ORIENT YOUR STEREOSCOPE CORRECTLY

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THE use of aerial photography since early 1941 has grown to such tremendous proportions that only the roughest estimate of the rate of growth can be made. Along with the increase in the use of aerial photography has come a proportionate increase in the use of stereoscopes for proper evaluation of the photographs made by the rapidly mounting quantities of aerial cameras in use. New people are being called upon constantly to use these stereoscopes for the study of aerial photographs for the many varied purposes to which they are put in connection with war time photography.

Instruction and practice is recognized as being necessary in order to get the most out of aerial photographs. Both the Army and the Navy are conducting schools by which they are training men heretofore unfamiliar with aerial photographs, in the intricacies of photo-interpretation, camouflage detection, and the many types of war time mapping. These Army and Navy schools are being augmented by the existing colleges and universities which are teaching courses under the defense training program in photogrammetry, camouflage and map making.

The principal instrument used in all of these training courses, and in the actual work which is done at the conclusion of the training courses, is the simple stereoscope. The stereoscope is the most important single instrument to anyone involved in the use and evaluation of photographs, and its importance is second only to the aerial photographs themselves. Unfortunately too few people really understand and appreciate the correct way to set up aerial photographs for stereoscopic study. Consequently few people get the full value of the three dimensional view which can be seen through a properly used stereoscope. In addition, many people undergo undue eyestrain because they do not know that it is possible to set up the photographs and the stereoscope in a way that will eliminate eyestrain even when used constantly over long periods of time.

Many people who use stereoscopes have learned through trial and error. After sufficient practice, such people are able to see three dimensionally to a certain degree and are satisfied. However, it is only when they look through a properly adjusted stereoscope at properly oriented photographs that they realize what they have been missing through the use of "rule of thumb" methods. So many users of stereoscopes know of no other system than to juggle a pair of photographs beneath a stereoscope until finally a three dimensional view of sorts is obtained. It is no wonder that a beginner looking through a stereoscope at a pair of photographs so oriented finds it very difficult or impossible to get the stereoscopic view.

The correct method of setting up aerial photographs for stereoscopic study takes a small amount of time and trouble. Naturally there are many conditions under which it is unnecessary to take the time and trouble necessary to set the photographs up the correct way. Approximate methods can be used for brief or casual stereoscopic study of only a few minutes' duration. However, even to set up the stereoscopes for a casual study requires a thorough knowledge and past practice of the correct method. A thorough grounding in the correct practices enables a person to approximate very closely to the correct method without actually going through the operations necessary.

The first step to be learned is how to avoid what is known as the "pseudoscopic" effect. The pseudoscopic effect is the exact opposite of the stereoscopic

effect. Instead of houses, trees and hills extending upward in a natural fashion as they do in a stereoscopic image, the houses, trees and hills appear to project vertically downward into the ground. Thus valleys become hills and vice versa. Sometimes the pseudoscopic effect is desired to aid interpretation, but that is the exception to the rule. Consequently, it is usually desired to know how to avoid the pseudoscopic effect rather than how to get it.

Inspect one photograph of the stereoscopic pair of photographs to be viewed and see if shadows in the photograph can be seen. Trees, houses or other objects

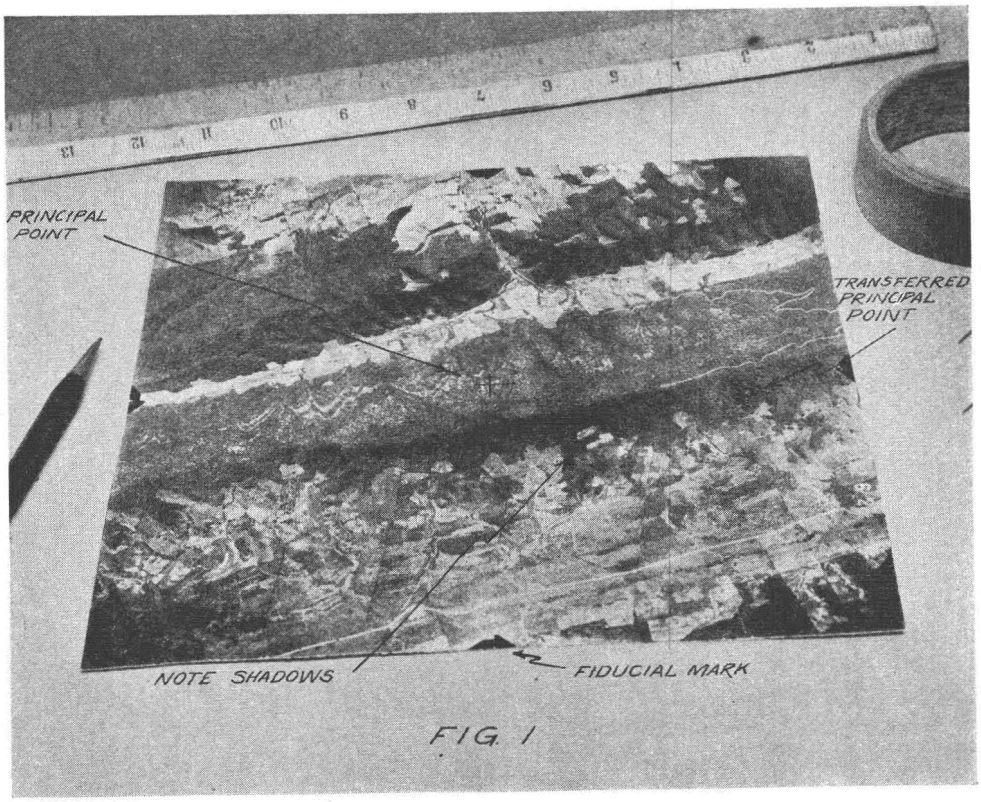
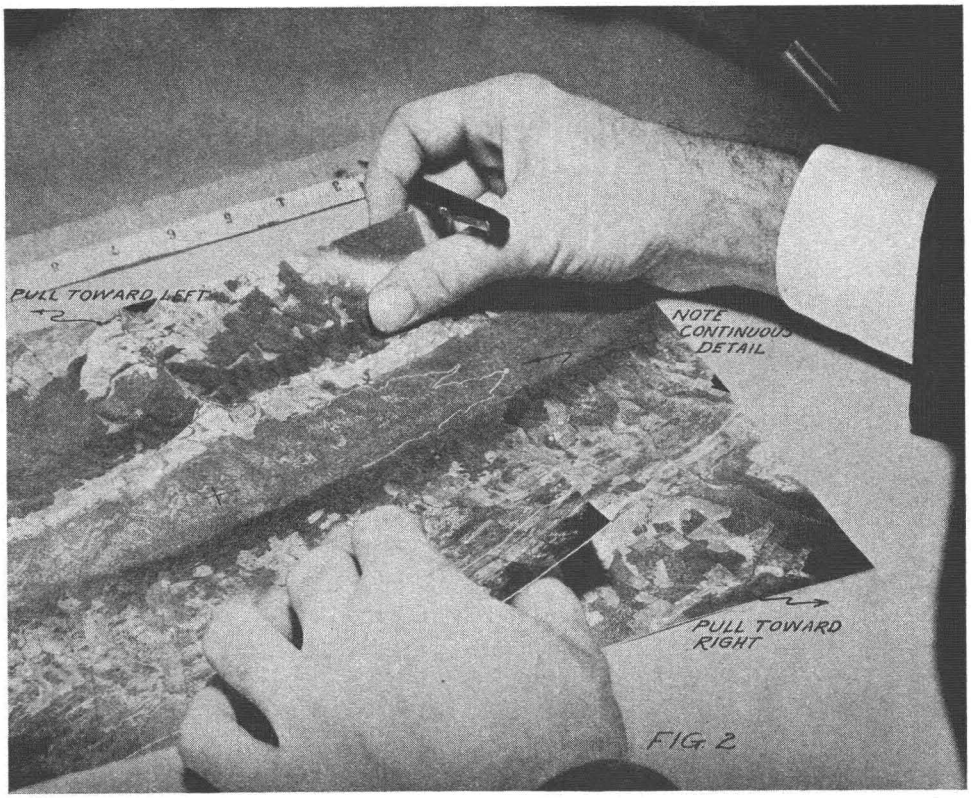


FIG. 1

will cast shadows and these shadows will be visible to a certain extent. If high hills or mountains are in the photographs, the shadows will be apparent on the slopes of the hills away from the sun. Lay one photograph of the pair on the table so that the shadows appear to be cast by a light somewhere out beyond the upper left-hand corner of the photograph. This orientation is shown in Figure 1.

Each photograph of a properly taken stereoscopic pair of photographs contains about 60% of the details shown in the other. This is shown in Figure 2. Using the second photograph of the pair, lay it over the first picture which is lying on the table, so that the detail is continuous as shown in Figure 2. Then pull the two photographs apart so that the overlapped portions are adjacent to each other (Figs. 2 and 3). If this is done, and if the operation to be explained later is followed, a pseudoscopic image will not be obtained. The photographs can now be considered as the left-hand photograph and the right-hand photograph.

Each photograph contains what is known as fiducial marks. Figure 1 illustrates one form of fiducial marks commonly used. However different types of cameras have different types of fiducial marks but they are all readily apparent either being in the center of the sides or at the corners of the photographs. Their purpose is to enable a person to locate the center of the photograph. The center of the photograph is commonly referred to as the principal point (Fig. 1). The principal point is simply determined by drawing lines between opposite fiducial marks and the intersection of the lines is the principal point of the photograph.



Actually, a line is not drawn across the entire photograph but only a short section of the line near the center as shown in Figure 1. Sometimes when the principal point is found it is marked merely by a pin prick with a small circle around it and other times a cross is used. It was explained above that each photograph of a stereoscopic pair includes about 60% of the photographic detail in the other. Consequently the principal point of one photograph will likewise appear in the other. This can be understood by reference to Figure 2. For instance, when the principal point of the left-hand photograph is located, it will probably be found that it lies on top of some recognizable spot of detail. If one looks closely in the other photograph, this same spot of detail will be found and a pin prick can be made or a cross made to indicate the point to which the principal point of the left-hand photograph has been transferred. Likewise the principal point of the right-hand photograph will be found to lie on top of a recognizable bit of detail which can be likewise found in the left-hand photograph. As a result of the determination of the principal points and the transference of the principal points,

four definite points exist in the stereoscopic pair of photographs (Figs. 3 and 4).

Fasten the left-hand photograph to drawing board or table by means of a fine needle or pin, pushed through the principal point (Fig. 3). For convenience, it will be found that the bottom edge of the photograph should be approximately five inches in from the edge of the drawing board or drawing table, when the photograph is thus fastened down. The next step is to fasten the right-hand photograph in position. The distance of the right-hand photograph from the left-hand photograph is important. Most reputable manufacturers of stereoscopes

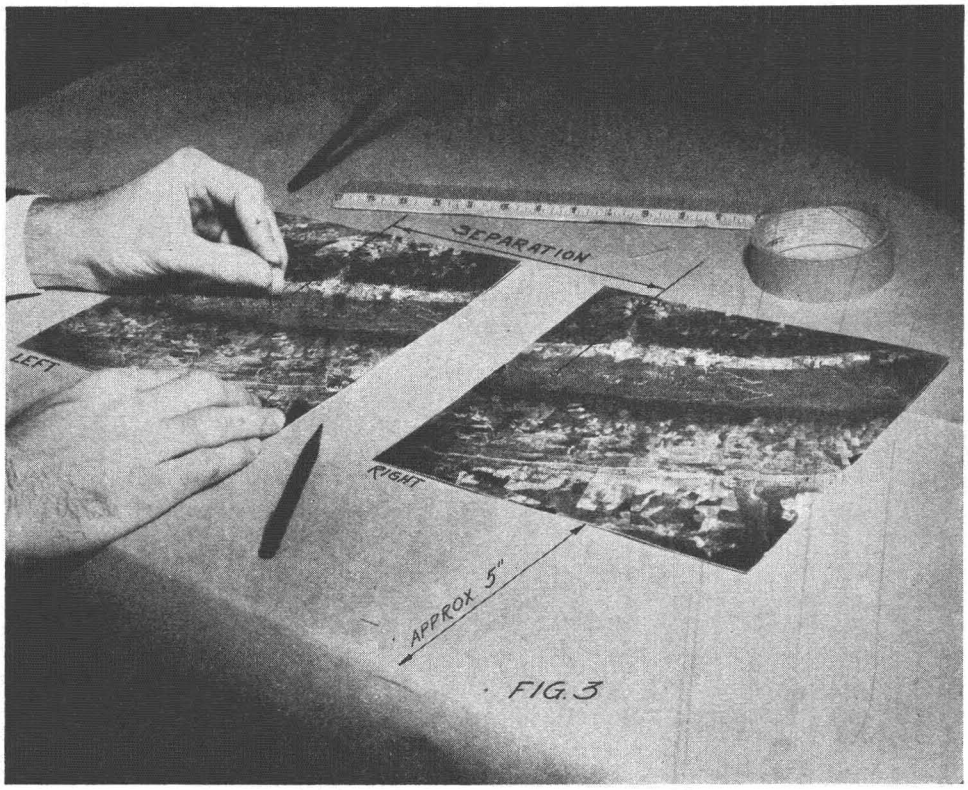


FIG. 3

provide this information in their descriptive handbooks. The separation is measured from a point in one photograph to the same point where it occurs in the other photograph. Usually the measurement is made from the principal point of the left-hand photograph to the transferred position of that point in the right-hand photograph (Figs. 3 and 4). This dimension for the Fairchild Model F-71 (Air Forces Type A-6) Stereoscope is $9\frac{3}{4}$ inches, and for the Fairchild Stereo-Comparagraph is $6\frac{1}{4}$ inches.

Lay the right-hand photograph on the drawing board opposite the left-hand photograph by the correct separation (Fig. 4). Push a thin needle through the principal point (center) of the right-hand photograph into the drawing board or table. Thus this photograph, like the left-hand photograph can be rotated about its center point. Lay a straight-edge across both photographs so that it is held against the two needles (Fig. 4). Rotate the left-hand photograph underneath the straight-edge in this position until the transferred principal point in the left photograph is directly beneath the edge of the straight-edge. By means

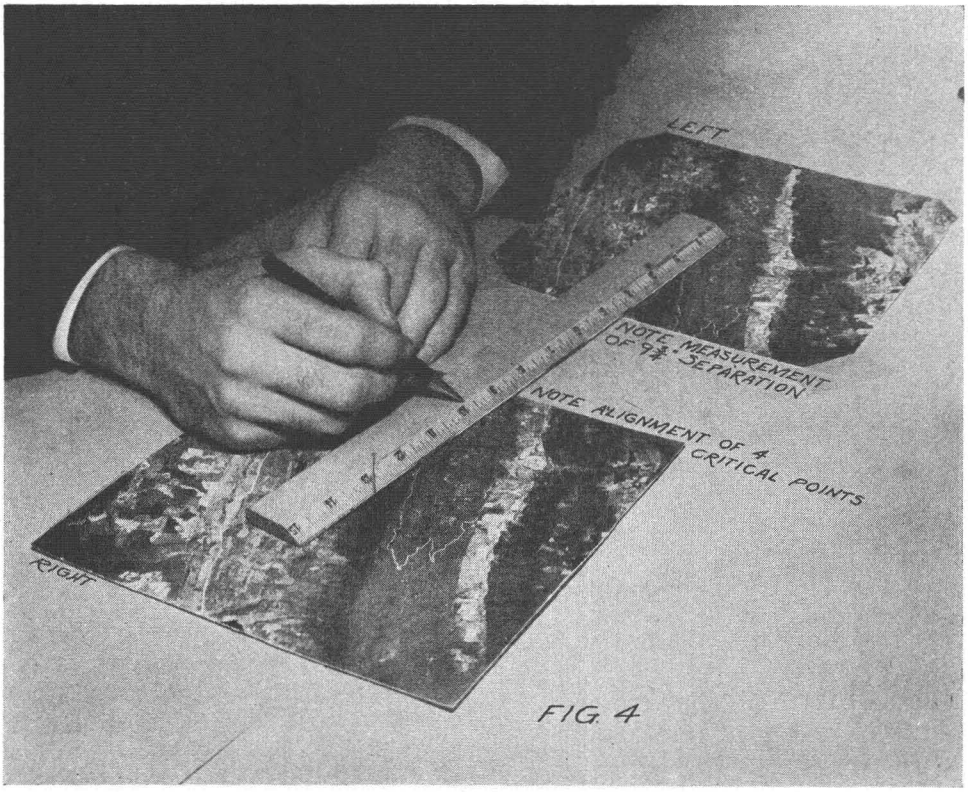

LEFT
NOTE MEASUREMENT OF 9" SEPARATION
NOTE ALIGNMENT OF 4 CRITICAL POINTS
RIGHT

FIG. 4


NOTE HANDGRIP ON STEREOSCOPE LEGS

FIG. 5

of Scotch tape or thumb tacks, fasten the left-hand photograph permanently in this position. Then rotate the right-hand photograph underneath the straight-edge in a similar fashion until the transferred principal point of that photograph is directly under the edge of the straight-edge. Then fasten the right-hand photograph securely to the drawing board and the orientation of the photograph has been accomplished. The needles can now be withdrawn.

With both the left and the right photographs now secured to the table in proper orientation, the stereoscope should be set up over the photographs (Fig. 5). In setting up the stereoscope, a line through the centers of the eye lenses or viewing points should be parallel to the imaginary line through the four points on the photographs. A good test is to lay a straight-edge along the four points and then look through the stereoscope. If the straight-edge appears to be non-continuous, it is only necessary to rotate the stereoscope clockwise or counter-clockwise until the straight-edge appears to be continuous across the entire field of view. When all of this is done, the three dimensional view will literally pop up at the observer. Furthermore, the observer can step back with confidence and call up a novice without making excuses about slipshod orientation.

To describe a simple operation such as the foregoing frequently requires, as in this case, a long space of time. However, if the Stereoscope, the stereoscopic pair of photographs, a ruler, thumb tacks or Scotch tape, and pins or needles are available to start with, this whole procedure need not take longer than 3 or 4 minutes. This method should always be used if the photographs are to be studied for long periods of time. The method should be used if the photographs are to be studied for the purpose of interpreting or detecting information of great importance. This method must be used if there is any intention of making parallax measurements for the determination of elevation.

A student or instructor who is thoroughly familiar with the above method can readily line up a pair of photographs without resort to the procedures outlined previously and can get the photographs reasonably close to the desired orientation. Such approximation serves for the quick inspection of a pair of photographs for the information of the observer himself. However no matter how experienced the observer is, if he must study the photographs for a long period of time, the approximate method is not sufficient. In conclusion the essential steps to be followed are here given.

a) Select the left and right photographs to avoid the pseudoscopic effect.
b) Determine the principal point of each photograph and transfer each to the other photograph.
c) Affix the photographs to the table along the base line with the proper separation.
d) Set up the stereoscope with the eye base of the instrument parallel to the stereoscopic base of the photographs.
e) Look through the stereoscope and view the three dimensional picture.