Rossi.

REBECCA B.A.B.S. (Beam Approach Beacon System.)

(1) The B.A.B.S equipment provides a radar beam down the line of the runway on a similar layout to the beam provided by the S.B.A. equipment.

(2) The ground equipment consists of a responder beacon which, on being interrogated by an aircraft's Rebecca, transmits a field of energy on each side of the runway with a slight overlap along the centre line of the runway. The field to the left of the runway transmits a 'dots' signal and that to the right a 'dashes' signal; down the centre, where the fields overlap, a steady signal is transmitted because the 'dots' and 'dashes' merge to give a steady signal.

(3) The aircraft's equipment picks up these radiations and a picture is presented on the Cathode Ray Screen of the Rebecca set; a fat pulse if the aircraft is to Star-board of the runway in the 'dash' sector and a thin pulse if the aircraft is in the 'dots' sector. When the aircraft is flying along the centre line of the runway the two pulses are superimposed and of equal length. The difference in length of the two pulses indicates the angular distance from the centre line.

(4) To carry out an approach, the aircraft is homed to within five miles of the airfield and from there homed directly over the B.A.B.S. beacon. From overhead the pilot then flies a set circuit by turning left over the beacon onto the heading of the down-wind leg of the circuit. He carries out cockpit check on the down-wind leg whilst the navigator informs him of the increase of range as the aircraft flies away from the beacon. He turns onto the final leg by executing, normally, a rate one turn from range seven miles on the downwind leg which should bring him to the desired point at range five miles on the final approach path at which point his height should be 1500 feet. From this point he alters course according to the navigators information regarding the signal on the Cathode Ray Screen and the pilot should decrease height from the five mile point at the rate of 300 feet per mile so that at 1 mile range, he should be in line with the runway and at an altitude of three hundred feet.

(5) The Cathode Ray Screen is calibrated in miles range; thus the navigator who is reading the screen can inform the pilot of the angle he is from the correct approac-h path and the distance from touch down point as indicated by the graduated screen.

(6) The success of this landing aid depends almost entirely on the Pilot and the Navig-ator working together as a well practiced team; as in a G.C.A. approach, a constant commentary should be given to the pilot so that at no time is he in doubt of his position.

-REQUIREMENTS-

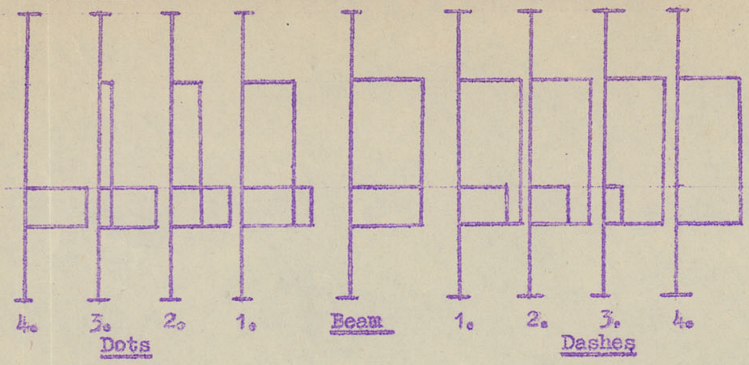
GROUND EQUIPMENT

B.A.B.S. Mk;11. A ground responder system which provides information to aircraft fitted with interrogating equipment. A special aerial has been developed using a rectangular cavity resonator across the front corners of which are cut two horizon-tal slots. The slots are switched by short circuiting at their centres and radiate energy to right and left of the centre line of the runway. Pulses to the left are of 12 microseconds duration and to the right of 6 microseconds. The equipment is mobile and works from accumulators, this places limitations on design and power. The range is approximately 12 Miles at 1000 feet.

AIRBORNE EQUIPMENT.

Rebecca. An airborne interrogator providing heading and distance information from a ground or airborne beacon.

DISPLAY ON THE CATHODE RAY TUBE :- REBECCA B.A.B.S.



CRASH WARNING.

This operated directly, either by the B.A.B.S. beacon operator or by Flying Control and is a visual warning on the Rebecca indicator to the operator to indicate that for some reason it is considered inadvisable for the aircraft to attempt to land. The blips increase in size and almost fill the whole screen; should this warning appear whilst making a B.A.B.S. approach the approach should be abandoned and Flying Control asked for further instructions. If, however the aircraft is still some distance from touch-down, the approach can be continued and descent made in case the obstruction is removed during the latter part of the approach but UNDER NO CIRCUMSTANCES is the aircraft to land whilst the general crash warning is showing on the screen.

AIRFIELD APPROACH :- REBECCA-EUREKA.

The Eureka set is a small portable radar responder beacon. On being interrogated by an aircraft's Rebecca, the beacon transmits a signal with a coding for easy identification. The signal is received by two aerials, one on each side of the aircraft's fuselage. These signals are conveyed to the Cathode Ray Tube of the Rebecca and are presented as a blip upon each side of the centre line of the tube. The size of the blip depends upon the energy received by the aerial, the aerial which has the stronger signal causes a longer blip to be formed. A Eureka beacon to the Stbd: side of the aircraft would give a long blip to Stbd: of the centre line of the screen and a short blip to Port; this has the appearance of an elliptical blip across the centre line, therefor, if the aircraft is turned to Stbd: the ellipse will appear to slide to Port until it is equally bisected by the centre line, the beacon will then be dead ahead.

A Rebecca-Eureka let down is accomplished by homing the aircraft to the Eureka beacon, when overhead turning onto the Safety lane of the airfield for a certain distance and letting down to safety height. The aircraft then turns back and again homes to the beacon letting down to the minimum altitude permitted. The let-down is completed with a bad weather circuit.

GEE LET-DOWN.

Gee let-downs are possible at most airfields in this country for they all have good Gee coverage. A Gee lattice which runs along a chosen safety lane and across the airfield is selected. The navigator directs the aircraft on to this lattice line at a point some distance from the airfield, then navigates the aircraft along the lattice line until the airfield is reached. Distance from the airfield is calculated by passing over a series of defined points the co-ordinates of which are pre-set on the Gee set by the navigator.

The let-down is normally commenced at 25 miles range. The navigator gives the pilot a course to reach the lattice line and when on it a course to hold the lattice. Six miles from the airfield is point "B" at which the aircraft should normally be at 1200ft: above airfield height with landing checks completed. The navigator then sets his co-ordinates for position "A" and directs the pilot to fly down the lattice until point "A" is reached at the minimum safe height.

STANDARD BEAM APPROACH (S.B.A.)

S.B.A. is a radio landing aid and employs three radio beacons the Main beacon and the Inner and Outer Marker beacons.

The Main beacon provides a beam which lies along the direction of the runway and to either side of the beacon which is installed 300 yds. from the upwind end of the runway. It therefor transmits a beam along the Q.D.R. of the runway which is termed the "Front" beam and a beam along the Q.D.M. of the runway which is termed the "Back" beam.

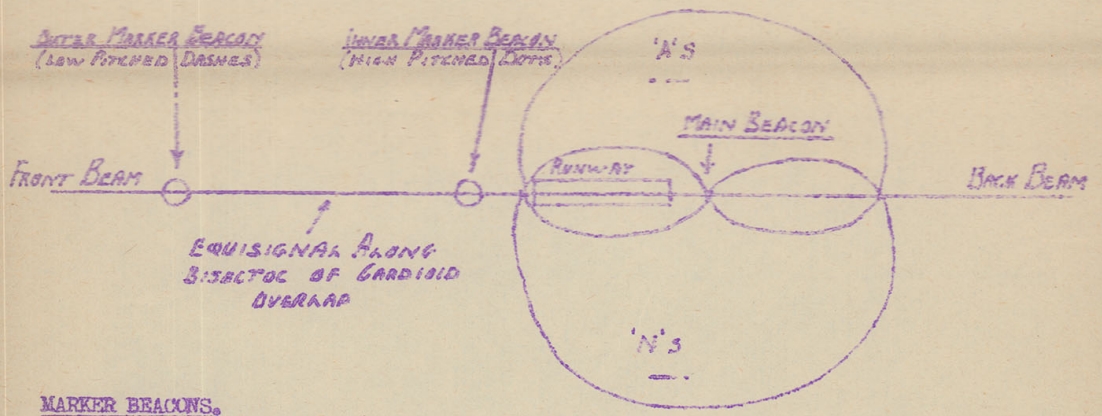
The two Marker beacons transmit vertical, fan-shaped lobes at fixed points along the approach path or front beam.

The aircraft equipment consists of two receivers; one tuned to the main beacon frequency, the other to the frequency which is common to all Marker beacons.

The ground installation is subject to siting difficulties and cannot readily be made mobile.

THE MAIN BEACON.

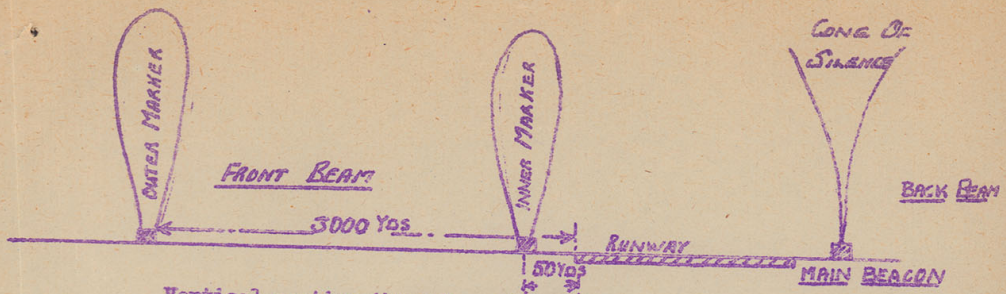
By the use of suitable spaced aerial and reflector, a roughly cardioid polar pattern is radiated; by introducing a second reflector on the opposite side of the main aerial and alternately switching the two reflectors, two cardioid patterns overlapping along the centre line of the runway are produced. The cardioid to the left of the Q.D.M. transmits a series of morse "A", the cardioid to the right transmits a series of "N" and since these two letters are interlocking, the bisecting line of the overlapping areas of the cardioids forms an equisignal or a steady note. Off the bisecting line in the overlapping areas is the twilight zone. In say the "A" twilight zone, the morse letter "A" would be heard against a background of interlocking "N"s which gives the impression of "A" superimposed on a slightly more faint steady note. As the receiver is moved from the bisecting line towards the "A" cardioid, the background note fades until, when the receiver moves out of the over-lapping area, the background note disappears and morse "A"s only can be heard. The twilight zone therefore, is useful indication of nearness to the approach path or steady beam.



MARKER BEACONS.

In order that the pilot may have some indication of when to commence his let-down, Marker beacons are placed along the approach path to the runway. These markers also serve to identify the correct approach path, since in addition to the Front beam, there is also the Back beam. The marker beacon are known as the "Inner" and the "Outer" markers and are situated approximately 50 yards and 3000 yards respectively from the touch-down point. They both radiate horizontally so that they are heard only for the short period whilst the aircraft is flying over the beacon. The Inner marker beacon transmits, a series of high pitched dots and the Outer marker beacon a series of low pitched dashes.

An additional indication of position is given by the Cone of Silence situated directly above the main beacon. In this area the signals fade out completely whilst the aircraft is over the beacon. Due to the action of the A.V.C., two cones of silence may be apparent but this is of no importance since it is still an indication that the aircraft is over the main beacon.



Vertical section through equisignal.

FRONT - BACK BEAM IDENTIFICATION.

To make identification of the front or back beam possible, the normal S.B.A. signals (A's & N's) are interrupted every minute for seven seconds. For the first $3\frac{1}{2}$ seconds a transmission, usually the call sign of the airfield, is beamed out along the direction of the front beam. By switching reflectors it is then beamed out along the back beam for the following $3\frac{1}{2}$ seconds. Therefor, in the front beam, a loud signal followed by a faint repetition will be heard and in the back beam a faint signal followed by a loud one will be heard.

PROCEADURE.

The following is a general outline; detailed instructions are found in the appropriate Air Staff Instructions.

A pilot using S.B.A. for a landing approach should maneouvre his aircraft to arrive at a position on or near the equisignal approach sector at about five nautical miles distance from the airfield. He should then fly the aircraft within the equisignal sector while approaching the airfield and maintain the correct rate of descent. The following aural indications of position should be noted.

(1) If the aircraft is within the equisignal approach sector a continuous note.
(2) If the aircraft deviates more than half a degree from this sector the Twilight zone will be entered, the pilot will then hear superimposed upon the continuous note, faint A's if to the left or faint N's ifto the right of the equisignal sector.
(3) If the pilot deviates still further A's or N's only will be heard depending on whether the deviation is to the left or right.
(4) A pilot approaching the main beacon in the Back beam would hear A's if the deviation to the right, N's if to the left.

Heights at which the aircraft should pass over the Inner and Outer marker beacons should be predetermined so that the pilot can adjust his rate of descent. When passing over the Outer marker beacon, dashes of low pitch will be heard, and when over the Inner marker beacon, high pitched dots for a few seconds.

.....8.....