



A DESERTED CABIN

FORMAN HANNA

AERIAL PHOTOGRAPHY

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To distinguish three types of aerial apparatus, the balloon, the airship, and the aeroplane. Photographic technic must take into account special factors for each type of flying machine. The balloon swings freely in the wind, while the airship and the aeroplane make their way by the aid of motors. The latter, especially in the case of airships, set the car in rapid and vigorous vibration, which has a very serious effect by rendering difficult the production of sharp pictures. The first question for the airman to solve, in making photographic preparation for flight, is in regard to the most suitable apparatus. While in theory, good results may be obtained with any hand-camera, cameras with focal-plane shutters are generally preferred. An indispensable condition is that every part of the apparatus shall be extremely thick, as on account of the great luminosity which exists at high altitudes, the smallest leak of light into the camera may completely fog the plates.

Different opinions are held as to the most suitable size of plate, but the following hints may be useful. If the pictures are to be used for projection, as is often the case, $3\frac{1}{4} \times 4\frac{1}{4}$ or a similar size is to be preferred, as lantern slides can then be made by contact. If a larger size is used, the lantern slides must be made by reduction, a more complicated process. For prints also, the size $3\frac{1}{4} \times 4\frac{1}{4}$ is generally sufficient, for it is large enough for direct prints, and enlargements up to 9×12 can easily be made in daylight enlarging apparatus.

In the choice of size it is wise to prepare for a large number of exposures on an aerial trip, so that the price of materials and plateholders, as well as the space they occupy, are not unimportant. A large size is, therefore, to be chosen only for special reasons.

In the choice of a suitable objective the speed and the focal length must be considered.

As to the latter, it is generally stated that the longest possible equivalent focus is the most desirable, but the present writer is of a different opinion. If, for example, we choose the focal length of the objective four times as long as the length of the plate, we are able to reproduce a length on the surface of the earth only one quarter as great as the height of the aviator above the ground. Such a field of view is in most cases too small.

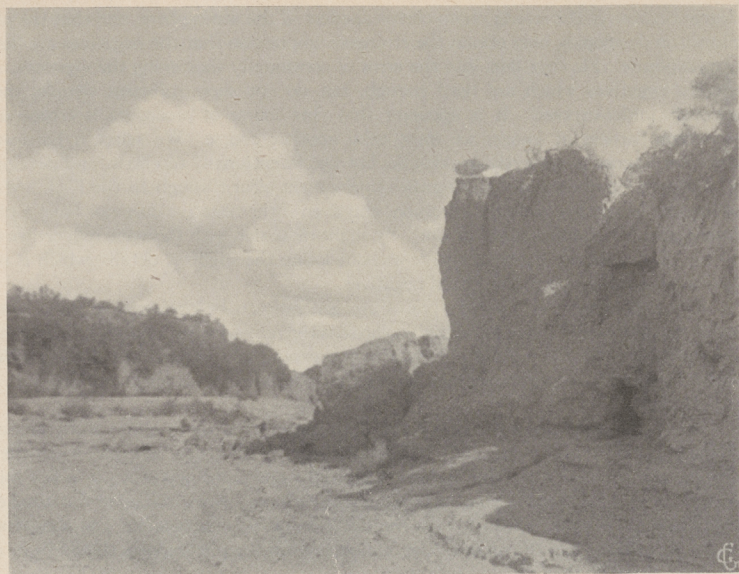
We therefore deduce the rule that we should choose, in general, contrary to the usual opinion, a focal length short in relation to the size of the plate, in order to be able to utilize a sufficiently large angle of view, and deviate only in special cases when it is necessary for special military or meteorological purposes. A suitable focal length for all cases of balloon work is approximately equal to the diagonal of the plate. If, for the purpose of obtaining military information, we select a long focus, this should not exceed 24 inches, for with greater focal length vibration is practically sure to show in the pictures. In such cases, teleobjectives offer the considerable advantage that the camera is short as compared with the equivalent focal length and is therefore easier to use. On the other hand, the working qualities of this type of objectives, even at the present time, after numerous important improvements, are much inferior to those of ordinary lenses of the same focal length, and, therefore, the former cannot at present be considered a satisfactory substitute for the latter in aerial work.

Practical experience shows that the exposure from flying machines may be from one-third to one-sixth of what would be given under otherwise similar conditions at the earth's surface. We might conclude from this that fast lenses are not necessary for aerial photography, but this is an error. As flights, on account of more favorable conditions of the atmosphere, are preferably undertaken in the early morning or late afternoon, and more advantageously in cloudy weather than in sunshine, we are often forced to make instantaneous exposures under unfavorable conditions of light and the possession of a fast objective is then very gratifying. Such a lens, can, besides, be used more generally, since in aerial photography depth does not need to be considered, for all objects can be considered as infinitely distant. The speed of the lens should also be as great as possible because, in this case, even if we are using a yellow filter, very short exposures, such as are required because of the vibration of the car of the airship, may be obtained with sufficiently sharp definition.

The focal-plane shutter has been most generally used. A shutter to be used for instantaneous exposures from aircraft must be as resistant as possible to the influence of gritty dust (sand ballast) and cold, for it often occurs that a flight is begun at a temperature of 60 or 70 degrees and that temperatures far below freezing are found at great heights, so that the shutter is exposed to considerable variations of temperature.

We find in practice that sharp exposures can be obtained from a balloon, provided that the passengers keep still, with exposures of 1-5 second and even longer. From airships and aeroplanes, however, 1-100 second is often too long, for the vibrations produced by the motor often result in blurred pictures. When photographing from a balloon, therefore, the time of exposure can usually be suited to the condition of the light, while in photographing from the other types of aircraft we are often confined to a minimum exposure quite inadequate under the existing light conditions. It is therefore evident that the photographer in motor-propelled aircraft works under essentially less favorable conditions than the balloon photographer. We may add that the bitter cold rush of air, which is the rule on aircraft driven by motors does not exactly lighten our labors, while, as is well known, a balloon even in a gale seems to be in perfectly quiet air.

Exposures from aircraft must frequently be made through a hazy atmosphere, and the use of a ray filter and a color-sensitive plate is then prescribed. The use of the former and not the latter offers absolutely no advantage. If the air is very clear and altitude is not too



"A lonely land where clouds float softly by"

GUSTAV GLUECKERT

great, ordinary plates are perfectly satisfactory. Nevertheless, it is always preferable to equip oneself with color-sensitive plates for flights, for it is never possible to predict what aerial conditions will be. It is also to be noted that orthochromatic plates with ray filters will not always guarantee better results than ordinary plates. This they accomplish amazingly well when we have to deal with a pure blue haze. If the atmosphere is gray or white, the ray filter and color-sensitive plate are more or less useless. It is also folly to expect that a picture of a great city taken through a layer of smoke will be as brilliant as that of a small village in an open valley.

The filter must be yellow; brownish filters must be avoided because they suppress not only blue and violet rays but also yellow and green. The color-sensitive plate must also be suitable to the special conditions. Before all, it must work clear. Since it is often necessary to use a very deep yellow filter in aerial exposures, and this must be deeper the mistier the air and the higher one goes, the plates must have a considerable sensitiveness for yellow rays, which is not present to the amount that is necessary, in all brands. It is therefore prudent to test the sensitive material which it is proposed to use on a flight, to see that it is in satisfactory condition. It is also desirable that the plates should work hard, since exposures from aircraft are as a rule somewhat monotonous, for the following reason:

If we assume a tree lighted by the sun, we see that it has, when viewed from a short distance, bright highlights and deep shadows; it therefore shows strong contrasts. These, however, appear weaker in proportion as we retire from the tree. At a very great distance we see neither the highlights nor the shadows, but the tree appears uniform in tone. It is apparent that a photograph will reproduce these same effects, often, indeed, in a greater

degree because of the strong photo-chemical effect of the atmosphere, and that the photographer on developing may obtain the erroneous impression that the negatives are flat from over-exposure. He thus falls into the error of continually shortening the exposure, and so obtains negatives which are hard enough, but do not show sufficient details; they are seriously under-exposed. It is apparent that this course of procedure is erroneous. To overcome flatness of image, we must take another course. We select a hard-working emulsion, expose as correctly as possible, but not intentionally too little, and develop with a hard-working developer, carrying the development clear through to the back. We thus utilize the deeper layers of the emulsion, and even if the negative does not have a pleasing transparency, but appears far too dark, by slight reduction with Farmer's reducer we obtain a very good printing, strong negative without losing the slightest details, which is not the case with under-exposed and forced negatives.

For exposures from aircraft, plates are generally to be preferred to films, since the latter do not usually possess the high color-sensitiveness which is desirable, yet it must be acknowledged that film rolls or packs form an exceptionally convenient material, which can easily be carried in great quantities and neither possesses great weight nor requires heavy plateholders.

It is advantageous if the apparatus is so constructed as to allow quick and certain changes of plates; this is especially important when flying at low altitudes when the views change quickly, and it is often necessary to make numerous exposures in a few minutes. In such cases it is advisable to equip the camera with magazines instead of the usual double plateholders. In order to work with the latter as quickly as possible, one should always make the exposures in the order of the numbers which the plateholders should bear, and in the order of which they should be arranged.

In order to be sure that the desired subject is well centered on the plate, one should use a direct-vision (wire frame) finder, as all finders containing lenses show such a small image of the distant landscape that its details cannot be perceived.

While we may expect to obtain entirely satisfactory black and white photographs from aircraft, color photographs in general give little satisfaction, whether we use the three-color process or autochromes. The latter fails principally because it requires too long exposures, about eighty times the ordinary. The conditions for three-color photography are considerably more favorable in this respect. With well-sensitized plates and an apparatus equipped with three fast lenses, the separation negatives may be made in about 1-25 second. The shutter should be set for this time, and the different exposures determined by suitable choice of stops. An exposure of 1-25 second, as we have already stated, is short enough to obtain sharp exposures from a free balloon, but will not attain this from dirigibles or aeroplanes with the motors running. The use of three objectives theoretically introduces parallax, but this is practically unnoticeable, as the distances concerned are proportionately great. The greater the height, the less useful is color photography. It is well-known that at great distances not only light- but also color-contrasts fall off considerably, and so the difference in color between a red roof and a green lawn becomes less and less as the aircraft goes higher and higher. This phenomenon is naturally recorded in the photograph, and thus the color effect is more or less lost.

Stereoscopic photography can be practised in a balloon only to a very limited extent, and with normal stereoscopic apparatus only at a very low altitude. At a greater distance from the earth the stereoscopic effect is lost because of insufficient parallax, and one can then obtain stereoscopic effects only by taking successive ordinary exposures at certain intervals during the flight. Naturally in this case the altitude should be nearly constant.