PART TWO

OPERATION

CHAPTER I

FIGHTER-SEARCHLIGHT TEAM CONTROL

Section I

OPERATION OF THE AAAIS DETECTION AND PLOTTING SYSTEM

34. GENERAL.--a. No matter whether the searchlights are employed with fighter aircraft, with AAA, or in combination with both, the AAAIS will be required to operate continuously. This twenty-four hour operation is contemplated even though an Aircraft Warning Service has been established in an organized Fighter Command. Under these conditions of continuous operation, where at all practicable, the radio locators should be connected to a source of commercial power. This will result in a material saving in operation cost and in wear and parts replacement on the generating unit. The latter should be kept available as a standby unit for emergencies.

b. In the operation of fighters over a searchlight defense, the long range warning which only an Aircraft Warning Service can give is required if the fighters are to be based on the ground. The 2 to 4 minutes of warning provided by the AAAIS is much too little for the operation of ground based fighters. Since ground alert operation of fighters is by far the most effective and efficient type, it is seen that sufficient long-range warning must be provided by an Aircraft Warning Service to allow of placing the fighters on orbit about the principal control point of each searchlight intercept unit respectively affected, prior to the arrival of the enemy target within range of the AAAIS. The function of the latter is, by providing the close-in, precision data requisite to the moving of fighters within the searchlight intercept unit to make possible the flexibility required if the attack is to be met most effectively, including the concentration of fighters against a continuous or formation attack through a narrow sector.

35. THE RADIO DETECTOR AND THE PLOTTER.—a. (1) The radio detectors selected for operation in the AAAIS are those assigned to searchlights located on the outer borders of the area. Such searchlights, being the farthest spread elements of the defense, occupy the most strategic locations for this purpose.

(2) Tracking of the target is accomplished before the target arrives within searchlight range. When the target arrives at the proper range and the proper angle of elevation, the lights go into action, and plotting ceases. The target can then be followed by direct sight, or indirectly by the intersection of the beams following it. The radio detector, once the target has been illuminated and can be carried visually, at once resumes searching its normal front for other targets. If, because of haze or clouds, the target cannot be seen from the ground, and carried visually in the beam, it is necessary for the radio detector to continue to track the target as long as the target is within proper carry range of its light.

b. (1) In practice, it is not necessary that all radio detectors operating in the AAAIS be kept constantly in operation. In order to cut down mutual interference between mounts, it is desirable not to operate all mounts until after targets are initially detected, and initial detection of targets will be made with greater certainty and at longer ranges if no more mounts are operated in the initial searching phase than reasonably certain coverage requires. At normal searchlight intervals of 6000 yards, not more than each alternate detector should be operated during the initial search period, and often the operation of only one out of each three will be found sufficient. If previous warning from the long range Aircraft Warning Service has indicated the approach of a heavy raid, not less than each alternate detector should operate in the initial search.

(2) Previous warning from the Aircraft Warning Service having alerted the defense, those detectors held out of action initially are kept standing by, with generators running and fully ready for operation, but with the high voltage switches open. Upon a pickup by a searching detector, the Searchlight Plot Observer in the AAA Operations Center gives appropriate warning and intelligence to the commanders of all threatened searchlight platoons. The platoon commanders thereupon place all their detectors in action, ready for detection and illumination of all possible targets.

c. Previous to initial action, the SCR-268 must be oriented by the following steps:

(1) The open sight must first be rendered parallel with the radio axis of the antenna by adjusting it carefully on a visible target while such target is being accurately tracked by the oscilloscope operators. The visible axis of the sight has thereby been rendered parallel to the invisible radio axis of the antenna. It must be checked frequently thereafter, whenever a target is visible, to insure that the radio axis has not wandered from its previous position, nor the adjustment of the sight disturbed.

(2) The mount is then traversed until the sight points at an object of known azimuth, such as the North Star.

(3) The azimuth circle on the base of the mount is then slipped until the azimuth of the object sighted upon appears under the pointer (0^{o} if the North Star be used.) If a Selsyn-driven converter or distant indicator is in use, it must be oriented similarly. In either case, it is imperative that the open sight be used and subsequently checked to detect any wandering of the radio axis from the geometrical axis of the antenna. (See Figure 21.)

d. (1) When one of the oscilloscope operators picks up a target and announces "Contact", the azimuth reader immediately repeats "Contact" over the data line to alert the plotter. When the detector commander calls "On Target" the azimuth reader reports "On target" to inform the plotter that accurate data in azimuth and range is available. Altitude data may not be accurate at the beginning of the plot, since the detector commander announces "On target" as soon as azimuth and range are correct, without waiting for accurate altitude data.

(2) The azimuth reader who has previously reported "Contact" and "On target", thereby alerting the plotter, gives the command "Take" immediately following his report of "On target" which in turn is followed immediately by the report, over the data line, to the nearest 10 mils, the azimuth indicated by the azimuth scale; the range reader then reports over the data line, to the nearest hundred yards, the range indicated by the range counter. The range data should be read immediately after the azimuth data has been transmitted. Upon hearing the azimuth of the plot, the plotter positions his plotting arm at that azimuth. Upon hearing the range, he makes a mark with a wax pencil on the plotting surface opposite the proper range mark on the range arm. Immediately following the reading of a set of data, the reader again commands "Take", and the new azimuth and range are read in the manner described above. This process is repeated continuously until the target has been illuminated or lost.

(3) When a target which is being tracked by a radio detector is

illuminated, the chief controller announces "Target illuminated", and this announcement is transmitted over the platoon net by the telephone operator. The detector commander calls "Target illuminated" so that it can be heard by the detector crew, and the azimuth reader immediately repeats this call over the data line.

(4) As soon as any other light forms an intersection on his beam, the detector commander in the light section which is sending in data on the target , and the detector commander of one other light involved in the first intersection, providing, of course, that this detector is on a data line, calls "Intersection", which is repeated over the data line to the plotting room. If the detector commander then orders "Change target", the azimuth reader will also repeat this command for the information of the plotter.

(5) If the radio detector loses the target while a plot is being made, the azimuth reader repeats "Off target" over the data line as soon as it is announced. This will inform the plotter that the data is no longer accurate, and he will then cease to command "Take".

(6) Data is supplied over the data line in the following order: azimuth, range, altitude. Altitude data is furnished with the first three or four readings after the altitude data has become accurate, and with every fourth or fifth reading thereafter. Angular elevation, and therefore altitude, is inaccurate below angular elevations of 150 to 250 mils above the angle of mask. (See Figure 22.) When the angular elevation rises above this minimum angle, the altitude data can be considered accurate, and should then be read. If the angular elevation is lower at the beginning of a plot, the range reader should follow his first range reading with the announcement "Altitude unknown", and should repeat this announcement every fourth or fifth reading until the altitude data becomes accurate, at which time he will begin to furnish altitude data to the plotter as outlined above.

(7) Altitude data is always preceded by the word "altitude", but azimuth and range data are given directly, without using the words "azimuth" or "range". Azimuth is read in mils to the nearest 10 mils, range in yards to the nearest hundred yards, and altitude in yards to the nearest hundred yards. In reading data each digit is pronounced separately. For example, if, at the command "Take", the azimuth were 3617 mils, the range 42,740 yards and the altitude 4820 yards, the data would be read as follows:

"Three-six-two; four-two-seven; altitude four-eight".

(8) An example of the complete transmission of data that might be heard by a person tapped in on a data line during a typical plot is as follows:

Azimuth reader:	"Contact"
Plotter:	"Contact"
Azimuth reader:	"On Target"
Plotter:	"On target"
Azimuth reader:	"Take"
Azimuth reader:	"Four-zero-eight"
Range reader:	"Three-five-one; altitude unknown"
Az. R.	"Take"
Az. R.	"Four-one-zero"
R.R.	"Three-three-seven"
Az. R.	"Take"
Az. R.	"Four-one-two"
R.R.	"Three-two-five"
Az. R.	"Take"
Az. R.	"Four-one-four"
R.R.	"Three-one-one"
Az. R.	"Take"
Az. R.	"Four-one-seven"
R.R.	"Two-nine-eight"
Az. R.	"Take"
Az. R.	"Four-two-one"
R.R.	"Two-eight-two; altitude unknown"
Az. R.	"Take"
Az. R.	"Four-two-four"
R.R.	"Two-seven-zero"
Az. R.	"Take"
Az. R.	"Four-two-eight"
R.R.	"Two-five-eight; altitude five-one"
Az. R.	"Take"
Az. R.	"Four-two-seven"
R.R.	"Two-four-six; altitude five-one"
Az. R.	"Take"
Az. R.	"Four-three-six"
R.R.	"Two-three-five; altitude five-one"
Az. R.	"Take"
Az. R.	"Four-four-one"
R.R.	"Two-two-five; altitude five-one"
Az. R.	"Take"
Az. R.	"Four-four-six"
R.R.	"Two-one-four; altitude five-one"
Az. R.	"Take"
Az. R.	"Four-five-one"
R.R.	"Two-zero-five"

Az. R.	"Take"
Az. R.	"Four-five-seven"
R.R.	"Two-zero-zero"
Az. R.	"Take"
Az. R.	"Four-five-seven"
R.R.	"One-nine-six"
Az. R.	"Take"
Az. R.	"Four-six-four"
R.R.	"One-eight-eight; altitude five-one"
Az. R.	"Take"
Az. R.	"Four-seven-two"
R.R.	"One-eight-one"
Az. R.	"Take"
Az. R.	"Four-eight-zero"
R.R.	"One-seven-five"
Az. R.	"Take"
Az. R.	"Four-eight-seven"
R.R.	"One-seven-zero"
Az. R.	"Take"
Az. R.	"Four-nine-five"
R.R.	"One-six-two; altitude five-one"
Az. R.	"Take"
Az. R.	"Five-zero-two"
R.R.	"One-five-two"
Az. R.	"Take"
Az. R.	"Five-zero-seven"
R.R.	"One-four-three"
Az. R.	"Intersection"
Az. R.	"Target illuminated"
Az. R.	"Changing target"

36. DUTIES OF AAA CONTROL PERSONNEL.--a. General.-- Since azimuth, range and altitude data come directly and continuously to the plotter from the detector, plots appear on the board with a delay estimated not to exceed 5 seconds. Altitude is announced at the time of the initial long range contact, and periodically checked as the plot progresses. This non-delay characteristic results in possible changes in the target's course becoming immediately evident on the operations board.

b. The Searchlight Plot Observer.--(1) When an initial contact is made, and a plot begins, the Searchlight Plot Observer, over the Searchlight Intelligence Net, at once calls the threatened platoons and notifies them that a target is approaching them from a certain general direction, as "West" or "South-south-east". As soon as several plots have been made, and the course of the target has established it-

self, the Plot Observer steps to one side or the other, if necessary, in order to spot its line of approach quickly by eye, and gives its course by a line determined by the 2 searchlight positions most nearly in line therewith, e.g.:

"One Jay - Two Jay - Two Fox:

"Target approaching you on line -- One Jay Three -- Two Fox One!"

(One Jay Three in this case is the No. 3 searchlight position of the first platoon of the "Jay" battery area, etc, while the designations "One Jay", "Two Jay", and "Two Fox" are those of the platoon command posts, respectively, of the first and second platoons of the "Jay" battery area, and of the second platoon of the "Fox" battery area. The code names are chosen for audibility over the telephone, and the number of the platoon is separated from the number of the light by the placing of the code name between, for additional clarity.)

(2) Each searchlight and radio detector commander knows the approximate position of the lights adjacent to his own. Intelligence on the courses of approaching targets given him in terms of such light positions, supplies him all the information he needs in order for him to direct his unit with sufficient accuracy to the proper sector to search for the target. Giving him data on azimuths of approach by mils or degrees would involve complications and delays at no increase in accuracy of value to him. Further, unless the target be directly approaching his position, its azimuth will be constantly changing. If given the sector in which to search within approximately thirty degrees, the detector can locate the target without difficulty. Further refinement of intelligence, involving delays and complications, is not warranted.

c. The Balloon Barrage Liaison Officer.-- The Balloon Barrage Liaison Officer has little or no need for intelligence of the immediate type available from the AAA Operations Board. His orders governing the raising or lowering of the barrage would normally have come to him from the Area Controller through the AAA Operations Officer prior to the near approach of hostile targets. Since he is a member of the Antiaircraft Artillery control group, his position is in the AAA Operations Center, however, under the control of the AAA Operations Officer, who is the representative of the Antiaircraft Artillery Commander of the Area.

d. The Searchlight Operations Officer.-- (1) The Searchlight Operations Officer exercises only supervisory control over the searchlights. The normal dissemination of intelligence to the searchlight platoon commanders over the Searchlight Intelligence Net is the function of the

Searchlight Plot Observer on the floor. The Searchlight Operations Officer is, however, able to cut into the Intelligence Net at will, for the purpose of listening, or for the transmission of such orders governing the periodic restriction or release of lights as may be necessary. He should NOT attempt to exercise tactical control in any way over the lights in the field. When, for any reason, it becomes necessary to restrict illumination in a given area for a stated time, such as to let friendly aircraft or a "Dark" raid through, suitable orders will be given him, normally by the Area Controllers through the AAA Operations Officer. He then selects the proper platoons to insure non-illumination, and issues suitable orders.

(2) Targets may frequently pass through the adjacent areas sufficiently close to the overlap along the boundary as possibly to require early action by his own lights. For this reason he requires the ability to confer readily with the Searchlight Operations Officers of the adjacent areas, and is accordingly given a direct line to each.

e. The Gun Plot Observer.-- The Gun Plot Observer is stationed on the floor overlooking the Operations Board. He transmits the grid coordinates of approaching targets to the gun and automatic weapon fire units concerned, using the grid which is superimposed on the AAA Operations Board. The gun and automatic weapons fire units, by means of individual relocation boards, convert these grid coordinates to azimuth and range for their respective positions. Under no conditions should the AAA Operations Board be incumbered with relocation arms in an attempt to do this relocation in the AAA Operations Center. He also transmits altitude and number of planes, if the latter can be determined, directly to each interested fire unit.

f. The Gun Operations Officer is normally stationed on the balcony overlooking the Operations Board, although during action, he may take a position on the floor overlooking the Operations Board. He conveys orders received from the Area Controller through the AAA Operations Officer, regarding the restriction or release of fire of appropriate fire units direct to the respective fire units.

g. The AAA Operations Officer.--(1) The AAA Operations Officer is the representative of the commander of the antiaircraft artillery units operating in the area. As such, he is in general supervisory charge of the AAA Operations Center and of the operation of the AAAIS Detection and Plotting System. He is in direct communication with the Area Controller, from whom he receives and carries out, orders affecting the operational control of the antiaircraft artillery units operating in the Fighter Control Area.

(2) He avails himself frequently of the advantages of direct personal conferences with the Area Controller in the adjoining Area Operations Room, to the great advantage of mutual understanding and cooperation.

(3) He has a direct line to the AAA Operations Officer in each adjacent area, for exchange of information.

(4) He has a direct line to the Wing Filter Officer, to facilitate the exchange of information regarding targets initially picked up by the AAAIS, and "told" to the Wing Filter Room.

(5) He has a direct line to the Wing AAA Liaison Officer, to facilitate the exchange of information.

(6) Where a searchlight defense for fighter cooperation is operating in an area which does not include other elements of the Antiaircraft Artillery, the AAA Operations Officer takes over the duties of the Searchlight Operations Officer.

(7) Where space permits, it is most desirable that the Fighter Control Area Operations Room and the AAA Operations Room pertaining thereto be combined in one. (See Figure 19.) The stations of the Area Controller and of the AAA Operations Officer are located immediately beside each other. This provides the ultimate in the facilitation of mutual understanding, cooperation and harmony, and in the elimination of the delays and mistakes caused by relays.

Section II

THE INTERCEPT OFFICER

PLACEMENT OF FIGHTERS PRIOR TO INITIAL ILLUMINATION

37. OBSERVATION OF PLOTS.-- The position of the Intercept Officer is one which permits him to observe most readily by eye the plots of courses of incoming targets as they appear on the board. In the case of a single-sided defense, it may be on the balcony overlooking the board. His station is such that his viewpoint of the board is from the inside looking outward toward the incoming plots. In the case of an all around defense, it is most important that this viewpoint be preserved by splitting the board into sections and placing the Intercept Officer's position on the floor, in the center. (See Figures 18 & 19.) From this position he can turn readily in any direction to face a plot coming in

toward him and aline its direction by eye with speed and accuracy, which could not readily be done from a distant position on a balcony at one side, particularly in the case of a crossing course. From the position in the center, he is able, by stepping a few feet to one side or the other, to aline a crossing course without difficulty. He also notes, from the target stand placed by the raid orderly at the position on the board representing the tracking radio detector, the altitude of the target, and the approximate number of planes involved.

38. DISPATCH OF FIGHTERS TO SUB-CONTROL POINTS.--a. Having alined the course by eye, the Intercept Officer selects the prospective point of penetration of the searchlight area and notes the sub-control point nearest in line thereto. He then, by radio, orders a fighter, or one or more flights of fighters, depending upon the size of the enemy formation, from the principal control point to the appropriate sub-control point.

b. (1) In the example which follows, the below-named conditions are assumed:

(a) A line of control points extending north to south, colored green, red, yellow, blue and orange, with the principal control point yellow,

(b) A fighter flight with the code designation "Dublin",

(c) An enemy raid approaching the orange sub-control point at an altitude of 18,000 feet.

The Intercept Officer decides to move the "Dublin" flight complete to the orange sub-control point. His command would be:

"Dublin! -- Vector! -- One-Eight-Zero! -- Orange! -- Angels! -- Twenty!"

(2) In case it should be decided to dispatch only one fighter out of the Dublin flight to the sub-control point, the command would be:

"Dublin! -- One ship! -- Vector! -- One-Eight-Zero! -- Orange! -- Angels! -- Twenty!"

c. Flights are normally moved out from the principal control point to sub-control points from the bottom first, once the altitude of the "stack" has been properly adjusted. As each flight moves out from the bottom, the others are all stepped down 2000 feet. Reinforcements are then fed in at the top as needed. Once it is known that a heavy, con-

tinuous raid will pass near a single sub-control point, a "stack" or partial "stack" should be placed on orbit at that sub-control point. Normally, a reserve should be maintained at the principal control point.

39. CHANGES OF COURSE BY THE ENEMY AFTER DISPATCH OF FIGHTER.—In case of a change of course by the enemy after the fighter has been dispatched to a sub-control point, the Intercept Officer should make full use of the flexibility of the system by taking action in a manner similar to the following:

a. Where a reserve of fighters remains at the principal control point, a fighter or fighters from the reserve should be dispatched to the new sub-control point. The fighter or fighters originally dispatched should be recalled to the principal control point unless the actions of the enemy make it inadvisable to do so.

b. When no reserve of fighters remains at the principal control point, the fighter originally dispatched should be halted at the sub-control point nearest him at the moment, immediately the change in course develops on the operations board. As the necessity dictates, he should be stepped back along the line of sub-control points in accordance with the course taken by the enemy. (The fighter can move laterally faster than can the enemy.) (See Figure 8.)

40. THE FIGHTER AT THE SUB-CONTROL POINT.—a. Once the fighter has been placed at the proper sub-control point, interception is accomplished visually. When a searchlight goes into action and illuminates a target, the searchlight crew immediately announces "Target illuminated!" As soon as any other light forms an intersection on the beam first producing the illumination, the detector commander in the light section first producing the illumination announces "Intersection!" which is immediately relayed over the data line to the operations room. The Intercept Officer then relays the announcement "Bandit Hot from _____" to the fighter orbiting the appropriate sub-control point, giving its approximate direction from the sub-control point and its altitude. For example, suppose a fighter, designated "Dublin" to be orbiting the green sub-control point, of the Hickory Searchlight Intercept Unit, when an intersection is produced in his area. A command to the following would be given by the Intercept Officer:

"Dublin! — Hickory Green! — Bandit Hot from West! — Angels Twenty!"

b. Under certain conditions, the Intercept Officer may find it necessary to order a fighter to intercept a target out of his normal

front, and distant laterally, as in a case wherein the fighter, for any reason, may have been placed at the wrong sub-control point. In such a case, the Intercept Officer should call the fighter, using his code designation, the code designations of the proper searchlight intercept unit and of the sub-control point in front of which an intersection has been formed, giving him an approximate initial vector and altitude, e.g.:

"Dublin! -- Hickory Green! -- Bandit Hot! -- Vector-One-Eight-Zero! -- Hickory Orange -- Angels Twenty!"

41. ACTION TAKEN IN CASE OF FAILURE OF COMMUNICATION.-- When communication with the radio detectors fails, and plotting consequently stops, all sub-control points should be manned at once. Fighters are evenly distributed along the line of sub-control points throughout the threatened area. Such a communications failure thus results in destruction of the flexibility of the system, and of its ability to concentrate force, but does not result in destruction of the ability of the defense to offer a material degree of effective resistance.

Section III

THE AREA CONTROLLER

42. DISTRIBUTION OF FIGHTER UNITS.-- Each Fighter Control Area has, normally, under its control at a given time, certain fighter units available for night operation over searchlights. These fighters should, at night, be so distributed among the available airdromes, as to be able to man all principal control points of the Searchlight Intercept Units of the Fighter Control Area without undue difficulty, time and space factors considered. Upon receipt of reinforcements sent by the Wing Controller from other Fighter Control Areas, they should be ordered to orbit the principal control point of each of the proper Searchlight Intercept Units, or held in reserve on the ground, according as the nature, strength and direction of the raid make advisable.

43. PLACEMENT OF FIGHTERS ON AIR ALERT STATUS.--a. Upon the receipt from the Aircraft Warning Service of initial long range warning of the approach of enemy targets, the area controller orders selected fighter units from ground alert to air alert status. An appropriate unit is placed on orbit, $2\frac{1}{2}$ miles in radius, about the marker beacon of the principal control point of each Searchlight Intercept Unit threatened. The altitude of the orbit circle should be approximately 2000 to 5000 feet above that of the altitude of the enemy, as nearly as the latter can be determined. If an enemy raid, or part thereof, has passed through a con-

tinuous searchlight belt, both the forward and rear line of control points should be manned, in order that withdrawing enemy planes may be engaged with full effectiveness, as well as those still coming in.

b. The Area Controller mans the principal control points of as many separate Searchlight Intercept Units as appear to be threatened by the course of the enemy targets. This would never be less than 2, and usually not less than 3 Searchlight Intercept Units. Since a target can easily make radical changes in course after long range detection is first made, an attempt to make too fine a prediction as to which Searchlight Intercept Unit would be eventually entered would be dangerous. Subsequent decisions as to the allocation or reallocation of units to the affected Searchlight Intercept Units, are the responsibility of the Area Controller.

44. EMPLOYMENT OF MULTIPLE FIGHTERS.--a. Decision as to the number of fighters to be placed initially on orbit about the principal control point of each Searchlight Intercept Unit must be made on the basis of the best information available concerning the size and character of the approaching raid, whether single plane, formation, or continuous-wave attack. The minimum number should normally be three. Three fighters can be flown in formation at night, without undue difficulty, particularly if navigation lights are used while orbiting the control point. Formations of six have been operated successfully at night, with navigation lights, although this number is considered the practicable minimum.

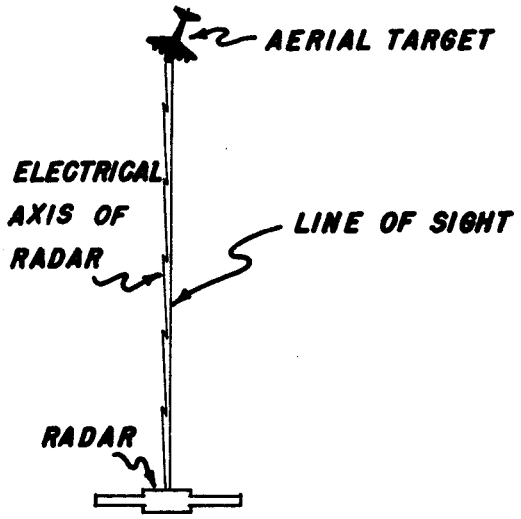
b. In case of warning from the Aircraft Warning Service of the approach of a heavy raid, flights should be "stacked-up" on orbit about the principal control points of the threatened Searchlight Intercept Units. The lowest flight should be placed initially at an altitude 2000 to 5000 feet above the altitude of the approaching raid, according to the best available information from the Aircraft Warning Service as to that altitude. Other flights should be "stacked" above, with a 2000 foot altitude separation between each two flights adjacent to each other vertically. As soon as more accurate information as to altitude becomes available from the AAAIS Detection and Plotting System, the altitude of the entire "stack" is adjusted accordingly by the Intercept Officer. Final adjustment of altitude of each flight is made by the Intercept Officer as he moves it to the proper sub-control point.

Section IV

THE WING CONTROLLER

ALLOCATION OF FIGHTER FORCES BETWEEN ADJACENT FIGHTER CONTROL AREAS

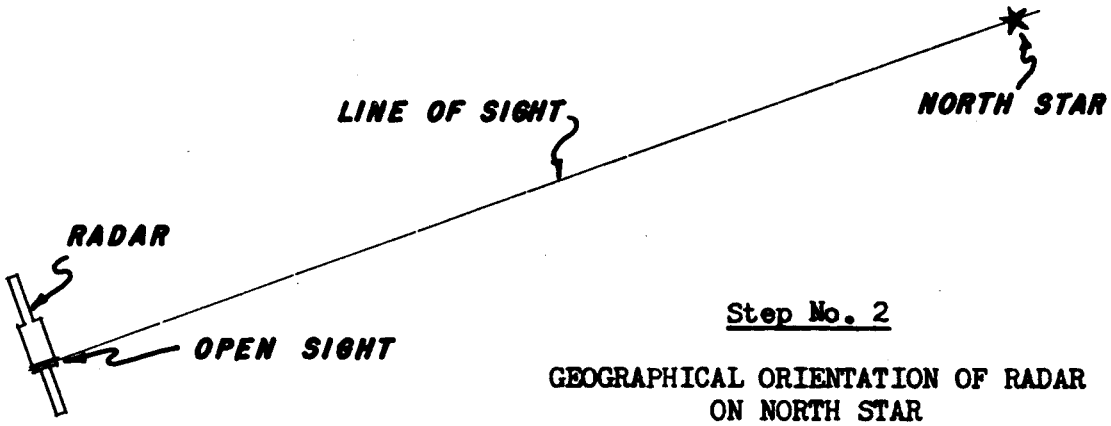
45. REINFORCEMENT.-- Decision as to reinforcement of a given Fighter



Radar operators track visible target while open sight is centered on same target by means of vernier adjustments in azimuth and elevation.

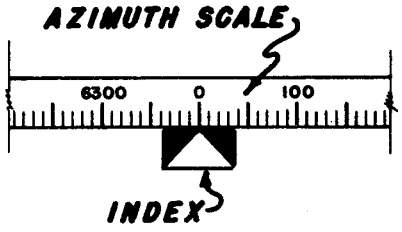
Step No. 1

ALINEMENT OF OPEN SIGHT WITH ELECTRICAL AXIS OF RADAR



Step No. 2

GEOGRAPHICAL ORIENTATION OF RADAR ON NORTH STAR



Step No. 3

ORIENTATION OF AZIMUTH SCALE BY SETTING INDEX TO ZERO WHILE RADAR IS SIGHTED ON NORTH STAR

FIGURE-21.

STEPS IN ORIENTING AZIMUTH SCALE WITH NORTH STAR

Control Area with additional fighter force rests with the Wing Controller. When a heavy raid is directed against a particular Fighter Control Area, its reinforcement may become advisable. This can best be accomplished from a general reserve of fighters within the Wing, if available. Reinforcement of a particular Fighter Control Area by drawing upon those assigned to an adjacent area must be carefully weighed against the possibility of imminence of another raid against the adjacent area.

46. RELEASE.-- Once decision to reinforce has been made, the reinforcing fighters should be wholly released to the control of the reinforced Fighter Control Area, insofar as tactical operation is concerned. The nature of the AAAIS Detection and Plotting System renders wholly impracticable the tactical control by one Fighter Control Area, of fighters operating over the searchlights of an adjacent area.

CHAPTER TWO

FIGHTER OPERATION

Section I

OPERATION OF FIGHTERS FROM THE SUB-CONTROL POINT

THE INTERCEPTION

47. THE FIGHTER AT THE SUB-CONTROL POINT.--a. Upon hearing the announcement, of the Intercept Officer, "Dublin! — Hickory Green! — Bandit Hot from West! — Angels Twenty!", as covered in Section II of Chapter One, the fighter immediately turns toward the outer border of the area, and looks in the stated general direction, in this case West, for the intersection. Upon perceiving it, he at once moves out toward it for the purpose of interception and attack, adjusting his altitude as he goes. The fighter moves outward while the illuminated target is moving inward, which normally results in interception being accomplished between the first and second rows of lights. In this zone, angles of intersection of beams on the incoming target first become good, and illumination is most favorable for the fighter.

b. (1) Cases may often occur in which several targets, distributed laterally, are approaching the area approximately at the same time, and several sub-control points have consequently been manned simultaneously. Under such conditions, indication should be given the fighter as to whether a given illuminated enemy plane is a proper target for him, or for the fighter at the neighboring sub-control point. This indication is in addition to the ordering out of fighters by the Intercept Officer, who may have ordered several out nearly at the same time, for the attack of simultaneously illuminated targets. Failure to give such indication can be expected to result, under such conditions, in the piling up of 2 or 3 fighters on the first target illuminated, leaving its neighboring targets, passing shortly afterwards on the right and left, to go unmolested, or only belatedly attacked.

(2) In order to give such indication, the crews of the sub-control point orbiting beacons, where used, are trained to point out targets

within their respective fronts by depressing the orbiting beacon in the direction of the intersection, for a period of 15 seconds. Since, by means of the oriented azimuth circles of their respective lights, they know accurately the angular limits of their respective fronts, they are able to determine whether or not a target is within those limits with more accuracy and facility than can the fighter, orbiting his circle. At the expiration of the 15 seconds, the orbit beacon is returned to vertical. The 15 second interval should not be exceeded, since the primary function of the orbit beacon is to mark a fixed control point. This is particularly vital when one or more flights are continuing to orbit the beacon, after the peeling off of an individual fighter or flight to make an interception. The fighters still on orbit will, however, be able to retain their position approximately during the 15 second interval.

c. The ordering out of a fighter from a sub-control point by the Intercept Officer, is to be construed as an aid to the fighter. His failure to receive such a command, whether because of failure of communications or for other reasons, should in no way be considered by the fighter as tying him to the sub-control point while proper targets pass. Whenever a target passes into his area and is pointed out by his orbit beacon, or is obviously a proper target, whether or not pointed out by the orbit beacon, he should attack on his own responsibility, regardless of failure to receive the customary order from the Intercept Officer. He should not normally, however, attack a distant target, not in his area and consequently not pointed out to him by his orbit beacon, without orders from the Intercept Officer.

d. Cases may arise when, for some reason, such as atmospheric conditions, the lights may be able to follow a target although not to produce actual full illumination. If the lights tracking the target at the time the fighter approaches its vicinity, are being directed by radio detectors, the intersection will constantly be in the immediate vicinity of the target, with the beams frequently "flicking" it. This will be the case even when the beams must penetrate broken clouds, or cloud ceilings not over a few hundred feet in thickness. In such cases the fighter should attempt to close in for the attack in the normal manner. Once having reached the near vicinity of the target, as indicated by the intersection, he should attempt to pick it up visually by such "flicks" as may occur, and to follow it by exhaust glow, if discernible. Under such conditions, wherein lights track an unseen target by radio detector data alone, the use of IFF, or similar means of identification, by the fighter, will be required if the searchlights are to keep from illuminating him.

e. Cases may occur wherein an apparent intersection has been formed and the fighter has moved out for the interception, but the lights have lost the target, or have failed altogether to illuminate it. Under such conditions, the fighter should normally return to the sub-control point, if not too distant.

f. After combat, the fighter calls the Intercept Officer for instructions. Depending upon the situation, the fighter might be ordered to proceed to the airdrome and land, or to return to the principal control point at a given altitude. Normally, the D/F system would be available, if necessary, for navigating him to the proper principal control point. He would not normally be returned directly to a sub-control point.

48. MULTIPLE FIGHTERS AT THE SUB-CONTROL POINT.— Attacks by waves or formations of enemy planes, often directed through a narrow front, are to be expected as normal. For meeting them adequately, the stationing of only a single fighter at a sub-control point is insufficient. A sufficient number of fighters, within the limits of those available, must be stationed at the sub-control point to offer effective resistance. A flight of from 3 to 6, flying in formation, with formation or dim navigation lights, should be placed on orbit at the proper level. If more are required, no larger formation than 6 should be attempted, but additional formations should be "stacked-up" at the sub-control point, with a 2000 foot altitude separation between each adjacent formation. The altitude of the lowest flight of the "stack" should be 2000 to 5000 feet above the altitude of the incoming enemy, according to the best available information. Flights, or individual planes, are normally moved out from the bottom of the "stack" first, the others stepping down successively. The flight leader, or senior flight leader, at the sub-control point is in charge of all operations from the sub-control point.

a. If the enemy is attacking in waves, by column of planes, so that targets are illuminated successively, the flight leader at the sub-control point peels off his planes in order successively from the rear, and orders them out to the attack. When the first target is illuminated, the flight leader peels off his rearmost fighter and orders him out. The fighter pilot thereupon peels off, turns out his lights, and moves out to the interception and attack. When the second target is illuminated, the second plane from the rear is dispatched accordingly, and so on. After combat, the fighters do not attempt to rejoin their formation, but call the Intercept Officer for instructions. These normally would be to land, refuel and rearm, but might be to rendezvous at the principal control point.

b. If the enemy attack is in formation, continuous, coordinated attack, by a formation of fighters, on its rear will be necessary if it is to be done any material damage before it passes completely through the searchlight area. This is accomplished in accordance with the principles set forth in Section II of this chapter.

49. ACTION TAKEN IN CASE OF FAILURE OF COMMUNICATION WITH THE GROUND.—a. If at any time after fighters have been placed on orbit about the principal control point, communication with the ground is lost, the flight leader or senior flight leader at the principal control point immediately mans all sub-control points of that Searchlight Intercept Unit, distributing all fighters evenly throughout.

b. The fighter, or senior flight leader, at any given sub-control point thereafter proceeds in accordance with his best judgment, and, if other sub-control points are manned, in accord with the pointing indications given by his orbiting beacon.

c. Upon completion of combat, each fighter makes no attempt to rejoin his formation, but proceeds to his airdrome and lands.

Section II

CONDUCT OF COMBAT

50. GENERAL.—a. Prior to takeoff, the following matters should be arranged:

(1) Cockpits should have been provided such shielding as necessary to insure against instrument glare on windshield and canopy.

(2) Care should be taken to insure that all flight instruments are uncaged and functioning.

(3) When electric sights are used, they should be dimmed to a point where they do not blind the pilot. A temporary expedient is to look at the sight with one eye and with the other to look past the sight at the target, superimposing the images. While variations in eye conditions between individual pilots, particularly in prism divergence, may introduce errors, this expedient should prove sufficiently accurate for short range fire.

(4) Each pilot should be carefully and thoroughly instructed in the fundamentals of the system and the prospective method of operation. The greatest emphasis should be placed on the necessity of:

(a) Maintaining the orbit circle of not over 2½ miles radius about the assigned principal control point until dispatched or until a proper target approaches the principal control point.

(b) Upon being dispatched to an assigned sub-control point, of proceeding directly thereto, and of maintaining the orbit circle thereat until an illuminated target approaches, or, if part of a formation, until dispatched to the attack by the flight leader.

(c) Staying always inside the searchlight area, except when in actual contact with a target which can be followed without illumination after it leaves the searchlight area, or when proceeding to the airdrome to land. It should be made clear that illumination of friendly fighters will almost certainly occur if they move beyond the outer boundaries of the searchlight area. Even though the friendly planes be carrying IFF or similar identification equipment, they are likely to be illuminated if they become intermingled with incoming enemy planes. The fighter must stay on his orbit circle until an intersection of two or more searchlight beams has been formed on or near the incoming enemy plane, thereafter moving out to the interception in such manner and at such speed as will cause the interception to occur just inside the outer line of lights.

(5) It should be made certain that each pilot knows the prescribed recognition signal, for use in case he should be inadvertently illuminated. This should be, if at all possible with the type of airplane in use, a prearranged reflected signal, a Very pistol flare, or similar signal. Experience has shown that the perception by the operators of a distant searchlight of any other type of signal emanating from an illuminated aircraft, cannot be depended upon, particularly when the plane is at high altitude and is illuminated by several lights. Radioed requests for cessation of illumination cannot satisfactorily be identified with a particular aircraft when bona fide targets may also be illuminated, and normally require too much time for execution.

b. When a flight has been ordered from ground alert on the airdrome to air alert at a designated principal control point, the take-off should be as compact as is consistent with safety. Each pilot must be extremely careful not to lose the plane ahead of him, and to close up the formation as rapdily as possible.

51. THE ATTACK BY INDIVIDUAL PLANES.—a. Under conditions when a flight has been placed on orbit at an assigned sub-control point, the formation should be held at an altitude from 2000 to 5000 feet above the level of the incoming enemy. Information as to the proper altitude would normally

be given the flight by the Intercept Officer, as described in Section II, Chapter One, Part Two. Airplanes are dispatched from the flight at the sub-control point as described in paragraph 48, Section I, Chapter Two, Part Two.

b. (1) Whether a flight, or only a single fighter, has been placed at the sub-control point, the actual attack of each successively illuminated, incoming, enemy target is necessarily, in its final phase, an attack by an individual fighter.

(2) When the fighter moves out to the attack, he should first locate definitely his target, which may initially require care, if the intersection be distant, or if several other targets be illuminated simultaneously. He should make use of the pointing indication given him by the depressing of the orbiting beacon for 15 seconds in the direction of the intersection, as described in paragraph 47, Section I, Chapter Two, Part Two. Then, making use of his margin of altitude, he should nose down to pick up speed, and proceed toward the incoming enemy.

(3) A head-on meeting is to be avoided. He should come in from the side in such a manner that when the turn is completed, he is not more than 500 yards to the rear and closing in on the enemy from directly astern and slightly below, meanwhile gradually regulating speed to that of the enemy.

(4) Searchlight crews are trained to handle their beams in such a manner as to avoid blinding the fighter pilot when in this position, and to keep the illuminated zone about the target sufficiently small as to allow the fighter to close to short gun range, about 200 yards, without being illuminated himself. The fighter pilot must, however, exercise great care not to fly through searchlight beams while getting into position. When searchlight crews are properly trained, the fighter can avoid the beams carrying the target without difficulty.

(5) While closing on the illuminated enemy from the rear, fire should be withheld until within 200 yards, and then maintained for a good burst of 3 to 5 seconds. After firing, the fighter should "S" out to the side, and repeat the attack if necessary.

c. After combat, the fighter should call the Intercept Officer for instructions, which would normally be to return to the airdrome and land. Immediate check of all instruments should be made after combat to detect possible damage to cooling system, gasoline supply, hydraulic system, etc. Upon landing, report should be made to the Intercept Officer or formation leader.

52. ATTACK BY FIGHTER FORMATION UPON AN ENEMY FORMATION.—a. When the enemy attempts to penetrate the searchlight area by flying in formation, the defending fighters are faced with the difficult task of launching coordinated attacks against it by a number of fighters simultaneously. Only such a coordinated, simultaneous attack can hope to do an enemy formation any material damage during its few minutes of passage through the searchlight area, as discussed in paragraph 10, Section II, Chapter Two, Part One.

b. For the attack, the leader of the fighter unit should follow the enemy formation from the rear. He should break his force into flights of 3 or 6 airplanes each, with flights "stacked-up" in altitude, depending upon the size of the enemy formation. He should send in one such flight at a time against the enemy's rear, the rest of the fighter unit following along behind. Searchlight personnel are trained to concentrate their illumination upon the rear of a large formation, when insufficient beams are available to illuminate the entire formation. As soon as the first flight has expended its ammunition, or otherwise completed its attack, a second flight is moved in to the attack, and so on.

c. (1) In making the attack, formation should be maintained by each flight up to within about 500 yards of the rear of the target. Upon radio signal by the flight leader, the fighters attack according to prearranged plan. These plans of attack are formulated during the training of the flight. They are a part of the indoctrination of the pilots. Designation of what plan to use, and minor deviations therefrom, are directed by the flight leader at the time of visual contact with the enemy.

(2) An example of such a plan would be as follows:

Leader attack left side, break away to left.
#2 Attack center, break away down.
#3 Attack right side, break away right.

Succeeding flights attack in like manner upon radio signal or observation of cessation of bursts of fire of preceding element.

(3) The attack is, in reality, a <u>coordinated</u> attack by <u>individual</u> airplanes which have been <u>positioned</u> for the attack in formation.

d. In the attack of a large enemy formation, it will be necessary to attack its base simultaneously by as many fighters as can attack at once without interference with one another. Normally this can be in multiples of 3, two elements being sent in simultaneously, one against the right rear and one against the left rear of the enemy formation.

Conceivably an enemy formation could be so large as to permit of attacking its rear by more than 2 elements of fighters simultaneously, without mutual interference. If so, this should be done.

e. After completing its attack, each fighter proceeds individually to the airdrome and lands. No attempt is made to reorganize the fighter formation in the air, because of the extreme difficulty of rendezvous operations at night with dim formation lights or none, and because of the lack of usefulness in such a proceeding, since the planes, after combat, stand in need of refueling, resupply of ammunition, and inspection.

f. For formation attacks, fighter aircraft should be provided with formation lights that are visible for a short distance to the rear of the plane only. They should be turned off before the break away -- or rigged so that when the guns are fired they are automatically extinguished.