# BHARATHIDASAN UNIVERSITY

## Tiruchirappalli- 620024
## Tamil Nadu, India

**Programme : M.Tech., Remote Sensing and GIS**

**Course Title : PHOTOGRAMMETRY**
**Course Code : 24MTRS-02**

## UNIT II: Elements of Photogrammetry-I:


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## UNIT II: Elements of Photogrammetry-I:

**Scale - Determination of Scale In Vertical Photo Over Flat and Variable Terrain, Average Photo Scale, Scale in Tilted Photographs - Relief Displacement - Tilt Displacement - Scale Distortions -Due to Lens, Flying Height, Relief, Tilt, Pitch, Yaw & Roll - Stereo Models - Parallax - Mosaics : Stereoscopic vision and depth perception of human eye - Monoscopy - Stereoscopy - Pseudoscopy - stereoscopic model - Base height Ratio - Vertical Exaggeration - Stereoscopic Parallax, stereoscopic methods of parallax measurement and Height measurement using parallax.**

# SCALE OF THE AERIAL PHOTOGRAPHS

## MAP SCALE & SCALE OF AERIAL PHOTOGRAPH

**“Map Scale” is the ratio between the map distance and the corresponding distance on the ground.**

**Similarly, the “Scale of an Aerial Photograph” is the ratio of a distance on the photo to that same distance on the ground.**

**On a map, scale is uniform everywhere because of its orthographic projection.**

**But on the aerial photograph, since it is a perspective projection, scale varies with terrain elevations.**

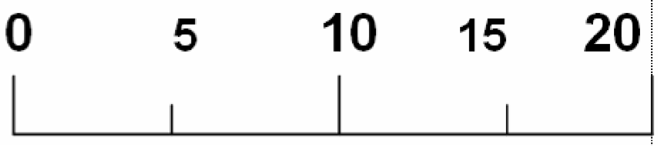
**Expressed in 3 ways,**

**1) Unit equivalents : 1 in. = 1,000 ft.**

**2) Dimensionless representative fractions : 1/10,000**

**3) Dimensionless ratio : 1: 10,000**

**Drawn as “Linear Scale” in map.**



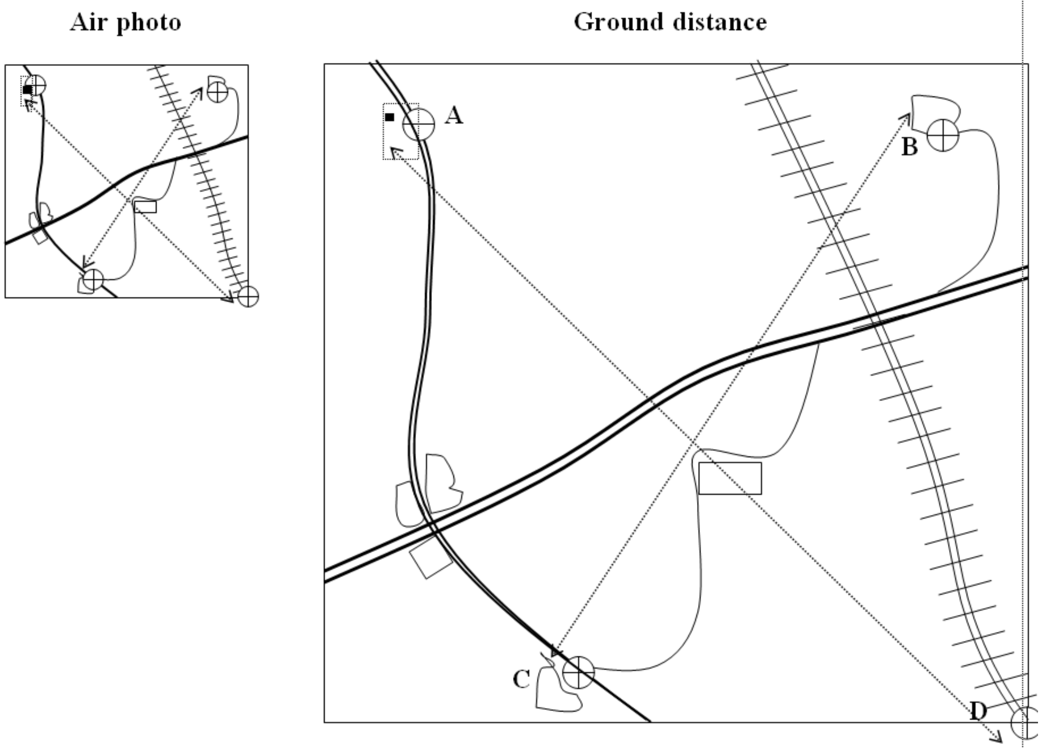
**The photo scale can be determined in 3 ways**

- ➔ **By establishing the selection between the photo distance and ground distance**
- ➔ **By establishing the relation between photo distance and Map distance**
- ➔ **By establishing the relation between the focal length of the camera and flying height**

**By establishing the selection between the photo distance and ground distance**

- **This method is usually adopted when the focal length and flying height of the camera are not known.**
- **The scale is calculated by comparing the photo distance and ground distance**
- **Scale = Photo distance : Ground distance**
- **or Scale = Photo distance / Ground distance**

## Measurement of Scale by Feature Matching method




(a) Scale = Photo distance : Ground distance

For example,

**The distance between points A and D in ground = 6 km and in air photo = 10 cm**

6 km = 6 x 1000 x 100 cm

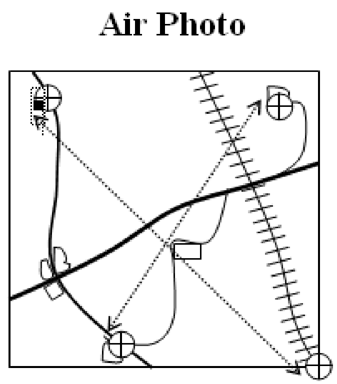
= 6,00,000 = 6 lakhs cm

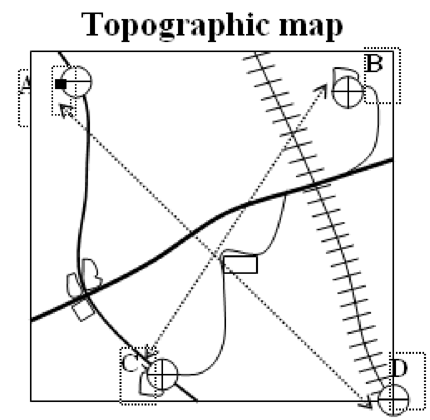
| |
|---|
| 10/6,00,000 = 1/60,000 |

**Therefore, 1 cm in aerial photograph is equal to 60,000 cm in ground.**

➔ **By establishing the relation between photo distance and Map distance Using Topographic map sheet**

- ❖ **Minimum of four points with wider separations is preferable**
- ❖ **The scale of the topographic sheet is used, e.g. 1: 50,000.**




(b) Scale = $\dfrac{\text{Photo distance}}{\text{Map distance}}$ x Map Scale

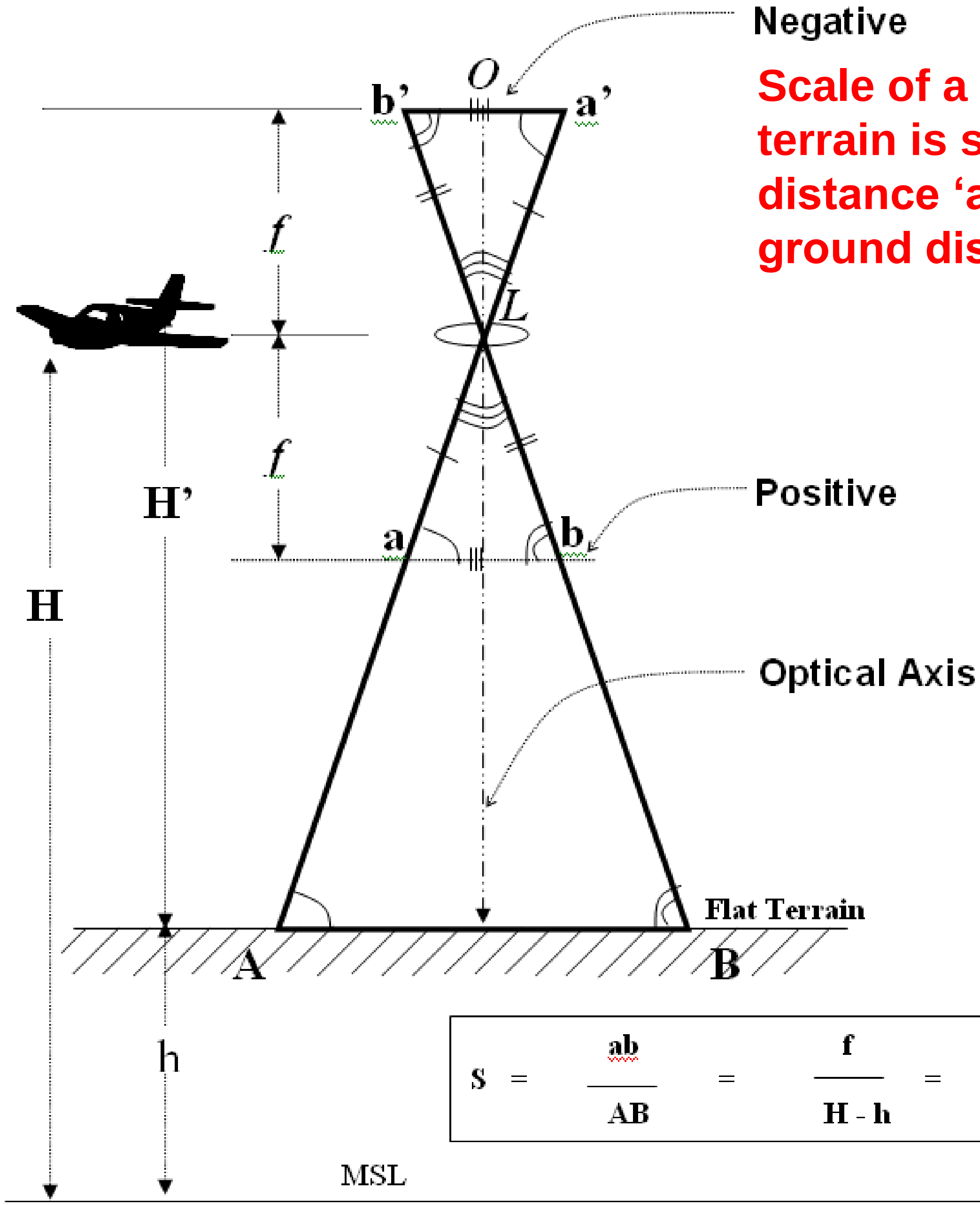
(i) The distance between points A and D in toposheet = 12 cm and in air photo = 10 cm

Then, scale = $\dfrac{10}{12} \times \dfrac{1}{50000}$

= 10 / 6,00,000 = 1 / 60,000

Thus, the scale of aerial photo is = 1 : 60,000

## A) SCALE OF A VERTICAL AERIAL PHOTOGRAPH OVER FLAT TERRAIN




$$S = \frac{ab}{AB} = \frac{f}{H - h} = \frac{f}{H'}$$

**Scale of a vertical photograph over flat terrain is simple the ratio of the photo distance 'ab' to the corresponding ground distance 'AB'.**

**The scale may be expressed in terms of camera focal length (f), and flying height above ground (H') by equating the similar triangles 'Lab' and 'LAB',**

**i.e., the scale of a vertical photo is directly proportional to camera focal length (image distance) and inversely proportional to flying height above ground (object distance).**

S = f / H'

f = focal length

H' = Flying height above the ground

**Problem 1:** Given: 1. Exposure station height = 5200 ft. above MSL
2. Ground elevation = 980 ft.
3. Focal length = 8 inches.

| Flying height, H' = H – h |
|---|

Where, H = Height above MSL
h = ground elevation

Therefore, H' = 5200 – 980 = 4220 ft. = 4220 x 12 = 50640 inches

$$\text{Scale} = \frac{f}{H'}$$

Where, f = focal length of the camera, H' = Flying height

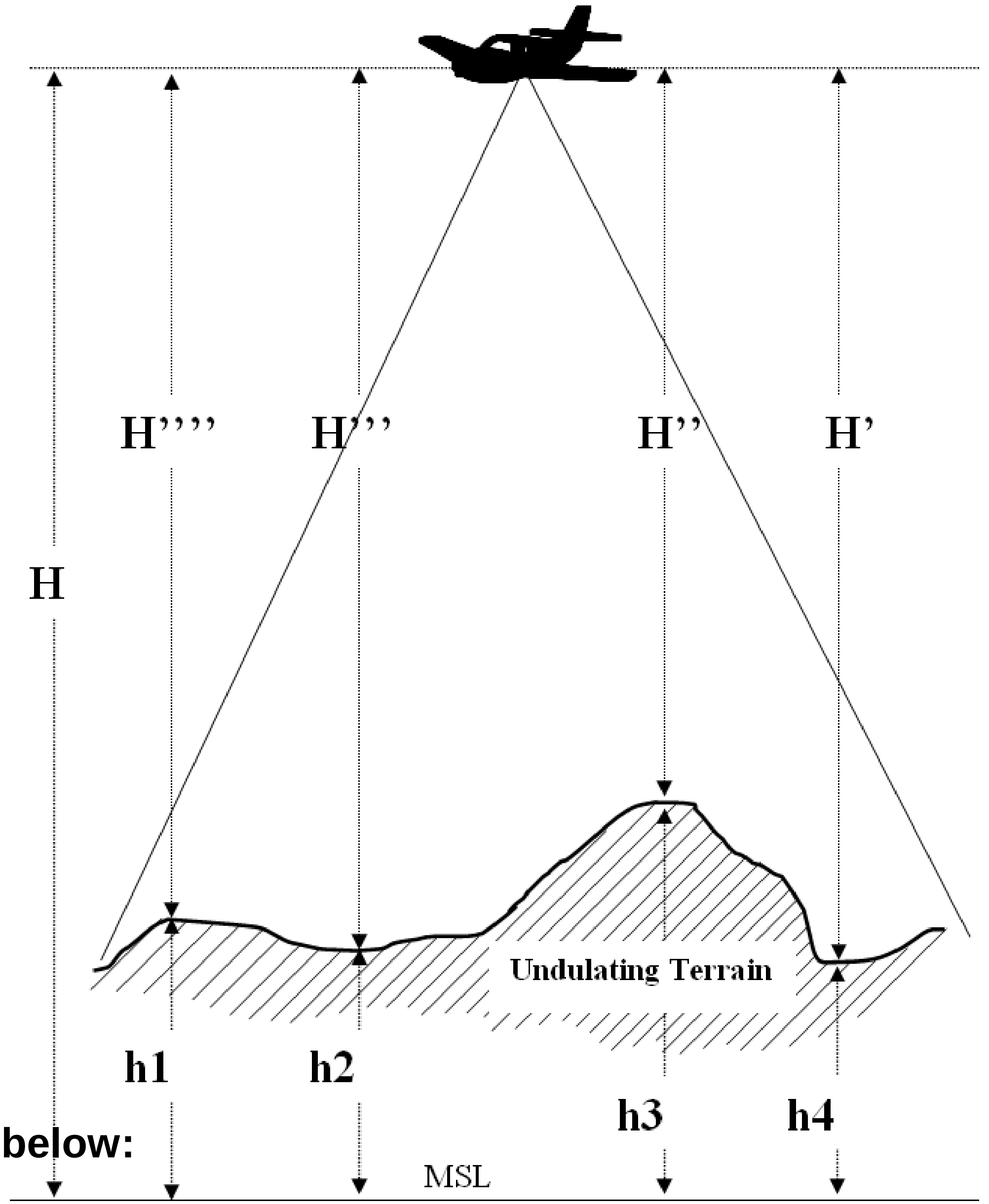
Scale = 8 inches / 50640 inches = 1 / 6330 = 1 : 6330

# Scale of A Vertical Aerial Photograph Over Variable Terrain

**Photo scale, increases with increasing terrain elevation and decreases with decreasing terrain elevation.**

**Photo Scale at different points can be calculated using the following equation**

$$S = \frac{f}{H^{n'}}$$




**C) Average Photo Scale**

**Calculate the average terrain elevation as below:**

**Average Object Height**

$h_{avg} = (h1 + h2 + h3 + h4 + \ldots h_n) / n$

**Then, calculate Average Flying Height H’ = H - $h_{avg}$**

**Average photo scale can be calculated.**

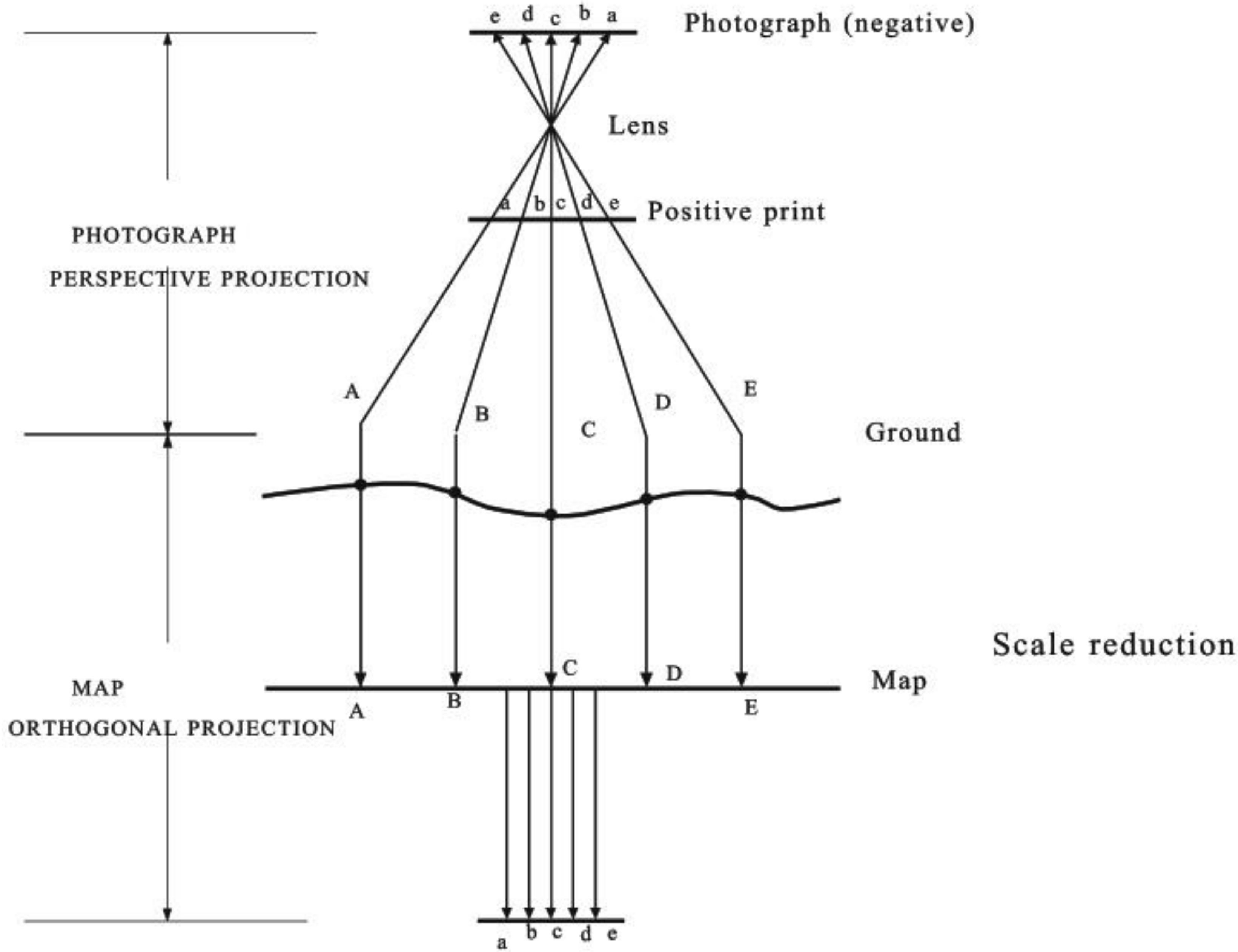
## DISTORTION AND DISPLACEMENT

**Because of the optical characteristics inherent in a vertical aerial photograph and the anomalies from the camera components, a vertical photograph is not a map.**

**According to Paine (1981), distortion in aerial photography is defined as any shift in the position of an image on a photograph that alters the perspective characteristics of the image and**

**Displacement is any shift in the position of an image on a photograph that does not alter the perspective characteristics of the photograph.**

**Displacement results mainly from the perspective viewing of the camera resulting in a perspective or central projection on the photograph. In contrast, a map is the product of an orthographic projection.**

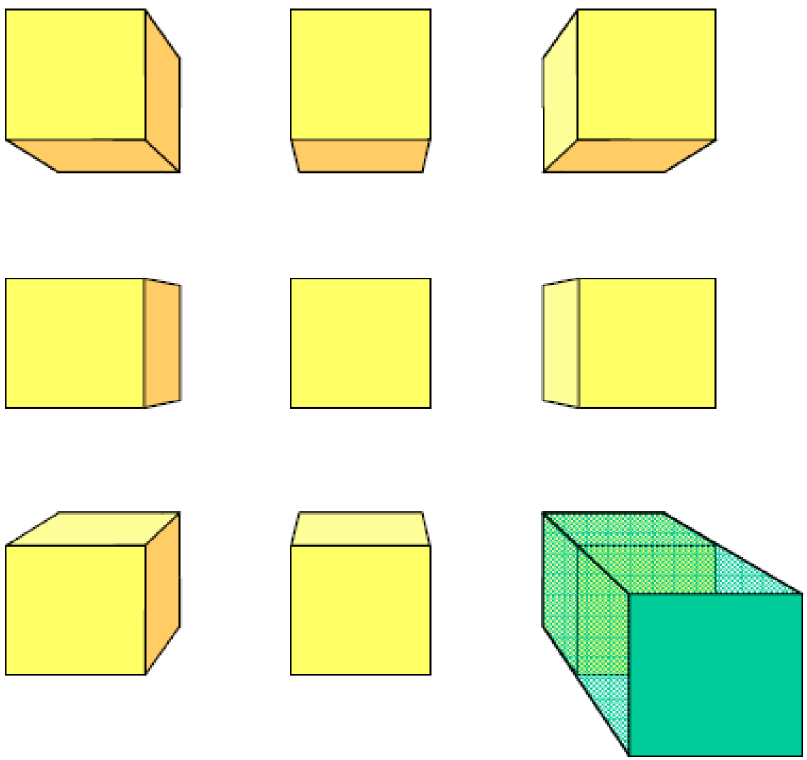


e d c b a
Photograph (negative)
Lens
a b c d e
Positive print
PHOTOGRAPH
PERSPECTIVE PROJECTION
A
B
C
D
E
Ground
Scale reduction
C
D
Map
MAP
A
B
E
ORTHOGONAL PROJECTION
a b c d e

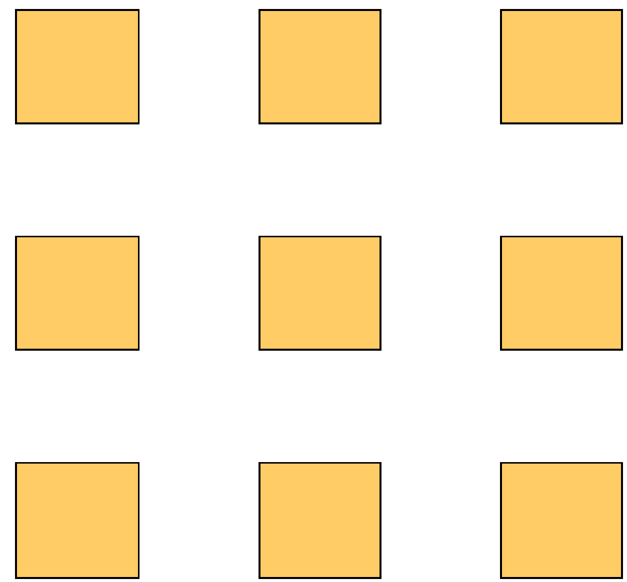
# Central Perspective

Imagine nine high-rise buildings wiewed from above

*Central Projection (photo):*



*Orthogonal Projection (map):*



- Radial displacement
- Scale differences

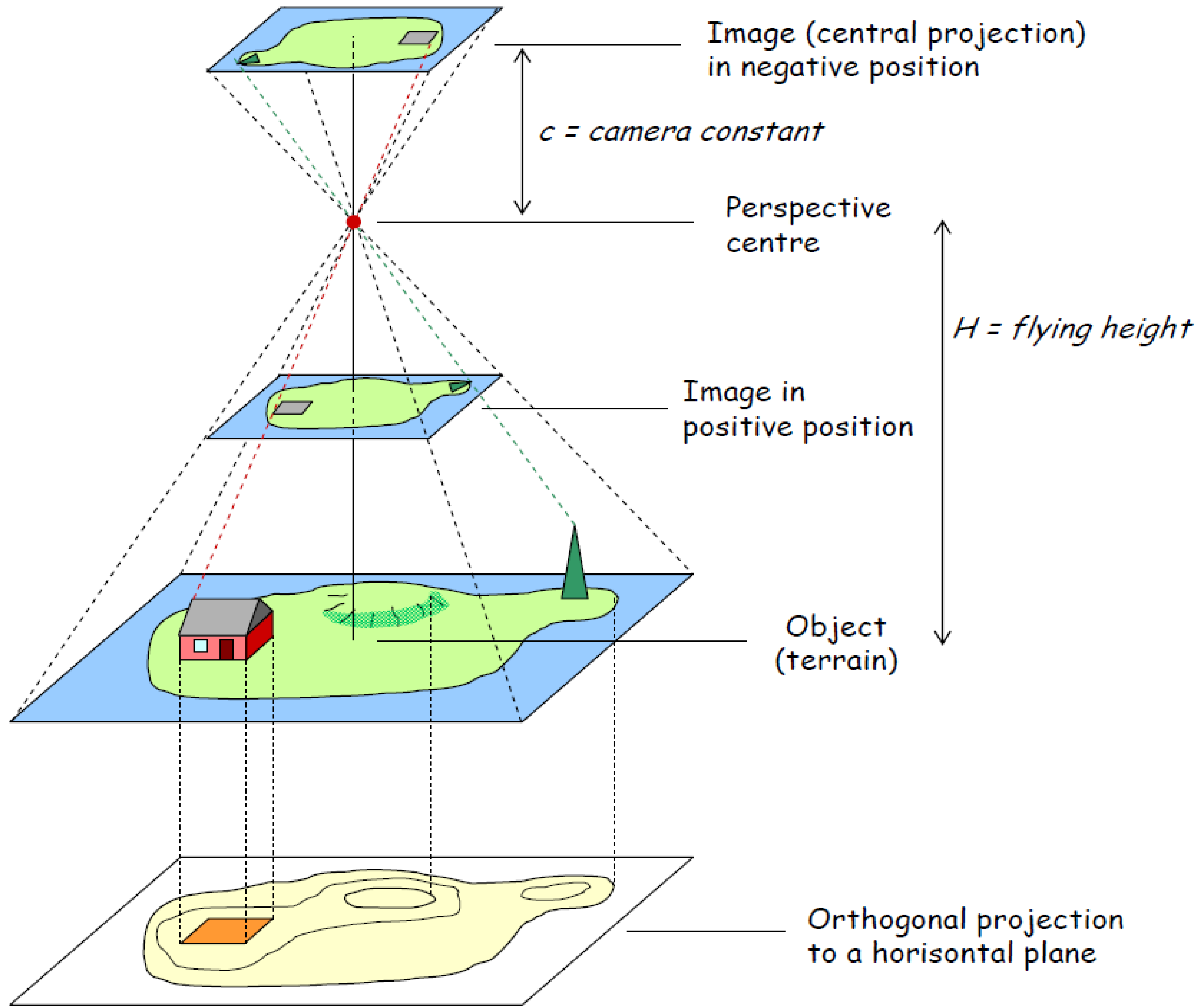
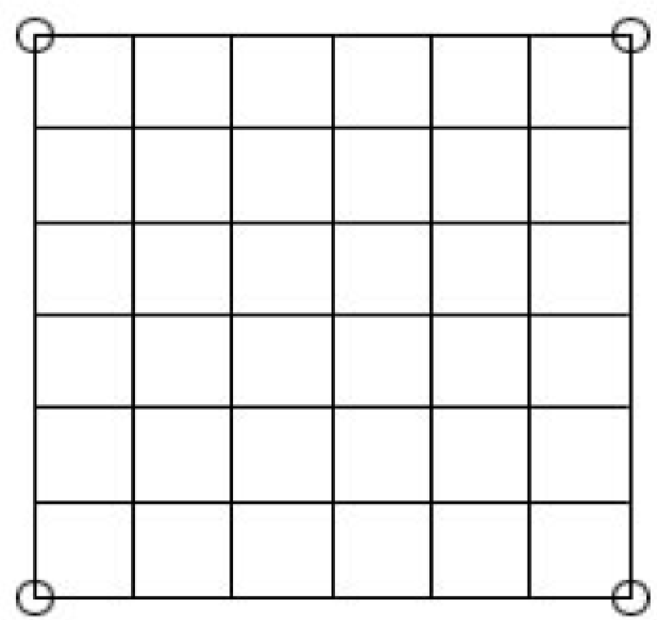
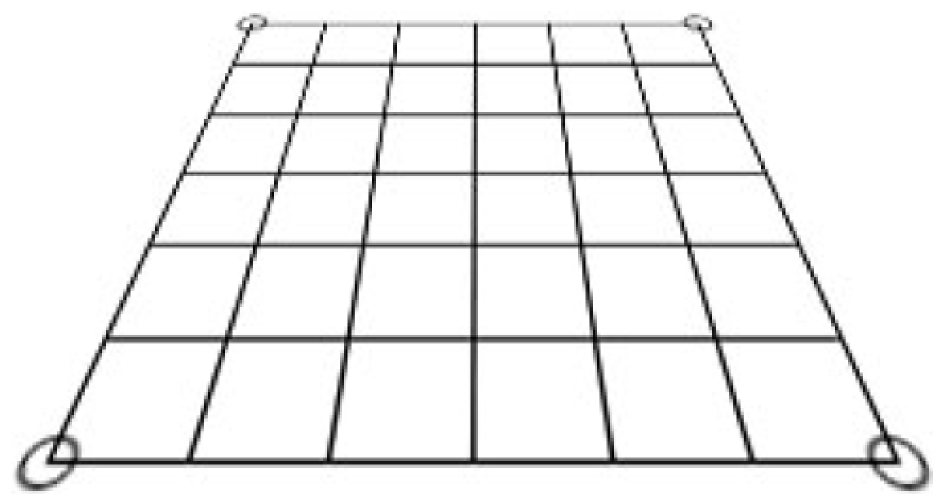


Image (central projection)
in negative position
c = camera constant
Perspective
centre
H = flying height
Image in
positive position
Object
(terrain)
Orthogonal projection
to a horisontal plane

# Geometry of the Perspective View



A regular grid viewed orthogonally from above.



Same grid but viewed from an oblique angle.
Note that the perspective view creates scale differences and removes parallellity.

## Types of Distortion

1. Film and print shrinkage
2. Atmospheric refraction of light rays
3. Image motion
4. Lens distortion

## Types of Displacement

1. Curvature of the Earth
2. Tilt
3. Topographic or relief

**Film and print shrinkage or expansion:** **the quality of the film and paper print is very important to the quality of data storage and accuracy.**

**Dilatation or shrinkage of film and print under heat or cold may change the scale of the photographs and the actual position of the objects on the photographs.**

## Scale distortions due to Lens Thickness

**Lens distortion causes imaged positions to be displaced from their ideal locations. lens distortion radiates from the principal point, which causes object displacement either toward (closer to) or away (farther) from the principal point (the optical or geometric center) of the photograph than it actually is.**

**Because this distortion is radial from the principal point, objects near the edge of the photograph are more distorted.**

**There are two type of lens distortion one is symmetric radial distortion and decentring distortion. In modern precision aerial mapping cameras, lens distortions are typically less than 5 micro meters.**

**Symmetric radial lens distortion** is an unavoidable product of lens manufactures although with careful design its effects can be reduced to a very small amount.

**Decentering distortion** is primarily a function of the imperfect assembly of lens elements, not the actual design.

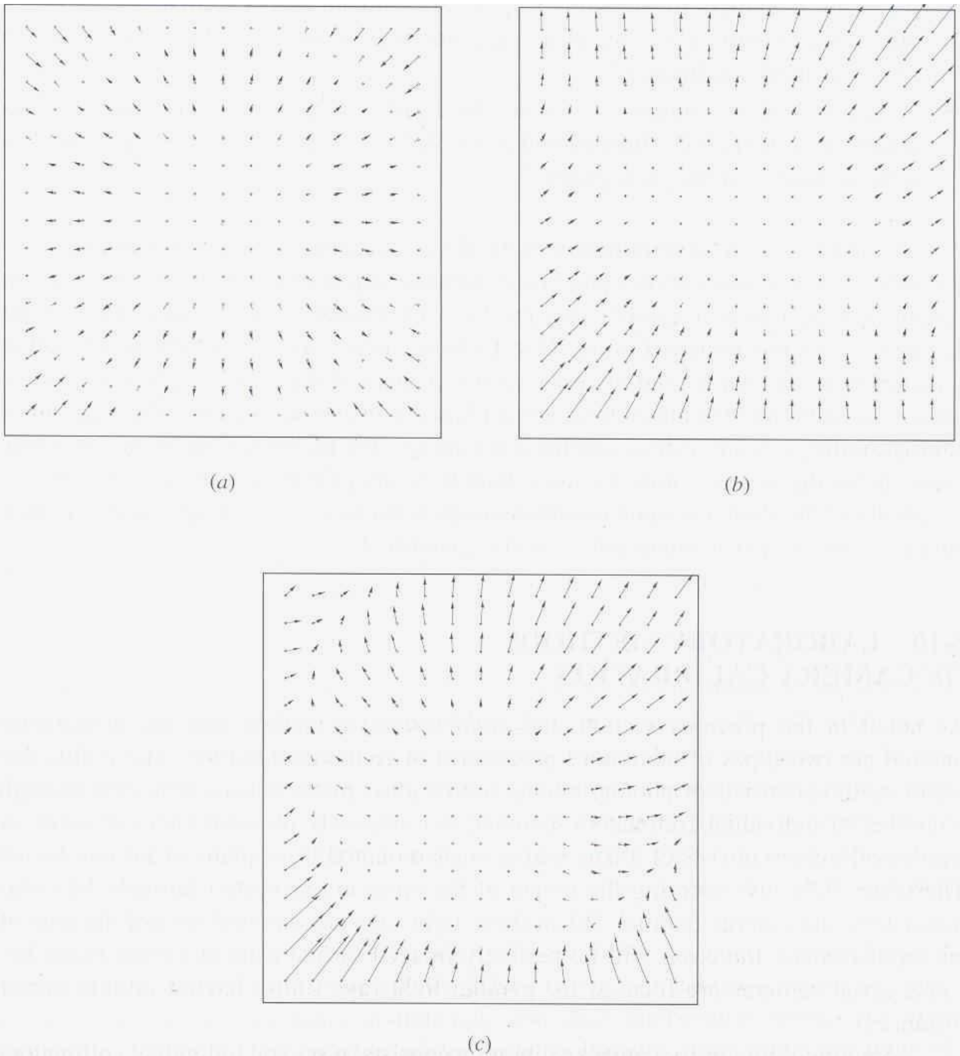
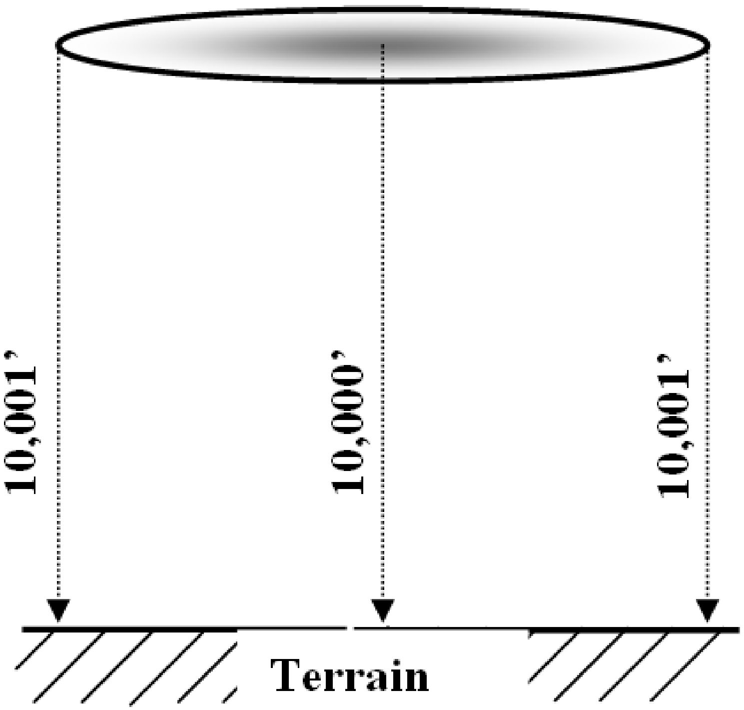
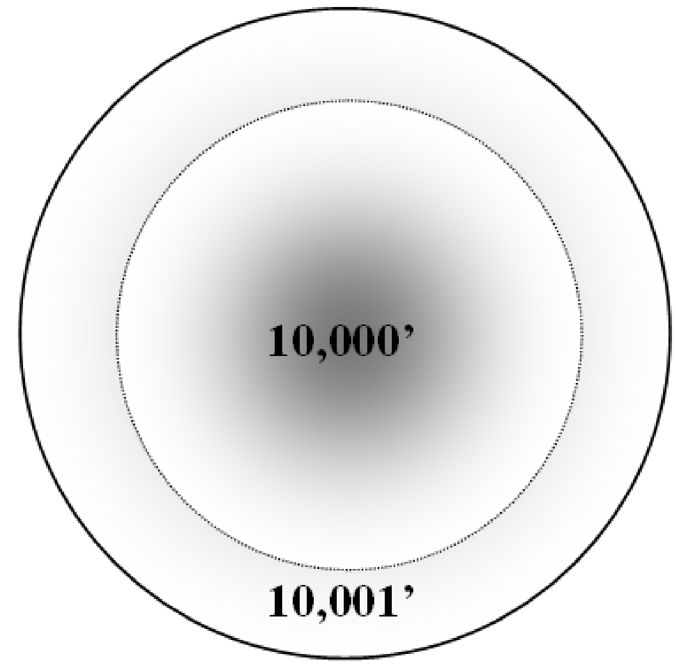


FIGURE 3-12
Lens distortion patterns: (*a*) symmetric radial, (*b*) decentering, and (*c*) combined symmetric radial and decentering.

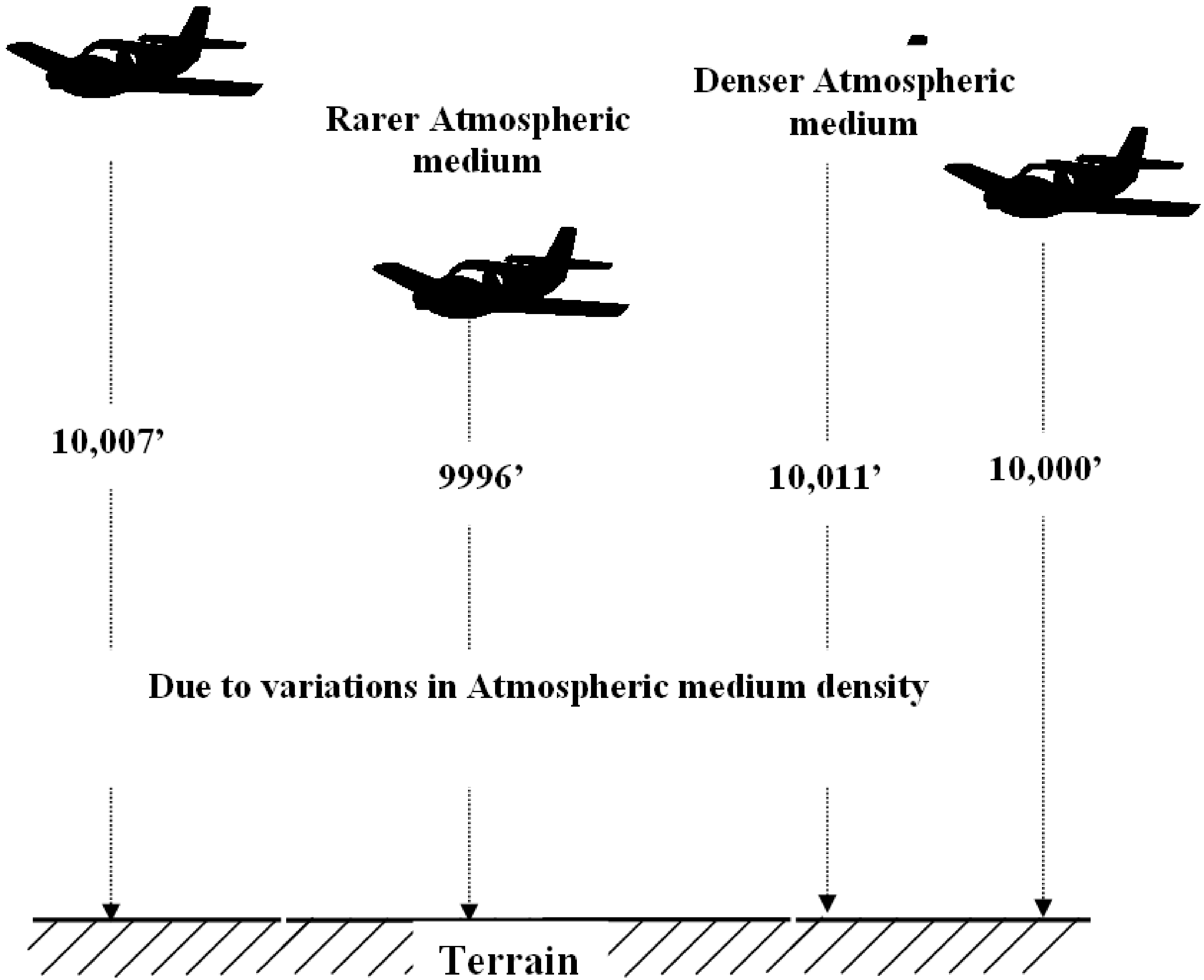
## Vertical Cross Section View of Biconvex Lens



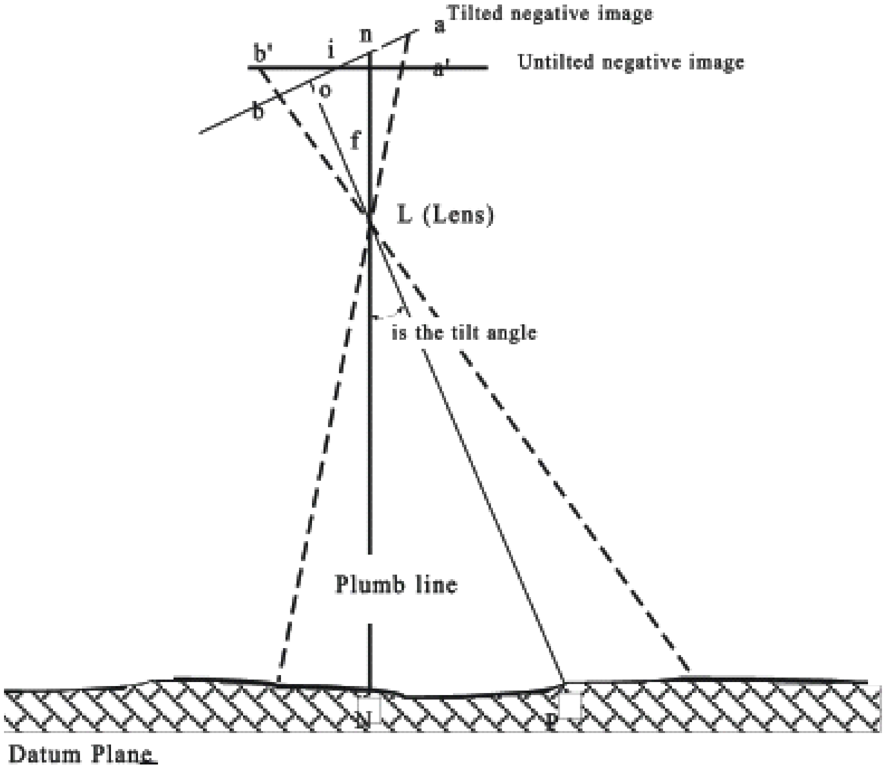

## Top view



# distortions due to sudden change in Flying height



# Scale displacement due to Tilt in the Aircraft



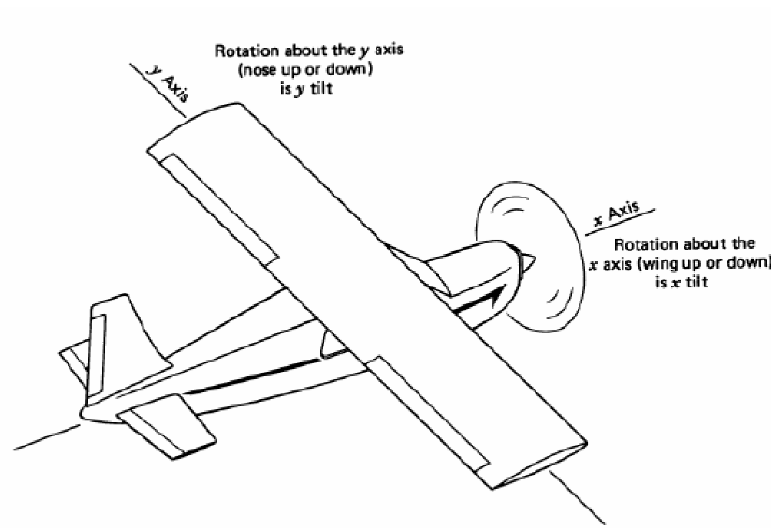
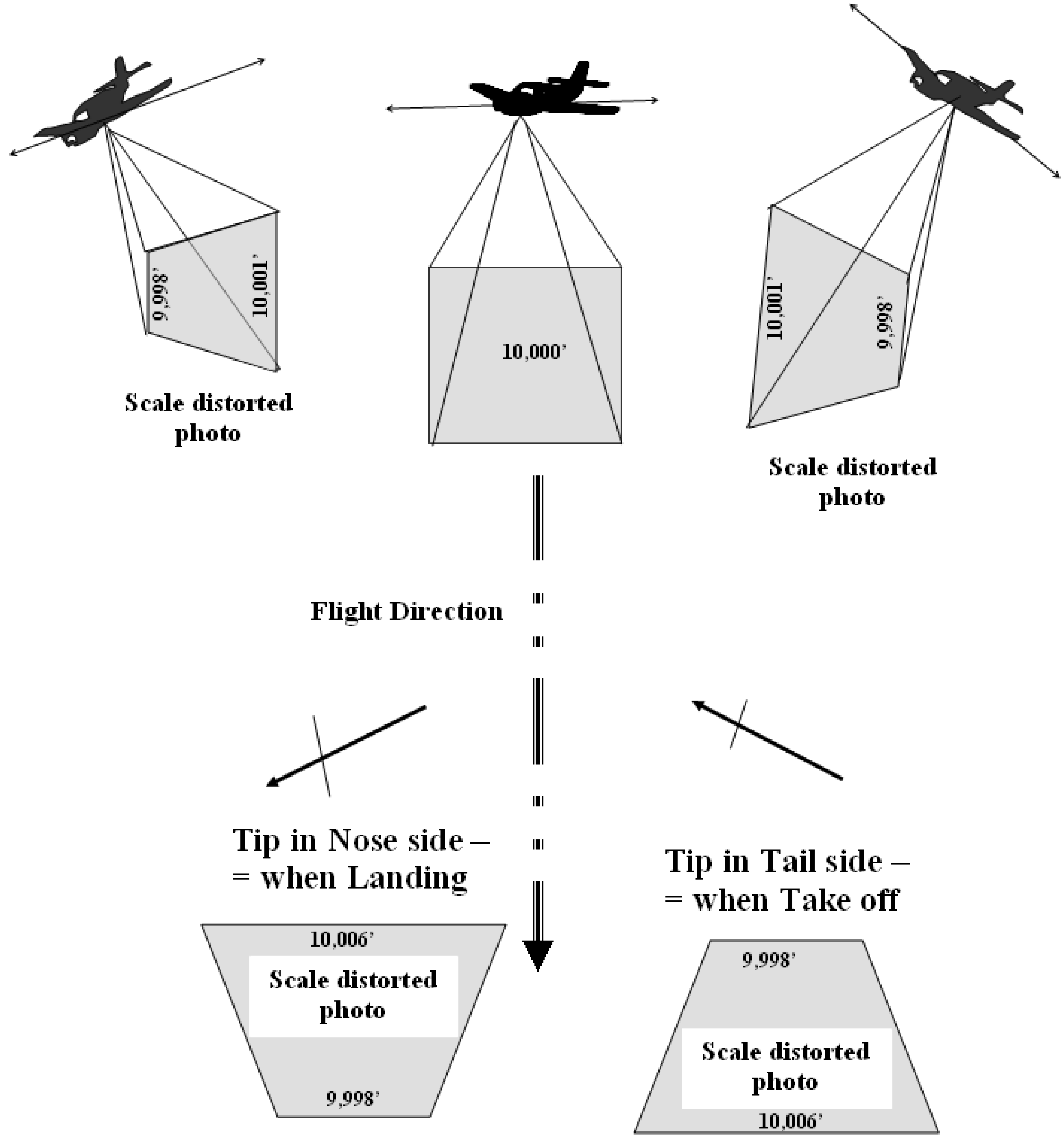




**Figure 2.9.** *x* and *y* tilt caused by the attitude of the aircraft (actually the camera) at the instant of exposure.

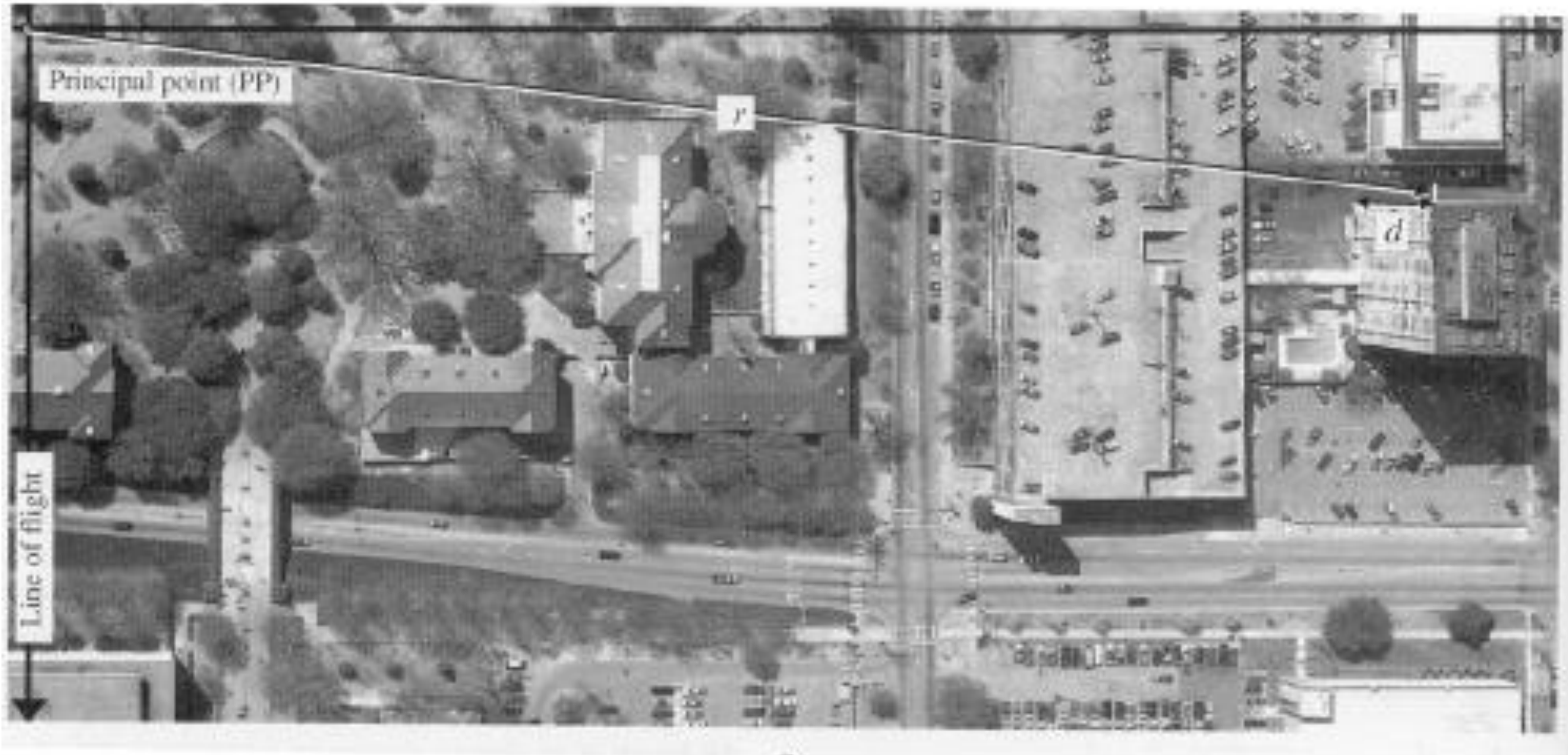
**Displacement due to tilt is caused by the aircraft or other airborne platform not being perfectly horizontal at the moment of exposure. Rotation of the camera about the y axis (nose up or down) is y tilt and rotation about the x axis (wing up or down) is x tilt**

**Both radiate from the isocentre and cause images to appear to be displaced radially toward the isocentre on the upper side of the photo positive (not the negative) and radially outward or away from the isocentre on the lower side.**


9,998'
10,001'
Scale distorted photo
10,000'
10,001'
9,998'
Scale distorted photo
Flight Direction
Tip in Nose side – = when Landing
Tip in Tail side – = when Take off
10,006'
Scale distorted photo
9,998'
9,998'
Scale distorted photo
10,006'

# Relief Displacement on a vertical aerial photograph

**Relief displacement is the shift or displacement in the photographic position of an image caused by the relief of the object**




Relief displacement:
- Caused by the terrain undulations.
- The amount of displacement depends on the height of the object and the radial distance of the object from the image nadir.
- The most important source of positional error.

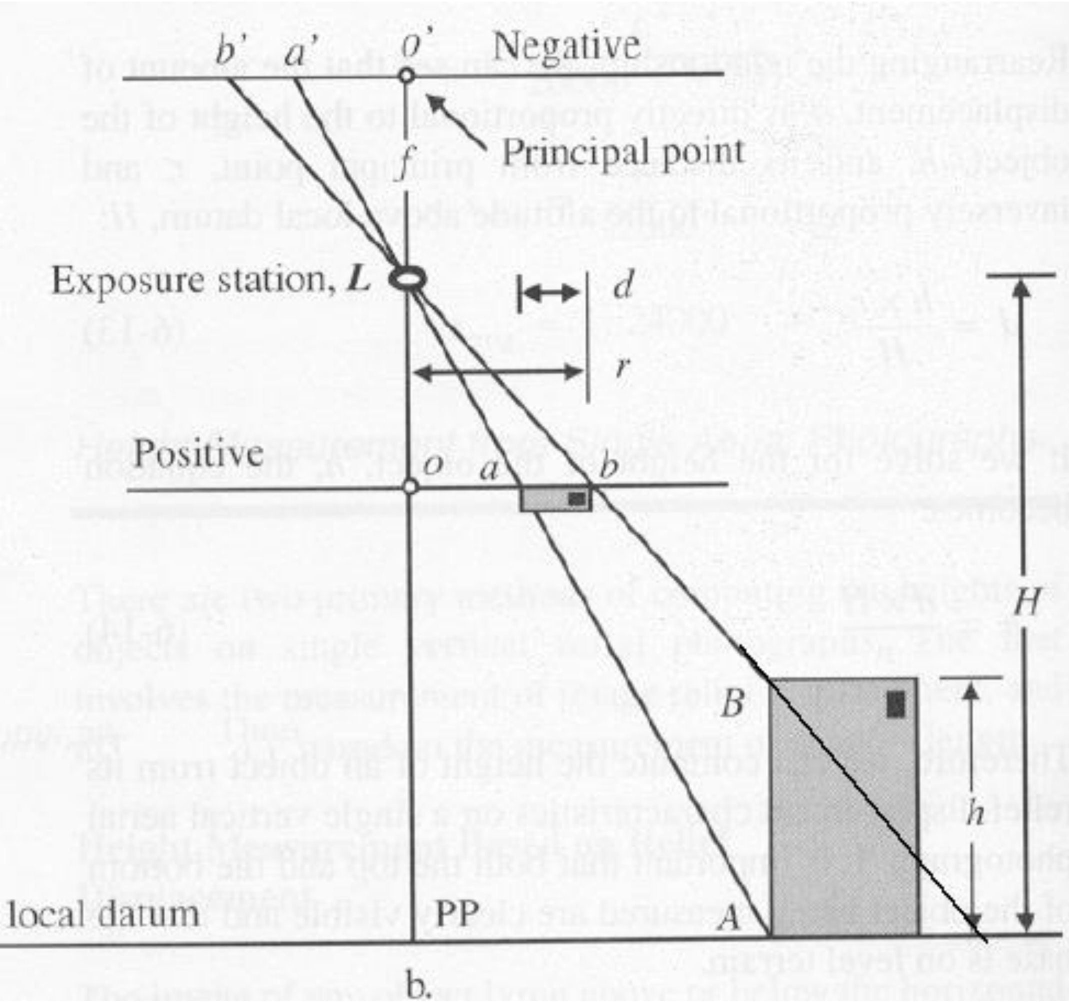
# Relief Displacement

- Objects at edges of photo will appear to lean away from the principal point
- There is a mathematical relationship between object heights and the amount of displacement, which allows us to determine the heights of objects
- Relief displacement can also be used to create three-dimensional images

Avery and Berlin, *Fundamentals of Remote Sensing and Air Photo Interpretation*

## Relief Displacement

# Relief Displacement on a vertical aerial photograph




**Relief displacement increases with**
**increase of radial distance from principle point (R) and Increase of object height (h)**

**Relief displacement decreases with**
**increase of Flying height above the datum (H)**

**From the above, we can calculate the Relief displacement as follows**

$$D = \frac{rh}{H}$$

Two towers were identified on a perfectly vertical photograph taken from 2500 m above the datum. The distances from the base of the towers to the photo center are equal and are measured to be 8.35 cm. If the height of tower1 is 120 m and that of tower2 is 85 m above the datum, find the relief displacement of the summit of these towers on the photograph? Conclude.

$$D = \frac{rh}{H}$$

**Where h = height above datum of the object point whose image is displaced**

**d = relief displacement**

**r = radial distance on the photograph from the principal point to the displaced image (the units of d and r must be the same).**

**H = flying height above the datum selected for measurement of h**

$$d = \frac{8.35\,cm \cdot 120\,m}{2500\,m - 120\,m} = 4.21\,mm \qquad d = \frac{8.35\,cm \cdot 85\,m}{2500\,m - 85\,m} = 2.94\,mm$$

**Conclusion:** **Relief displacement varies directly as the height of the object. Because tower1 is higher than tower2, its image is displaced more.**

A vertical photograph taken from an elevation of 535 m above MSL contains the image of a tall vertical radio tower. The elevation at the base of the tower is 259 m above MSL. The relief displacement ‘d’ of the tower was measured as 54.1mm, and the radial distance to the top of the tower from photo centre was 121.7 mm. What is the height of the tower?.

$$d = rh/H$$

$$h = dH/r$$

**d**-relief displacement, **h**-height above datum of object point whose image is displaced, **r**-radial distance on photograph from principal point to displaced image

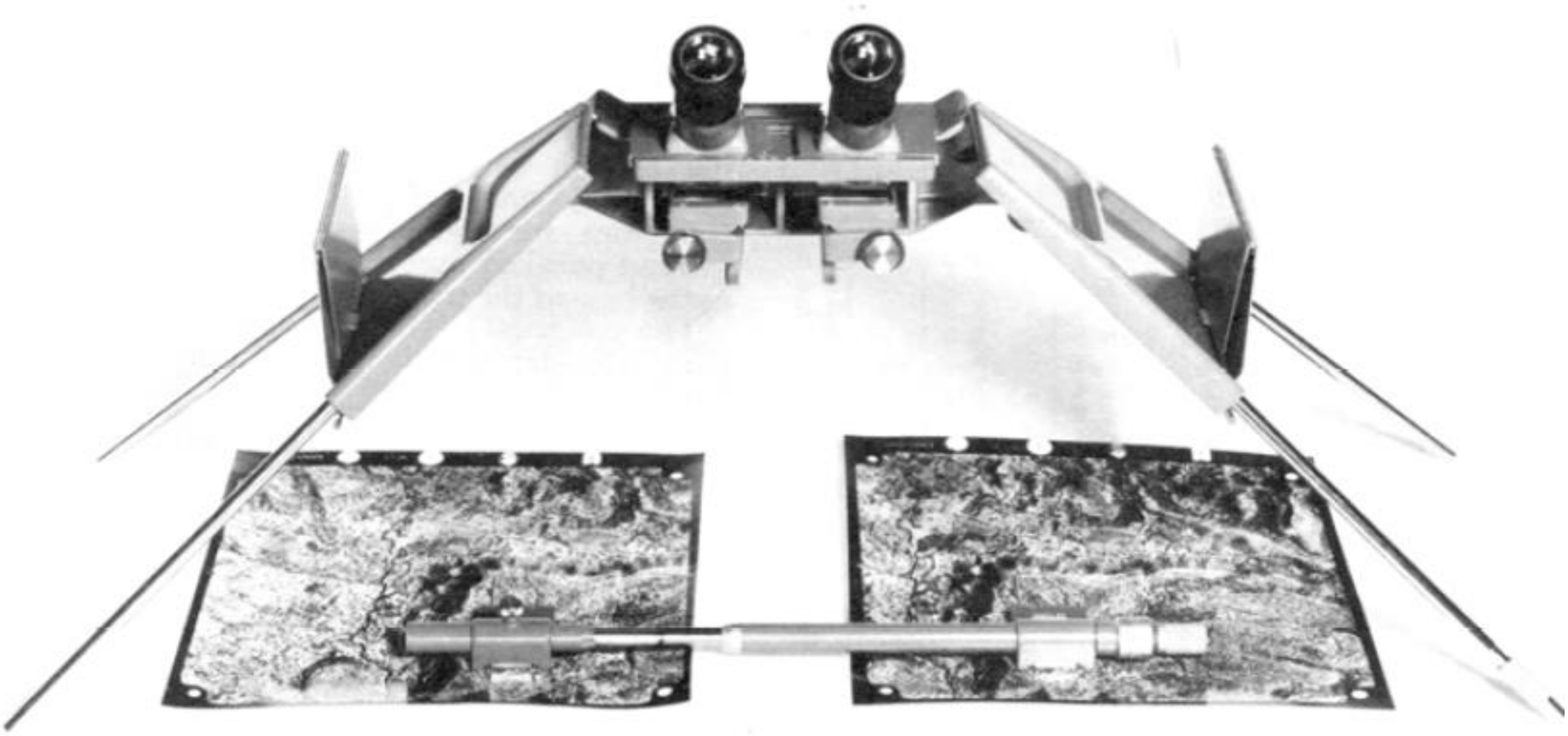
H = 535 - 259

d = 54.1mm, r = 121.7 mm, H = 535 – 259 = 276 m

$$h = \frac{54.1 \text{ mm} * 276 \text{ m}}{121.7 \text{ mm}} = 122.69 \text{ or } 123 \text{ m}$$

h = 123 m

# Principles of Stereoscopy



## STEREO MODELS

In our daily activities, we unconsciously measure depth or judge distances to vast number of objects about us through our normal process of vision

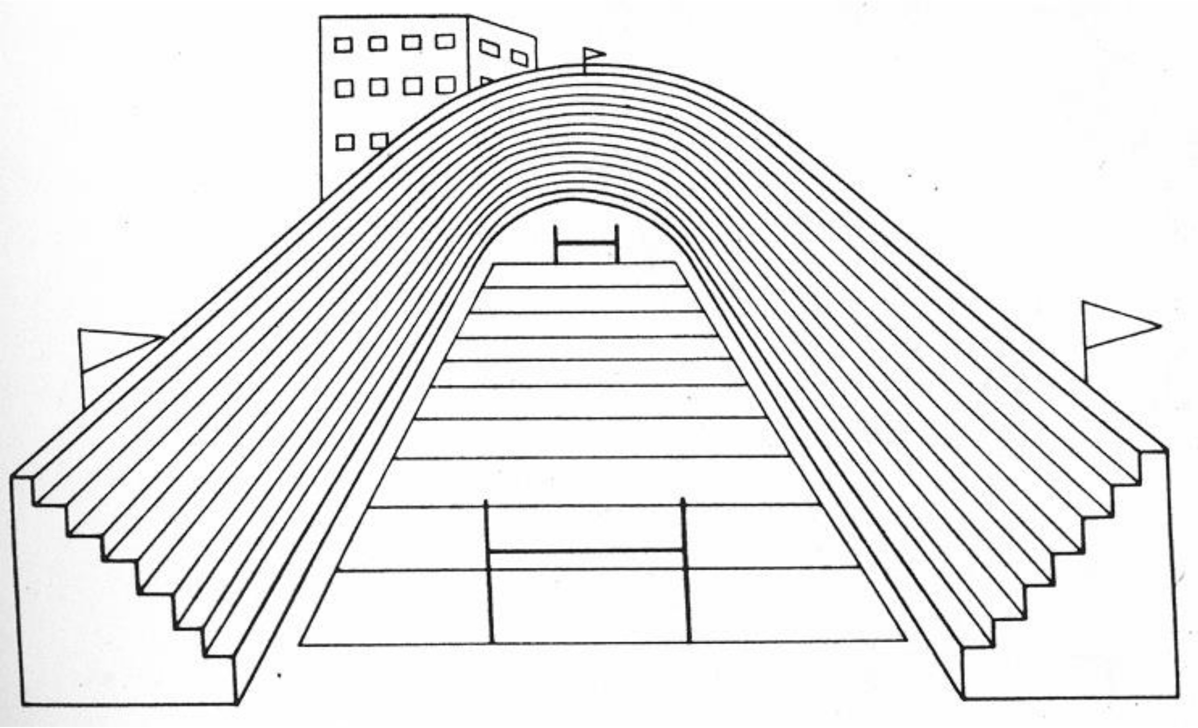
Methods of judging depth may be classified as either **stereoscopic or monoscopic**.

Persons with normal vision (those capable of viewing with both eyes simultaneously) are said to have binocular vision and perception of depth through binocular vision is called **stereoscopic viewing**. Studying the aerial photographs with aid of stereoscope

Monocular vision is the term applied to viewing with one eye and methods of judging distances with one eye are termed **monoscopic.** Studying the aerial photographs with out aid of stereoscope

Distances to objects, or depth can be perceived monoscopically on the basis of

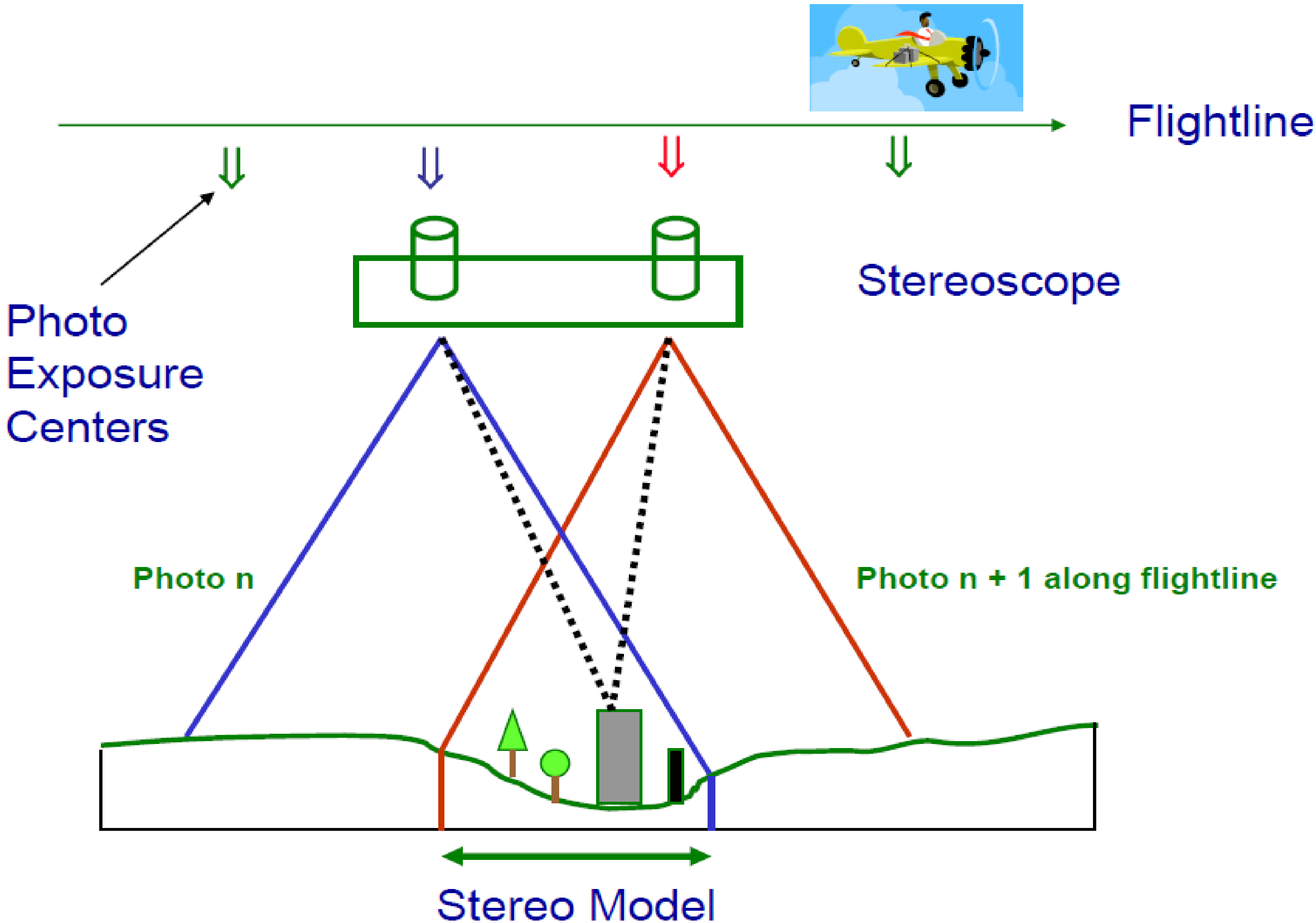
1) Relative sizes of objects, 2) Hidden objects, 3) Shadows and 4) Differences in focusing of the eye for viewing objects at varying distances.



Monoscopic methods of depth perception - Enable only rough impressions to be gained of distances to objects.

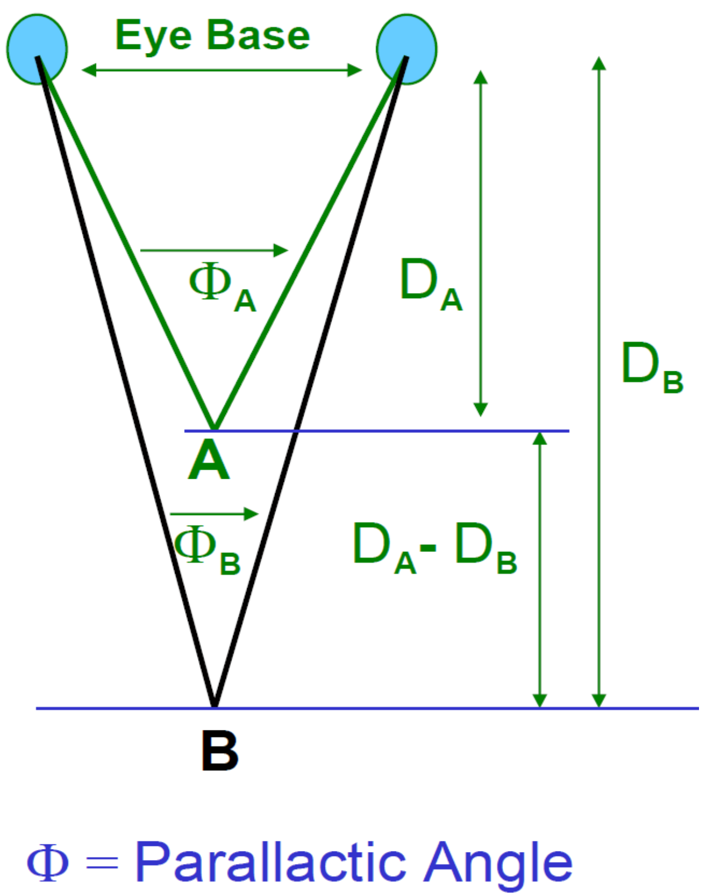
Much greater degree of accuracy in depth perception can be achieved by – stereoscopic vision.

# Formation of Stereoscopic Model



# STEREOSCOPIC DEPTH PERCEPTION

**With binocular vision, when the eyes fixate on a certain point, the optical axes of the two eyes converge on that point, intersecting at an angle called the parallactic angle. The nearer the object, the greater the parallactic angle and the object with long distance having the low parallactic angle.**




The optical axes of the two eyes L and R are separated by a distance $b_e$ called the eye base. For the average adult, the distance is between 63 and 69 mm or approximately 2.6 in.

When the eyes fixate on point A, the optical axes converge, forming parallactic angle $\phi_a$. Similarly, when sighting an object at B, the optical axes converge, forming parallactic angle $\phi_b$.

The brain automatically and unconsciously associates distances $D_A$ and $D_B$ with corresponding parallactic angles $\phi_a$ and $\phi_b$. The Depth between objects A and B is $D_B$ - $D_A$ and is perceived from the difference in these parallactic angles.

The ability of human beings to detect changes in parallactic angles and thus judge differences in depth is quite remarkable. Although it varies some what among individuals. The photographic procedures for determining heights of objects and terrain variations based on depth perception by comparisons of parallactic angles can be highly precise.

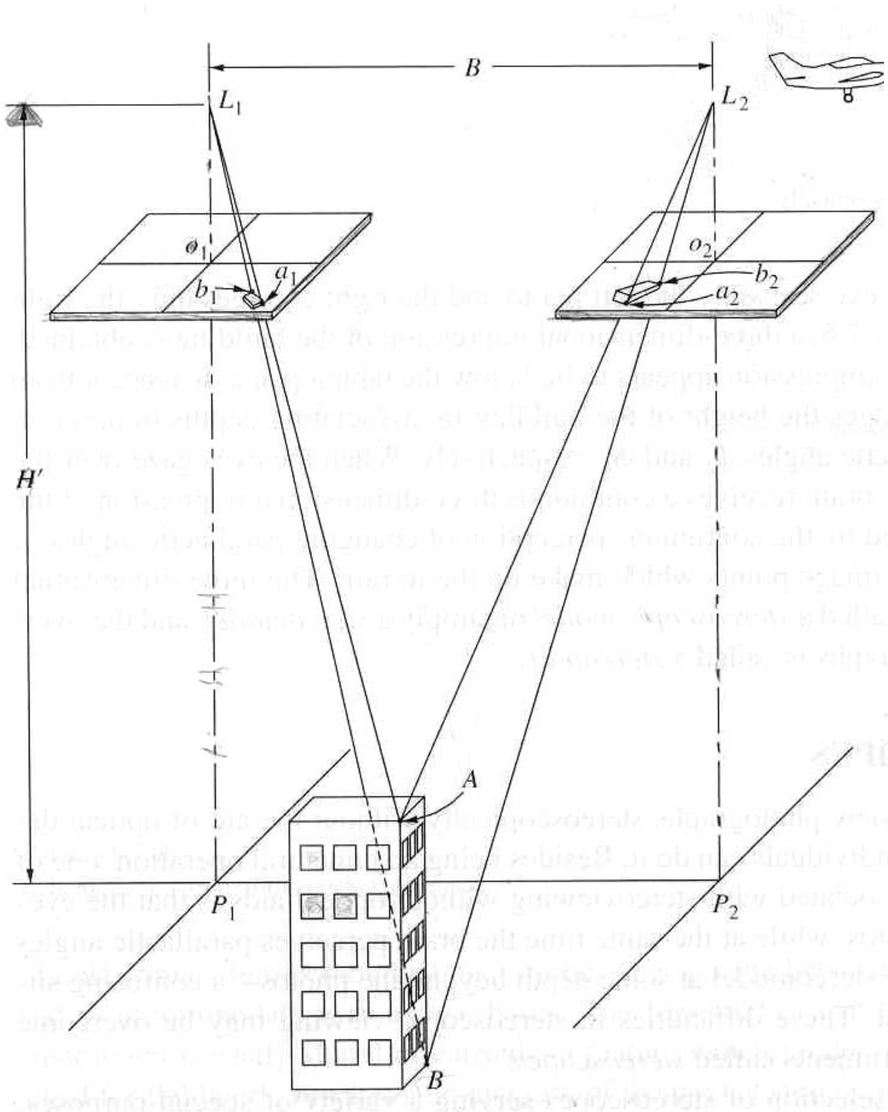


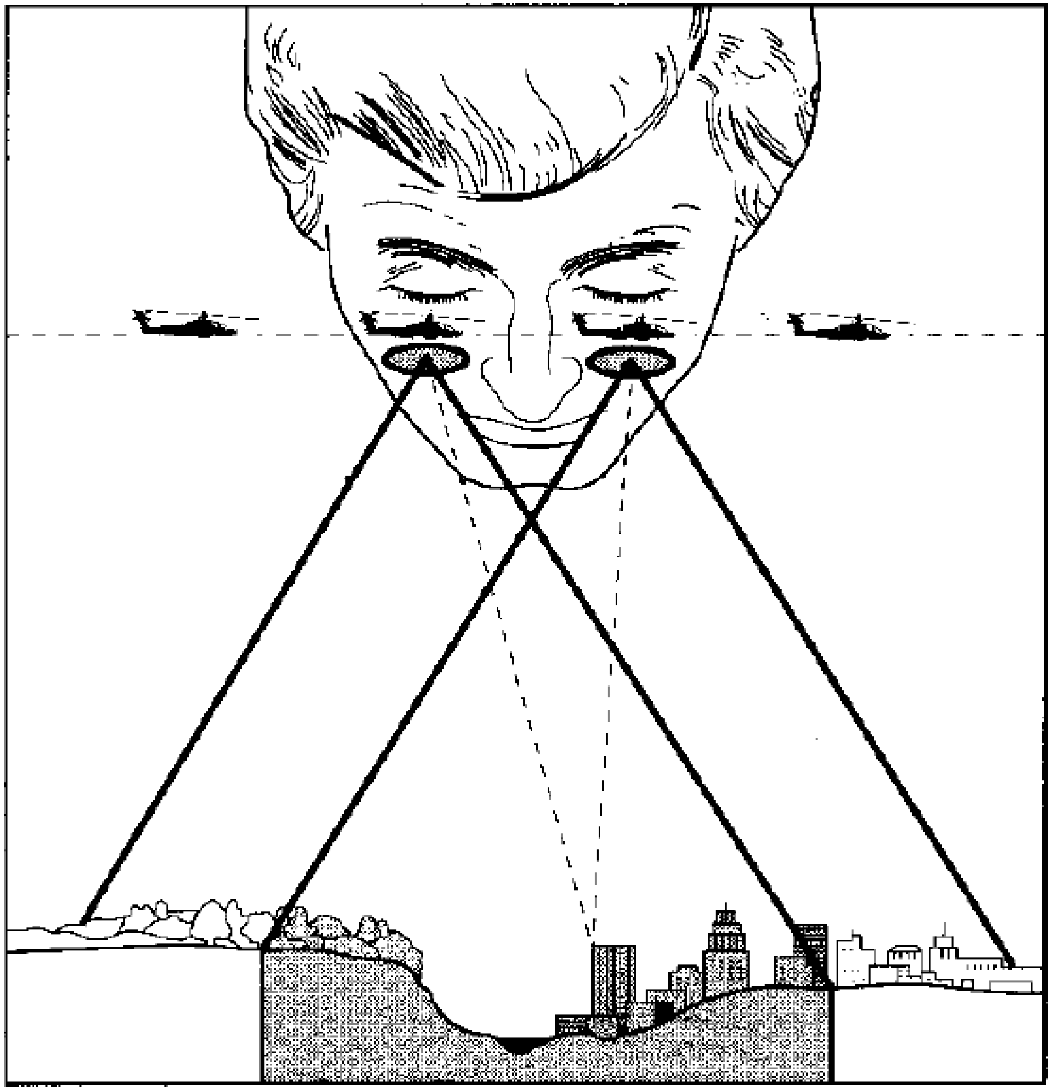
**FIGURE 7-5**
Photographs from two exposure stations with building in common overlap area.

**A pair of aerial photographs is taken from exposure station $L_1$ and $L_2$ so that the building appears on both photos.**
**Flying height above ground is H' and the distance between the two exposures is B, the air base.**
**Object point A and B at the top and bottom of the building are imaged at $a_1$ and $b_1$ on the left photo and at $a_2$ and $b_2$ on the right photo.**

**If these two photos are laid on a table and viewed so that the left eye sees only left photo and the right eye sees only the right photo so that three dimensional impression of the building is obtained**

The brain judges the height of the building by associating depths to points A and B with the parallactic angles $\phi_a$ and $\phi_b$ respectively.
When the eyes gaze over the area entire overlap area, the brain receives a continuous three dimensional impression of the terrain. The three dimensional model thus formed is called a stereoscopic model or simply **stereomodel** and the overlapping pair of photograph is called a **stereopair**

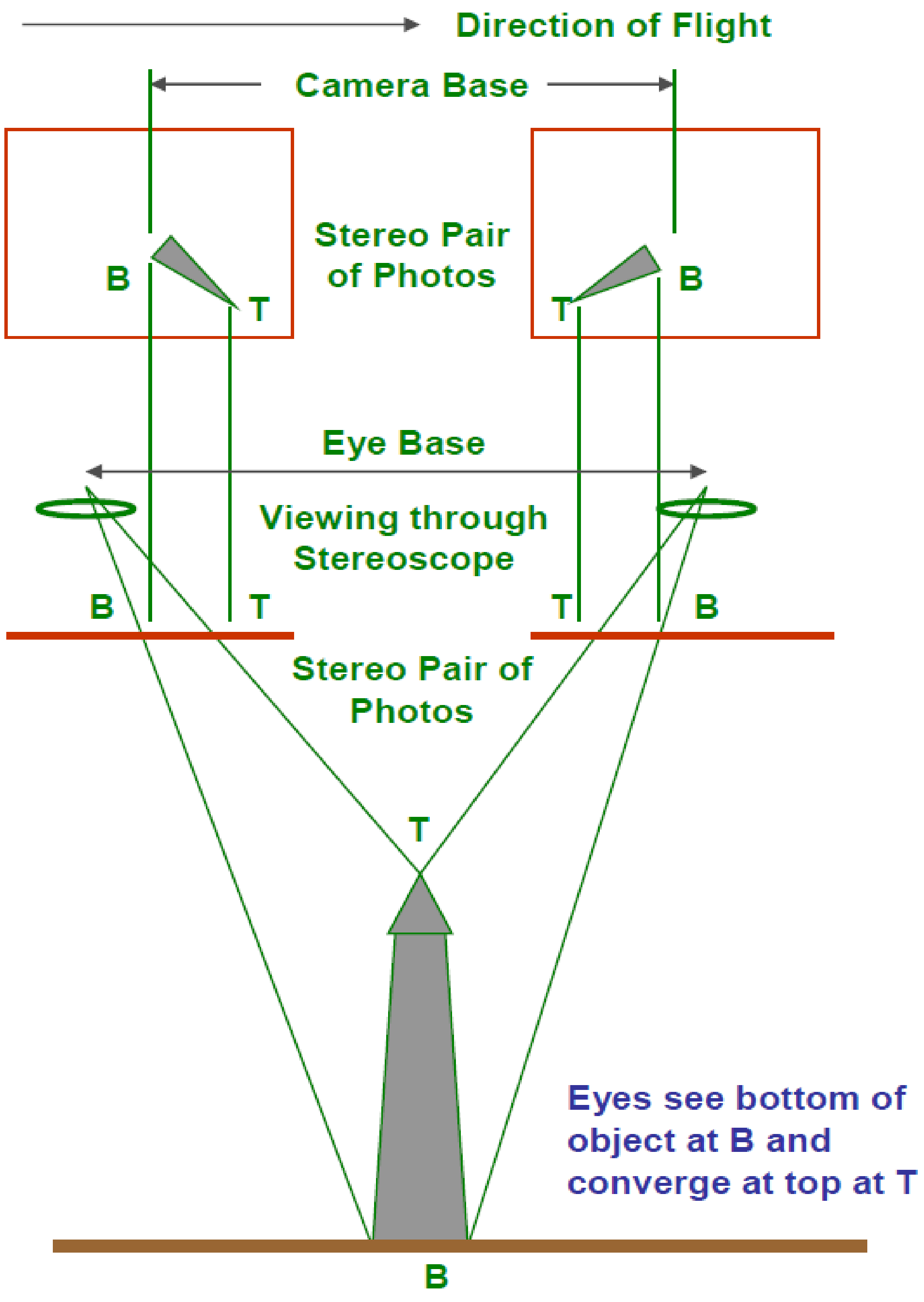
# The "giant" eyebase of stereo photography



← Stereo Model →

After Jensen, 2004

# Principles of Stereo Viewing



# Base Height Ratio – Vertical Exaggeration

Under the normal conditions, the vertical scale of a stereomodel will appear to be greater than the horizontal scale i.e an object in the stereomodel will appear to be toll. This apparent scale disparity is called vertical exaggeration.

The vertical exaggeration is caused primarily by the lack of equivalence of the photographic base-height ratio, B/H' and the corresponding stereo viewing base-height ratio, $b_e$ /h.

The term B/H' is the ratio of the air base (distance between the two exposure stations) to flying height above average ground.

$b_e$ /h is the ratio of the eye base (distance between the two eyes) to the distance from the eyes at which the stereomodel is perceived.

For topographic mapping and other precise quantitative photogrammetric measurements, photography preferably taken with a wide or super wide angle (short focal length) camera so that a large base – height ratio (B/H') is observed

The larger the b/h' ratio, the greater the intersection angles or parallactic angles.

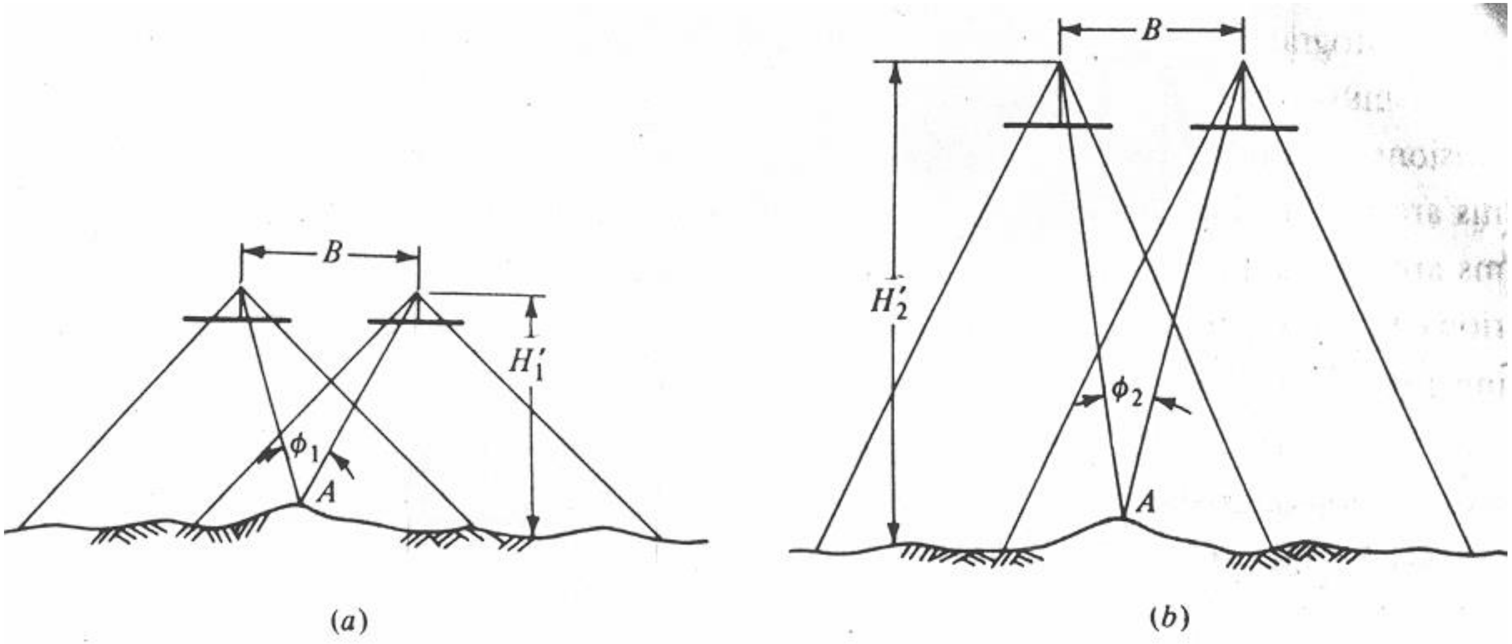


FIGURE 10-6
Parallactic angles increase with increasing $B/H'$ ratios.

The air bases are equal in these two cases. But the focal length and flying height are half those of right side figure
Decreased b/h' ratio can be attained by increasing flying height and now by using a longer focal length camera to compensate the scale reduction, this can be done.

Aerial photographs with Decreased b/h' ratio is more desirable for

- Mosaic construction because
- Scale variations
- Image distortions / displacement due to
- Relief, tilt and flying height variations
- Are much less.

# VERTICAL EXAGGERATION IN STEREOVIEWING

**The condition of increased vertical scale of the photo object than its normal height is known as vertical exaggeration.**

- ❖**Scale disparity**
- ❖**Vertical scale is greater than the horizontal scale**

**Although other factors are involved, Vertical Exaggeration is caused primarily by the lack of equivalence of the B/H' ratio in obtaining the photography and the corresponding (be / h) ratio in stereoviewing.**

- ❖ **Ratio of the air base to flying height above the ground (B/H')**
- ❖ **$b_e$ /h – is the ratio of the eye base to the distance from the eyes at which the stereomodel is perceived.**

**The product of the B/H' ratio and the inverse of the be/h ratio gives an approximation of vertical exaggeration, or**

$$V = \frac{B}{H'} * \frac{h}{be}$$

## STEREOSCOPIC PARALLAX

**Apparent shift in the position of an object, with respect to a frame of reference, caused by a shift in the position of observation**

**Change in position of an image from one photo to the next is caused by aircraft's motion**

- **Called stereoscopic parallax, x parallax, or simply parallax**

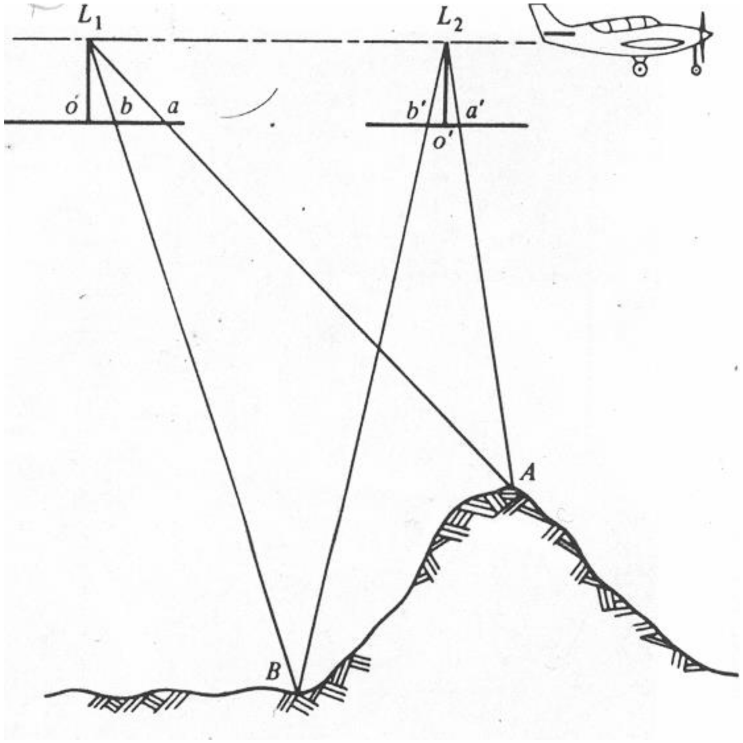
Two important aspects of stereoscopic parallax

- **Parallax of any point is directly related to the elevation of the point**
- **Parallax is greater for high points than for low points**

Images of object point A and B appear on a pair of overlapping vertical photographs which were taken from exposure station $L_1$ and $L_2$.

Point A and B are imaged at a and b on the left hand photograph. Because of forward motion of the air craft between exposure, these points appear at a' and b'.

Because Point A is higher than B, in other words the parallax of point A is higher than point B.




This lead to two important aspects of stereoscopic parallax such as

1. The parallax of any point is directly related to the elevation of the point

2. Parallax is greater for high points than low points

**Variation of parallax with elevation provides the fundamental basis for determining elevations of points from photographic measurements.**

**Also, X,Y and Z ground coordinates can be calculated for points based upon their parallaxes**

**Parallaxes of object points A and B are pa and pb respectively. Stereoscopic parallaxes for any point such as A expressed in terms of flight line photographic coordinates is**

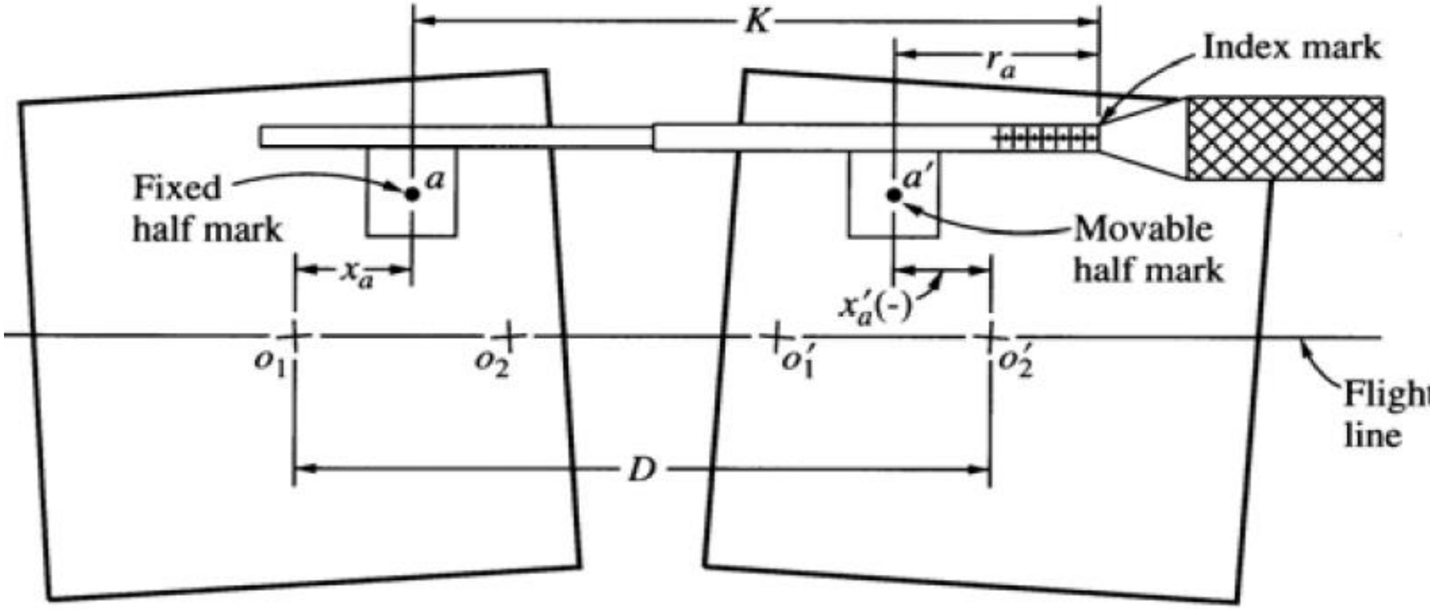
$$p_a = x_a - x'_a$$

**pa is the stereoscopic parallax of object point A, xa is the measured photo coordinate of image a on the left photograph of the stereopair and x'a is the photo coordinate of image a' on the right photo.**

## Stereoscopic Methods of Parallax Measurement

Through the principal of the floating mark, parallaxes of points may be measured stereoscopically. This method employs a stereoscope in conjunction with an instrument called a **parallax bar** also called as **stereometer**.

A parallax bar consist of a metal rod to which are fastened two half marks. The right half mark may be moved with respect to the left mark by turning micrometer screw. Reading from the micrometer are taken with the floating mark set exactly on points whose parallaxes are desired. From the micrometer reading, parallaxes or differences in parallaxes are obtained.




**When a parallax bar is used, the two photos of a stereopair are carefully oriented, flight line of each photo lies precisely along a common straight line as line AA'. The left half mark called the fixed mark is unclamped and the right half mark or moveable mark may be moved left or right with respect to the fixed mark (increasing or decreasing parallax) as required to accommodate high points or low points with out exceeding the run of the parallax bar graduation.**

**After the photos have been oriented and the left half mark is fixed in position as just described, the parallax bar constant C for the setup is determined**

**The spacing between principal points is a constant (D). Once fixed mark is clamped, the distance from the fixed mark to the index mark of the parallax bar is also a constant (K)**

**The parallax of point A is**

$$p_a = x_a - x'_a = D - (K - r_a) = (D - K) + r_a$$

**The term (D – K) is C, the parallax bar constant for the setup. Also $r_a$ is the micrometer reading. By substituting C into the above equation**

$$p_a = C + r_a$$

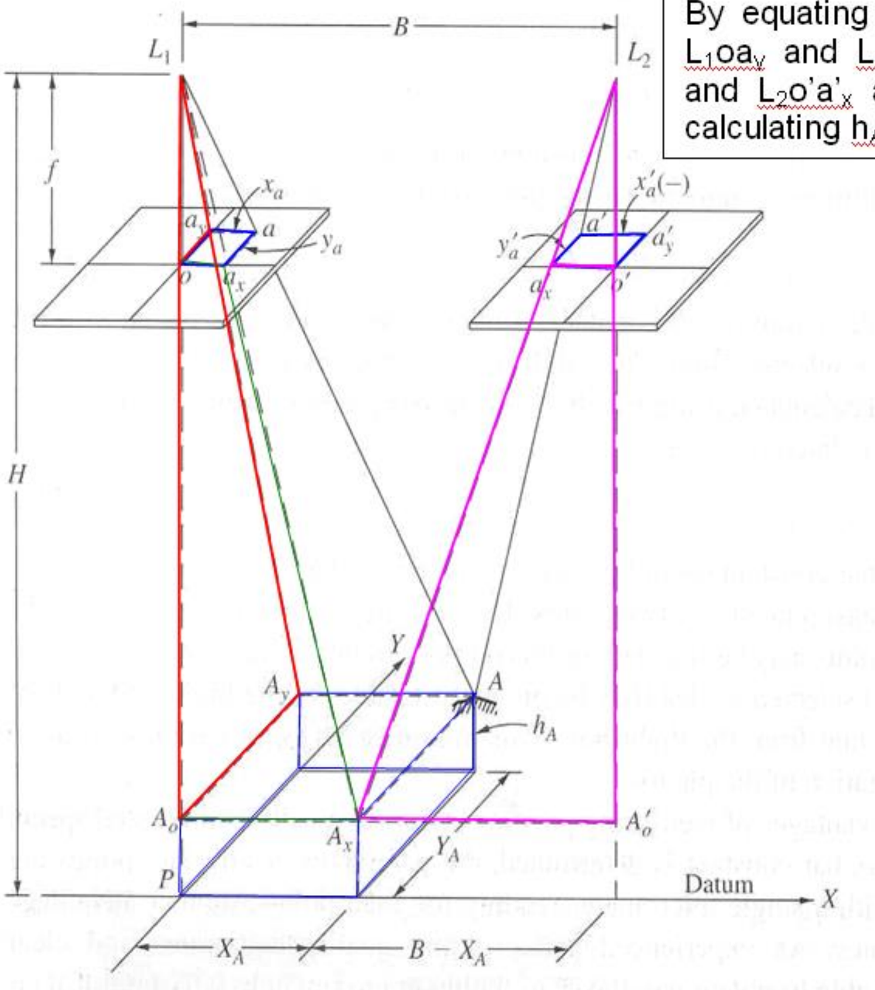
**If p and r is known, the value can be calculated by**

$$C = p + r$$

**The parallax bar constant should be determined on the basis of micrometer readings and parallax measurements for two points.**

## Parallax Equation

X,Y and Z ground coordinates can be calculated for points based upon the measurements of their parallaxes. An overlapping pair of vertical photographs which have been exposed at equal flying heights above datum




By equating similar triangles such as $L_1oa_y$ and $L_1A_0A_y$, $L_1oa_x$ and $L_1A_0A_x$, and $L_2o'a'_x$ and $L_2A'_0A_x$, formulas for calculating $h_A$, $X_A$ and $Y_A$

$$h_A = H - \frac{Bf}{p_a}$$

$$X_A = B \frac{x_a}{p_a}$$

$$Y_A = B \frac{y_a}{p_a}$$

hA is the elevation of point A above datum, H is the flying height above datum, B is the air base, f is the focal length of the camera. pa is the parallax of point A, XA and YA are the ground coordinates of point A, xa and yb are the photo coordinates of point 'a' measured with respect to flight line axes on the left photo.

These equations are called **parallax equations**.

**Approximate Equation for Height of Objects from Parallax Differences**

In many applications it is necessary to estimate heights of objects to a moderate level of accuracy

By modifying the above equation, we can calculate the approximate height of the object

$$h_A = \frac{\Delta p H}{b + \Delta p}$$

or

$$h_A \approx \frac{\Delta p H}{b}$$

$h_A$: Height of the point A above ground

$\Delta p$: $= pa - pc$ is the difference in parallax between the top of the feature and the ground

$H$ : is the flying height above ground

$b$: is the photo base for the stereopair

# PHOTO MOSAICS

## Mosaics:

**An assemblage of two or more individual overlapping photographs to form a single continuous picture of an area.**

**Photographic reproduction of a whole series of aerial photographs assembled in such a manner that the detail of one photograph matches the detail of all adjacent photographs at a much smaller scale.**

## Uses of Mosaics:

➔Useful in the field of planning – landuse / engineering

➔Geological and natural resource inventory

➔Many more interpretations and mapping them

➔Shows areas completely and comprehensively

➔Prepared rapidly and economically

➔Alternate plans can be conveniently investigated

➔Useful for detailed study and best overall plan can be finally adopted.

➔Used as planimetric map substitutes for many engineering projects

➔Eliminates most of the ground surveying and plotting

➔Design drawings and construction specifications are superimposed directly over the mosaic as overlay

➔Time and cost saving and

➔Higher accuracy.

**Types of Mosaics:**

i. Index or photo index

ii. Strip

iii. Controlled

iv. Semi controlled

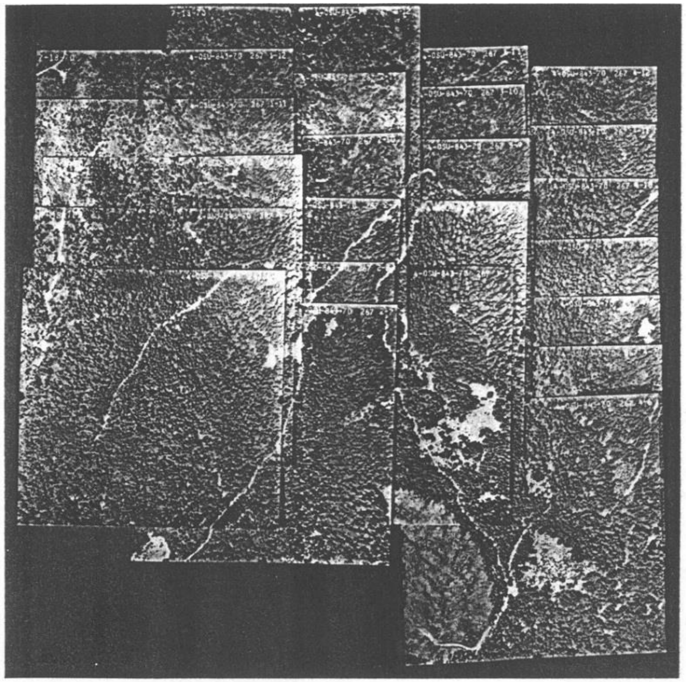
v. Uncontrolled

vi. Temporary and

vii. Orthophoto mosaic.

## 1. Photo indexing or index mosaics

Uncontrolled mosaic which has been laid to very rough specifications. Prepared immediately after the flight for the purpose of providing an index to individual photographs for correlating photo numbers and photo coverages.



The primary use

- for indexing
- for photo retrieval from the files
- to know the ground coverage and
- to check for any gaps or missed areas for any necessary reflights
- Least expensive type of mosaic – uncontrolled and
- Not permanently mounted on a backing.

## 2. Strip Mosaic:

A strip mosaic is the assembly of a series of photographs along a single flight strip. Useful in planning and designing linear engineering projects like, Rail roads, pipelines, etc.

May be controlled, uncontrolled or semicontrolled.

## 3. Controlled Mosaic

A compilation of rectified photographs, so assembled that their principal points and other selected intermediate points are located in their true horizontal positions.

Rectification – the process of projecting a tilted or oblique photo on to a horizontal plane.

This projection may be of graphic or by photography in a special camera called rectifier or rectifying camera.

**Each photograph is oriented in position by matching the photographic images of selected control points to the corresponding plotted position of the pre-established points**

**The rectified photo will have**

- ➔ **horizontality or free from tilt**
- ➔ **better uniformity of scale**
- ➔ **uniformity in tones and contrasts of the print.**

## 4.0 Uncontrolled mosaic

**Prepared by simply matching the image details of adjacent photos.**

- ➔ There is no ground control and
- ➔ Vertical photos which have not been rectified or ratioed are used.
- ➔ They are not as accurate as controlled mosaics
- ➔ But for quaitative uses they are completely satisfactory.
- ➔ Usually, the central portion of each photograph is taken which is relatively free from relief and tilt displacements, and scale distortions.
- ➔ The photos are laid out in strips in straight lines.
- ➔ Then the different strip mosaics are matched together to compile a mosaic for the entire area.

## 5.0 Semicontrolled mosaic:

**Assembled utilizing some combination of the specifications for controlled and uncontrolled mosaics.**

- **By using ground control but using**
- **Photographs that have not been rectified or ratioed (or)**
- **Use rectified and ratioed photos but no ground control**
- **These mosaics are a compromise between economy and accuracy.**

## 6.0 Temporary Mosaic:

**Whenever the conditions do not permit to prepare a controlled or uncontrolled mosaic and a large area needs to be viewed within a short time, then a very temporary mosaic may be prepared.**

- Save the photo from trimming and
- The same photos can be used for stereoscopic viewing for photo interpretation after this purpose
- Alternate photos in a strip are taken
- Their borders only are trimmed
- Used without rectification or ratioing
- Strips are laid in a soft board
- Multiple strips are assembled and pinned on the board and used.

## 7. Orthophoto Mosaic:

**An assembly of two or more orthophotos to form a continuous picture of the terrain. Ortho photos are derived from vertical aerial photographs using a differential rectification instrument.**

- ➔ **Have had no image displacements due to relief and tilt – they are removed**
- ➔ **So that they show features in their true planimetric positions**
- ➔ **Distances, angles and areas can therefore be measured directly**
- ➔ **They have the pictorial advantages of aerial mosaics and the geometric correctness of maps.**
- ➔ **They can usually be prepared more rapidly and economically than line and symbol maps.**