PART 3 : SECTION 3

CHAPTER 2

BLIND APPROACH BEACON SYSTEM

BABS BEACON

Function

1. The BABS beacon is placed upwind of the landing runway and aligned to enable aircraft to make precise radar approaches to that runway.

Method of Operation

2. The BABS beacon is a responding radar beacon used in conjunction with Rebecca or other interrogator types of radar. It operates on a frequency range of 213 to 233 mc/s, and changes the frequencies of the interrogating signal by 5 (or multiples of 5) mc/s in responding. A fighter BABS equipment has been developed to receive on 193 mc/s and transmit on 190·5 mc/s.

3. The retransmitted signal is radiated by a directional aerial system in two overlapping sectors ; the signal in the sector on the right of the beam (looking toward the beacon on the final approach) is coded to produce a thickened blip on the cathode ray tube, and the transmission to the left produces a thin blip. The thick blip represents the " dashes " sector, and the thin one the "dots" sector. The sector signals are received by a non-directional aerial on the aircraft, and are presented on one side of the vertical time base only. This change is effected by placing the BABS/HOMING switch in the BABS position.

4. The dots and dashes sectors are overlapped in line with the runway approach to form a beam about 1° in width. In this beam the dots and dashes signals are received with equal intensity ; consequently their respective blips on the Rebecca cathode ray tube are of equal length. Thus by comparing the length of one blip with that of the other (Fig. 1), and assessing the range indicated, the aircraft's position relative to the BABS beam can be determined.

5. A time delay is introduced in the response of the BABS beacon so as to make its transmission appear to come from a point 10,000 ft. upwind of the touchdown point, irrespective of the beacon's actual position. (This distance may in future be changed to two nautical miles.) In compensation, a corresponding delay is introduced in the circuit which controls the start of the vertical time base on the cathode ray tube. The resulting position

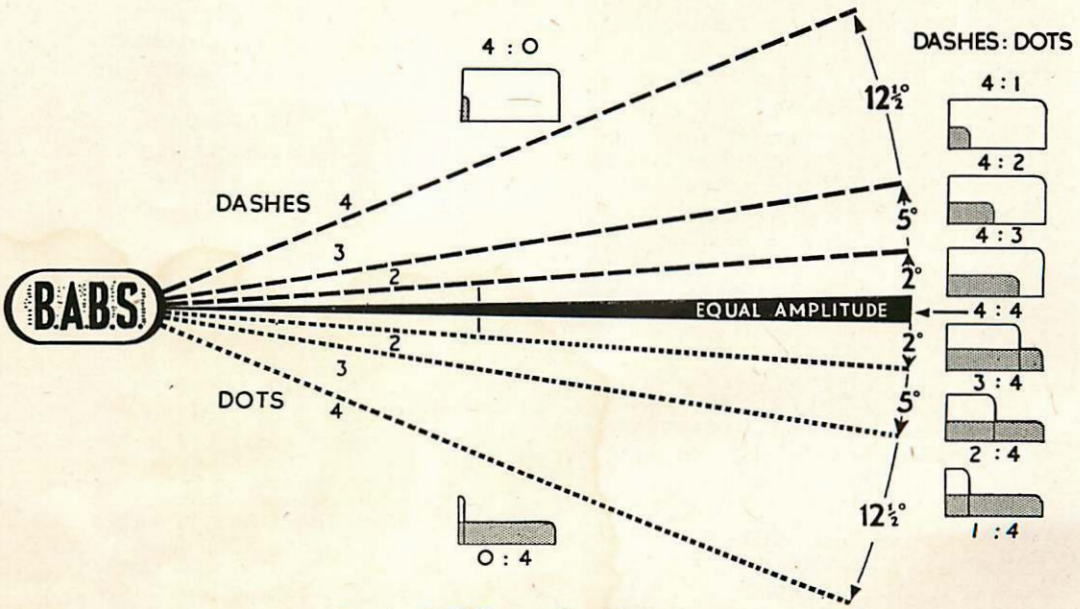

Fig. 1. BABS Beacon Signal Radiations.

of the blips thus gives a range reading adjusted to the touchdown point. This change is also introduced when the BABS/HOMING switch is turned to the BABS position.

6. **Crash Warning Indication.** Should a crash or other emergency arise to render the runway unfit for landing, the aerodrome controller operates a remote control, and the BABS beacon transmits the crash warning signal. This signal increases the time of production of the blips on the Rebecca display from 12½ to 30 microseconds, *i.e.* about 3 miles of trace. The operator advises the pilot accordingly.

Operational Limitations

7. **Range.** The low power of the BABS beacon limits the range to approximately 13 miles.

8. **Accuracy.**

(*a*) *Azimuth.* ± ½°.

(*b*) *Range.* ± 10 per cent. of the distance indicated.

9. **Identification.** The BABS beacon has no identifying letters, as has the Eureka beacon. Used in conjunction with Eureka homing, however, there is little need for further identification.

10. **Weather.** Heavy precipitation may produce clutter on the display, making interpretation more difficult ; but, generally, weather has little effect on the efficiency of the beacon.

11. **Traffic Density.** Theoretically, the number of aircraft that can use the beacon at one time is limited to about 40, beyond which their transmissions saturate the required pulse repetition rate and so confuse the response of the beacon. The normal BABS let-down and runway approach procedure, limits the landing rate to one aircraft every three to four minutes. With a suitable marshalling system feeding aircraft onto a direct approach, the landing rate could be increased considerably.

12. **Mobility.** The BABS beacon can be in operation within 20 minutes after arrival on the site, providing suitable locations have been prepared in advance.

BABS APPROACH AND LET-DOWN PROCEDURES

13. The procedures detailed in this chapter are for guidance only. Pilots should acquaint themselves with the local BABS orders before using BABS at any airfield.

14. There are three distinct phases in the Eureka/BABS approach procedure :—

(*a*) Homing to within five miles of the Eureka beacon adjacent to the required aerodrome.

(*b*) Homing from there to the BABS beacon on the aerodrome.

(*c*) The BABS let-down and final approach.

15. The frequencies, coding, and times of operation for the Eureka and BABS beacons involved are detailed in RAFAC.

Homing to the Eureka Beacon

16. Rebecca is switched on and the frequency channels for the Eureka beacon selected. The blip is watched for the identifying letter of the beacon.

17. The operator passes homing instructions to the pilot according to his interpretation of the beacon's position relative to the nose of the aircraft. If a starboard correction is required, the drawled word "R-i-g-h-t" is used ; the shorter, double "left-left" calls for a correction to port. The words "Dead Ahead" are self-explanatory, and the aircraft heading at that moment must be regained and held.

18. Range announcements are required at five-mile intervals until the aircraft is within 15 miles of the beacon. At this distance, permission is requested of air traffic control to carry out a BABS approach (see para. 33). Should there be other aircraft using BABS at the time of calling, air traffic control will give the height to fly, and turn to land, in addition to the usual landing instructions.

19. On receipt of holding instructions, the pilot changes altitude to arrive over the BABS beacon at the height specified (see paras. 29 to 31).

20. Alternatively, if the aircraft is cleared to land, height is lost to arrive over the BABS beacon at 1,500 ft. above aerodrome height, with due regard to safety clearance of surrounding obstructions.

21. From the 12-mile mark, range is called out at one-mile intervals. Homing continues to within five miles of the Eureka beacon. At this point, the operator calls "Range five miles, switching to BABS".

Homing to the BABS Beacon

22. Homing is now transferred from the Eureka beacon to the BABS beacon. The frequency channels for the BABS beacon are selected, but the BABS/HOMING switch is left on the HOMING position. (The BABS position switches to a non-directional receiving aerial which presents the blip on one side of the time base, and cannot be used for homing.)

23. The shapes of the BABS blips are different from the Eureka blips. The dashes blip is thick and the dots blip thin, one being superimposed on the other. Homing is carried out in the normal manner, *i.e.* by turning to equalize the blip lengths on either side of the time base. The operator continues to call out range for each mile. When the blips indicate that the aircraft is over the beacon, the operator calls "Beacon". The pilot reports to control, "Beacon, at .....feet". At this point the BABS approach procedure starts.

BABS Let-Down and Runway Approach

24. On arrival over the BABS beacon the pilot does a Rate One turn onto the reciprocal of the runway approach heading, in the shorter direction. Height is maintained at 1,500 ft. above aerodrome height. The operator changes the BABS/HOMING switch to the BABS position on receipt of "Steady downwind" from the pilot, and calls the sector when a change occurs, and range at each mile, to help the pilot in regaining the beam. The following table recommends suitable interception angles for each sector :—

In sector 4	intercept at 40°
In sector 3	,, ,, 30°
In sector 2	,, ,, 20°
In sector 1	,, ,, 10°
In "slight" sector ...	,, ,, 5°

25. An outbound heading should be determined which holds the aircraft steadily in the beam. From this, drift will be established and can be applied (in the opposite sense) on the final approach (Fig.2).

KEY TO FIG. 2

Holding Pattern

1. Pilot ... Flies on inbound heading to range four miles.
2. Nav. ... Calls range and sector each mile.
3. Pilot ... Turns port at Rate One onto QDR.
4. Pilot ... Maintains QDR for two minutes.
5. Nav. ... Calls range and sector each half-mile.
6. Pilot ... Turns port at Rate One onto QDM.
7. Nav. ... Calls sector during turn.

Let-Down and Runway Approach

1. Nav. ... Homes aircraft on to BABS beacon—switches aerials.
2. Pilot ... Calls A.T.C. "Beacon, height..... feet". Turns downwind onto beam.
3. Nav. ... Calls range and sector each half-mile.
4. Pilot ... Completes vital actions. Calls A.T.C. "6 miles downwind".
5. Pilot ... Turns 45° to starboard at Rate One, maintains heading for one minute.
6. Pilot ... Turns Rate One port towards QDM. Loses height to 1,500 ft. plus airfield height.
7. Nav. ... Informs pilot of height to fly, calls sector during turn.
8. Pilot ... Makes corrections to find and remain on beam.
9. Pilot ... Begins descent at 500 ft./minute.
10. Pilot ... Calls A.T.C. "Finals".
11. Nav. ... Calls range and sector each quarter-mile and tells pilot of required height each mile, *e.g.* "4 miles 1,200" (this includes airfield height).
12. Pilot ... If cloud is not broken, or if aircraft is outside slight dots or dashes, overshoot on QDM minus 45°.

26. At 6 miles the operator calls "Range—6 miles". The pilot acknowledges this with "Roger, turning finals", then again reports to control (para. 33). The pilot makes a procedure turn to starboard, maintaining altitude at

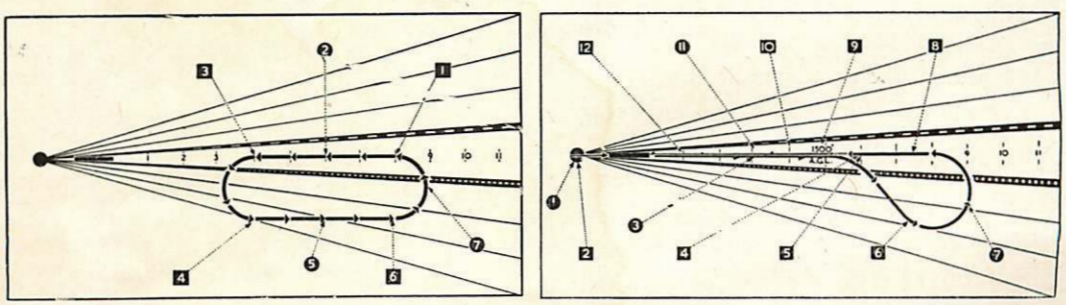

Fig. 2.

(*Left*) Specimen BABS Holding Pattern. (*Right*) Specimen Let-Down and Runway Approach.

1,500 ft. above aerodrome height. During the turn the operator gives a continuous commentary on sector indications. Should the signal fade (as it sometimes does in the early stages of the turn) the call "No signals" should be given.

27. In still air the procedure turn should bring the aircraft back into the beam. If it becomes apparent that this will not occur, the pilot should stop the turn at a heading that attacks the beam at a suitable angle for the sector. The table in para. 24 can again be applied.

28. When the aircraft regains the beam, an adjustment for drift may be required to hold the aircraft in the steady beam. The drift assessed on the downwind leg is used. The pilot now informs the operator "Steady on final". The operator begins a continuous commentary on the on-beam or sector signals received, and announces the range at one-mile intervals down to the two-mile mark, thereafter at each half-mile. At the five-mile mark the pilot reports to control (para. 33), and begins the final let-down. The operator now includes a check height at the five-mile and each subsequent mile mark in his commentary. The heights *above ground* for a standard BABS descent are given in the following table, to which must be added the QNH height of the aerodrome in question. The resultant figure announced to the pilot is given to the nearest 50-ft. level *above* the actual figure (see column 3 of table).

Range (*miles*)	*Height above Ground* (*feet*)	*Check Height* (*Airport* 264 *ft. A.S.L.*)
5	1,500	1,800
4	1,200	1,500
3	900	1,200
2	600	900
1	300	600

Holding Procedure

29. On receipt of holding instructions from air traffic control, the pilot alters to, and thereafter maintains, the height specified for holding.

30. Homing is continued to arrive over the BABS beacon, when the pilot reports "Beacon, at.....(holding height).....feet". No further reporting is necessary, unless requested by control, until the pilot is ordered to carry out a let-down and final approach. The pilot should, however, inform the operator when turns are started and completed. The reciprocal track is intercepted as directed in paras. 24 to 26, and the procedure turn is carried out at the six-mile mark.

31. The beam is regained and followed down to the three-mile mark (Fig. 2). A turn to port through 180° is then made, and an outbound track is flown parallel to the beam for two minutes, or until seven-mile range is reached. A turn to port is again made to regain the beam on an inbound heading. This oval circuit is repeated until further instructions are received from control.

32. When landing clearance is received, the aircraft completes the pattern, losing altitude, until it regains the beam on an inbound heading at 1,500 ft. (approximately at the seven-mile mark). The procedure for the final approach as given in para. 28 is then carried out, including the final report to control at the five-mile mark.

R/T Check Points

33. There are six occasions during a complete BABS approach when R/T communication with control is mandatory :—

(*a*) At a point approximately 10 minutes from the aerodrome, or when instructed by the air traffic control centre to communicate with approach control.

(*b*) When over the main beacon.

(*c*) When an aircraft may carry on after being told to hold.

(*d*) At the six-mile mark on the downwind leg.

(*e*) At the five-mile mark on the approach leg.

(*f*) When overshooting.

34. The number of R/T check points is reduced when a straight-in approach is permitted (see para. 33(*a*) and (*e*)).