

ject at the Annual and Semi-Annual meetings, and finally to publish a manual on Photo Interpretation.

In the cartographic field the compiler engages in photo interpretation peculiar to his needs. Reference to currently available keys generally requires the laborious use of several publications, none of which meet our specific needs. For several years ACIC has produced a publication showing all cartographic symbols which appear on any ACIC chart regardless of scale. What ACIC needs is a photo interpretation guide to supplement the symbol book. The Center is preparing such a guide which describes each feature in the symbol book and illustrates it with stereograms, if available, and with single photos otherwise. It is believed that this material will make a definite contribution to photogrammetric compilation as practiced at this Center.

This paper shows that ACIC is endeavoring to develop procedures and techniques not only for the sake of increased economy, accuracy and speed in production, but also to meet operational problems resulting from the gifts of unconventional photographs we receive as source material. As in any development effort, many frustrations are experienced. For instance, in our search for a suitable stretchable medium for elastic prints, we found a vinyl film four mils thick which might be satisfactory if it could be obtained in two mil thickness. However, upon inquiry to the manufacturer we found that in order to get two 10×10 inch sheets for testing, we would have had to agree to take the entire output from a machine load of ingredients or the equivalent of a roll one foot wide and 30 miles long, without stretching. Needless to say our search continues.

*A Comparison of the Kelsh and Balplex Plotters for Large-Scale Mapping**

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ABSTRACT: This paper outlines the motivation behind the purchase of the Balplex plotter, discusses whether anticipated benefits were realized and compares the Kelsh and Balplex plotters with respect to ease of operation, maintenance and accuracy of final results.

YEARS ago it was axiomatic in aerial mapping that you were not considered a photogrammetrist until you had devised and published a new method for determining tilt. Today with the booming highway program, unless you have formed at least one new mapping partnership, you may be considered a failure to your profession.

Many of these new firms have inquired regarding the relative merits of the Kelsh and Balplex plotters for large-scale commercial mapping. This paper will attempt to furnish an answer by summarizing the past two years experience with both plotters.

There are, of course, several ways of approaching such a comparison.

Several years ago, for example, the Geological Survey initiated a research

project which had for its goal the determination of practical C-factors for the Kelsh and Multiplex stereoplotters. During the course of this study over one hundred quadrangles throughout the country were thoroughly tested. Following this the results were analyzed statistically. It was soon apparent that differences in individual operator skill, differences in terrain, vegetation, soil and crop characteristics—these and other factors caused wide variations in the end results. However, from the sheer weight of data submitted a pattern gradually emerged from which definite conclusions could be safely drawn.

Compared with this epic undertaking the report submitted in this paper offers no such broad and penetrating look. The opinions and conclusions cited herein are based on the use of the two plotters on

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large-scale mapping projects in a restricted area embracing chiefly the states of the Upper Midwest. In this region the smooth, stone-free fields and black soil, while excellent for farming, offer unique mapping problems not encountered in other parts of our land.

This paper will outline the reasons for purchasing the Balplex plotter, will discuss whether this reasoning proved valid, and finally will compare the two plotters from the viewpoint of ease of operation, maintenance and accuracy of results.

It should be stated at this point that the decision to purchase Balplex units was based in no way on dissatisfaction with results obtained using the Kelsh plotter. Field tests had previously proved beyond doubt the accuracy and efficiency of this sturdy, simple instrument for large-scale mapping.

ADVANTAGES SOUGHT IN BALPLEX

In purchasing the new plotter, the principal motivation was a desire to widen our arsenal of photogrammetric weapons, to take advantage of certain features which seemed to offer promise in the new instrument. Specifically it was hoped to obtain the following:

1. An instrument designed to operate efficiently with both vertical and low-oblique photography.
2. An improved lighting system coupled with more positive means of distortion compensation.
3. An instrument which could be mounted in series for horizontal and limited vertical bridging.
4. An instrument better suited to mapping areas of high relief because of smaller model scale.
5. Finally a small financial saving was anticipated due to lower first cost and less floor space required.

The question boils down to whether these objectives have been realized, whether new advantages have been discovered or unforeseen difficulties have been encountered.

First, regarding oblique use, the Balplex works very well with 20-degree convergent and transverse photography. The well-distributed light, the compact model area, and the ease with which the lens may be canted make model orientation relatively easy.

On the Kelsh plotter, this operation had



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previously been found possible but awkward to the point of impracticability. This was due mainly to the sheer extent of the stereomodels plus difficulties caused by the weight of the projectors.

Lighting of the Balplex models appears comparable to the Kelsh and little difference in brilliance of the platen image has been noted.

Distortion compensation by correction plate in the Balplex printer works adequately and requires no maintenance as opposed to the necessity for periodic cleaning of the cams and lens mount bearings in the Kelsh.

For bridging purposes, the Balplex units may be readily used on the conventional multiplex 14-foot bar with minor modifications, thus offering the possibilities of stereotriangulation. With the bulk of present-day single-strip highway maps, the speed and somewhat better accuracy of stereotriangulation over stereotemplates is advantageous.

The three-projector Balplex units offer further advantages in that adjoining stereomodels may be tied together in questionable areas before contours are drawn.

While it is true that the smaller model scale of the Balplex is advantageous in areas of high relief, by the same token the larger Kelsh scale is undoubtedly a strong advantage in the flatter areas. The two instruments supplement each other in this respect.

The financial advantage in the lower initial cost of the Balplex is of course, complicated by the number of units pur-

chased, the type of printer to be used for each instrument and other considerations beyond the scope of this paper. If a large number of units are purchased, and if automatic dodging is required in diapositive preparation, the cost advantage definitely belongs to the Balplex.

Summing up this portion, in general the Balplex plotter has lived up to its advance promises, particularly with respect to its use with oblique photography and for bridging purposes.

DETAILED COMPARISON OF PLOTTERS

Now for a point-by-point comparison of the plotters with respect to ease of operation, maintenance and most important of all, accuracy of final results.

First, the Balplex plotter, by the internal nature of its construction, offers certain problems, particularly in inexperienced hands.

Calibration is more difficult as mechanical tolerances are smaller than those of Kelsh, due to smaller instrument size. Compared with the open construction of the Kelsh, adjustments are harder to reach. While this feature may offer little difficulty in large organizations where specialists are available, ease of calibration is important to small firms.

Despite an efficient blower system the heat generated by the Balplex bulb causes an index change when the plotter is first turned on. This, of course, can be overcome by proper precautions.

Because of the detail inevitably lost in reduction, Balplex diapositives of good quality are much more difficult to make, particularly where negative quality is borderline. This difficulty may resolve itself when and if automatic dodging becomes available for the Balplex.

On the other hand, the mechanical motions for clearing parallax are excellent and the model is smaller and may be reached from one side of the instrument with ease.

Generally the Balplex may be considered as a "hotter," somewhat trickier instrument which performs well in expert hands and requires somewhat more know-how.

Regarding maintenance, this has so far offered few problems on either instrument.

It is possible that the higher operating temperatures within the Balplex may eventually cause the lenses and mirrors to deteriorate. But this is mere speculation. So far no difficulty has been encountered

with lenses, mirrors or with maintaining calibration of the Balplex.

The Kelsh plotters are still in excellent condition after several years of continuous two-shift operations. Part of the wiring has been replaced but the lenses, cams and other essential parts show little wear.

It appears from limited experience that there is little to choose between plotters with respect to maintenance.

Before going into the question of comparative accuracy, it might be mentioned that many areas in the Upper Midwest are extremely difficult to photograph for topographic mapping, particularly for two-foot contour mapping. The fields are large and very smooth; the soil is dark and tends to remain discolored for several days after each rain. Furthermore the farmers have a vicious habit of either burning the fields in the spring or, equally as bad, disking the stubble into the soil, rendering the area a homogenous black mass with little or no contrast or texture.

In these areas the Kelsh plotter, using diapositives made on the LogEtronic printer, offers the greater accuracy in that any contrast between fine detail available in the negatives, however slight, is captured in the plates. These areas are practically hopeless on the Balplex unless electronically dodged plates are made by undergoing two extra steps in the printing process.

In areas with a reasonable amount of relief and normal contrast in ground detail i.e. (the average "good" model), very little difference in accuracy has been noticed. For two-foot contour mapping we normally photograph at the same elevation for either plotter, but try to work the extremely flat or low contrast areas on the Kelsh because of the improved models resulting for automatic dodging of the diapositives. When this feature is available for both plotters there should be little to choose between them, in our opinion.

CONCLUSION

In conclusion, it is felt that these plotters tend to supplement each other rather than being purely competitive. An organization equipped with both types is well prepared to take advantage of the strong points of each, using either vertical or oblique photography, using stereotemplates or stereo-triangulation in areas of low or high relief, with a fairly wide range of direct plotter scales.