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DEFENCE OF GREAT BRITAIN
AGAINST AIR ATTACK

HANDBOOK FOR PLOTTERS

AT AN

OBSERVER CENTRE

1939

By Command of the Air Council.

Donald Banks

AIR MINISTRY,

September 1938.

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THE PLOTTER'S HANDBOOK

DEFINITIONS.

"A Plotter."—A plotter is a member of an Observer Centre Staff who receives information from a number of posts with a common alphabetical prefix and whose task it is to plot the information thus received upon the Centre table.

"Plotting."—Plotting is the name given to the process whereby information from a post or posts is displayed upon a centre table in such a manner that it can be read off with the minimum of delay, and transmitted to other Headquarters.

A visual representation on the map of the track, number, height and other details of aircraft crossing the area is the result aimed at.

1. A plotter new to the work at an Observer centre may have to learn his work by being put down at the centre table and at once having to take charge of three or more observer posts, and carry on to the best of his ability.

There are, it is true, positions where he may listen to reports coming in from posts and hear an experienced plotter dealing with the situation, but, without some guidance, he may not understand what is being done, or why.

These words are written in the hope that they may make the plotter's introduction to his work more easy, and ensure that he does not fall into errors from which even more experienced plotters are not always immune.

A plotter's principal duty is to (a) "plot" the reports sent in by the posts on to the Centre Map by means of counters, so that the track and all details of each raid can be visually represented and every detail reported to the R.A.F. Headquarters concerned with the absolute minimum of delay; (b) make every endeavour to keep a CONTINUOUS TRACK of any raid by asking his posts for further information and by informing the plotter to whose area it is passing.

2. **Centre Map.**—(i) A thorough knowledge and understanding of the map is the first essential, and a short description will be given :—

The map is of the area covered by the group to which it belongs and the coast line or prominent features may be marked in.

The map is on a scale of one inch to one mile.

The posts are shown in their correct positions, and will be seen to be divided up into groups, lettered "A," "B," "C," "D," etc.

Normally there are three posts of each letter, numbered A1, A2, A3, B1, B2, B3, etc.

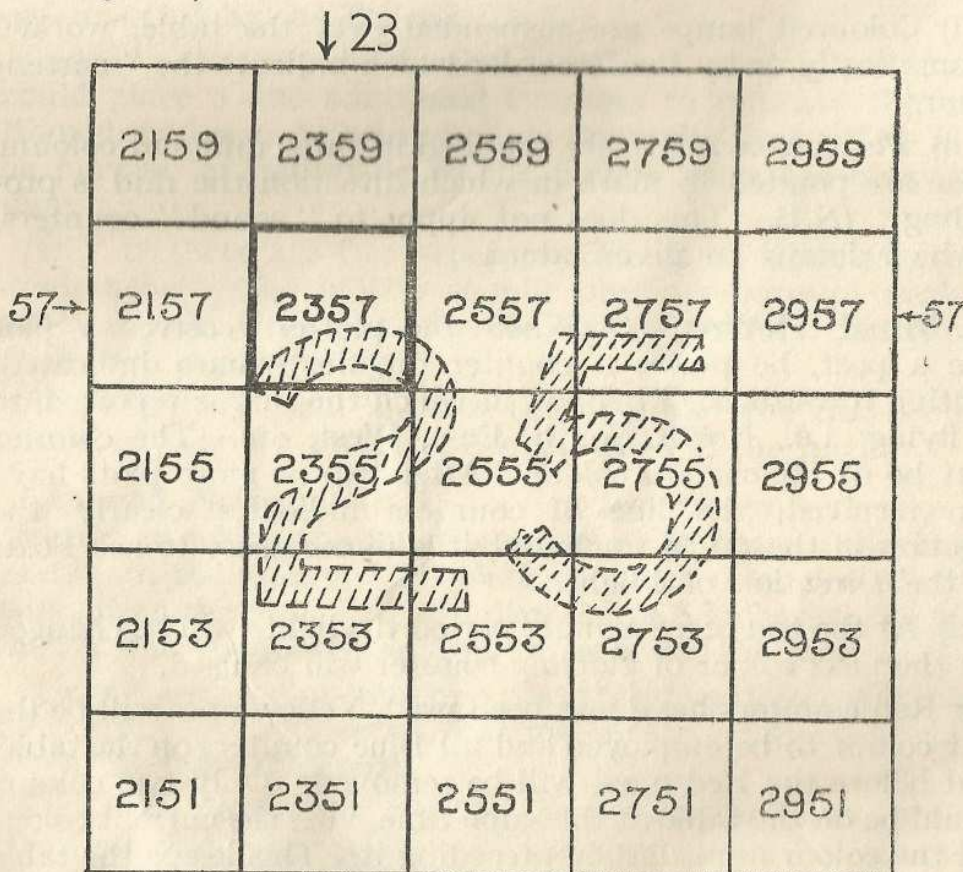
A plotter takes charge of all posts of the same index letter, i.e., all the "A" posts or all the "B" posts, etc.

The vertical lines of the map run true North and South, North being at the top when the map is looked at with the numbers and lettering the right way up.

The map is divided up into squares. The smaller squares, each having a four-figure number printed within them, are 2 kilometre squares, each side of the square being 2 kilometers or $1\frac{1}{2}$ miles long.

Twenty-five of the small 2 kilometre squares are contained in a 10 kilometre square; each 10 kilometre square has a distinctive two-figure number marked in it.

(ii) In order to find quickly any given plot which the plotter may receive from a post, it is necessary that he should understand something of the construction of these Map squares. (See diagram.)



↑ 23

10 KILOMETRE SQUARE 25
Diagrammatic Sketch of figuring for
Centre Map.

(iii) He will notice, for instance, that every 2 kilometre square in, say, 10 kilometre square No. 25 has a 2 for its first figure and a 5 for its third figure. So receiving a plot 2(3)5(7) he would look for this square somewhere within 10 kilometre square No. 25. If he will next observe that the figure 23, the first two figures of the plot received, run vertically all the way up and down the map and come between the figures 21 and 25, and that the figures 57, the second pair of figures of the plot, run horizontally all the way across the map and come between the figures 55 and 59, he will begin to have an idea of how to go about finding any square required, whether he is sitting with the figures upside down to him or whether the square is covered.

3. The System of Plotting.—(i) A clock is hung in a prominent position and has each 5 minute space coloured Red, Yellow or Blue.

Taking any quarter of an hour commencing from the quarter, the first five minute space is coloured Red, the second Yellow, and the third Blue.

(ii) Coloured lamps are suspended over the table, worked automatically or by the Recorder which indicate the "current colour."

(iii) Plotting counters are supplied in three different colours. These are pointed to mark in which direction the raid is proceeding. (N.B.—This does not apply to "sound" counters, of which details are given later.)

4. Visual Plotting.—(i) When the plotter receives a plot from a post, he places a counter on the square indicated, pointing towards the direction in which the raid is reported to be flying, i.e., North, South, East, West, etc. The counter must be of the current colour. After two or more plots have been received, the line of counters indicates clearly the direction of the raid's track and it is unnecessary to ask Posts for the Direction of Flight.

(ii) At the end of a 5 minute period the lights will be changed and the next colour of plotting counter will be used.

If Red counters have just been used, Yellow ones will be the next colour to be employed and all Blue counters on the table, used before the Red ones, will be removed. Only two colours should be on the table at the same time, viz., the current colour and the colour immediately preceding it. This keeps the table clear and causes it always to represent the current situation. "Stale counters," as they are called, must always be removed.

(iii) In addition to the plotting counters, square Red and square Blue counters are used for representing the number of aircraft in a formation and the height at which the raid is flying.

RED Number of aircraft.
 BLUE Height (in thousands of feet).

These counters are numbered from 0-9, and any number can be represented by suitable combination of counters.

(iv) If a raid is reported to be below 500 feet the blue counter 0 should be used to represent height.

(v) Should a plotter receive from a post the message "LOW RAID URGENT" he is to give priority to the plots from this post until the raid has passed out of sight and hearing.

(vi) If two Posts are plotting the same aircraft and using the same height they should be reporting the same square number, but in practice this is not always the case. If two Posts give different square numbers plotters should place their counter on the square which most nearly continues the track IN A STRAIGHT LINE. If a straight track is being obtained, a plot should not be placed BEHIND the leading counter, as the position of the leading counter has already been reported by the Tellers.

(vii) If a Post reports that an aircraft is turning, the plotter should place a few additional counters to indicate the turn although he has not received plots from the Post. This is for the purpose of indicating to the Tellers what the aircraft is doing.

(viii) If there are two separate aircraft in sight of a Post simultaneously the plotter should obtain reports of each in turn and make clear by the tracks on the table the direction in which each is proceeding.

(ix) The height and number counters and the raid number must always be kept adjacent to the head of the track.

5. Sound Plotting.—(i) In this system the post reports the direction in which the sound appears to be heard. No height enters into the matter. All plots are given on a circle 5 miles radius from the post, i.e., at a distance of 5 inches on the map, whether the aircraft is far from, or near to, the post.

A single sound plot from one post therefore does not indicate the position of the aircraft, but merely its supposed direction or bearing from that post.

Two such plots from neighbouring posts, however, provide data from which the position of the aircraft can be estimated. Its position is, of course, where the lines joining each post to its own plot (produced if necessary) intersect or cut.

(ii) Sound counters, also of the three different colours, are shaped to represent roughly a sound trumpet. One of these counters is put on the square given by the post reporting, and is

turned so that its pointed end points towards that post. (If the post is reporting as it should do, the counter will always be 5 inches away from the post.)

(iii) From examination of the counters on the table, the position of the aircraft can be estimated as described above, and when this has been done a "Halma" man of the correct colour is placed on the spot and the trumpet counters removed.

The direction in which the aircraft is proceeding can be judged as soon as a second Halma man is placed and a visual plotting counter of the correct colour is placed alongside the leading Halma man to act as a "Direction" indicator. This indicator is moved forward as subsequent Halma men are placed.

(iv) The number of aircraft and height of raids which are only heard, but not seen, cannot be estimated at the posts, or only most crudely and approximately.

(v) When aircraft are reported as being heard overhead at any post, a Halma man should be placed on the position of the post as marked on the centre map. After a Post has given an "overhead" it is necessary for the Plotter to obtain another plot after a short interval as this will enable an accurate Direction of Flight to be obtained.

(vi) Occasions occur when the noise of aircraft can be heard from a post, but it is impossible to say that the noise appears to come more from one direction than another. This is especially the case with aircraft flying at great heights.

A circular counter with a hole in the middle of it, in the requisite colour, is used to represent this state of affairs, and is placed on the post making the report. Position and direction taken by the raid in this case can only be approximately gauged by looking at the distribution of the counters on the map.

(vii) Although the most accurate positions of aircraft are obtained when more or less simultaneous plots are given by adjacent posts or when an aircraft is reported "Overhead" by a post, a fairly good track can be maintained by skilled plotters from reports received from single posts *if it is assumed that the aircraft is flying on a steady course.*

For instance—if an aircraft flying on a steady course is passing a post and frequent directional sound plots are given, the plotter by noting the rate at which the direction changes can infer whether the aircraft is passing close to or far away from the post reporting. This will enable him to place Halma men on an assumed track which (if maintained as a straight line) will not differ much from the actual track.

Again, if an aircraft is flying straight towards a post the directional plots from the post will be constant until the aircraft is reported "Overhead" and will then be constant in

the opposite direction as long as the aircraft can be heard. These reports enable the plotter to estimate and plot the track with great accuracy. A track having been obtained by one of the methods referred to should be assumed to remain steady unless reports from posts definitely indicate that the aircraft has altered its course.

If the track is assumed to remain steady, single plots from other posts hearing the aircraft will enable "positions" to be fixed.

The plotter *must* place a Halma man immediately he can obtain or infer a "position" because the Tellers only report the square on which a Halma man is placed. A failure to place a Halma man causes unnecessary delay in reporting positions to R.A.F. Headquarters.

6. Distinction of Types of Aircraft.—(i) Square counters with a white "F" may be used to indicate a track which has been reported from R.A.F. Hdqtrs. as that of Fighter aircraft, or if this can be definitely inferred because the aircraft first appeared from the known locality of a Fighter aircraft aerodrome.

(ii) Hostile bombing raids will be given a distinguishing number by R.A.F. Hdqtrs. and will retain the same number the whole time the raid is over the country.

7. Switches.—(i) On the latest pattern table each plotter has 3 control switches :—

(1) For controlling circuits to his posts.

With this switch pushed away from plotter it is in the stand-by position (for ringing calls from posts to plotter).

With this switch upright—the plotter is in telephonic communication with his posts.

With this switch pulled towards plotter, a ringing call is made to the posts by the plotter.

(2) and (3) Inter-communication switches.

Each of these switches is labelled with the letter of an adjacent group of posts. By throwing the switch, the group of posts concerned is brought into telephonic communication with the posts of the plotter concerned.

Viz. the "C" plotter can bring the B posts or the D posts into circuit with his own C posts.

There are two main uses for these switches :—

(a) To enable the plotting to be carried on by a reduced number of plotters.

(b) To enable two different lettered posts to overhear one another's plots for the purpose of height-finding if an aircraft is visible to both posts simultaneously.

(ii) *Communication Indicators*.—Near the plotter's position are three or may be four small indicators marked with the letter and number of the posts concerned—viz., P.1, P.2, P.3, P.4.

These indicators are worked to show which posts are in telephonic communication.

(iii) *Double-plugging*.—There are two sockets for telephone plugs at each plotter's position. This enables learners to "listen in" or the Controller to talk to the post without disconnecting the plotters' telephone.

8. On taking up Duties.—(i) A plotter on taking up his duties should put on his headphones and "plug in" to his position on the table.

(ii) If communication has not previously been established, he should then begin to call his posts softly by their distinguishing number, A1, A2, A3, or, as the case may be, in succession, to see if he gets any answer. All his posts talk on a common line and are plugged through direct to him while the exercise is on. All that he says to any one post can be heard by the other posts on his line. Anything that any one post reports to him can be heard at his other posts. This is very important to the whole system of plotting and to the plotter himself.

On receiving an answer on a clear line from any post, he will move his indicator to show that A2, or whichever the post may be, is in communication.

He should then test his ringing circuit to the post and instruct the post to test their ringing circuit to the centre if this has not already been done.

(iii) When reports begin to come through, the plotter must remember that it is for him to control the three (or four) posts on his line. Should he unduly raise his voice in trying to make his posts hear, his neighbour at the table is likely to talk louder also.

(iv) It is to the general interest, therefore, that all should moderate their voices as much as possible.

(v) It is for the plotter to control his posts in the case where the aircraft can be seen and reported from two or more of his posts simultaneously. It should be his object to check any post of his which tends to usurp all the plotting to itself.

What is required is to obtain plots in turn from the posts able to give them, preference being given to that post to which the aircraft is at the moment nearest, since this is the post that should be able to give the most accurate plots.

(vi) Posts are restricted in normal giving of plots to a radius of 8 miles (8 inches on the map) from them, but may, under exceptional circumstances, be authorised by the plotter to give plots up to the limit of their map, viz., up to 10 miles away from them.

(vii) Posts which can see an aircraft which is being reported by another post should be encouraged to obtain a "corrected" height.

(viii) Should two posts plotting simultaneously on the same aircraft give the same square, it is an indication that the height which they are both using is the correct height of the aircraft.

When two posts plotting on the same aircraft, but using different estimated heights on their instrument, give different plots, it indicates that one or both of the posts is using the wrong height.

(ix) It may briefly be mentioned that the following rough and ready rule applies:—

"If a post is using a height greater than that at which the aircraft is flying, then the resultant plot will be too *far* from the post giving the plot, and vice versa, if using too small a height, the plot will be too *close* to the post giving the plot."

(x) Double tracks of counters which sometimes appear on the table when wrong heights are being used can be interpreted in the light of above, but this duty is usually performed by the Controller or his Deputy.

(xi) Posts overhearing each other's plots are, if they understand the method, able to correct their heights themselves, and plotters should realise that for the same purpose, posts may sometimes ask for the last plot given by a neighbouring post with which they are not in communication, i.e., A3, for example, may ask the "A" plotter what B2's last plot was. The "A" plotter should look at or ask for his neighbour's last plot, and, if possible, give the information, as it provides data for his post in height correction.

(xii) As the plots come in, now from this post on his line, now from that, the plotter will place his plotting counters on the squares indicated, turning them in the direction in which the raid is proceeding.

(xiii) Posts should always report in a definite sequence as in the following example:—

"B2 calling, plane(s) seen 6,153, flying North, height 6,000 feet."

Subsequent reports on the same plane should be :—

“ B2 calling, same plane(s) now 6,357.”

The direction of flight and the height are not repeated unless a change has been seen by the post.

When reporting by sound the example is :—

“ B2 calling, plane heard 6,153.”

and subsequently

“ B2 calling, same plane now 6,357.”

Plotters should encourage their posts to use this form of report invariably.

(xiv) The first information is usually a square number, and it is of the utmost importance that the plotter should get a counter down on this square without delay. He should always have a plotting counter of the current colour in his hand when reports are coming in from his posts. This counter on the table attracts the attention of the “ Teller ” and enables him to warn R.A.F. Headquarters that aircraft of some kind or another have been sighted (or heard) in the locality (or direction) indicated, although fuller details are not yet available.

As the aircraft approach the post, further information will be forthcoming, and the plotter can supplement the information on the table with the requisite types of counters. Posts are often unable to distinguish the type of aircraft reported until they are near the post, if at all.

(xv) Again, it is a mistake on the part of the plotter to keep on asking for the “ direction ” when he has already a series of counters on the map which themselves show clearly which direction the aircraft is going, unless it appears that the aircraft has changed its direction or conflicting reports are received.

(xvi) An important part of a plotter's duty is to warn his posts, from watching the progress of a raid on the table, of any aircraft approaching them which they may not yet be able to see (or hear). This is most easily done by giving the particular post or posts in the path of the oncoming raid the latest square number in which the raid is known to be, remembering that anything further than 10 miles from a post is off its map.

(xvii) Good plotters make good posts, and vice versa. If once the posts are allowed to get out of control and all shout at once, or if one post is allowed to monopolise the plotting to the exclusion of others, not only does the plotter make things more difficult for himself, but the posts become discontented, and the efficiency of the system is seriously affected.

(xviii) Cases do occur of posts to which an aircraft is nearer, being unable to see it, while posts further away can still report it. These are due to tricks of light and cloud, and must be

treated as exceptional cases by the plotter whose one object should be to get the quickest and most accurate information as to the position and movements of the aircraft from the moment it comes within the plotting area of any of his posts.

(xix) If the plotter can hear talking at his posts when no reports are coming through, it means that the speaking (or microphone) switch at some post has been inadvertently left in the "ON" position. Plotters should call the attention of posts to this, as otherwise there is a wastage of battery power.

(xx) An aircraft once reported by any of his posts must never be lost track of, provided that it is humanly possible to follow it.

If a post makes a few reports and then ceases reporting while the aircraft is still within his range and no other post is on it, the plotter must press for further information, and, if no result from one post, then from another, and so on. He must not sit back and think "no reports coming in—nothing for me to do."

Should he judge that the aircraft or raid has passed out of the area watched by his posts and may now have entered another area, he should warn his neighbouring plotters, and not rest content until everything has been done to pick the raid up again. In general, it is his duty to think not only of himself and his own posts, but also of how the movements of aircraft in his area are likely to affect other plotter's posts.

9. The Overhead Message.—(i) It is an axiom in observer work that if a post, say A1, could know for certain exactly when an aircraft was overhead at, say, B2, a neighbouring post that is marked on A1's chart, A1 would have no difficulty in obtaining the correct height of that aircraft provided it is visible. (N.B.—This is only a special case of the general system of height-finding.)

To allow of this being done, posts are encouraged to warn Centres of aircraft about to pass overhead at their posts, as follows :—

"Planes about to pass overhead at B2."

(ii) When a plotter gets such a warning, "Planes about to pass overhead at B2," he will inform the "A" plotter; the latter warns his posts that aircraft or a raid is just going to pass overhead at B2. So do any other plotters whose posts are in range of B2. When B2 says "Raid now overhead," the "A" or other plotters concerned inform their posts, and these get a chance of height correction.

The "A" plotter should enquire what the corrected height is made out to be; plotters will notice that it is not the post at which the aircraft are overhead that can get the height, but any other post within 8-10 miles of that post.

10. General Information.—Any information regarding Aerial Combats, Crashes or Forced Landings, etc., received from posts should immediately be passed to the Controller.

11. Cancellation and Closing Down.—(i) Plotters should take particular care to make certain that any cancellation or closing down message reaches each of their posts. It is not sufficient in this case to rely on posts overhearing a general message. Individual acknowledgments of the receipt of the message should be obtained from each post.

(ii) After the posts have been closed down, plotters should see that their counters are ready in the tray for next opening of the centre, otherwise a delay will occur, due to bad organisation of the counters, when the centre next opens.