AERODIST®

AN AIRBORNE 'TELLUROMETER' SYSTEM®

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MODEL MRC2

For long-range extension of horizontal control in surveying. For aircraft positioning in aerial surveying.

The TELLUROMETER Microwave System of Distance Measurement has provided surveyors with a means of accurately measuring lines up to about 35 miles. It was early realized that operation of the equipment from an aircraft would enable its usefulness to be extended.

Firstly, the range of the TELLUROMETER system is greatly increased and measurements can be made when the two ground stations are not in line of sight.

Secondly, the position of an aircraft can be continuously determined. This facility is an aid in aerial survey.

A TELLUROMETER system (termed Aerodist) has been developed which enables one, two, or three ranges between an aircraft and ground points to be simultaneously and continuously determined with a fairly high degree of accuracy.

'Aerodist' was originally developed to a specification laid down by the U.S. Army Engineer Research and Development Laboratories.

Range of 'Aerodist'

'Aerodist' has a range capability, for each line being measured, in excess of 100 miles. This is subject to the requirement of unobstructed line of sight between ground point and aircraft. Hence, measurements between two ground points of up to 200 miles can be made. Direct height can be measured up to any height that an aircraft can at present fly.

Accuracy

Distances can be measured with an error that does not exceed 1 metre plus 1 part per 100,000 of the range being measured. This error includes the errors involved in reduction of the measurement to a spheroidal distance.

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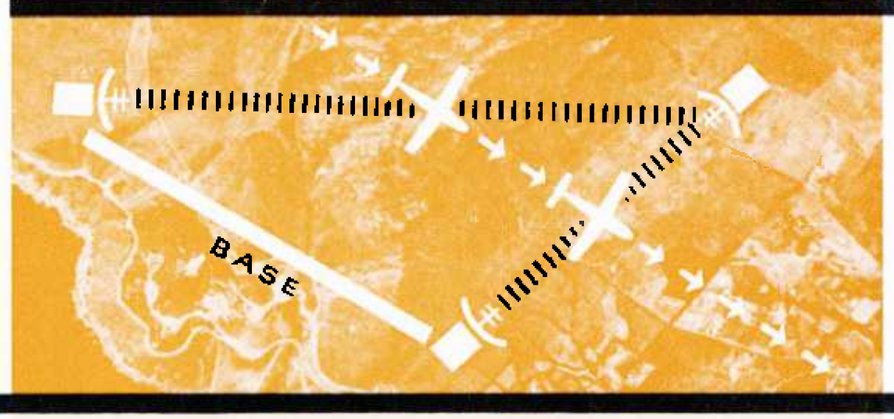
USES OF AERODIST

Long-range extension of ground control in surveying

Unknown ground points can be rapidly positioned with reference to a known base line. This can be performed in two ways: either by continuous trilateration, using three-range measurements . . .

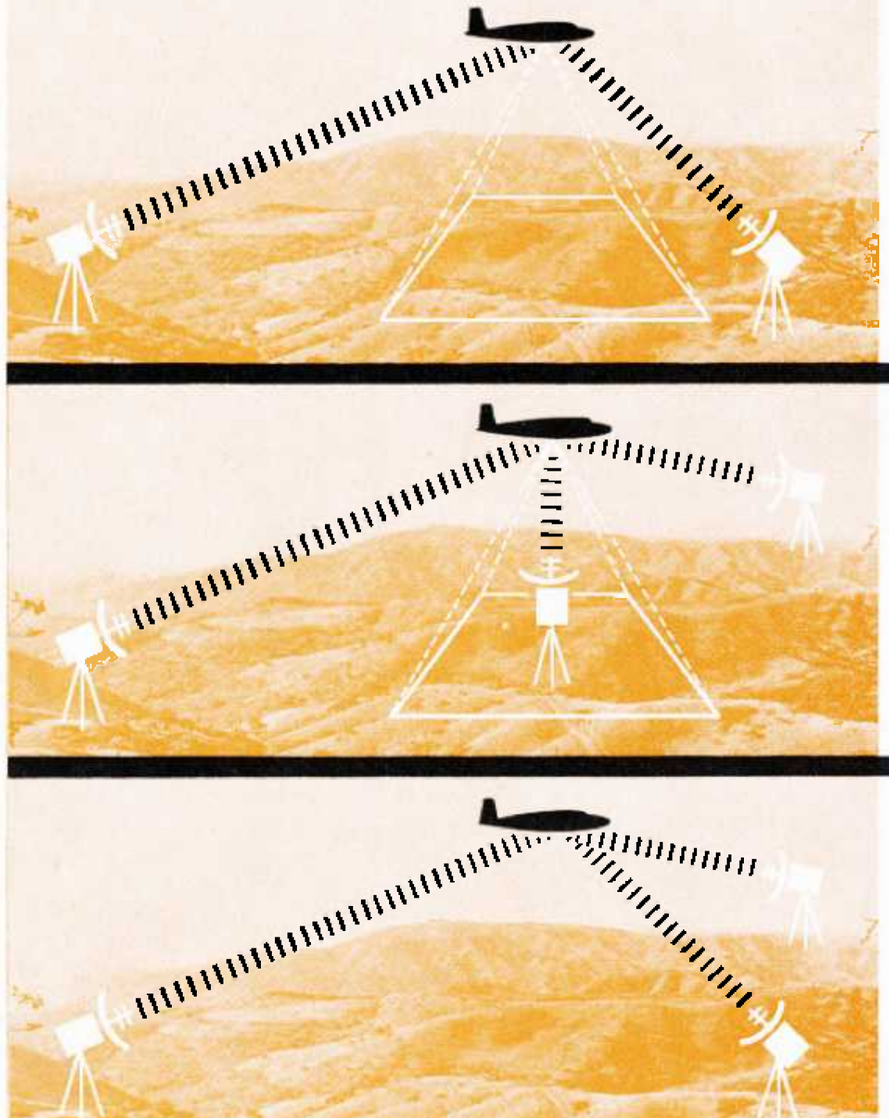
. . . or by two distance measurements from two known ground points, using a line-crossing technique.



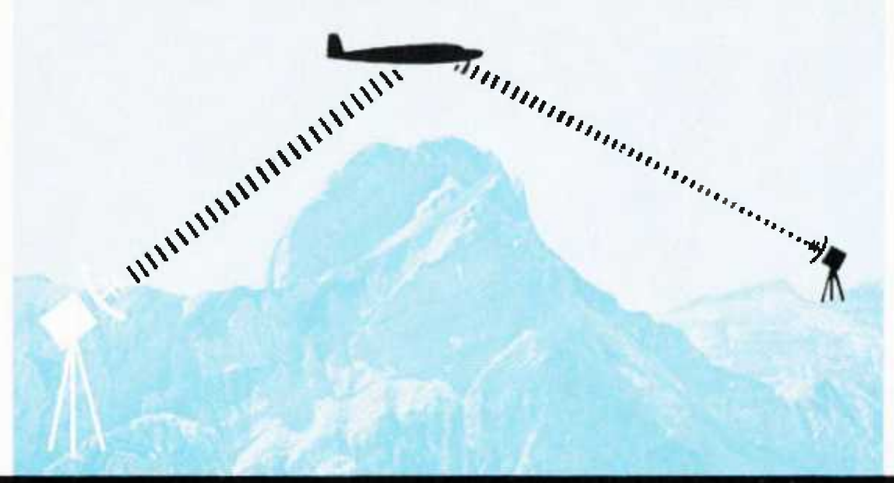
Air Survey

The surveying aircraft can be positioned, either continuously or at the instant of photographic exposure, with reference to known ground control points. Position in the horizontal plane is obtained by two range measurements to two ground points.

The height of the aircraft can be obtained by two methods: either barometrically or, if greater accuracy is required, by means of a third, vertically directed, Aerodist channel



It is also possible, though not practical for surveying purposes, to position an aircraft by means of three simultaneous range measurements to three ground points.



Long-range measurements

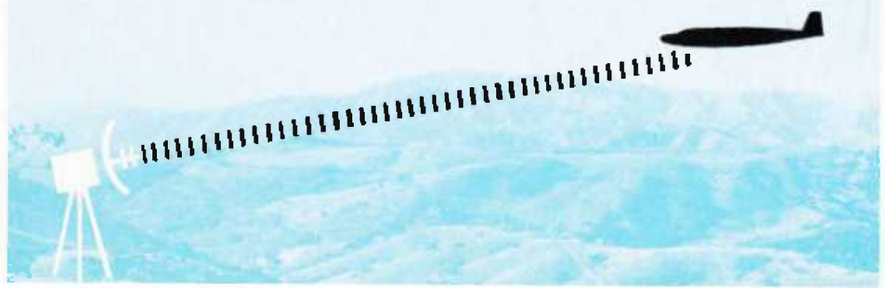
'Aerodist' enables range measurements to be made between ground points which are not within optical sight of one another. This condition may be brought about by Earth curvature, owing to the large distance involved, or by intervening terrain, such as mountain ranges.

Radar calibration

'Aerodist' has been used for the rapid and accurate determination of coverage of radar antennae.

Navigational aids

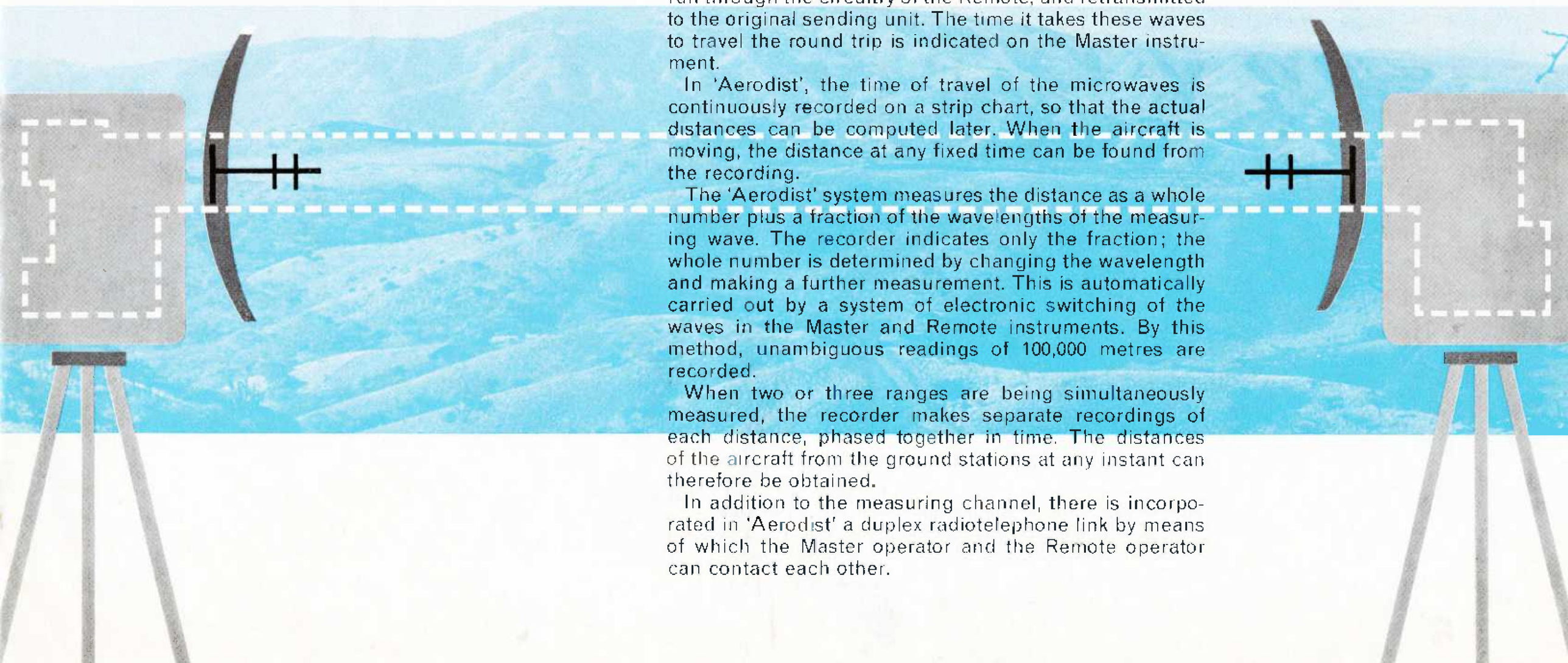
Calibration of navigational devices can be accurately and easily carried out with the aid of 'Aerodist'.



Speed measurements

A single channel 'Aerodist' system provides a means of carrying out aircraft speed trials

DESCRIPTION OF THE AERODIST SYSTEM



The fundamental principles of 'Aerodist' are those of the well-known TELLUROMETER system. Two instruments ('Master' and 'Remote') are situated at the points between which the distance is to be measured. The Master instrument transmits a series of microwaves towards the Remote instrument. These steady waves are received, run through the circuitry of the Remote, and retransmitted to the original sending unit. The time it takes these waves to travel the round trip is indicated on the Master instrument.

In 'Aerodist', the time of travel of the microwaves is continuously recorded on a strip chart, so that the actual distances can be computed later. When the aircraft is moving, the distance at any fixed time can be found from the recording.

The 'Aerodist' system measures the distance as a whole number plus a fraction of the wavelengths of the measuring wave. The recorder indicates only the fraction; the whole number is determined by changing the wavelength and making a further measurement. This is automatically carried out by a system of electronic switching of the waves in the Master and Remote instruments. By this method, unambiguous readings of 100,000 metres are recorded.

When two or three ranges are being simultaneously measured, the recorder makes separate recordings of each distance, phased together in time. The distances of the aircraft from the ground stations at any instant can therefore be obtained.

In addition to the measuring channel, there is incorporated in 'Aerodist' a duplex radiotelephone link by means of which the Master operator and the Remote operator can contact each other.

Single Channel Master Installation

Dimensions: 12" × 6" × 18"
Weight: approx. 30 lbs.
Power Consumption: approx. 200 watts

Two Channel Master Installation

Dimensions: 12" × 12" × 18"
Weight: approx. 60 lbs.
Power Consumption: approx. 320 watts

Three Channel Master Installation

Dimensions: 12" × 18" × 18"
Weight: approx. 90 lbs.
Power Consumption: approx. 440 watts

Aircraft with three channel antenna system. Each antenna: Size 18" × 14" dia. Weight 25 lbs.

Three Channel Strip Chart Recorder

Dimensions: 12" × 9" × 8"
Weight: approx. 40 lbs.
Power Consumption: approx. 36 watts

AIRCRAFT INSTALLATION

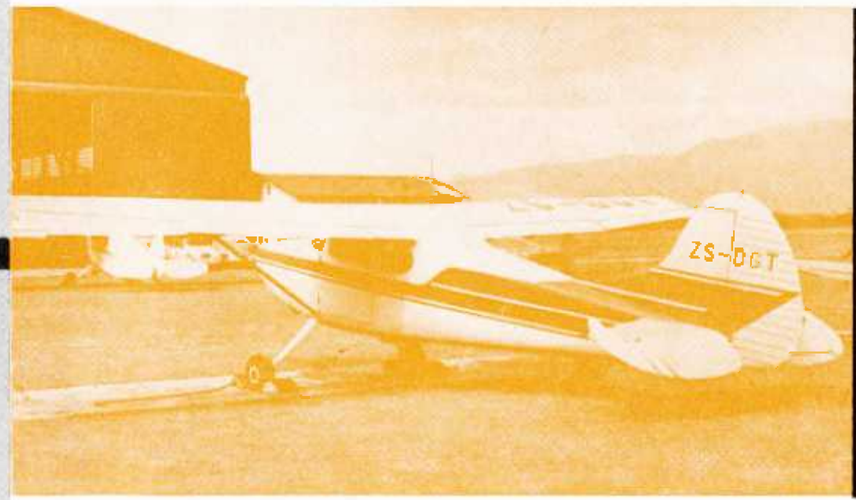
The Master instrument (one per measuring channel) has been specially designed to fit into light-weight aircraft, and its physical properties include small size, low weight, and low power consumption.

The aircraft antenna (one per channel) is remotely controlled for directioning and is also of small size, and simple to instal. For line-crossing procedures only, two simple non-directive antennae can be used. These, with the equipment, are very easy to instal. No aircraft modification is required as the antennae can be directed through the aircraft windows.

The range measurement between each Master instrument and its corresponding Remote on the ground is controlled wholly from the aircraft.

READ-OUT

Read-out in Aerodist Model MRC2 is in the form of a continuous record of one, two, or three ranges on a strip chart recorder. Under development are read-out systems giving either continuous digital display of ranges or automatic plotting of aircraft course.



Typical two channel installation in a light aircraft.

GROUND EQUIPMENT

The Remote instruments on the ground are highly portable, small in size, and economical in power consumption, operating from ordinary 12-volt rechargeable secondary batteries.

OPERATION OF AERODIST

Both Master and Remote instruments are extremely simple to operate. The Master operator must:

(a) Contact the Remote Operator
(b) Initially adjust the recorder
(c) Periodically make meteorological observations
(d) Periodically orientate the antenna

The Remote operator must:

(a) Periodically make meteorological observations
(b) Orientate the antenna

During line-crossing operations, orientation of antennae is unnecessary.

TESTS

Aerodist has been exhaustively tested in the United Kingdom in collaboration with Fairey Air Surveys Ltd., using Ministry of Supply trials aircraft.

Further tests are currently being undertaken in the United States of America under a development contract with the Geodesy, Intelligence and Mapping Research and Development Agency.

Results of these and other tests are available either direct from the manufacturer or from the main distributors or representatives.

DESCRIPTION FOR LICENSING PURPOSES

The TELLUROMETER 'Aerodist' Model MRC2 system comprises one or more Master Transmitter/Receiver Instruments in the aircraft and a corresponding number of Remote (Responder) Transmitter / Receiver Instruments at points on the ground, each Master and Remote constituting a single line measuring system.
Radio Frequency Band — 1215 to 1400 Mc/s.
Radiated power — approx. 3 to 4 watts.
Integral R/T communication facilities between Master instrument and its corresponding Remote.
Beamwidth at half power points — Master 75°, Remote 30°.
Frequency modulation of carrier — Modulation frequencies in the band 1.3 to 1.5 Mc/s. Modulation index unity.

REGISTERED PATENTS

(a) Union of South Africa	No. 3,587/55
(b) Australia	No. 214,439
(c) France	No. 1,210,627
(d) India	No. 58,888
(e) United States of America	No. 2,907,999
(f) Canada	No. 585,103
(g) Switzerland	No. 348,430
(h) Japan	No. 28834/56

Patents pending elsewhere

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