COMMENTS ON THE BROCK AND MULTIPLEX METHODS OF STEREOPHOTOGRAMMETRY*

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THE Brock Process of mapping bears the distinction of being the greatest contribution to photogrammetry this country has made, for which reason, all members of the Society should be particularly interested in learning that this method is again in use. Like so many other things that are produced far in advance of general recognition of their importance, it required much educational work to convince the public of its value. Those difficulties would not be so troublesome were the method being introduced today, as the importance of photogrammetric methods is now being generally recognized.

It is difficult to compare the Brock Process with the Multiplex method for they differ widely in principle. The Brock Process was devised in this country without the slightest regard to developments abroad which accounts for the unique design of the instruments. The method is remarkable for the simplicity and ruggedness of construction of the various instruments and the fact that the method lends itself well to production of maps in quantity. Many engineers can be employed simultaneously on the same map sheet while in the case of the Multiplex method the number of men who can work on a single map sheet is limited.

The fine results being obtained at present with the Multiplex and other stereoscopic methods do not excel those obtained with the Brock instrument fourteen years ago. This is evidenced by the fact that map accuracy specifications applicable to maps made at that time were essentially the same as those recently drafted by the Society's Committee on Map Specifications and Tests.

Brock Process maps should be about twice as good as those made with the Multiplex instrument providing aerial photographs of the same flight altitude are used. This advantage is not employed in increasing map accuracy but rather in reducing the number of models necessary to cover a given area. The fact that flights can be made with the Brock camera at twice the altitude required by the Multiplex for the same accuracy naturally reduces the number of models to be processed, assuming that cameras of the same field of view were employed in both cases.

It is a peculiarity of the Brock Process that the plates are horizontalized before the map work is undertaken, whereas in nearly all other methods the plates are set up in such manner as to recover their relative positions in space. In either procedure a true stereoscopic model is the result. With the Multiplex one projects directly from the model to the map surface in true scale but in the Brock Process the drawing is not in orthographic projection as it comes from the stereometer but each contour plane has its own particular scale. This necessitates an optical reprojection of each contour line to convert the prospective drawing to an orthographic one such as is required in map construction. This is a disadvantage but not a serious handicap unless the contour lines are extremely congested. There is little doubt but what this reprojection step could be eliminated should this be considered sufficiently advantageous to warrant the expense.

The Brock Process results in contoured templates, each covering a single stereoscopic model. Assembly of these individual templates in correct position and orientation on the map sheet is usually provided by the radial line or slotted

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template method of locating horizontal positions of several well-defined points on each template. In contrast with this, the Multiplex instrument sets up several models simultaneously that are undoubtedly held in correct position and orientation more rigidly than can be the case for any radial line plot. The use of analytical methods of extending supplemental horizontal control for the Brock templates would seem to warrant attention.

The Brock Process is the only one in this country that utilizes an aerial camera employing glass plates. Many aerial photographers would undoubtedly object to the use of this camera due to the time required in loading its magazines, but a photogrammetrist who has worked on models obtained from glass plates as well as film negatives will appreciate the greater value of the glass plates. Until such time as the film manufacturers can produce a flexible base which will hold its shape with the permanence of a glass plate this condition will remain unchanged. The convenience of film is paid for now in reduced map accuracy.

The field of view of a Brock camera is 70° while that of cameras employed with wide-angle Multiplex instruments is 90°. A lens of 70° field was considered large fifteen years ago and it is worthy of note that these lenses were sufficiently distortion-free that no corrections on this account were made. The lenses fitted to the cameras were carefully selected from the very large number that were tested. The importance of increasing the angle of view of Brock cameras was recognized and considerable study was devoted to the development of such a camera but unfortunately these studies could not be pursued to a successful conclusion. However, a wide-angle $5\frac{1}{4}$ inch lens with considerable negative distortion was found and the distortion compensated for by the introduction of a glass plate of proper thickness between the lens and the photographic plate. After being modified in this manner it was found that the lens was fairly satisfactory so far as freedom from distortion was concerned but the illumination at the edge of the field was so small that full advantage of the wide-angle was not obtained. The present effect of those studies is that the Brock equipment as it stands today can be employed with certain 90° wide-angle lenses merely by inserting the proper coupling links in the correcting projectors. Full advantage of a 90° field might require the use of a larger plate or a lens of shorter focal length.

It is my belief that the renewed activity of the Brock Process should do much to broaden our viewpoint and tend to prevent our pursuing a narrow path as we increase our use of photogrammetric methods.