focal length and other factors and discuss the accuracy of elevation determinations with the Stereoplanigraph. The statement of maximum error ratio does not satisfy. What is the probable accuracy of these determinations? For example, one may safely say that elevations may be determined with a wye level with such accuracy that all elevations will be correct within one hundredth of a foot. What is this value for the accuracy of the Stereoplanigraph, either in ratio of flying height or in actual figures?

I still maintain that the matching of contours on adjacent models and the agreement of several surveyed lines common to adjacent parcels is not any check as to absolute accuracy, regardless of the fact that I, like many others, may be prone to accept it as such when it is our own work that is in agreement. The only test of accuracy of position and/or elevation is a definite instrumental determination in which the test line originates from and closes upon definite control points of a known higher degree of accuracy than that of the test lines. Preferably using entirely different methods, I ask for positive tests - not relative relationships based on a uniformity of assumptions and method of procedure.

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*HOW FAR DOES THE PRECISION OF AERIAL PHOTOGRAMMETRY SATISFY THE DEMANDS OF CADASTRAL SURVEY?

by

O. v. Gruber of Jena

The precision of measurement with stereoscopic plotting instruments is largely governed by the flying height, and further by the relative spacing of the exposures. In addition, it is dependent upon the focal length of the camera used. A few characteristic examples will give an idea of the facts without the need of going into too much detail:

	FLYING HEIGHT	PICTURE SCALE	MAP SCALE	MP	ML
1. SWITZERLAND (WILD INSTRUMENTS).....	ABOUT 2300M. (7500 FT.)	1:14000	1:10000	±1.56M. (±5.11 FT.)	±1.19M. (±3.90 FT.)
2. SWITZERLAND (ZEISS INSTRUMENTS).....	2700 TO 3500M. (9000 TO 11500 FT.)	1:13000 TO 1:17000	1:10000	±1.24M. (±4.06 FT.)	±0.91M. (±2.98 FT.)
3. HOLLAND (ZEISS INSTRUMENTS).....	900M. (3000 FT.)	1:4300	1:1000	±0.19M. (±0.62 FT.)	
4. BERLIN..........	340M. (1100 FT.)	1:1650	1:500	±0.24M. (±0.79 FT.)	
5. BERLIN..........	350M. (1150 FT.)	1:1700	1:1000	±0.35M. (±1.15 FT.)	

From the foregoing figures, it will be seen that the error in position (mp) increases with the flying height where larger heights are concerned, while, oddly, it does not diminish with lesser heights. The reason is not only that examples (1), (2) and (3) refer exclusively to sharply defined points (marked stones, posts, and the like), while (4) and (5) take in every variety of plotted point, but principally because, at the high velocity of the airplane, the distinctness of photographs at low flying heights cannot exceed a certain limit. In example (5), the larger error in position is due also to the fact that the individual pictures were not orientated by reference to given fixed points, and that errors are included such as necessarily arise in bridging spaces poor in control. In the examples cited, determination of the error in position of mapped points is exclusively concerned. In order to determine how far the accuracy in determining points by photogrammetry may be carried, an investigation with the aid of the Zeiss-Stereoplanigraph was recently made. Marked boundary points in the same territory were repeatedly plotted from different stereoscopic pairs of pictures, and the coordinates obtained with the plotting machine converted into cadastral coordinates on the basis of the same control points. The difference between the various measurements allowed the pure errors of photogrammetric determination to be recognized. The average flying height was 720m. (2360 ft.), the average picture scale 1:3450 and the scale to which plotting was done in the machine 1:2500. The mean error in position was found to be ± 0.14m. (=5.5 in.), and the mean error in level ml ± 0.10m. (±4 in.). The mean error in a stretch computed from the machine coordinates therefore is ± 0.20m. (±8 in.).

Upon considering the figure just mentioned of ± 0.20m. (±8 in.) for a mean error in a stretch computed from aerial photographs by means of coordinates, and comparing it with the maximum errors admitted for property cadastral survey, it will be seen that a mean error in distance of 0.20m. (±8 in.) corresponds to a maximum error of 60 cm. (24 in.).

In contemplating the results of photogrammetric mapping, it will be seen that the mean error in position of the different examples correspond to the following mean errors in distance:

(1)	(2)	(3)	(4)	(5)
±2.20m.	±1.76m.	±0.27m.	±0.34m.	±0.49m.
(±7.21 ft.)	(±5.77 ft.)	(±0.89 ft.)	(±1.12 ft.)	(±1.61 ft)

From these figures, it follows that the mean accuracies of examples 1 and 2 completely suffice for the production of 1:10,000 cadastral maps of large-lot territory in the alpine region. Actually, aerial photogrammetry is used in Switzerland also for making 1:1000 scale general maps, and 1:5000 cadastral maps are also produced with its aid. In the second case, however, photogrammetry is not used for determining legal property boundaries, but only for supplementing cadastral maps with all of the details not directly referring to property rights.

For cadastral survey for civil engineering purposes, the accuracy of plans made from photogrammetric views suffices if the correct flying height is employed, and provided the objects concerned are sufficiently visible from the air. It goes without saying that in all cases where either precision or visibility is insufficient, photogrammetry needs complementing by local measurement, and, of course, local examination of the property can therefore never be intended to displace the old methods of cadastral survey, but represents a new aid capable, under given conditions, of speeding up and bettering the economy of surveying operations. This will be particularly the case with higher-priced land, when, though photogrammetry does not yield the accuracy required for legal survey, it is used as the basis for the plotting sketch and the preliminary plan, and for complementing objects of importance from the civil engineering but not from legal point of view.

* This article is extracted from a longer article with the same title which is available in the Library of the Society.

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DISMANTLING THE STEREOPLANIGRAPH

by
Hans Gruner

"She certainly came down in a hurry!" That was the general verdict of those who in passing by witnessed the disassembling of the photogrammetric heavy-weight champion.

Those of our members who have seen the Stereoplanigraph in operation during its stay in the Interior Building in July, August and September will probably be in a position to visualize the process of dismantling from a mere description lacking photographic illustrations. Those who did not see the instrument may be contented with the statement that by this time the machine is on its way to the Los Angeles offices of the Fairchild Aerial Survey Corporation, via Panama Canal, solidly greased, wrapped, boxed, tin-sealed, and reboxed, in 19 containers most of which are steel reinforced and provided with proper hoisting facilities in order to protect their precious contents against the usually rough treatment during continental and maritime transit.

The job was done by two men temporarily assisted by four husky helpers in five and one-half days - from October 1st to 6th. When the machine arrived in Washington, early in June, the reverse operations of assembling and adjusting took 11 days for one man plus four occasional assistants.

Conforming to terms and designations used in the literature dealing with this instrument (*), the conventional three dimensional system of axes materialized by three tracks is shown in the diagram. The base of the instrument, a sturdy T-shapped beam bears the tracks of two horizontal axes X and Z. A vertical column of triangular cross-section rides on the Z-track and bears the rails for the Y-movement. The carriage which runs over them holds near the ends of two L-shaped horixontal arms the projecting apparatus, briefly called "cameras". They are detachable and

* The only comprehensive literature in English so far, may be found scattered through the book "Photogrammetry, Collected Lectures and Essays" by Chapman and Hall, London. We shall endeavor to supplement the literature by discussions in future News Notes.