attacks, or possibly a little lower to provide look-up for better radar detection and FQ weapons guidance.

A compromise between [free chase and close escort] was the "extended protection," in which fighters still flew in visible contact with the bomber force but were allowed to attack any enemy fighter which drew near to the main force.

Lt. General Adolph Galland, Luftwaffe

Similarly, rear escorts are positioned behind the strike force to guard against RQ attacks. These elements are generally stationed near the enemy's maximum RQ weapons range relative to the trailing bombers of the strike force. When each side is equipped with similar weapons, this should allow detection and engagement of RQ attacks before they can

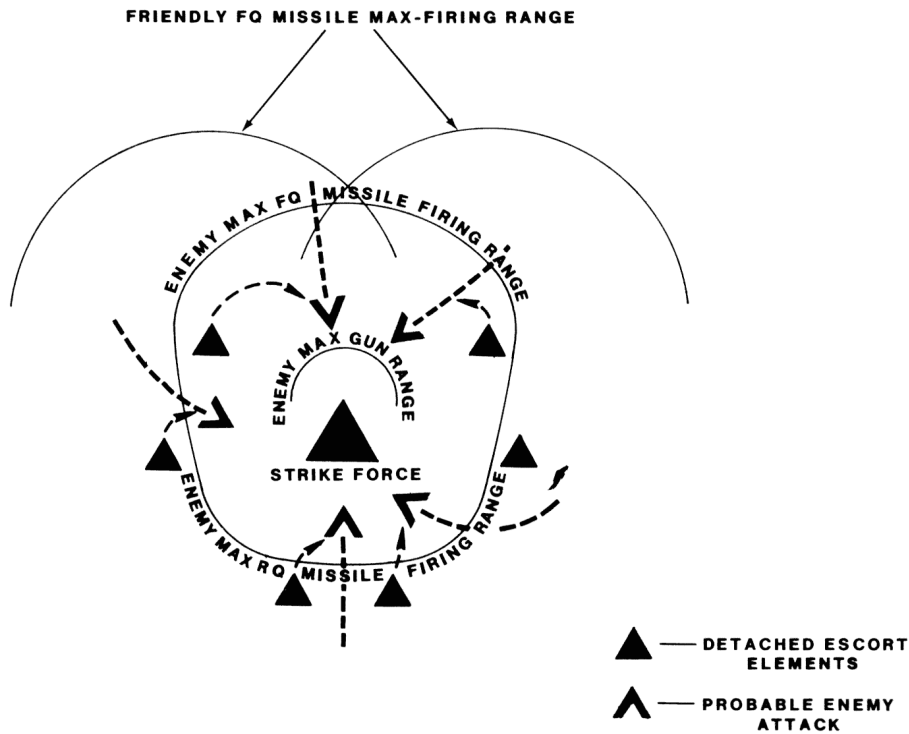


Figure 9-2. Detached-Escort Positioning



become major threats to the strike group. If this maximum weapons range is considerable, however, or if the enemy's weapons have greater range than those of the escort, rear protection may require additional rear-escort elements positioned closer to the strike force. Otherwise the enemy may be able to slip in from the side of the strike group for a close-range attack while remaining out of the rear escort's effective firing range. Whenever it is engaging hostile fighters, the rear escort especially must be certain that a guided weapon is not locked onto a friendly aircraft.

Lateral separation for the rear escorts can generally be somewhat less than that for the forward elements, since the rear escort is not likely to be required to turn more than about 90° to engage a threat to the strike group. Separation of one to two fighter turn radii should be adequate between the rear elements. Rear-element altitude is typically somewhat higher than that of the strike group to provide greater potential energy for quick reaction. Since this scenario assumes fighter opposition, and the trailing aircraft in any formation are most vulnerable to attack, additional trailing elements are often added to the escort for rear-hemisphere protection of the fighters themselves. Such additional elements, sometimes called "rear guard" or "top cover," generally trail the rear element depicted in Figure 9-2 at a comfortable visual range and stepped-up higher. If more rear-guard elements are available they may be added in trail of the last, each stacked higher or lower than the preceding element, *ad infinitum*. The rear guard can also act as a reserve, moving up to fill holes in the defense created by escort engagement of hostile attacks.

The other escort elements depicted in Figure 9-2 are the flankers to either side of the strike group. These are essentially gap-fillers between the forward- and rear-escort elements, and their mission is to guard against attacks that attempt to split the defenses. Depending on the size of the overall formation and the weapons involved, several flanking elements could be required, or none at all. These elements are sometimes stepped-up considerably higher than the strike group and moved in laterally to guard against near-vertical diving attacks from above.

Whenever the assets are available, each of the detached-escort elements described should be composed of at least two fighters for mutual protection. The detached escort serves as the first line of defense against a fighter attack, and it is most likely to be engaged by the enemy. The speed of the escorting fighters is also important, both for offensive and defensive maneuvering potential. Since the speed of a strike group, particularly when it is heavily loaded inbound to a target, can be considerably slower than the escorts' desired maneuvering speed, weaving is often employed. The escort fighters can weave back and forth to retard their forward progress while they maintain a high airspeed. Care should be taken that the weaving does not degrade visual lockout within an element or take the element far out of position.

Discipline is a key factor in success of the detached escort. Unlike a fighter sweep or a remote escort, the detached escort is tied to the strike group and must avoid engagement with any enemy fighters that are not directly threatening the strike force. The enemy can be expected to use

decoys and feint attacks to draw off the escort fighters. Hostile fighters that appear to be approaching an attack position should be offensively engaged by the detached escort. Whenever an attack turns away from the strike group, however, pursuing escorts should immediately return to their assigned positions.

In escorting bombers it is a good idea to range out on the sides, front and rear and hit enemy fighters before they can get to the bomber formation, but do not run off on a wild-goose chase and leave the bombers unprotected.

Major George Freddy, Jr., USAAF

### *Close Escort*

Close escort doctrine stations fighters over, under, around, and among the aircraft of the strike group itself. In a guns-only environment the close escort and the detached escort may be one and the same because of the short weapons ranges involved. Otherwise, the purposes of the close escort are analogous to those of the overhead CAP in point defense; that is, to provide a response to attacks from any direction, and to harass an enemy in the final stages of his attack. Heavily armed bombers may assume this task themselves.

The detached escort normally serves as a tripwire for this system, detecting incoming raids and calling them out for the close escort. The nearest fighters in close escort then leave the strike group to assist the detached escort with an "inside-out" attack on the enemy aircraft. Exceptional maneuverability and all-aspect weapons (which may include guns and unguided rockets) are valuable attributes for the close escort mission. Great speed and sophistication are not requirements, since all attacks are visual, with the enemy coming to the close escort. The close escort doctrine is usually not very effective unless it is combined with a detached escort for advance warning of incoming raids. Without such warning the attackers are often into the strike group before they can be detected and engaged.

For each [bomber] group we provided one squadron of P-38s for close and one squadron for top cover. The other two P-38 squadrons made a fighter sweep three to five minutes ahead of the bombers. . . . We were generally able to contact the major concentration of [Japanese] fighters and keep them too busy to make anything like a coordinated attack on the bombers.

Colonel Charles W. King, USAF

### *Integrated Fighter Escort*

A hypothetical strike-escort mission may clarify how all the various tactics outlined in this section can play together. Figure 9-3 sets the stage for the mission. The strike group intends to follow the indicated ingress and egress routes for a feint attack on the northeastern enemy airfield, turn left just short of this airfield to attack the real target, then head directly for home. To add credibility to the ruse, an independent fighter sweep is sent by an entirely different route to harass the northeastern enemy airfield, a tactic that might be expected as part of a prestrike softening-up process.

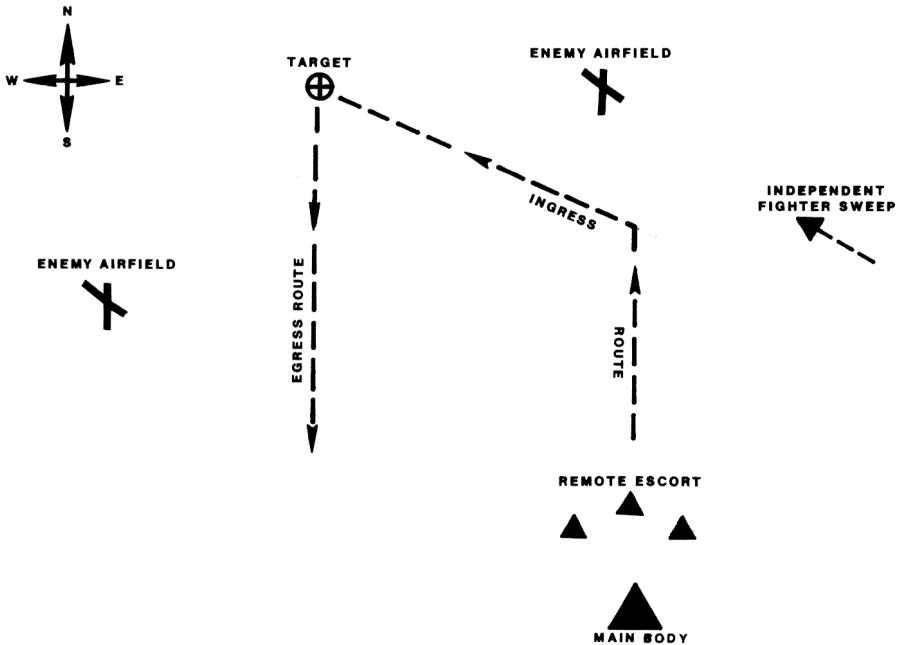


Figure 9-3. Fighter-Escort Mission

This sweep is designed to draw enemy GAIs into battle, causing an expenditure of defensive assets. The hope is that, by the time the real strike force passes through the area, most of the hostile fighters from this airfield will be engaged, destroyed, or out of fuel.

Meanwhile the main body, consisting of the strike force itself, the detached escort and the close escort, proceeds along the ingress route. Preceding this force by a few minutes is the remote escort, composed of three elements, whose task is to clear the route of enemy interceptors or CAPs which may be lying in wait.

In Figure 9-4 the strike force has made the turn toward the intended target and is passing the embattled northeastern airfield. The elements of the remote escort have split and are proceeding on different missions. The center element continues straight for the target area to engage any hostile fighters which might be in that vicinity, or (heaven forbid) to suppress surface defenses. The left and right elements of the remote escort head for CAP stations assigned to block possible interference from either of the two enemy airfields.

Figure 9-5 shows the target under attack by the strike force and the two blocking CAPs in position. Once the strike force arrives on target the remote escort already there is relieved by the detached and close escorts and is free to resume a sweep to clear the egress route. The independent fighter sweep assigned to the northeastern airfield has already reached its disengagement fuel state and is also heading for home. Meanwhile, a reception escort is inbound for a sweep of the enemy's southwestern airfield.

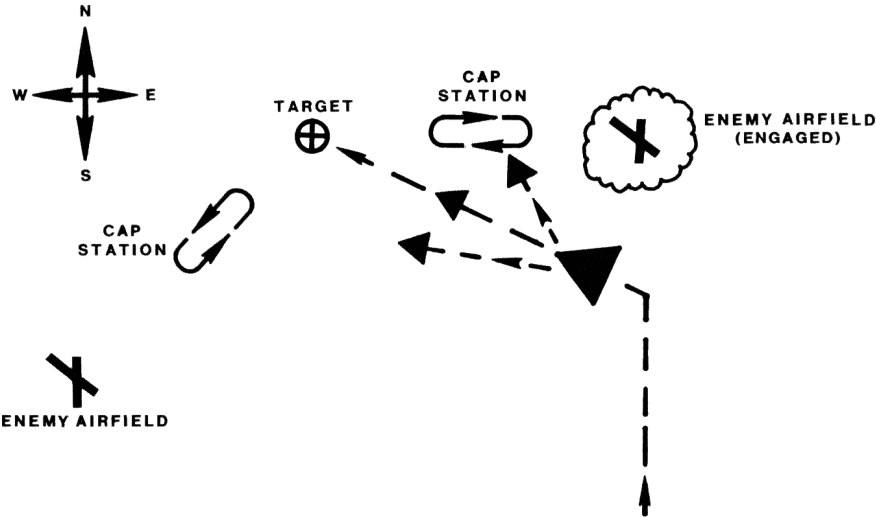


Figure 9-4. Fighter-Escort Mission (Continued)

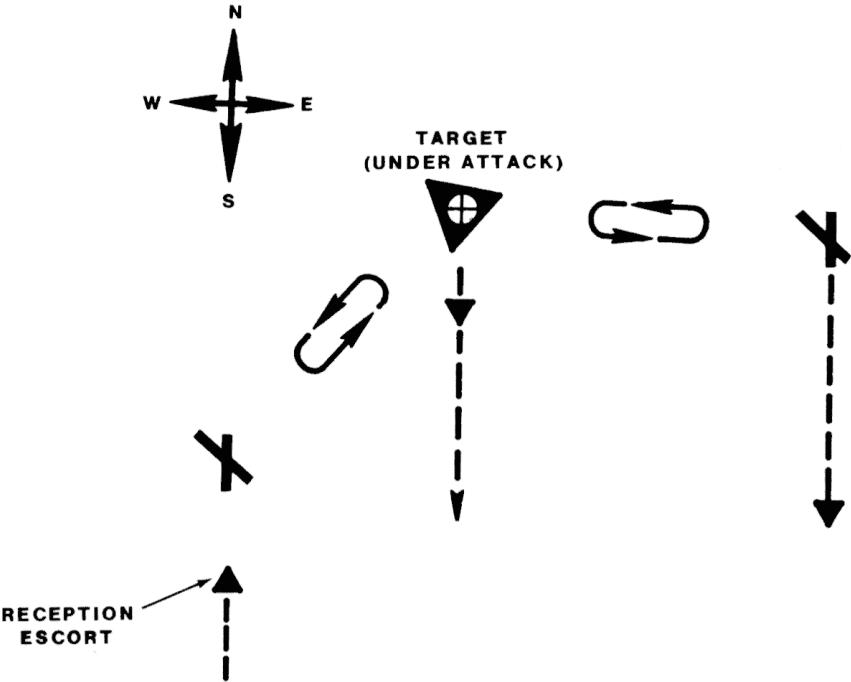


Figure 9-5. Fighter-Escort Mission (Continued)

Finally, Figure 9-6 depicts the strike force, having completed its attack, exiting the area accompanied by its close and detached escorts. The remote escorts, meanwhile, have terminated their stationary CAPs and are also leaving the area. Their exit times have been specified relative to the time of target attack so that they provide something of a moving screen for the strike force, shielding the main body from the hostile airfields. Since the remote escort probably does not have visual contact with the main body

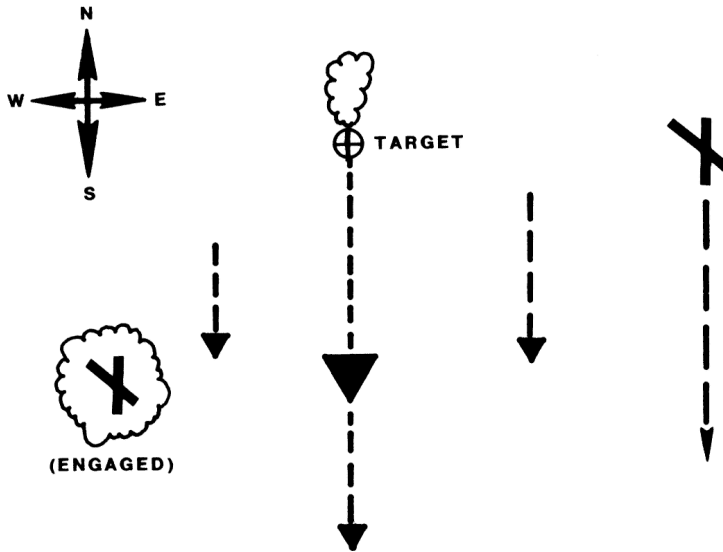


Figure 9-6. Fighter-Escort Mission (Conclusion)

through most of the mission, strict adherence to strike timing is critical for maximum effectiveness. The reception escort has also timed its sweep of the southwestern airfield to coincide with the approach of the retreating bomber formation. After passage of the main body, the reception escort retires along the general exit route of the bombers.

At the start the American escort also made tactical mistakes. Instead of operating offensively against our fighter units, they limited themselves to a close direct escort. They tried to repulse our attacks in the close vicinity of the bombers. In doing this they went through the same negative experiences as we had done over England and Malta: the fighter pilot who is not at all times and at any place offensive loses the initiative of action. The American fighters learned and readjusted themselves. After January, 1944, they went over to aggressive free-for-all fights in the approach sector.<sup>3</sup>

This example demonstrates, without even getting into the fine points about how each element would carry out its mission in the face of opposition, that strike-escort planning and coordination can be a very complex affair. It should also be apparent that a large number of escort assets might be required for such a mission. If adequate assets are not available (and they seldom are), some priorities must be assigned. Normally the most effective element in defense of the strike group is the remote escort, closely followed by independent (but coordinated) fighter sweeps. Some fighters should usually be assigned to these missions before consideration is given to other escort concepts. Detached escorts have proven to be next in effectiveness. If additional aircraft are available, they can be assigned as close escort or reception escort according to the anticipated requirements and effectiveness of these tactics. Although the overall role of the fighter escort is defensive, greater effectiveness can be achieved by maintaining an offensive attitude through aggressive employment of fighter sweeps and

remote escorts. Detached escorts should also seek to be offensive through early detection and engagement of enemy fighters, but their aggression must be tempered by considerable discipline if escort integrity is to be maintained.

### Notes

1. Martin Caidin, *Fork-Tailed Devil: The P-38*, p. 282.
2. Adolph Galland, *The First and the Last*, p. 198.
3. *Ibid.*, p. 201.