THE MONOSCOPE

A NEW TRANSFERRING INSTRUMENT FOR USE WITH AIR PHOTOGRAPHS

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In order that full advantage may be derived from air photos a simple reliable instrument is necessary to provide a means for changing the scale of the photo to the scale of the map so that information may be transferred from one to the other. The Monoscope has been designed for this purpose.

A PRIMARY PROBLEM in the use of air photos is that of transferring information from a number of photos of varying scales to a base at a fixed scale. The lack of a device which would make possible the transfer of information speedily and easily to the required standard of accuracy was perhaps the greatest hindrance to the general use of air photos for mapping purposes.

For a number of years interest was focused on research in other countries where absolute precision was the goal, and the development of an instrument, simple in design, for practical application to conditions in Canada was overlooked. The net result has been that such precise, costly and complex instruments as were developed were neither available nor suitable for a large number of workers for whom the use of air photos constituted only a limited portion of their work.

Foresters found themselves in this position. Certainly valuable information concerning forest cover, topography, and drainage was visible in air photos, yet this could not be used to full advantage until some relatively inexpensive and simple apparatus was devised to transfer it to a base map. Almost all known devices for the purpose of changing scale have been experimented with in the hope of finding a satisfactory instrument for use with air photos but, since none of these developments have met with general approval, it indicates that none are fully satisfactory, and also that there should be a co-ordinated effort with a view to producing such an instrument.

Studies by H. E. Seely begun about 1930 resulted in the production of the Duoscope which has proved itself to be an adaptable and efficient transferring instrument. It has been used in Canada by the Dominion Forest Service and to a limited extent by the forest industries both in Canada and the United States for preparation of inventory and operating maps from vertical air photos. Use of the Duoscope depended largely on two factors—normal vision in both eyes, and ability to control the convergence of the eyes. While the latter factor could to some extent be developed by use, nothing could be done in cases where there was a marked difference in vision between the two eyes. It is especially for those in this category that the "Monoscope" was devised.

In general appearance, the Monoscope resembles the Duoscope. There are (Fig. 1) two large adjustable mirrors (A) mounted on two bars (B) which

are supported by legs (C). Between the two large end-mirrors a central assembly (D) of mirrors and telescope, adjustable so that it may be moved back or forth along the bars, is mounted. Scale adjustments are made by varying the relative distances between the telescope and map and the telescope and photo by means of the adjustable end-mirrors and central assembly.

The Monoscope differs from the Duoscope in that it superimposes the images of the map and the photo in a telescope. Those superimposed images are viewed with *one* eye. Hence those with one bad eye, or who are unable to control the convergence of their eyes, can use this instrument without difficulty.

The two images are superposed by means of a telescope which has two objectives. It is represented diagrammatically in Fig. 3. The ray from the photo on the left side enters the telescope through the side objective and is reflected from the semi-transparent mirror up through the ocular. The ray from the map on the right side enters the telescope through the end objective and passes through the semi-transparent mirror to the ocular. The map image is erected by mirrors, the photo image is not so erected, and the photo therefore must be reversed under the instrument. This is of no consequence since, when the photo is reversed, the image appears erected. The purpose of erecting the map image is to facilitate the tracing operation.

Front-surface mirrors are used throughout. The objectives are camera lenses which give a sharp image over the whole field. The range of the instrument is approximately from $2\frac{1}{2}X$ enlargement to $3X$ reduction.

The successful operation of the instrument depends on balancing the brightness of the two images, for if one is too bright it obscures the other. If both images are not clear after the lenses have been adjusted, the brighter object should be shaded or the light on the less bright should be increased.

In summarizing, it may be stated that some of the chief characteristics of the Monoscope are:

1. It is a simple instrument which provides a means for changing the scale of the photo to the scale of the map so that information may be transferred from one to the other.
2. It is quite light in weight, and portable, which makes it a practical field, as well as, office instrument.
3. It has a range from $2\frac{1}{2}X$ enlargement to $3X$ reduction. This range can be increased by obtaining a third objective lens of longer focal length.
4. It requires no specialized lighting.
5. By substituting a simple mirror assembly for the telescope and mirror assembly it could be used as a stereoscope for regular contact prints or for enlargements. The simple mirror assembly is manufactured at a very reasonable cost.
6. It is simple to operate.
7. A person with only one eye can use it.
8. It is relatively inexpensive.

Telescope of Monoscope