STEREOSCOPY AND STEREOSCOPIC VIEWING

STEREOSCOPY

Stereoscopy, or solid vision, is the term given to the following natural phenomenon: When a person looks simultaneously at two photographs that have been taken of the same scene from two viewpoints, viewing one photograph with each eye, he can see an image of the scene in three dimensions. Stereoscopic, or binocular, vision is the facility, which makes stereoscopy possible.

Normal two-eyed vision is required for realizing and measuring depth by stereoscopy. Two primary clues are involved in stereoscopic vision. The first clue is the double-image phenomenon. A simple demonstration indicates what is meant by double vision. If a pencil is held 12 to 15 inch or 300 to 375 mm in front of the eyes and the gaze is fixed on a spot on a far wall, there will be two images of the pencil. The left image is formed by the right eye, and the right image is formed by the left eye. When the gaze is now concentrated on the pencil, two images of an object on the wall will be formed. The right image is formed by the right eye, and the left image is formed by the left eye. If, while the eyes are gazing at the wall, the pencil is moved away from the eyes and toward the wall, there would be a position of the pencil some where in front of the wall where the double image would disappear. Stereoscopic vision is not possible at distances closer than about 10 inch, unless the eyes are aided by lenses, because the normal eye cannot comfortably focus any closer. The perception of depth by stereoscopic vision is not possible beyond about 2000 ft. or about 700 m, because the parallactic angle is too small beyond that distance. This is the phenomenon called stereoscopy.

STEREOSCOPES

There are two basic types of stereoscopes for stereoscopic viewing of photographs, namely, the lens stereoscope and the mirror stereoscope. Each has advantages and disadvantages. The lens stereoscope, consists of two simple magnifying lenses mounted with a separation equal to the average interpupillary distance of the human eyes, but provision is made for changing this separation to suit the individual user. The lenses are mounted in a frame so that they are supported at a fixed distance above the tabletop. If the distance between the lens and the tabletop equals the focal length of the lenses, then the images of the points on the photographs will appear to come from infinity. The lens stereoscope presents a magnified image to the viewer.

Photographs overlap one another to a certain extent when oriented under the lens stereoscope. Thus, a portion of the overlap area is obscured from view. One of the photographs must then be rolled back in order to view the entire area stereoscopically.

The mirror stereoscope consists of a pair of reflection prisms (or mirrors), and a pair of wing mirrors, each of which is oriented at 45 degrees with the plane of the photographs. The total optical path distance, from the eyes to the plane of the photographs varies from 8 to 18 inches, depending on the kind of mirror stereoscope. A pair of meniscus lenses are located above the prisms in order to provide comfortable viewing of the stereoscopic image. These are interchangeable in some mirror stereoscopes in order to accommodate individual eye variations. Some types of mirror stereoscopes have a set of removable binoculars, which are placed at the position of the meniscus lenses. The binoculars produce an enlargement of a limited portion of the stereoscopic image for detailed study, as in the interpretation, selection or identification of ground control points.

The greatest single advantage of the mirror stereoscope is the fact that the photographs may be completely separated for viewing, and the entire overlap area may therefore be seen stereoscopically without having to flip the photographs. Without the aid of binoculars, however, the scale of the stereoscopic image is small compared with the scale as seen through the lens stereoscope. Because of its size, the mirror stereoscope is not so portable as is the pocket stereoscope, and its use in the field is somewhat awkward.

ORIENTING A PAIR OF PHOTOGRAPHS FOR STEREOSCOPIC VIEWING

Before the stereoscopic, or three-dimensional, impression of the terrain may be realized, the photograph must be properly oriented under the stereoscope. This orientation is performed as follows:

1. Make certain that the photographs are consecutively numbered and in the same flight line. After aerial photographic negatives have been processed, they are numbered consecutively to show the flight number and the photograph number before photographs are printed. This numbering enables a person to identify a pair of adjacent overlapping photographs.

2. Lay one photograph down on the other so that their overlap areas coincide.

3a. When using a lens stereoscope, separate the two photographs in the direction of the flight line until conjugate images are separated by about the same distance as are the centers of the lenses.

3b. When using a mirror stereoscope, separate the two photographs in the direction of the flight line until conjugate images, are about the same distance apart as are the centers of the large wing mirrors.

4. Place the stereoscope over the pair of photographs so that the line joining the lens or eyepiece centers is parallel with the direction of flight.

5. While looking through the stereoscope, make any necessary adjustments to permit you to see a stereoscopic image comfortably. For this purpose, change the separation of the photographs slightly, rotate either photograph, or rotate the stereoscope, or carry out a combination of these slight adjustments. At the first attempt at seeing stereoscopically, the adjustment may prove a bit difficult. But, once it has been mastered, this adjustment becomes easy.

If the two photographs are picked up and interchanged, the left eye sees the right-hand photograph and the right eye sees the left-hand photograph. Thus, valleys look like ridges, and hills appear as depressions. This is called pseudoscopic viewing of a stereo pair, and is advantageous in delineating drainage lines because they appear quite unnaturally as knife-edge ridges.