Using Assumed Position

	Hc	Δ	Az
ZEISS ARG 1	41°34'	21'A	220°
WEEMS/LINE OF POSITION BOOK	41°33'	20' A	220°
DREISONSTOCK/HO 208	41°34'	21' A	220°
HUGHES TABLES	41°34'	21' A	220°
MYERSCOUGH & HAMILTON RNT	41°34'	21' A	219°
HO 249 / AP 3270 VOL III	41°34'	21' A	219°

Using Dr Position

	Hc	A	Az
ZEISS ARG 1	41°12'	01' T	220°
AGETON/HO 211	41°12'	01' T	220°

Sample Great Circle Distance And Initial Course Calculation

From: N 17° 22' & W 025° 28'
To: N 40° 08' & W 073° 17'

1. Set latitude to starting position (+90°)
2. Set time angle (difference of longitude 47° 49' + 180° = 227° 49'), against declination (destination latitude N 40° 08').
3. Set departure latitude (N 17° 22')
4. Read: altitude (ZD) of 46° 55', therefore distance = 2815 nm and azimuth of 309° 10' as initial great circle course.

Note that the Log Haversine method gave 2818.2 nms and IGC of 309° 11.5'.

The Instrument Revealed

The first indication that the Luftwaffe were using a new method to solve the problem of sight reduction was the discovery of a fragment of a photograph in the wreckage of a Dornier 217 of III/KG 100 that crashed near the town of Totnes in Devon, England on the 30th April 1944. This damaged portion later proved to be from the instruction booklet on the ARG1. Less than a month later, a Junkers 290 of 1/FAG 5 was shot down into the Atlantic Ocean, some of the aircrew including the observer survived, and during their subsequent interrogation, details of the ARG1 began to emerge. In addition, U-Boats that surrendered in May 1945, were found upon inspection to be equipped with the ARG1. After the cessation of hostilities with Germany, examples of the ARG1 were sent to the Admiralty Research Laboratory at Teddington, in Middlesex, the Royal Aircraft Establishment at Farnborough in Hampshire, and a large quantity of instruments and documents were transported to Wright Field in Dayton, Ohio.

Under interrogation in England in 1946, Dr. G. Forstner stated that Zeiss had made 100 instruments, and that the total order was for 5000 of which at least 3000 had been made by other contractors. Production of the ARG1 co-incided with the cessation of long range flights by the Luftwaffe and only one bomber squadron was known to have used the ARG1. They were greatly preferred to the previous use of tables and Forstner felt that the single insertion of time angle, declination and latitude was a major advantage over the Bygrave slide rule.

Appraisal By The Allies

In July 1945, Dr. S. M. Burka, a navigation specialist at Wright Field, indicated that the ARG1 was the most worthwhile non-electric navigation aid yet picked up in Germany.

In October 1945, the British Admiralty concluded that the apparatus was simple and easy to use and was well designed and constructed. Results were in most cases correct to 1. except when badly formed triangles were attempted, but the overall accuracy was probably similar to that obtainable from five figure logarithms.

In March 1946 the Royal Aircraft Establishment at Farnborough stated that the instrument was very similar to that produced by Bastien Morin in France before the war. The ARG1 computer solved the astronomical triangle with 1. accuracy in about the same time as that required for use of the Astronomical Navigation Tables (AP 1618).

Developments

A Ue R An ARG1 training instrument, known as the A Ue R, was produced by Dennert & Pape at Altona (see photographs 3 and 4). The grid is drawn on a luminous disc of 19 cm diameter, which fits into a circular recessed plastic dish, in which it may be rotated through finger holes in the bottom of the dish. The latitude scale, engraved at 1° intervals from +90° to -90° is set against a fiduciary mark on the dish. A link arm attached to the dish holds a bulls eye magnifier, (power x2) for setting time angle and declination and reading altitude and azimith. The observer's sighting line is fixed by a cross engraved on the plane undersurface of the magnifier and a circle on its top surface. The overall diameter is 24 cm and its weight is 0.4 kgs. The overall accuracy obtained was ± 10' which was sufficient for training purposes.

ARG2

This model (see photographs 5 and 6), made largely from steel, was developed to be more suitable for mass production than the ARG1, from which it differed in the following respects

1. The overall diameter was 29 cm, and its overall height 7.3 cm.
2. The grid diameter was 20 cm (twice the diameter of the ARG1).
3. The latitude scale was set by means of a vernier knob, calibrated at 5' intervals, thus eliminating the fixed microscope.
4. The moveable microscope was replaced by a simple magnifier with a power of x14.
5. The 24v lamp-holder underneath the instrument was eliminated by the substitution of overhead illumination, situated close to the viewer.
6. There is a small "dead zone" in the grid near the vernier knob which he magnifier cannot cover.

The accuracy of this variant was found under test to be in the order of ±0.86' of altitude. Only two instruments