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FIGHTER DEFENSE AGAINST MASS AIR ATTACKS

Colonel A. Aleksandrov

During the recent war the air arm repeatedly delivered powerful attacks upon various objectives. Hundreds, and sometimes even thousands, of bombers participated in these attacks. They usually operated under cover of a large number of fighters. Diverse targets, both in rear areas and in the combat zone, were attacked. In the latter instance, the air arm attacked with the direct cooperation of the ground forces.

In daytime operations the attacker endeavored to complete his mission within the shortest possible time and with minimum losses to himself. This was accomplished by the concentration of a large mass of bombers against one or more targets during a relatively short period of time.

It was natural that in carrying out these air attacks the air arm encountered strong opposition from the enemy's antiaircraft defenses. The attacker resorted to various measures to reduce his losses. The most important are listed here:

1. Flying the bombers in compact combat formation with strong fighter cover (from 0.5 to 1.5 fighters to each bomber).

2. Flights at great altitudes, often reaching heights of 7,000 to 8,000 meters and more, which hampered the interception of the bombers and lowered the effectiveness of antiaircraft fire.

3. The adoption of various means of operational and tactical concealment to mislead the defenders and preserve the element of surprise.

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These, then, were the most important factors in an aerial situation where defending interceptors or fighters were active. We can conclude that the following conditions are necessary to repel mass air attacks successfully:

1. An efficient organization for the observation of enemy air activity.

2. Early alerting of one's own fighter groups.

3. Carefully planned grouping of fighter planes on the ground and the correct choice of the order of their going into action.

4. A high degree of combat readiness and precise organization of take-offs.

5. Skillful operation of fighters in combat, which demands appropriate pilot training, choice of suitable combat formations, proper distribution of forces, and development of cooperation.

6. Continuous direction of fighters from the ground and in the air.

Observing and Engaging Enemy Aviation

The fundamental purpose of the system of observation of the combat activity of enemy aviation is to secure information on the location and strength of enemy aviation and the nature of its activity.

Enemy activity may be observed in a number of ways. In actual combat there were many cases where an enemy air attack was detected only through radio interception: when the aircrafts' radios were being checked while the ships were grounded, during the completion of a take-off, assembly in the air, and during the initial stages of a mission.

However, during the war, long-range "radio locating stations" acquired a decisive importance because of their ability to warn interceptors well in advance of the appearance of enemy aircraft. These stations made possible the constant observation of the enemy's aerial forces. If an enemy aircraft went beyond the wave band of one of these radio locating stations, he was kept under constant observation by neighboring stations which followed his flight course and transmitted all pertinent data to the command points in charge of the fighters.

It is apparent that in carrying out an air attack the attacking force always attempted to delude the defending fighters (e.g., by causing various types of interference with the operation of the radio locators). Consequently, the fighter command adopted measures to secure uninterrupted observation of the enemy's activities. These measures were successfully met by the following operations carried out by fighters.

Detection of the enemy was considered successful whenever the fighters were able to take off, attain the required altitude, and encounter the enemy far from the objective or threatened area.

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The depth of the enemy's detection was not fixed. It depended upon many factors, chiefly upon the radio locating stations' range of sensitivity. As a general rule, the range of detecting the enemy was always being increased, as this permitted the fighters to prepare to repel an attack, concentrate their forces over the threatened area and, once having encountered the enemy, drive him off before he reached his target.

The range at which the enemy was detected (T) in units of time consists of the following minimum factors: the time consumed in warning the fighters and the command for executing the take-off (t_o); the time spent in taking off and assembling in the air (t_o); the time consumed in flying to the area under attack with the required rate of climb, taking into account aircraft coming from the most distant airfields (t_p), and the time expended in combat until the enemy is destroyed (t_z). These factors are depicted schematically in Figure 1. Naturally, the greater the speed possessed by the enemy fighter, the greater the range at which he must be detected. The chances for the success of the fighter planes are improved when they have a small time reserve.

The operation of directing interceptors to the enemy had a very important bearing on defense against enemy bombing attacks. This task became more complex when the hostile aircraft flew at a great height or with extreme speed, since under these conditions it was almost impossible for the fighters to intercept them without prior direction. There were instances in actual combat of fighters barely arriving at the area of attack, or missing it entirely because of inadequate direction.

This direction was carried out by several means. Among others may be listed the ground radio locating stations by which the bearing of enemy aircraft was determined by intersection at a great distance (many hundreds of kilometers), radio sets in the aircraft themselves which positioned by intersection the enemy craft at short distances, and those radio stations located at observation and direction posts.

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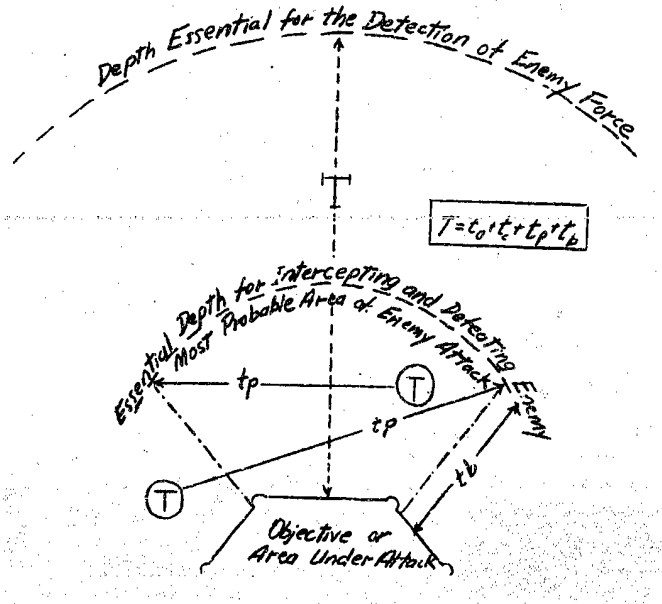

Figure 1. Example of Calculating Minimum Depth of Detection

The ground radio locating stations and the radio sets in aircraft were the most effective means for directing the interceptors to the target in any kind of weather. In most cases they were also used for intercepting enemy aircraft.

Direction in the sense of depth is divided into remote and proximate direction. A system of remote direction involved a rough orientation by the fighters of the enemy's location; a system of proximate direction, on the other hand, meant an immediate encounter between the fighters and the enemy.

The most powerful ground radio locating stations were utilized for remote direction. When the enemy was detected he was kept under constant observation and all data pertaining to his flight was transmitted by radio to the fighter command posts. This data (location, altitude, course and number of aircraft) was relayed by the command posts to fighter group commanders already in the air.

Proximate direction was effected by means of less powerful radio locating stations and radio sets and remained in effect until the encounter began. If circumstances permitted, radio stations at observation posts were also used in proximate direction.

In the organization of interceptor direction, the establishment of reliable communications between stations controlling remote and proximate direction was always to be desired. The remote direction stations went into operation first. After informing the proximate direction stations of the enemy's position, they continued their observation of distant targets. When the enemy emerged from the field of observation controlled by proximate direction stations, he was once again picked up by the remote stations.

In order to guarantee the reliable and uninterrupted direction of interceptors, the radio locating stations covered the area in their own zones where aerial engagements might occur as well as the approaches to this area.

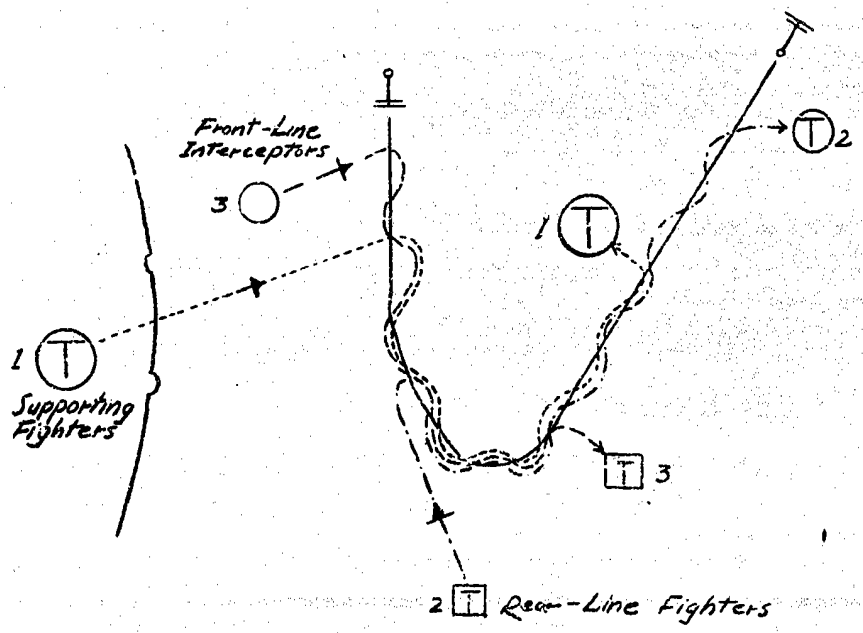

Figure 2. Example of Coordinated Attack Against Bombers by Front-Line Interceptors With Supporting and Rear-Line Fighters

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The fundamental methods developed during World War II for directing interceptors to hostile targets from the ground were the following: (1) direction transmitted to the fighters from data concerning the location of the enemy's aircraft (in relation to the ground); (2) essential data on the enemy's course and altitude given fighter group commanders.

The first method did not require preliminary calculations on the ground (these calculations for intercepting the enemy were worked out directly by the fighter group commander in the air), and for this reason it was considered the simplest method. It was justified when the fighter commanders at the command points did not have time to process the enormous amount of data transmitted by the observation stations. This method, however, had one very serious drawback. In order to reach their target successfully, the interceptor crews had to be able to observe the terrain below them since the directions transmitted by the radio referred to check points on the ground.

It must be borne in mind that only the second method guaranteed the absolutely successful interception of the enemy by fighters. Obviously, its application demanded fine organizational work on the part of the command points of the air arm. The first method was utilized usually only for orienting the fighter group at the time of the take-off and afterwards during the initial stages of the flight when the terrain below was visible to the fighter pilots.

Grouping of Fighter Craft and Their Commitment to Action

The manner of grouping fighter craft on the ground (i.e., their distribution on the airfields) was usually determined by the necessity of speedily concentrating in the air sufficient interceptors to intercept hostile aircraft and destroy them before they reached the approaches to the combat zone or the objective (area) under the attack.

The necessary grouping of aerial forces was obtained first of all by distributing a basic quantity of fighters in a given front-line area as near as possible to the chief operational directions used by the enemy's bombers. Fighters based at airfields were kept dispersed so that all aircraft could take off as quickly as possible. The fighters were disposed in such a way that it was possible to draw upon fighters from supporting fronts or from the rear lines to repel enemy air attacks. This coordination with supporting fighters and with fighters protecting rear objectives was utilized more than once in World War II and proved to be very effective.

In the case just mentioned, the fighters could operate in the following manner: taking off from a supporting front or from a rear-line area, intercepting and engaging the enemy, then landing at a given front (Figure 2, variants 1 and 2); taking off from an airfield at the given front, intercepting and engaging the enemy, then landing at airfields located in the rear lines or on a supporting front (Figure 2, variant 3). It is evident that all the details of this coordinated operation conformed with prepared plans.

The order of the fighter craft's entry into action usually depended upon the aerial situation, chiefly upon the number of enemy aircraft taking part in the attack, their combat formation, and whether they were supported by their own fighters.

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In all cases the defender strove to create a favorable concentration of forces in the air; this advantage may have consisted of superiority over only a part of the enemy's formation. We can tentatively say that an aerial situation is considered favorable to the defense when two or three fighters are opposing one enemy bomber and when one enemy interceptor craft is matched by one of ours. Of course, these numbers are not to be considered invariable; the changing combat properties of aircraft, differences in training and instruction of flight personnel, etc., all normally play an important role in making up air strength.

Determining the exact moment for the take-off of our fighters played an especially important role in repelling massed enemy air attacks. Usually, the take-off schedule was determined beforehand. This included studying the probable areas of interception and basing our interceptors accordingly, the probable duration of the flight to the designated areas, the time needed to reach the most effective altitude, assembly of the fighters in the air, and approach to the area of engagement, as well as studying the location of airfields where the fighters could land after the engagement (see Figure 3).

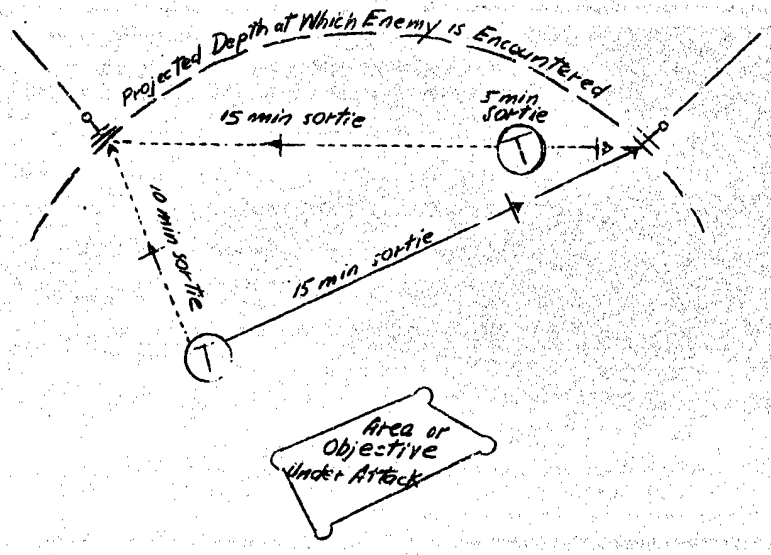

Figure 3. Relation of Interceptors' Rate of Climb to Their Base and to the Enemy's Course of Action

In circumstances where the system of direction indicated encountering the enemy at a great range after an extended flight, the fighters attempted to take to the air earlier than the time set for their take-off. It must be observed that the most destructive factor encountered by the defense was late take-offs, since

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this enabled the enemy aircraft to reach the target and carry out the attack before being intercepted. During actual combat there were cases of such tardy take-offs not only preventing the interception and destruction of enemy aircraft, but even preventing their pursuit as they emerged from the target area.

Determining the proper moment for taking off was of vital consequence to fighter planes with a small flying range (1½ to 2 hours). In their case, not only a tardy take-off but also a take-off followed by an extremely quick or rapid climb was detrimental, since during the course of an extended flight in pursuit of the enemy the fighters would have already expended a considerable quantity of their fuel, the item which determined the extent of their participation in combat (see Figure 4).

In order to increase the depth of flight at which interceptors were able to destroy the enemy, especially over territory held by the defenders, the construction of isolated special airfields where groups of fighters could land, refuel, and rejoin the battle without delay became increasingly vital and important.

These airfields were quite familiar to all flight personnel and were included in the general liaison system (see Figure 5). Their presence enabled interceptors to operate more freely and at greater ranges.

Combat Readiness, Take-Offs, and Assembling

The experience gained from the recent war showed that the interceptors' high state of combat readiness was due to locating a part of the striking force in guard or duty positions, by bringing the remaining fighter strength to a state of immediate readiness for take-offs, by organizing clearly the transmittal to the fighter groups of the situation in the air and the missions to be accomplished, and by the speedy adoption of decisions by fighter commanders and their quick transmittal to fighter pilots.

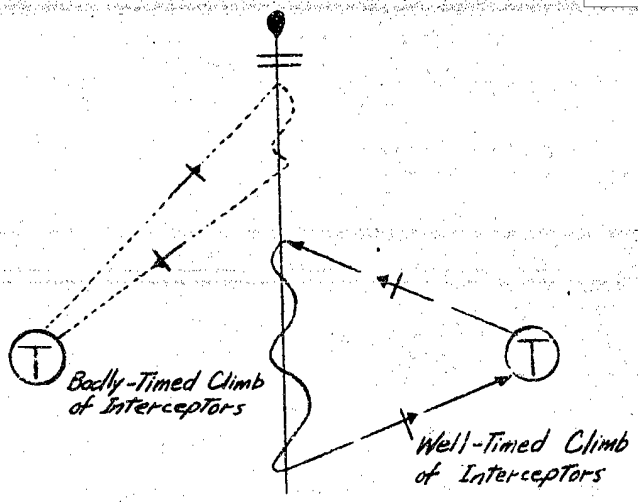

Figure 4. Example of Too Rapid Climb by Fighters (in Relation to Fuel Reserves)

The high level of combat training given the pilots and the efficient organization and execution of take-offs and assemblies in the air by the fighters was just as important as the factors just mentioned.

The organization of take-offs by interceptors was guided by one fundamental requirement: the guarantee that they would be in the air within the shortest possible time. To this end, the interceptors, by previous arrangement, were disposed on the field in such a manner that they took off in sections on order and formed their squadron formations without unnecessary taxiing. The interval between the sections taking off was kept to a minimum by clear and concise directions from the senior commander at the command post. In addition to this, all measures were taken to avoid hindering the take-off of the interceptors (grounding other aircraft, readying the antiaircraft units, preventing columns of dust, etc.)

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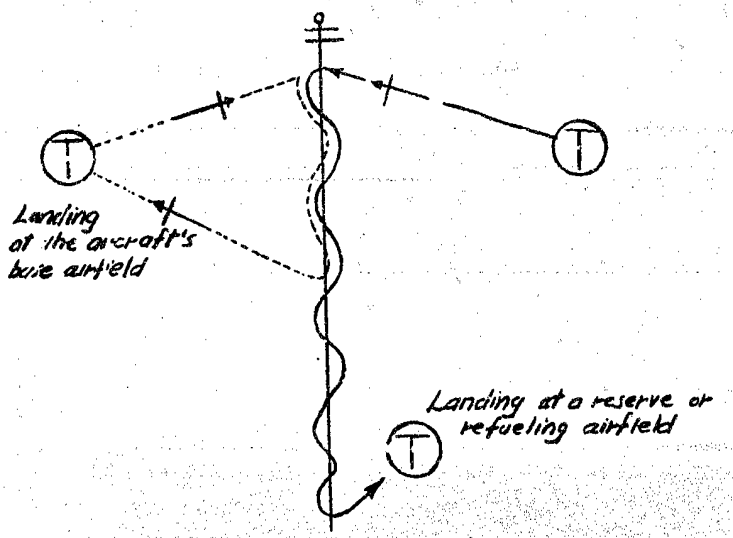

Figure 5. Advantages of Utilizing Reserve or Refueling Airfields

Depending upon the number of aircraft taking off and the furthest point of their course, the assembly of fighters into groups was usually accomplished either after the first turn, executed at 150 or 180 degrees, or during their flight around the airfield's perimeter.

If the interceptors were obliged to engage the enemy in larger groups, they usually effected their assembly either while engaged in large circular sweeps to gain altitude in the area of their own base, when the enemy was very close at hand, or while turning to gain altitude on the way, when the enemy craft were at a great distance from the air base.

The senior commander determined the order of assembly at the time of take-off.

Combat Formations

Combat formations of interceptors, destined to destroy large groups of the enemy's aerial arm, were of many kinds. They were determined by the aerial situation. However, the general priciples governing the disposition of interceptors in combat were the same as those which applied under other circumstances.

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As a general rule, a fighter combat formation consisted of the following:

1. A striking force made up of one or more echelons designed to engage the enemy's bombers.

2. An umbrella force designed to pin down the effective resistance of the enemy's fighters until the striking force achieved its objectives.

3. A reserve force designed to supplement the striking and screening forces.

The distribution of interceptors in these groups depended upon various factors, but above all upon the enemy's expected resistance and his combat formation. When the enemy bombers were inadequately supported, two-thirds of the defending force consisted of a striking force of fighters, which were divided into echelons of 10 to 20 aircraft each.

Each of the echelons making up the striking force either attacked the bombers in dense combat formations (the "wedge" formation, etc.), or dispersed themselves in depth and along the front in "bearing", "S"-ing, "wedge," or "column" section formations, the various units attacking the enemy either in sequence or simultaneously.

Combat experience showed that the screening group was more effective when composed of sections flying at different altitudes in echelon formation, since this increased their maneuverability. Several of the units composing this group might be attached to echelons operating with the striking force and convoy them directly during the attack and during their return, etc.

The reserve group was usually made up of sections flying at different altitudes in echelon formation and distributed among the air units most vulnerable to attack.

In the usual combat formation the various types of fighters were disposed so that the aircraft with the greatest firepower made up the striking force. In the screening and reserve groups were found the best aircraft available to carry the fight to the enemy fighters and to hold the initiative throughout the engagement.

As a general rule, large groups of fighters entered combat in the following manner. If circumstances permitted, they converged upon the target with an altitude advantage over the enemy. After the enemy appeared in the interceptors' field of vision, the commander of the fighter group made his final disposition of forces and informed his subordinates specifically of their missions. The screening group, as a rule, went into action first. It attacked the enemy fighters in the convoy and tried to engage them so as to draw them away from the bombers. The striking force, regardless of the success attained by the screening group, quickly attacked the bombers with the aid of those units least opposed by antiaircraft fire or enemy fighters. Usually its attacks came in rapid succession. They pressed home the attacks on the bombers until they had left the target area and until other enemy fighters in the convoy had been drawn off.

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The reserve group followed the other two groups into action and protected them from high-altitude attacks by enemy fighter echelons.

The fundamental target of all defensive fighter craft was the enemy bomber. Therefore, the success attained by the interceptors in engagements which were intended to repel air attacks by hostile forces was evaluated first by the number of bombers knocked out and secondly by the degree to which the interceptors disrupted the enemy's attack.

In replusing enemy air attacks carried out by large air groups under an effective umbrella (either antiaircraft fire or fighters), it is expedient to commence defensive operations with large masses of interceptors simultaneously. In this way much success was realized through the effective coordination of all the forces.

Actual combat showed that the entry of interceptors into combat by small groups was inefficient since in this instance they sometimes were unable to overcome the resistance put up by the enemy's fighter escort.

Tactical Control of Interceptors in Combat

The tactical control of interceptors engaged in combat with large formations of enemy aircraft was extremely complex, especially when the battle raged intensively over a large area. The uninterrupted control of such an engagement from the ground was often neglected because of the great number of fighter groups engaged, the rapidly changing situation, the sudden changes of position of the combat zone, and the great altitudes at which the combat took place.

The use of large masses of fighters showed that the control of fighter groups from the ground, which usually began with a description of their objectives as they encountered the enemy ended with the entry of the interceptors into the combat zone where the enemy was encountered. Here control was left entirely in the hands of the subordinate commanders of the air units or segments, each of whom acted independently without close coordination of the total firepower.

It is uncertain whether such a situation is normal. We feel that in combat all the actions of the interceptors should be coordinated by the senior commander, who, present in the air with the interceptors, can direct the subordinate groups under his command. He can indicate which group is to attack the bomber group, which group is to engage the covering fighters, which groups are to consider themselves reserve forces, whether support is needed, etc.

In this case the fundamental means of controlling the interceptor groups in battle would be control supervised in the air, which does not imply a complete divorce from ground support. Through ground control points the interceptors can receive information and orders from the senior aviation commander while the engagement is in progress (concerning the cessation of hostilities and the r direction of interceptors to another hostile echelon, etc.).

In other words, control of the fighter arm of aviation during the repulse of mass air attacks is obtained by two methods:

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1. Ground control of all phases concerned in the repulse of a massed air attack by the enemy.

2. Uninterrupted control, carried out in the air, of the various groups of fighter craft composing the interceptor force.

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