GROUND PHOTOGRAPHY

Far more information can be gained from a photograph than any individual observer could collect, because no one man has or can have the knowledge to grasp all phases of the situation observed. A photograph, on the other hand, can be subjected to detailed examination not only by a skilled photo-intelligence officer, but also by specialists in any number of fields, each of whom will see details not noticed by the others.

A. Requirements for Good Intelligence Ground Photographs

The intelligence photograph is a far cry from a tourist snapshot; the details that mark the difference may seem small, but they are important. For an analyst to obtain the maximum intelligence yield from a photograph, it must fulfill several specific conditions. Three of these are qualities inherent in the picture itself, others are in the form of essential accompanying data.

1. Photographic Requirements

First, the print to be studied should have low to medium contrast. Since the details that form the key to photoanalysis are frequently in shadow areas, the interpreter needs low to moderate contrast in the print. The light areas of the target should not be a burned-out white, with the shadow areas a dense and impenetrable black. Proper exposure or even slight overexposure when the picture is taken, and possibly slight underdevelopment, will produce the right degree of contrast.

The second requirement is the highest resolution of which camera and film are capable. "Resolution" is the technical term for sharpness

of image, and it can be achieved by properly focusing the lens, holding the camera steady when the film is exposed, and by using a fast shutter speed (1/100th second or faster).

The third requirement is that the print be complete -- made from the full negative and not cropped. The analyst's ability to take measurements from a photograph is frequently keyed to knowledge of the angular field of view of the lens used. Angular measurements coupled with range distance give true measurements, and the degree of angle that the photograph encompasses must be known. If the print has been cropped or masked, the angular relationship will not work out, and exact measurements are practically impossible. The solution is simple: print all photographs with a little of the clear margin showing on all four sides. The resulting black border assures the interpreter that he is working with the full frame.

These three requirements are fundamental to good photo interpretation. They would seem to be easy to achieve, yet contrasty, unsharp, and cropped prints continue to spoil their share of photographs and to nullify hard-won intelligence. With cooperation and understanding this loss can be greatly reduced, if not eliminated.

2. Essential Accompanying Data

For maximum utilization of each photograph, certain information is necessary. The essential data should be recorded at the time of each exposure or as soon thereafter as possible. The types of necessary information and the reasons for their importance are as follows:

(1) "Where was the picture taken?" Give the geographic location, including country, province, city or town, and any other data that can fix the exact position. "Ten rail clicks south of KM post 147 on X-Y rail line," or "300 yards SSE of intersection of highways N30 and N12" are acceptable additional details. Next, note the direction in which the camera was pointed, as "North," "North-northwest," "Estimated 25° left of photographer-sun azimuth." Any of these notations is acceptable, but the more accurate the azimuth reading (compass) the more valuable the photo will be.

(2) Report the date, time, and time system (local or Zebra). This enables the analyst to refer to astronomic data on sun position and gives him a secondary method of making height determination. A time accuracy of plus or minus 5 minutes is desirable in ground photography.

(3) Report camera make and model number; each has its own format size and lens focal length, as well as its own inherent faults. The importance of focal length is paramount because each focal length has a fixed angle of view, which forms the basis for measurement computations, as mentioned earlier. This camera data need be recorded only once for each roll of film and target, unless more than one lens is used, in which case, of course, the change must be noted. It should be obvious that a system of numbering exposures and keying them to the essential data should be carefully followed.

(4) Make an estimate of range to target distance and record that estimate. Of the several methods of range estimation, the most accurate depends on having an object of known size in the target area. This

might be a man, a truck, or a freight car. To accomplish range determination by this method, the photographer extends his arm in front of him at full length toward the target, holding a pencil (or similar article -- even a blade of grass will do) in his hand, with the point up. With the left eye closed he aligns the pencil point with the selected object, then quickly closed the right eye and opens the left. The reference point will apparently have moved in relationship to the object. He estimates the difference in position in terms of the object -- for example, number of truck lengths. Assuming that the truck is 20 feet long and the difference is 4 truck lengths, 4 is multiplied by 20 and then by 10 (eye base-arm length ratio). The result -- 800 feet -- is the range. Remarkably accurate measurements result from this method.

(5) Finally, note and record any unusual conditions at the scene, such as sounds, smells, colors, or presence of smoke.

B. Special Techniques

1. The Complete Photographic Study

To make a complete photographic study of a target requires views from three distances -- distant views to show the entire target and its environs for exact positioning; medium-distance views, for recognition of the relationships of target components; and close-ups, for details of structure, size, and purpose of individual components.

These three classes of views based on range can be photographed either by moving progressively closer to the target or by the use of normal, telephoto, and long-telephoto lenses.

A question may arise here as to the most desirable number of exposures. As a generality, there is no such thing as too many photographs. Each different view yields some measure of information, and this is particularly true of telephoto views, in which there are problems of atmospheric interference. Therefore, photograph a target as thoroughly as time and security conditions will allow.

2. Field Calibration

Another technique is aimed at overcoming the effect of the inherent imperfections in camera lenses. Each lens has its own distortion pattern that displaces the photographic image from its true position. When the lens is available to the photo analyst, he has it calibrated on an optical bench. This is not often possible, however, but it is possible for the photographer to provide calibration data. To do this, he positions himself and the camera between two parallel lines, such as the curbs of a street or, even better, railroad tracks. With the camera in its horizontal position and level, he makes one exposure down the center of the street or track. Turning the camera round to use its vertical format, he makes a second exposure from the same position. By means of these two photographs the optical technician can plot the pattern of distortion and compute its effect on his measurements.

3. Cycloramic Photography

The principal advantage of cycloramic photography is that, when it is properly done, the resulting photographs can be used as the basis for a precise map of the area shown. Cycloramic photography consists of making two series of overlapping exposures covering the full 360 degrees around two given points. The photographer takes his position at a precisely identifiable point and makes the first exposure. Using the view finder, he sets up the second photograph with approximately one-third overlap with the first. This procedure is repeated until the photographer has turned the full circle. Even though one or more views may have no apparent intelligence value, the full circle must be photographed.

Having exposed the first 360° pan, the photographer moves to a second identifiable position from which his first camera station is visible and repeats the process, exposing another 360° circle with one-third overlaps. The two sets of photographs (or three, if it is feasible to take another) give complete essential data that allow the photogrammetrist to execute radial-line intersections to points of interest and on this basis revise existing map coverage or compile a new map.

There are times when a single negative cannot cover a specific area. Here would be an opportunity to use "panorama" - or partial cyclorama. Take as many shots as are needed - each with a 30-40% overlap.

6. Stereophotography

Of all the tools of ground-photo reporting, stereophotography probably has the greatest versatility and value. Stereophotography gives the interpreter the ability to make accurate measurements of depth, height, and width, and to see the view in three dimensions. The third dimension can be of great help in distinguishing between components of a target or several units of a similar type in proximity to one another. Stereophotographs can be made with an ordinary single-lens camera by taking two or more pictures of the same object from two different camera stations with the optical axis parallel. As a rough guide, the camera stations should be separated by 1 foot for each 100 feet range. The stereo base (camera separation distance) must be recorded if the photos are to be of use.

Stereophotographs can also be made successfully from a moving train or auto by holding the camera in the same position and making a series of exposures as rapidly as possible. The 35mm Robot (sequence type) camera is well suited to this work because of its semiautomatic feed and cocking device. Stereo shots can also be taken of moving objects, such as aircraft or vehicles, with photographer and camera in a fixed position.