EINFÜHRUNG IN DIE LUFT— UND ERDBILDMESSUNG.

(INTRODUCTION TO AERIAL AND TERRESTRIAL PHOTOGRAMMETRY).

by

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A new book has just appeared on the use of photography for cartographic surveys. It is written by the scientific collaborator of the firm of Carl ZEISS, Jena, which has produced so many fine optical instruments.

In a small volume of 106 pages, the author has succeeded in precising the present status of a science whose very rapid progress during the past twenty years has now put us in possession of improved means enabling us greatly to extend its employment. Its object is to facilitate a rapid and at the same time scientific initiation into this new science for those who desire to keep abreast of its most recent developments. In this he appears to have succeeded. After a short historical sketch in which nothing of importance has been omitted, the theory is expounded in a few clearly written pages, stereo-photogrammetry is made apparent by a curious diagram showing the curves of equal parallax produced by two pencils of rays and by a magnificent anaglyph which shows the advantages to be derived from this type of printing so that the various forms of the terrain may be completely apprehended.

The author describes in a few pages the taking of photographs from the ground and their utilization by means of the Pulfrich stereocomparator, then the more recent improvements of the apparatus for exposures from the air (for which there is a panoramic chamber with nine objectives). He explains the various methods of utilizing these photographs graphically, the use of the stereoscope and the restitution apparatus; then the simultaneous utilization of two photographs, the instruments for double projection, the multiplex aeroprojector, the Hugershoff aerocartograph, the stereophotograph of Poivilliers, the Wild autograph, the Bauersfeld stereoplanigraph, and finally the principal sources of error in the instruments, or those made by the operator. The last few pages are devoted to a study of the principles for piecing together the photographs obtained by radial or polygonal triangulation and the limits of accuracy of these methods.

P. V.

PROBLÈMES DE NAVIGATION ASTRONOMIQUE PARTICULIERS A LA NAVIGATION AÉRIENNE

(THE PROBLEMS OF ASTRONOMICAL NAVIGATION PECULIAR TO AERIAL NAVIGATION).

(From an article by M. LOUIS DAVIOT in Bulletin N° 40 of the *Association Technique, Maritime et Aéronautique*, Paris, 1936, pp. 471-508).

(Translated from the French).

In this article M. Louis DAVIOT summarizes first the special problems of aerial navigation with regard to fixing the position. Thereafter he studies the repercussions of these particular requirements on the various operations which are essential to a determination of the position and enumerates the different devices now in existence which allow these various operations to be performed in aerial navigation. From this the author deduces general conclusions with regard to the degree of accuracy and the suitability of the devices at present available to aerial navigators. He ends by outlining a programme for the immediate realisation of devices for astronomical aerial navigation which will increase the accuracy and convenience in fixing the position of an airplane in flight.

In the chapter on *Chronometric instruments,* the author points out the practical convenience of using navigational watches which can be set exactly to the time, that is, in which the second hand can be stopped at any place on the dial.

In the chapter on *Navigational documents,* he lists the special ephemerides compiled in the course of the past few years in certain countries for the use of aviators, and shows how some of these publications permit a saving of 50% in the time required for the calculations, as opposed to the ordinary nautical ephemerides.

In the chapter on *Sextants.* after showing that above an altitude of 400 metres the natural horizon, even over the sea, becomes either invisible or in any case rather uncertain, the author states that the bubble sextant has become the usual observational instrument for airplanes. However, owing to the multiple accelerations, to imperfections in piloting and the atmospheric reactions, the bubble will only give an exact horizontal plane in the airplane in very exceptional circumstances. One may, however, estimate the maximum approximation on which one can rely under favourable circumstances to equal 20' approximately. Practical experience has shown that a centring of the bubble is difficult to realize if its apparent diameter differs from one sight to the next and research should be instituted to produce a level in which the bubble will retain the same dimensions and the same characteristics with but slight variations between $-30°$ and $+40°$ C.

Given the necessity for taking a number of observations and treating these by the method of averages, the author states that it might be advantageous to provide the instrument with an averaging device.

We extract the following passage from the article of M. DAVIOT where he sets forth the desiderata to be realized, as a result of his numerous experiments :—

> " The accuracy of the sextant observations still depends upon three primordial requirements of practicability in aerial navigation :
>
> 1° — It must allow an easy inspection of the bubble.
>
> 2° — Permit the star to be found readily by the observer.
>
> 3° — Permit the observer to take the sight of the star without difficulty.
>
> The first requirement demands an optical system disposed for the observation of the bubble having an ocular ring of large diameter, well placed.
>
> The second condition requires an optical system with a large field and with a direct sight on the star.
> Generally, this system comprises in practice a simple plate of glass with parallel faces.
>
> The third requirement demands that the sextant should be very compact and easily handled, lacking which it is almost impossible for the observer to hold it steady in the wind outside of the cockpit.
>
> This requirement, in spite of its apparent simplicity, is the one which has cost the designers the greatest trouble.
>
> There are so many independent factors to be reconciled in an aviation sextant that it is not just to judge the true accuracy of such an instrument until after actual practical experimentation in flight.
>
> After such experimentation, we may state that in calm weather, at temperatures comprised between $-30°$ C and $+40°$ C., the aviator using a good sextant may count on obtaining an accuracy of at least 7' in the determination of the altitude after a series of observations having a duration of the order of about 90 seconds. These figures are the result of experimentation which we have been able to follow in detail for about twenty bubble sextants of different types, with which about 2,000 verified sights of stars were taken in flight. "

A special chapter is devoted to various apparatus for calculating the astronomical position which the author has listed in accordance with the following classification :

Method of Similitudes	Marcq St. Hilaire method
Bastien method	Kahn method
Favé-Brill method	Weems method

After having analysed systematically the sources of error which may affect the final determination of the position, the author estimates that in the present state of the means available, the aerial navigator may be able to determine his position at a definite instant within about 12 miles under favourable circumstances.

Summarizing, the author proposes that the improvements should be directed towards realizing a satisfactory aviation sextant, and at the same time one should continue the development and improvement of the sidereal counters, the nautical ephemerides, and the mechanical position calculators for airplanes.

H. B.