PART 3 : SECTION 3

CHAPTER 1

GEE, REBECCA, AND EUREKA

GEE

Purpose

1. Gee is an airborne radar device which, in conjunction with its associated ground equipment, enables the crew of any aircraft to determine their position anywhere over an area having Gee coverage, if they are not flying too low.

Ground Equipment

2. In the United Kingdom there are a number of Gee chains, each comprising a master transmitter and two or three slave transmitters, all of which are situated on the ground. The master transmitter transmits radio pulses, each pulse being received not only by the aircraft receiver but also by the slave ground stations. The slaves automatically retransmit each pulse at a fixed time interval after reception, so that the aircraft receives pulses from the slaves as well as from the master transmitter. By timing the intervals between receiving the various pulses, the aircraft navigator can find his position.

Aircraft Equipment

3. The time intervals between pulses are measured by a cathode ray tube. The navigator has only to perform two or three simple adjustments to the setting knobs of the receiver, for the time differences to be displayed on counters in the cockpit. By reference to a Gee chart, which is a normal plotting chart overprinted with a Gee time-delay lattice, the aircraft's position can be obtained. The whole operation should take between 15 seconds and 1 minute, depending on the navigator's experience and the conditions under which he is working.

Accuracy

4. Accuracy is high near the transmitters (within hundreds of yards). At extreme range (about 300 miles) the "ellipse of probability" round a fix is 7 to 8 miles long and 2 to 3 miles wide. The average fix can be taken as accurate to within 2 miles.

REBECCA AND EUREKA

Function

5. Rebecca is an airborne radar interrogator which provides position fixing, homing, and runway approach facilities, when used with the appropriate ground beacons. The ground beacons for fixing and homing are designated "Eureka" ; those for runway approach assistance are designated "BABS" (Blind Approach Beacon System).

Principles of Operation

6. **Ranging Indication.** The Rebecca transmits a pulse which is detected by the Eureka receiver on the ground, and which causes the Eureka beacon to transmit a pulse which in turn is picked up by the Rebecca receiver. The interval between transmission of the initial Rebecca pulse and reception of the Eureka pulse by the Rebecca receiver is timed and indicated by a blip on a vertical straight line time base (Fig. 1) on a cathode ray tube. It can be read off as a distance by the Rebecca operator.

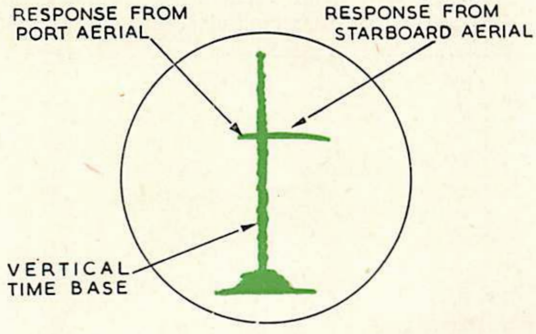

Fig. 1. Rebecca—Presentation of Responses.

7. **Heading Indication.** The Rebecca receiving aerial system consists of two aerials, one on either side of the aircraft. These aerials are directional, *i.e.* signals from dead ahead of the aircraft are received with equal intensity by both aerials, but signals from the starboard side are received more strongly by the starboard than the port aerial, and vice versa. By using a switching motor with the Rebecca equipment it is

possible to display alternately the signals received by the starboard aerial as deflection blips to the right of the vertical straight line time base, and the signals received by the port aerial as blips to the left of the time base. Since this motor switches the display from side to side approximately 20 times per second, the impression of a continuous display is created (Fig. 1). Comparison of the relative sizes of the blips, one on either side of the time base, gives the relation between the strength of signal being received by each aerial, and an approximation of the direction in which the Eureka beacon lies relative to the aircraft heading.

Homing Procedure

8. When the blips from the port and starboard aerials are of equal length, the aircraft is heading directly towards, or away from, the beacon. This ambiguity is resolved as the range indicated by the composite blip increases or decreases. A quicker method to prove homing is to alter heading by 10° to 15° and note the reaction in blip displacement. If the blip increases in length in the opposite direction to the change of heading, the beacon is ahead, and vice versa.

9. No set procedure is laid down to allow for drift. A computed drift may be applied, in which event the corresponding displacement of the blip on either side of the time base must be watched for a further change. If blip amplitude on either side of the time base tends to become equal, the drift correction is insufficient ; if the longer blip increases in length relative to the shorter blip, the drift correction is excessive. A systematic adjustment of heading should be made until the aircraft appears to be homing with a constant relative blip displacement.

Fixing Procedure

10. With a knowledge of range from two or more beacons, arcs of circles of corresponding radii can be centred on the beacon positions to intersect, theoretically, at the position of the aircraft. When only two beacons are used, two intersections result ; and additional navigational information may be required to solve the ambiguity. When three beacons are used, this ambiguity is resolved and a definite fix obtained.

BABS Procedures

11. BABS procedures are described in Chapter 2.

Performance

12. **Range.** Range is limited by the optical horizon and influenced by the power output of the ground beacons in use. At 7,500 feet a Eureka beacon has given satisfactory range readings at 69 miles. At higher altitudes the Mk. 4 Rebecca should be readable at the full-scale range (120 miles).

13. **Accuracy.** Range accuracy is about ± 10 per cent. of the indicated range, *e.g.* ± 2 miles at 20 miles. Bearings obtained by turning the aircraft to equalize the blips are accurate to approximately ± 5°.


TELEBRIEF
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