CHAPTER 9

MAP SETTING AND POSITION FINDING

SECTION 1 - SETTING A MAP

901. Introduction

1. "Setting" a map means turning the map so that map directions and hence map detail correspond with that which is on the ground. This is also called "Orienting" the map. Setting a map is not always necessary, and it is sometimes more convenient to hold the map so that the names are the right way up. However, if there is any doubt about where you are, or in which direction you should turn, it is advisable to orient the map, and when moving over a complex route it is generally more important to hold the map correctly oriented than to have the names the right way up.

2. There are two basic methods of setting a map:

   a. by inspection of the surrounding detail; and
   b. by setting on the North point.

These are described in the following arts.

902. Setting a Map by Inspection

1. This is the simplest and quickest way of setting a map, provided you have some idea of your own position.

2. If you are on a straight road, line up the road on the map with the road on the ground, pointing it in the right direction: at a cross roads, the map can be set similarly.

3. If you are not on a road, or are on a road which is not straight and you cannot identify the bends, it is necessary to locate other objects such as a particular house, church, or bridge whose direction you can cheek in relation to your own approximate position.

4. In open hilly ground, you may have to rely on the shape of the ground and on the corresponding positions of the contours. If you are on a ridge or a spur, set the map so that the feature corresponds with the contours. Cheek for direction by using a recognizable hill top, saddle, or some other pronounced feature.

5. Setting a map by this method is not precise, but the map can be set quickly and accurately enough for you to be sure of your direction, and to be confident of your position within an acceptable margin of error. See Figure 9-1.

903. Setting a Map by the North Point

1. If you cannot immediately recognize sufficient detail around you to enable you to set the map as described above, the simplest approximate method of setting is by the sun, if it is visible. Assuming you have a watch, the direction of True North (or South) can be found by the method described in art 718. The setting will not be precise, but should be accurate enough to enable you to recognize local detail.

2. If, however, there is no local detail, or if you need to set the map more precisely, a compass must be used. With a Silva compass, ensure that the magnetic declination has been applied (see art 805) and then place the compass on the map so that the meridian lines are parallel to the eastings and the sighting arrow is pointing towards the top of the map. Rotate the map with the compass on it until the compass needle is oriented north, ie, between the two luminous points on the orienting arrow. The map is then set with the grid lines pointing to grid north.

3. If a prismatic compass is used, lay the compass with its axis along an easting, and turn the map and compass until the inner circle of mils reads the appropriate grid magnetic angle against the lubber line. If the magnetic declination is east of grid north the bearing on the compass must read 6,400 mils minus the grid magnetic angle.

4. In all cases, the grid magnetic angle must be worked out for the current year as explained in Chap 7. Sect 3.

SECTION 2 - FINDING YOUR POSITION

904. General

If you do not know your position, the first essential step is to orient the map by one of the methods described in Sect 1, preferably with a compass.

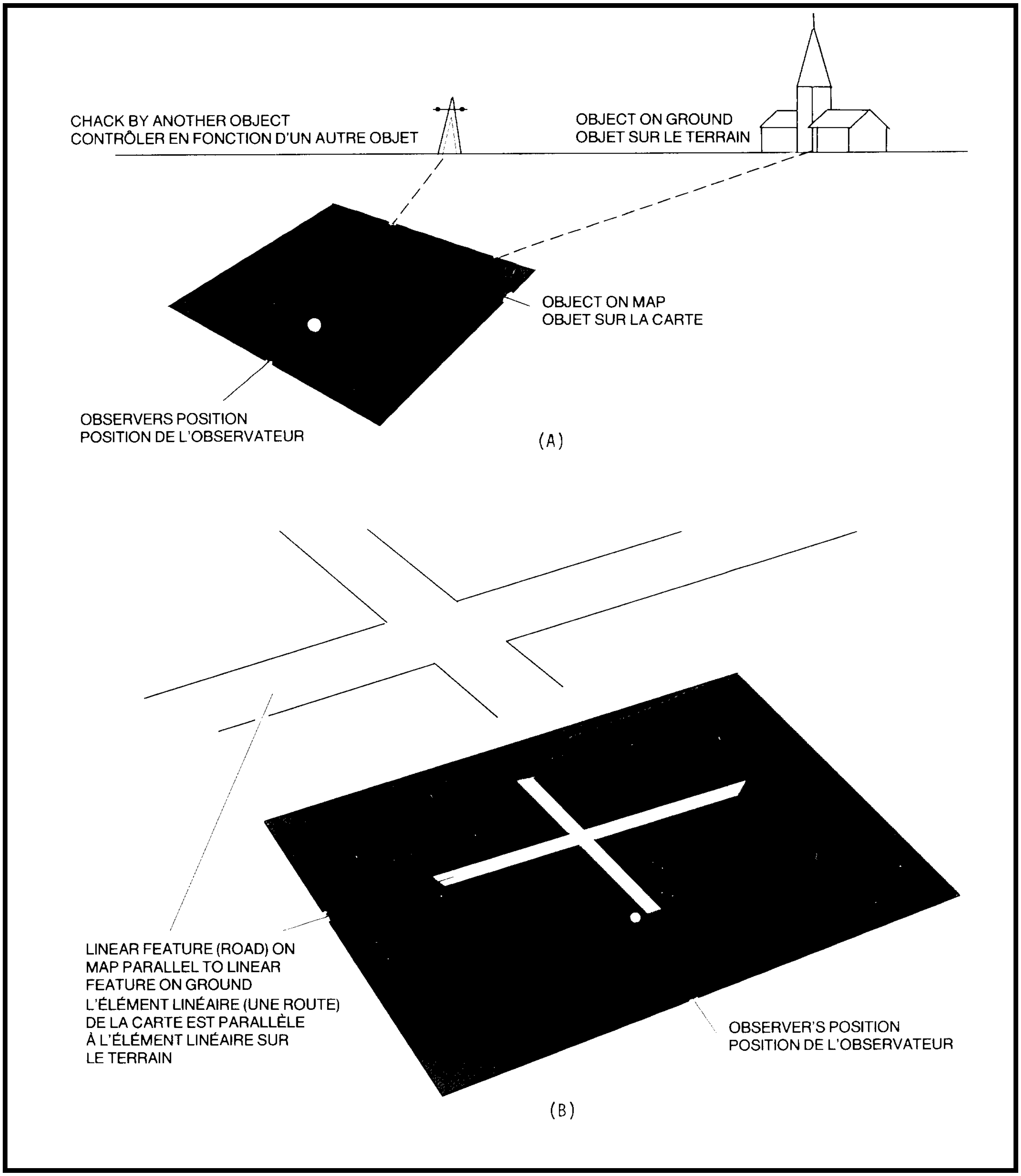

Figure 9-1 Setting a Map by Inspection

905. Finding Position from Local Detail

1. In the normal case where you know your approximate position but wish to pinpoint it more accurately, and where there is local detail marked on the map, identify at least two definite points as close to you as possible and preferably at right angles to each other in direction. Keeping the map correctly oriented, as initially determined, mark the direction of your own position from each selected point and note where these intersect. The point of intersection should be your position. Cheek this by sighting on a third point in a different direction; to confirm your findings, verify that the approximate distances from your position to the identified points are correct.

2. If you can line up your position with any recognized straight line on the map, eg , a section of a railway or a road, or between two identified points, this will also confirm the setting of your map and the line on which your position must be. A direction cutting this line from a known point at right angles will give you your position. Again it should be confirmed by sighting on another point.

3. On hilly ground, the contours will help in determining your position, especially if you place yourself on the line of a ridge or spur which is clearly defined, or in more open country on a distinctive hilltop. Streams and stream junctions are useful landmarks.

906. Finding Position from Distant Detail (Resection)

1. In the absence of local detail, and contours which are not sufficiently close or shaped to give you a reliable indication of position, your position can only be determined from distant objects such as hilltops, corners of woods, or other natural features, possibly on a sky line. Select three points around you so that your position is within the triangle formed by the points, and preferably so that the lines from each point cut each other at angles exceeding 800 mils.

2. If you have a means of accurately marking the line of sight from each point on your map, while still keeping it correctly oriented, do so. If your map is correctly set these lines will meet at a point which is your position, or at least they will make a small triangle within which your position falls. Cheek by sighting on a fourth point, if available. See Figure 9-2.

3. If, however, you have a compass, it may be easier to determine the bearing to each point, record it, and convert it to a grid back bearing (art 707). Then plot on the map the grid back bearing from each point. These lines should then meet at a point or in a small triangle of error, as in para 2. Alternatively, plot the bearings on tracing paper or talc, and then fit the pattern of the three rays to the map so that they pass through the points observed. Your position is then the point where the three rays meet. This method avoids the need to convert the magnetic bearings to grid bearings.

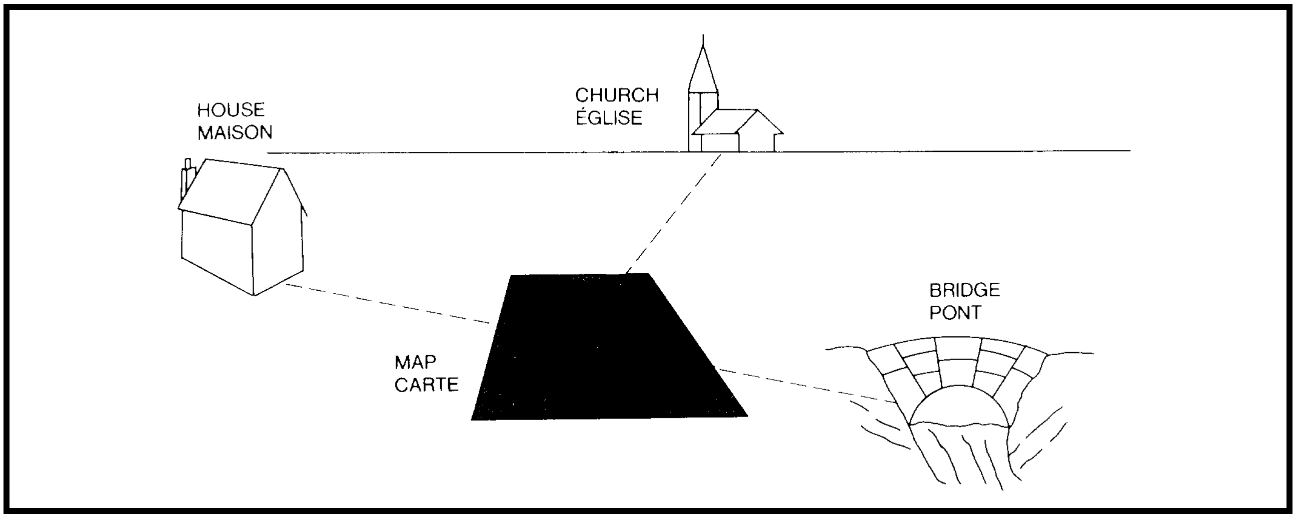

Figure 9-2 Resection

4. It is important to select three points so that you are inside the triangle formed by them. If the points are roughly equidistant your position should be at the centre of any triangle of error. Always check your determined position from a point of local detail.

5. The Silva compress provides us with yet another variation of effecting resection to determine our position:

a. Assume you are somewhere in the area shown on the map at Figure 9-3.

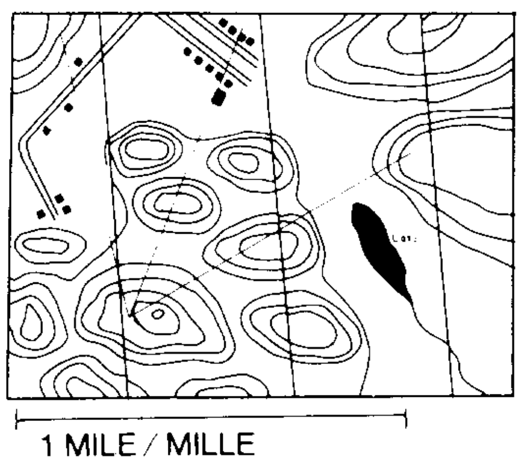

Figure 9-3 Resection by Silva Compass - Situation

b. Take a bearing to the church indicated in Figure 9-4.

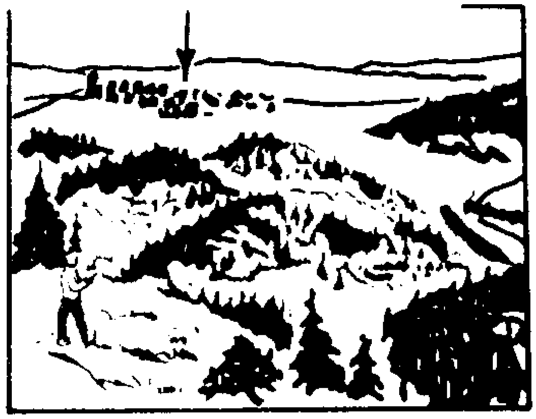

Figure 9-4 Resection b Silva Compass - Step 1

c. Without disturbing the dial setting, place the compass on the map so that either side of the base plate intersects the church as shown in Figure 9-5.

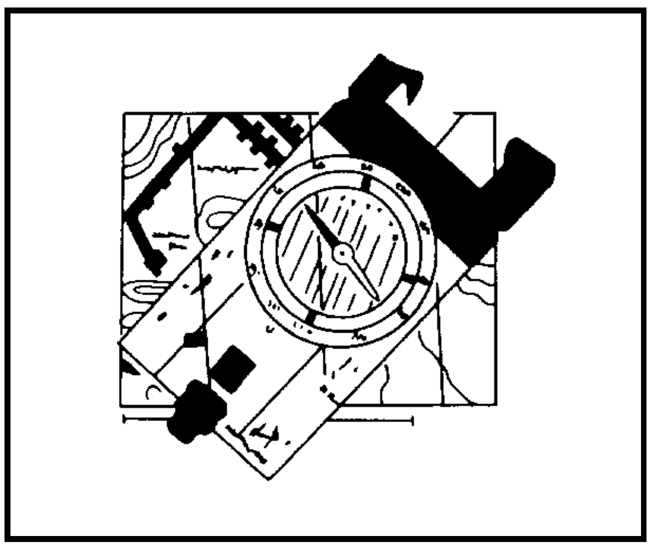

Figure 9-5 Resection by Silva Compass - Step 2

d. While keeping the edge of the compass base on the symbol of the church, turn the entire compass on the map until the compass meridian lines on the bottom of the dial are parallel with the eastings on the map, and so the orienting arrow points up or north on the map. See Figure 9-6.

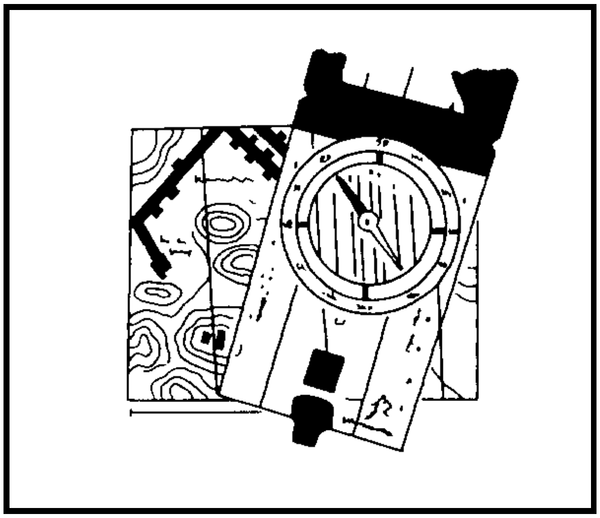

Figure 9-6 Resection by Silva Compass - Step 3

e. Draw a line on the map along the edge of the compass, intersecting the symbol for the church. Your position is somewhere along this line. To establish your exact position along the line you need another bearing.

f. Repeat the steps taken in subparas b, c, and d only take your bearing this time to the north end of the lake as detailed in Figures 9-3 and 9-4. This time the line drawn on the map will intersect the line drawn from the church where the two lines cross is your exact position. See Figure 9-7.

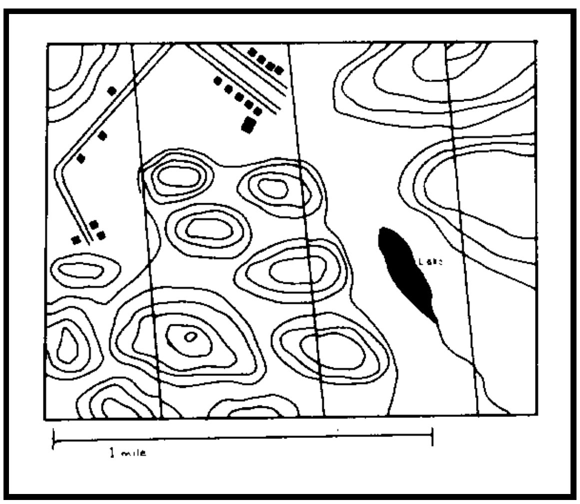

Figure 9-7 The Resection

SECTION 3 - FINDING THE POSITION OF A DISTANT OBJECT

907. General

1. It may be necessary to locate the position of a distant object for one of two reasons:

   a. to locate the position on the map of an object visible on the ground; or
   b. to find on the ground an object whose position is known on the map.

908. Locating a Visible Ground Object on the Map

1. The simplest way of solving the first problem is by the use of a compass. Take up a position which you can identify on the map, and take the compass bearing of the object. (Don't forget to allow for compass error.) Plot the grid bearing on the map. Your object will then lie on this line.

2. Orient your map (Sect 1) and study it along the line, comparing it with the features on the ground. Determine the approximate distance at which your object lies in relation to these features, eg, between a river and a hill. Assuming your object is marked on the map, eg, a building or a road junction, you should then be able to locate it on the map. If it is not marked, identify objects close to it which are marked, and determine its position by reference to these objects, eg, 20 metres to the right of the building and 50 metres beyond the road junction.

3. If the object is not marked on the map, and an accurate grid reference is required, it will be necessary to plot another line of sight to the object from a second known point of observation. The intersection of the two lines of sight will then be the position of the point you wish to locate. It is necessary for your two points of observation to be far enough apart to allow for a minimum 40 mil angle of intersection at the point to be located.

4. If you have no compass or cannot use one for any reason, place the map (correctly oriented) between you and the object in such a position as to enable you to look along the line of sight from your position on the map to the object to be located. Mark this line on the map. This will then give you the approximate line on which your point should fall. Then carry on as in para 2.

909. Locating a Map Position on the Ground

1. To find on the ground a position known on the map, draw on the map the line of bearing from your position to the object. Measure the grid bearing and convert it to a compass bearing. With your compass, look along this bearing and identify the point on the ground by reference, if necessary, to adjacent detail which is more readily recognizable.

2. If this is not possible, orient the map and look along the line of bearing to identify the point as in art 908-4.

(910 to 999 not allocated)

CHAPTER 10

AIR PHOTOGRAPHS

SECTION 1 - INTRODUCTION

1001. Scope and Purpose of This Chapter

The object of this chapter is to help all ranks to make use of air photographs to supplement the map, or, where necessary, to use the photographs as a substitute for a map. The detailed interpretation of air photographs for intelligence and similar purposes is outside the scope of this chapter, nor does it cover the making of maps from air photographs. Its essential purpose is to assist the non-specialist who has to handle air photographs, photomosaics, and photomaps to make the best use of them.

1002. Advantages and Disadvantages of Air Photographs

1. The advantages of air photographs over topographical maps are:

    a. Up to Date Information. An air photograph is usually more recent than the latest available map, and will therefore show more up to date information. The date and time of the photograph is normally shown on it.

    b. Additional Minor Detail. Maps have necessarily to omit much minor detail depending on their scale; vegetation is generalized and heights of buildings are not shown. On air photos individual trees, bushes, rocks, and similar minor objects can be identified, and may be items of particular value as an aid to location of one's position or of the position of a target. Enemy gun positions, vehicles, and tracks of vehicles are all identifiable. The height of buildings, chimneys, trees, etc, can be assessed from the lengths of their shadows.

2. The disadvantages of air photographs are:

    a. Difficulty of Interpretation. The detail on the ground is viewed in the photograph from an unusual viewpoint, and therefore training and experience is needed to interpret it correctly. An expert interpreter can extract a considerable amount of information which is not apparent to an untrained observer, but with practice anyone who can read a map will be able to interpret most topographical detail.

    b. Inconsistency of Scale. On a map the scale is constant over the map, and distances can be measured accurately between two points within the limits imposed by the scale of the map. On an air photograph, there are variations in the scale due to differences in the height of the ground and to errors in position caused by the tilt of the aircraft and camera. These variations are explained in more detail in Sect 3, but at this point it need only be accepted that air photographs are not true to a constant scale, and distances measured on them are not accurate.

3. To sum up, a map gives a clear, broadly accurate, but often out of date picture of the ground. The air photograph gives an extremely detailed and up to date picture, but one which needs careful reading and which sometimes contains large distortions. The best answer. is obtained by using both aids together.

1003. Interpretation of Air Photographs

1. To cultivate an eye for an air photograph, four qualities are needed:

   a. ability to identify an object viewed from above;
   b. appreciation of the effect of shadows and their shapes;
   c. appreciation of the effect of tone; this is apparent on all types of photographs; and
   d. ability to deduce the meaning of the signs shown on the photograph, eg, tracks converging on a point probably indicate the presence of something of importance.

The basic points in interpretation of air photos are given in Sect 5.

1004. Instruction in the Use of Air Photographs

Only a few specimens of air photographs are shown in the manual. It is assumed that instructors will have typical air photographs and steroscopes available for issue to the class in conjunction with maps of the same area. For initial instruction, it is essential to have photographs of areas and objects which can also be visited on the ground.

SECTION 2 - TYPES AND CHARACTERISTICS OF AIR PHOTOGRAPHS

1005. Types of Air Photographs

1. There are two basic types of air photographs:

   a. vertical; and
   b. oblique

2. For a vertical photograph, the camera points vertically downwards from the aircraft in level flight. This gives a plan view of the ground. This is the type of photograph used for mapping from air photographs, and is the type most commonly issued for supplementary map information. See Figure 10-1.

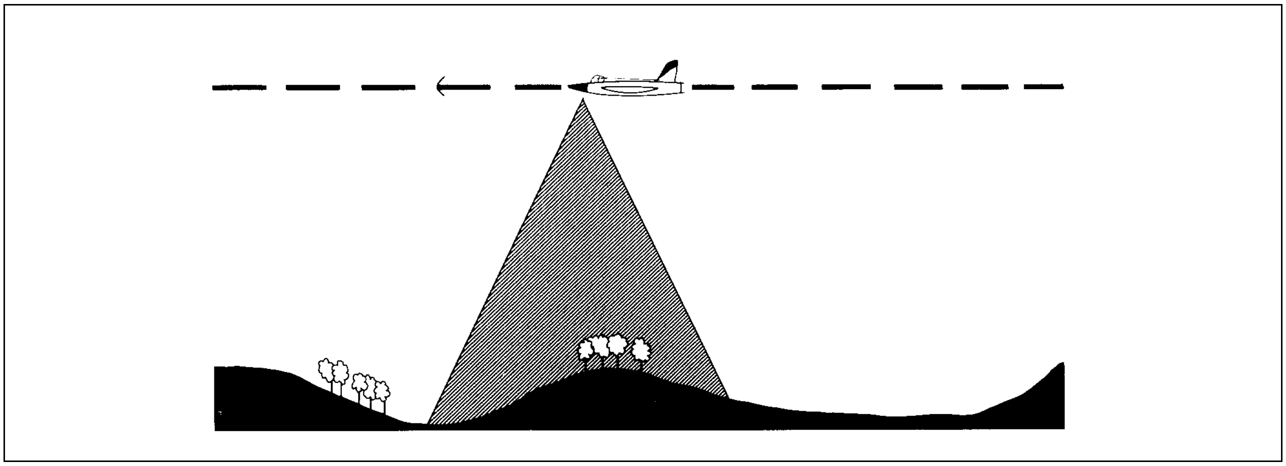

Figure 10-1 Vertical Photography

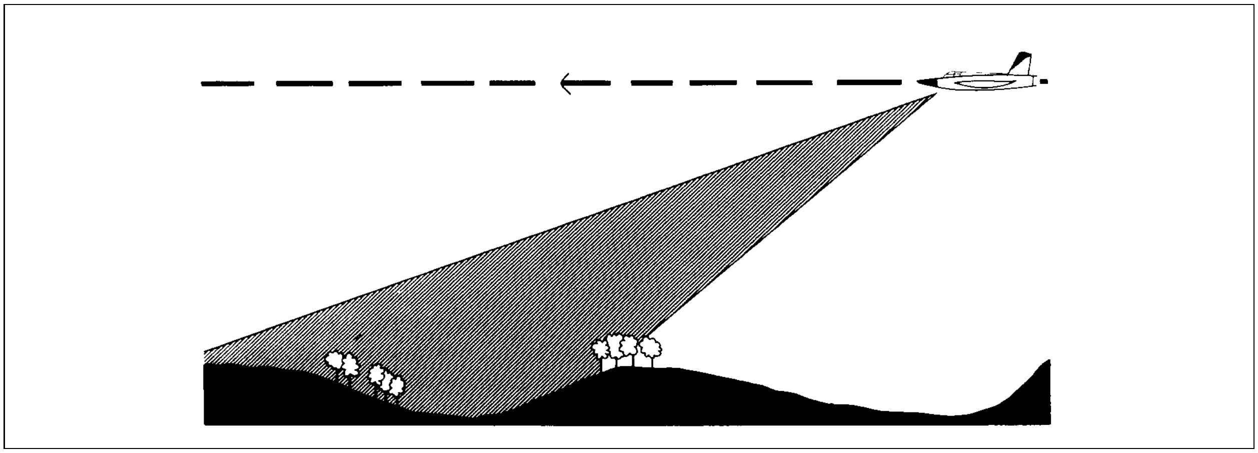

Figure 10-2 High Angle Oblique

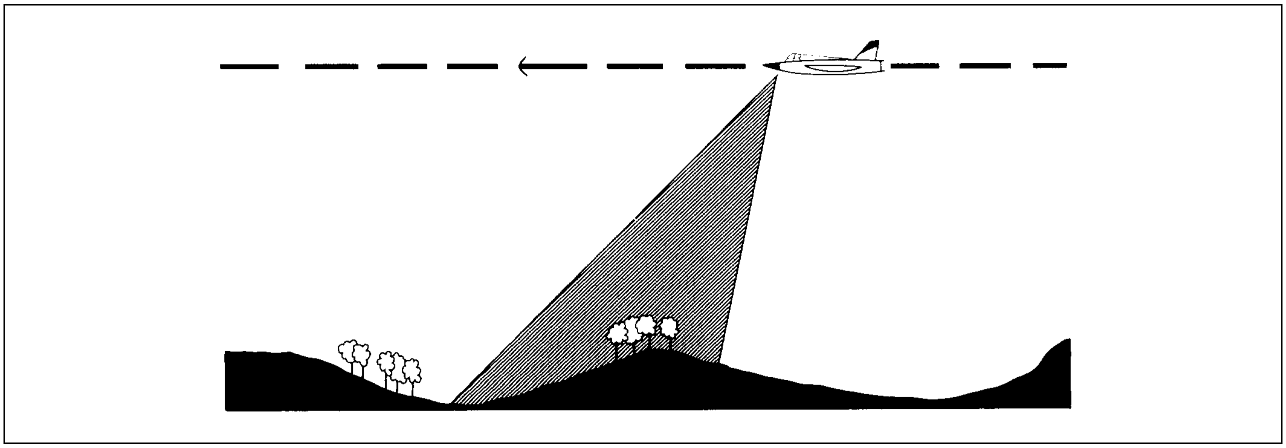

Figure 10-3 Low Angle Oblique

3. For oblique photographs, the camera points in a slanting direction towards the ground. The photograph gives a side view, similar to that obtained from a hill top or from a high tower. Oblique photographs are principally used for intelligence purposes to cover particular objects, and to get side views from which extra information may be obtainable. It is now seldom used in Canadian mapping.

4. There are two types of oblique photographs, "High Angle" and "Low Angle". In high angle obliques the camera points only slightly downwards, and the view will always include the horizon. With low angle obliques, the camera points steeply downwards and the horizon does not appear in the photograph: most objects are seen more or less in side view, although those in the foreground are seen almost in plan. See Figures 10-2 and 10-3.

5. It should be noted that the terms "High" and "Low" have no relationship to the height of the aircraft above the ground, but only to the angle of the camera.

1006. Characteristics

1. A vertical photograph gives a plan view of the ground, and is therefore easy to compare with a map. Objects of some size, eg, woods, on the photograph can normally be identified easily by their shape on the map, and vice versa. Dead ground and other detail will normally be visible, with the exception of objects which may be masked by tall buildings or overhead cover, or ground which is obscured by, deep shadow. The relief of the ground can only be seen with the aid of a stereoscope, Sect 4. A typical vertical photograph is shown in Figure 10-4.

2. An oblique photograph gives a perspective view of the ground. The scale of the photograph varies considerably, and it is therefore more difficult to relate the photograph to a map. There is dead ground behind billings and trees, though it may be possible to see vehicles under overhanging trees which are not visible in a vertical photograph. The shape of the ground can be seen to some extent, but small undulations do not show Lip clearly, and it is easy to miss an area of dead ground. The heights of buildings and other objects in the foreground can be judged fairly accurately.

3. In a low angle oblique the foreground is much closer than in a high angle oblique taken from the same height; the ground can therefore be examined more closely. In a high angle oblique the area covered by the photograph is much larger and more distant. See Figures 10-5 and 10-6.

1007. Titling on Air Photographs

1. The initial photograph of a photo mission contains the necessary detail to permit the full utilization of the photographs of the mission. Figure 10-7 is a typical example of what will be found on the initial print. An explanation of each line is as follows:

a. A23692-1: The first six digits reflect the roll number, the (-1) is the photo number of the mission.

b. ICAS 74.3: Interdepartmental Committee on Air Survey number.

c. Line 1-E (1-21) Item 7, Camp Shilo, Man. 13,700' ASL, 12-5-74: The line numbers reflect successive flight lines over the area to be photographed. They move progressively northward, ie, the southern edge of the mission area is flown first and the 'E' or 'W' indicates the direction of flight. The (1-21) is the number of photos in the line. The "Item" number indicates an item of the total contract of the mission flown by civilian photomapping establishments. The mission was flown at 13,700 feet above average sea level (sometimes mean sea level, MSL) on 12 May 74.

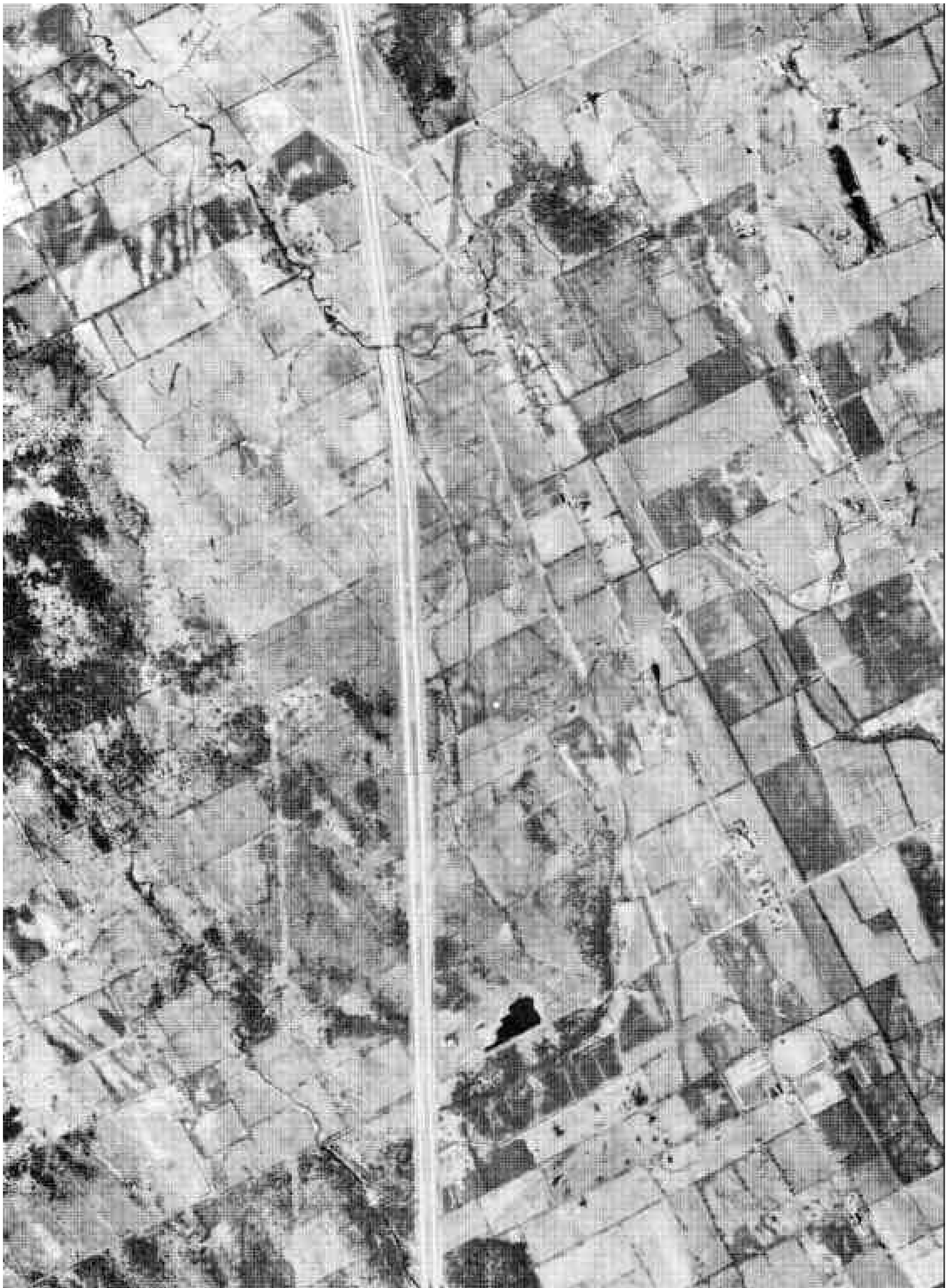

Figure 10-4 Vertical Photograph

Figure 10-5 High Angle Oblique Photograph

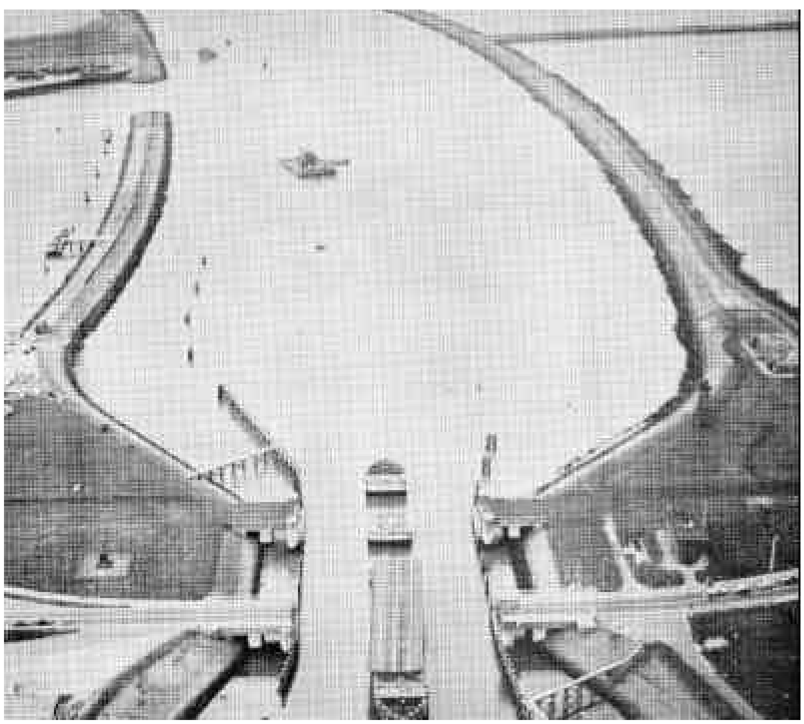

Figure 10-6 Low Angle Oblique Photograph

d. ZEISS RMK A15/23, MAG. 111615, PANCHROMATIC FILM: ZEISS RMK, the camera name, is followed by its number and then the magazine number and type of film.

e. LENS 112650, 153.22 mm ZEISS B: The lens number, focal length and type of filter being used.

f. 026: This figure reflects the actual photograph number in the overall sequence.

g. The bottom edge of the film includes, from left to right, the local time, a levelling bubble and an altimeter.

2. Subsequent prints in the strip will include the following detail: roll number; camera and lens number together with the focal length of the latter; photo number, local time, levelling bubble and altitude. This information will permit the determination of the scale of any particular photograph. See also Sect 3.

3. In special cases, a security classification will be reflected.

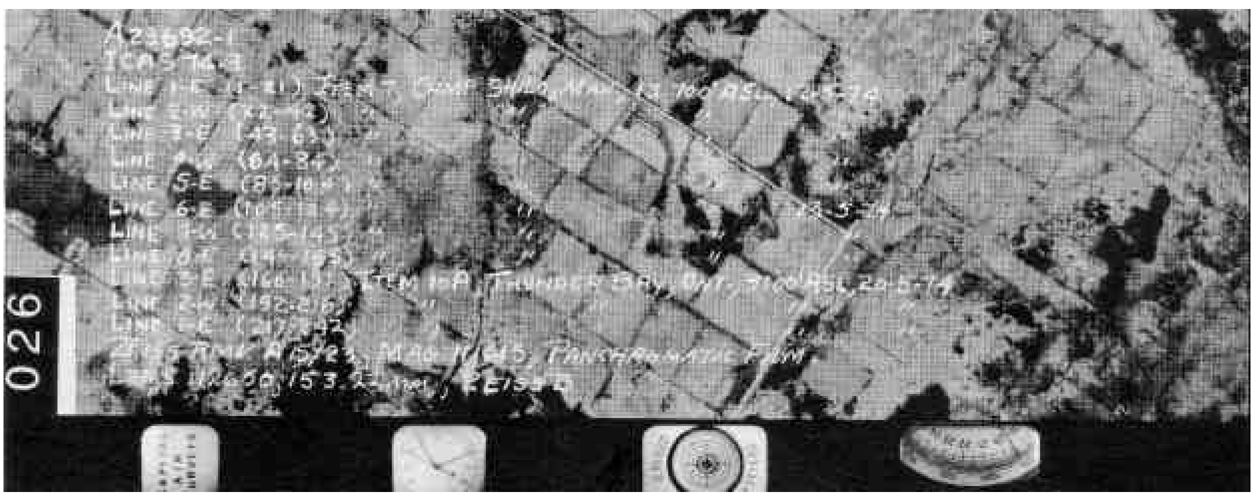

Figure 10-7 Air Photograph Titling

1008. Methods of Photography

1. Vertical photographs are usually taken in "Strips" along a straight line. Within each strip, the successive photographs should have an overlap of about 60 per cent: this allows the centre of each photograph to appear on the succeeding photograph, the two photographs thus forming a pair for stereoscopic viewing. To cover an area a series of parallel strips are flown, each overlapping the strip next to it by about 20 per cent: this is called a "Block" of photography.

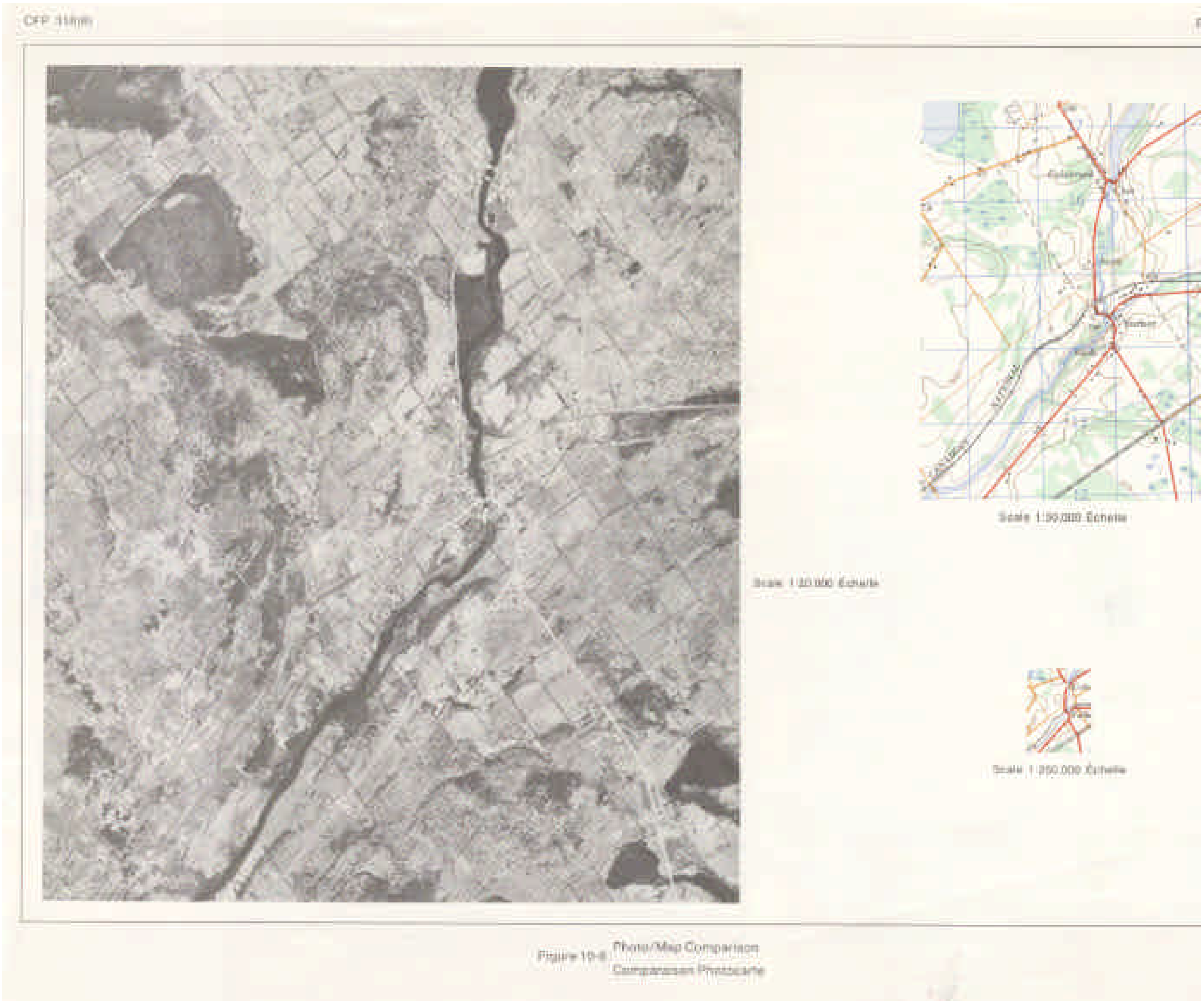

Figure 10-8 Photo/Map Comparison

2. When a single object is to be photographed, a single photograph or a pair of photographs may suffice. This is called pin-point photography.

3. Oblique photographs may be taken in strips or as pin-points. They are not normally used for block photography. Oblique photographs may however be taken in strips as part of a "Fan Array" of three cameras, one vertical in the centre and one oblique on each side.

SECTION 3 - SCALES AND MEASUREMENTS

1009. Variation in Scale

As stated in Sect 1, the scale of an air photograph normally varies over different parts of it. Only in perfectly flat country, with the axis of the camera truly vertical can the scale of a photograph be constant over the whole area. In hilly country, the scale will vary because the top of a mountain is nearer to the camera than the bottom of a valley, and therefore it appears larger. A deduced scale of a photograph can therefore only be approximate, and when there are marked differences in ground height between adjacent photographs the variation in scale between them will make it difficult to fit the photographs together.

1010. Deducing the Scale from a Map

To deduce the approximate scale of a vertical photograph from a map of the same area, identify two points on both the photograph and the map and measure the distance between them on each. If the scale of the map is 1:X, the distance between the points on the map is D, and the distance between the same points on the photograph is d, (D and d being expressed in the same units), then the scale of the photographs is I:P where 1:P = d/X x D

For example, if the scale of the map is 1:50,000, the distance on the map is 5.6 cms, and the distance on the photograph is 8.4 cms, then the scale of the photograph

1:P = 8.4/50,000 x 5.6

= 1:33,333

To obtain the best general approximate scale, several different pairs of points should be measured on different parts of the photograph, and the average scale accepted. If, however, measurements are required only in one part of the photograph, it is better to deduce a scale for that part only.

1011. Scale from Photographic Data

1. When no map is available or when no suitable points can be identified on both map and photo, the approximate scale can be deduced from the focal length of the camera lens and from the height of the aircraft above the ground.
The scale of the photograph is then

$$1:P = \frac{\text{Focal length of lens}}{\text{Height of aircraft above the ground level}}$$

Note: Both items must be expressed in the same unit. For example with a height of aircraft of 20,000 ft and a focal length of 6 inches the scale of the photograph =
1:P = 6/20,000 X 12
= 1:40,000

2. It must, however, be noted that the height of the aircraft recorded on the titling strip of the photograph is normally the height above mean sea level. If, therefore. in the above example the general level of the ground in the photograph is 5,000 feet above mean sea level, the height of the aircraft above the ground becomes 20,000 - 5,000 = 15,000 feet, and in consequence the scale of the photograph becomes 1:30,000 instead of 1:40,000.

3. This method of course gives only the scale of a contact print taken directly from the negative. If the photograph has been enlarged, the scale ".ill have been increased correspondingly. For example, if the scale of the original contact print is 1:30,000 and the print is enlarged three times, then the scale of the enlarged print will be
1/30,000 x 3 = 1:10,000

1012. Oblique Photographs

The scale of an oblique photograph will vary widely from foreground to background, and a mean scale is of no value. A local scale can be obtained, using the map method, by measuring of points of detail lying close and parallel to the object to he measured, but this scale cannot be applied to other parts of the photograph.

1013. Bearings

Approximate bearings can be measured on a vertical photograph by comparison with the map. Measure on the map the grid bearing of the line joining two points identifiable on both the map and the photograph. Then, on the photograph lay off this bearing from the line joining the two points and thus establish a north south grid line through one point. Other bearings from this point may then be measured on the photograph.

1014. Comparison of Vertical Photograph with Maps on Different Scales

1. Figure 10-8 shows maps at 1:50,000 and 1:250,000 scales respectively covering the area of the vertical photograph illustrated. The average scale of the photograph is about 1:20,000. The dates of the photograph and of the two maps are different, and discrepancies of detail are therefore to be found; the photograph is the most recent.

2. The 1:50,000 map is approximately 2 1/2 times smaller than the photograph and the 1:250,000 map is at a scale 7 1/2 times smaller. The latter scale makes direct comparisons difficult.

3. Particular points for identification and comparison are:

a. main roads, railway, and dam;
b. buildings - note changes and development;
c. pattern woods - isolated clumps readily identifiable;
d. water features - differences in tone (see Sect 4); and
e. loss of detail under trees.

SECTION 4 - PRINCIPLES AND USE OF THE STEREOSCOPE

1015. Stereoscopy

Stereoscopy is the ability of the brain to accept an image of an object from each eye, and with these two images to create a three dimensional or stereoscopic image of the object. If each eye looks simultaneously at a separate air photograph of the same area of ground, taken from different positions in the air, then the brain will create a three dimensional image of the area of ground. In practice, this is achieved by looking simultaneously at two successive vertical photographs in a strip which overlap each other by about 60 per cent (see art 1008). The instrument which assists this viewing of two photographs simultaneously is called a stereoscope. It is possible to view two photographs stereoscopically without a stereoscope, but this requires concentration and practice; it is better to use a stereoscope.

1016. Stereoscopes

1. There are many different types of stereoscopes. The simple basic stereoscope consists of a frame holding two lenses for the eyes at a fixed distance apart set up on two legs which hold the frame with the lenses at a distance of about 15 cms from the table on which the photographs are placed side by side, see Figure 10-9. The lenses give a measure of magnification (usually about two or three times), and are focussed to suit viewing of the photographs at the fixed distance of the height of the legs.

2. More refined stereoscopes enable the photographs to be set wider apart, and can provide variable magnification. The principles of viewing, however, remain the same.

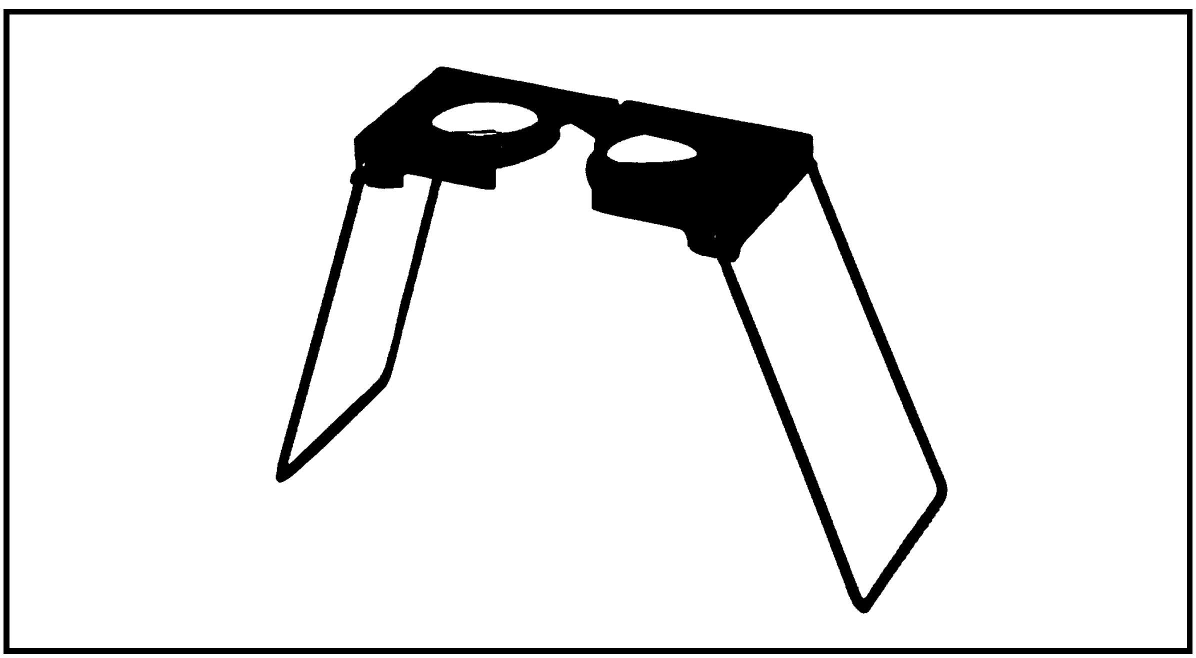

Figure 10-9 Stereoscope

1017. Using the Stereoscope

1. A pair of photographs must be correctly placed under the stereoscope if the ground is to be seen properly in relief. The rules are:

   a. The photographs must be a stereo-pair; that is to say, they must contain the same area of ground taken from two different view points. Normally, they are two successive exposures in a strip.

   b. They must be positioned so that the common areas of the two photographs are adjacent and the line of flight is parallel to the line joining the lenses of the stereoscope.

   c. Shadows should normally fall towards the viewer. If the shadows fall away from the viewer the effect of the relief may be reversed, so that craters will appear as mounds and valleys as hills.

2. Place one photograph of the pair on the table in a convenient position for viewing; place the second photograph on top of the first so that the detail common to both is overlapping; move the top of the first about five cms to the side, carefully keeping it in the same orientation relative to the first photograph. Place the stereoscope over the photographs. Look through the stereoscope, and the ground should appear in relief. If the image appears double, move the upper photograph slightly sideways or up and down until the two images appear in coincidence. After fastening the photographs down by weights or pins, the stereoscope can be moved to examine any part of the common overlap.

3. If, when the photographs are set as above, the top photograph overlaps, the lower one, thus obscuring a strip of it from view, the overlapping edge may be turned up gently to clear the line of sight. Take care not to crease the photograph, which will damage it for further viewing.

SECTION 5 - PHOTO INTERPRETATION

1018. Introduction

1. Interpretation of air photographs should be carried out under a stereoscope, if possible. If photographs are to be used in the field without a stereoscope, then photographs should be studied under a stereoscope before setting out.

2. The full interpretation of air photographs requires much training and experience and is beyond the scope of this section, which deals only with the basic principles.

1019. Principal Factors

1. Photo interpretation is based on the following factors:

   a. shape;
   b. size;
   c. shadow;
   d. tone;and
   e. associated features.

2. Shape can often provide immediate identification. Size is often a question of comparison with other objects of known size. If the scale of the photograph can be calculated reasonably accurately, sizes can be measured.

3. Shadow is an important factor when light conditions of photography are good. Many objects can be identified readily from their shadows whilst their plan view does not show their nature at all, eg, tall buildings and chimneys. If the photographs are taken when the sun is low, the value of shadows is enhanced. Shadows can, of course, obscure detail as well as reveal it, especially in hilly areas.

4. Tone is related to texture and colour, and is the measure of the amount of light reflected from the object. Texture has more effect on tone than colour. Smooth surfaces reflect more than rough surfaces; hence a black toned road may appear lighter than a field of rough green grass.

5. Many objects can be identified from their associated features. Tracks may reveal the presence of objects not otherwise noticeable.

1020. Camouflage

1. Camouflage is applied in two ways:

   a. Camouflage of the object itself, usually by painting, with the dual object of breaking up its distinctive outline and of making it merge into the background.
   b. Camouflage by concealing the object itself with netting, scrim, branches, etc.

2. Camouflage of the first kind is more effective against an observer on the ground than in an air photograph, the latter is not materially affected. Camouflage of the second kind is more effective against air photography, but it can be detected when viewed under a stereoscope, since this may reveal a mound or some object above ground level. Changes in position of such objects over a number of days combined with the location of tracks leading to the area will assist in revealing the identity.

1021. Water

For various reasons, the tone of water may vary widely from white to black; it is therefore normally identified by its associated features and by the natural shape of its banks. Water features such as canals or drainage ditches are harder to distinguish from other artificial features.

1022. Vegetation

1. Woods and trees are dark toned. Conifers are generally darker than deciduous trees. Orchards and plantations are prominent because of their regular spacing. Shadows of individual trees help in the identification between deciduous trees and conifers.

2. Crops and grasslands are distinguished by their tones, generally the taller the crop the darker its tone. The smoother textures are also lighter in tone. Ploughed fields have a regular dark toned appearance.

1023. Roads and Tracks

Roads are generally uniform width and may run in straight stretches of varying lengths, but the curves are not as regular as those of railways. Concrete roads tend to appear lighter than tarred or undeveloped roads; the latter are usually less regular and may show separate wheel tracks. Bridges, embankments, and cuttings can generally be identified from their shadows.

1024. Military Features

Military features are similarly identifiable but this is a specialist task and is not covered in this publication.

SECTION 6 - PHOTOMOSAICS, PHOTOMAPS, AND ORTHOPHOTOS

1025. Photomosaics

1. A photomosaic is a collection of overlapping air photographs assembled to form a composite picture of the terrain. It may be issued either to supplement a map for a special operation or as a substitute for a map when no adequate map is available.

2. Photomosaics can be produced more rapidly than a normal map and have the advantages and disadvantages inherent in air photographs as listed in Sect 1.

3. Photomosaics vary in accuracy according to the amount of "Control", ie, points of known position used to position the photographs when making the assembly. The more control used, the more accurate the photomosaic will be, but the longer it will take to make it. The accuracy to which it is made is therefore dependent on the availability of both factors: control and time. In general, the user must assume that it is not as accurate as a map at the same scale, and distances and bearings measured on it must be treated with caution. It does, however, provide a better aid than a collection of individual photographs, and in some cases it may approach the accuracy of a map.

4. The interpretation of detail is the same as on an air photograph, but in this case, the stereoscope cannot be used as there is no overlapping pair.

1026. Photomaps

1. A photomap is a printed photomosaic, on which the background detail of the mosaic has been cartographically improved (sometimes with the addition of colour) to clarify the interpretation, and to which a grid and map framework have been added. It is thus an advanced form of photomosaic on which much more preparation work has been carried out and which therefore takes longer to produce. On the other hand, its accuracy is close to that of a map. (See Figure 10-10.)

2. The photomap shows the photographic detail but roads be coloured or otherwise emphasized, important buildings may be made prominent, vegetation may be classified, and names may be added. The amount of cartographic work undertaken will vary according to circumstances, the object of the cartographer being to provide the best document possible within the time and resources available.

3. Photomaps are issued as map substitutes when no normal map is available, but in some circumstances, they may be issued because the nature of the area or the local requirements make a photomap more useful than a normal map.

1027. Orthophotographs

Air survey equipment is now available by means of which vertical air photographs may be reproduced and assembled in photomosaics (orthophotomosaics) and in which the distortions in scale due to hilly ground and or air camera tilt have been eliminated. The final product is still a vertical air photograph or mosaic, but its accuracy, is as good as a normal surveyed map. Orthophotographs are not yet available for general issue, but in due course this may occur, and for this reason they are mentioned in this publication.

(1028 to 1099 not allocated)

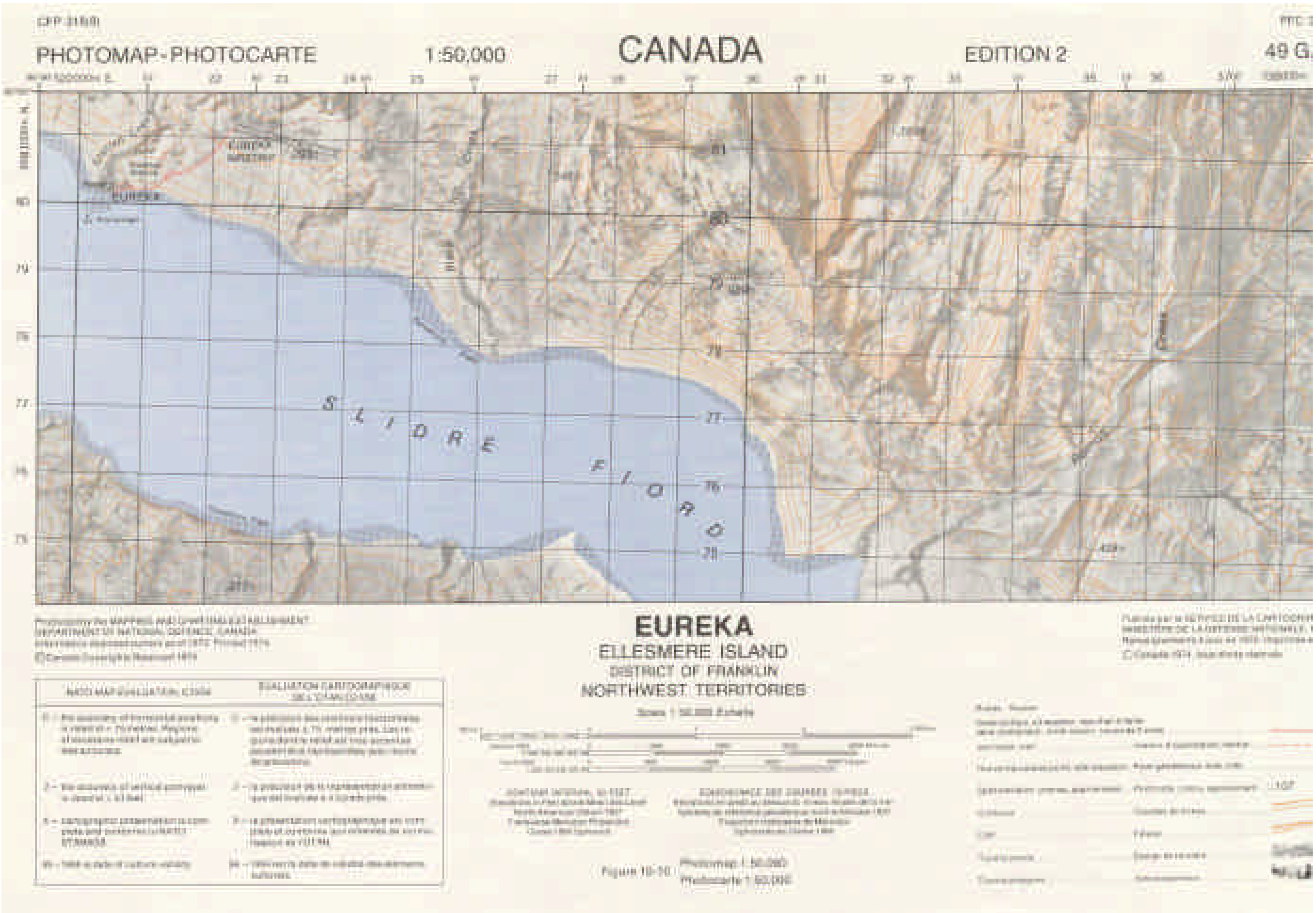

Figure 10-10 Photomap 1:50,000