

What do you understand by the term "Aerial Photography"? What are factors that influence aerial photography?

Aerial photography is a technique in remote sensing where acquire photographs of earth surface from an elevated platform such as aircraft, Drone, Balloon or other airborne platform.

The word "Aerial" comes from Latin word, which means "of the air" or "belonging to the sky".

Aerial photography is used in topographic Mapping, Monitor land use, urban development Planning.

Factor Influencing aerial Photography :-

When we use these images for remote sensing, the Quality & Accuracy of the data we depend on a key factor :-

1. Sun Angle & Time :- The sun position creates the shadow that can either help highlight Topography or obscure ground features.

2. Flying Height :- Higher altitude gives larger area coverage but less detail lower altitude

gives more detail but smaller coverage.

3) Camera & Lens quality! - Good resolution, focal length & camera stability produce sharper aerial - photographs.

4) Platform stability! - Roll, pitch & yaw can cause unwanted camera orientation changes. Excessive speed combined with inadequate shutter speed can cause image motion & blur.

5) Season & Time of photography! - Different season show different land cover. Remote sensing data is essentially a "snapshot in time", so choosing the right season & time ensures you capture the features need with optimal clarity & minimal - distortion.

Q-2.

Differentiate b/w "Aerial Photography" and "Aerial Photogrammetry".

Ans. -

Aerial Photography

- ① It is the process of taking photographs from the air.
- ② It uses an aerial camera or sensor.
- ③ It does not necessarily involve accurate measurements.
- ④ Gives you photographs (2D)
- ⑤ Record perspective geometry

Aerial photogrammetry.

- ① It is the science of obtaining measurement & information from aerial photographs.
- ② It uses photographs, geometry and software.
- ③ Accurate measurement is an important objective.
- ④ Maps, DEMs, contours, 3D model.
- ⑤ Uses Mathematical principle of perspective geometry.

Q-3.

Describe the various type of distortion in an aerial photograph?

Ans: -

An Aerial photograph, is any photograph taken from air.

Distortion: Distortion is the shift in the location of an object that changes the perspective characteristic of the photo.

Type of distortion:-

- These are basically four type of distortion.

- 1) Film & Print shrinkage
- 2) Atmospheric refraction of light rays.
- 3) Image motion.

4) Lens distortion

1) Film & Print shrinkage :- The physical contraction or expansion of photographic film or paper prints due to change in temp. & Humidity.

2) Atmospheric Refraction of Light Rays :- The bending of light rays as they pass through earth atmospheric layers of varying density & temp.

3) Image Motion ! - The relative movement b/w the sensor & ground target. This motion blur degrades image resolution & geometric.

4) Lens distortion ! - Small effects due to the flaws in the optical component of camera system leading to distortion.

Q-5.

Explain and show with diagram the geometry of a tilted photograph. Indicate the position of principal point, Nadir point and Isocentre on photograph and Ground along with geometrical parameters.

Ans -

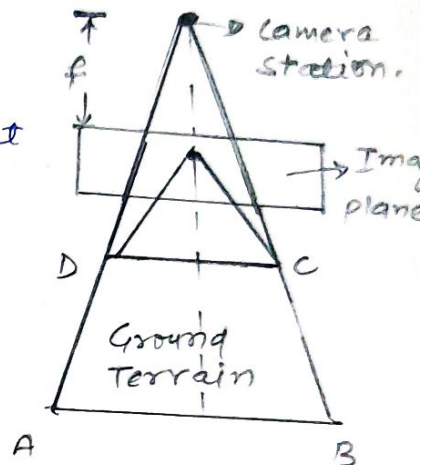
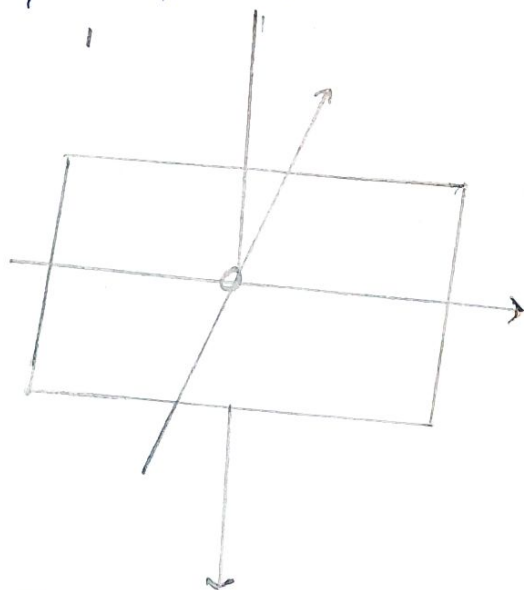
A Tilted photograph is an aerial photograph taken when the camera's optical axis is not exactly vertical.

In tilted photograph, three important points are —

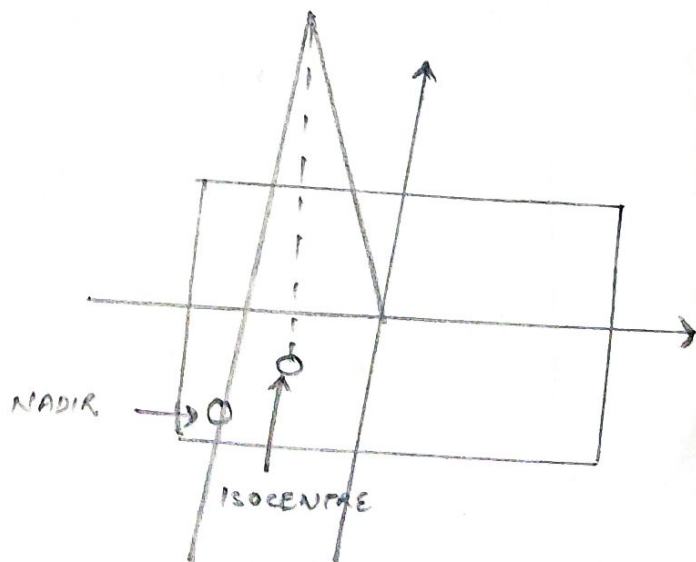
1. Nadir Point (N) :- A point on the photograph where a vertical line from the camera intersects the photograph.

2. Principal Point (P) :- The point at which the camera's optical axis drawn perpendicular to the negative plane, & intersects the negative.

3. Isocentre (I) :- The point that falls b/w Nadir point & principal point.



True Vertical Air photograph



Tilted Aerial photograph

Q- 6.

Describe the concept of scale of an aerial photograph with respect to

- a) Ground distance,
- b) Focal length,
- c) Variable Ground elevation.

Derive eqn for calculation of scale of photograph over varying Terrain.

Ans -

Scale is the ratio b/w the photo distance & ground distance.

$$\text{Scale} = \frac{\text{Photo distance}}{\text{Ground distance.}}$$

a) Scale Using Ground distance :-

If distance on the photograph is d & ground distance is D .

$$S = \frac{d}{D}$$

b) Scale with focal length :- A vertical photograph over flat Terrain, the Scale is determined by the focal length of camera (f) & flying Height above the Ground (H).

$$S = \frac{f}{H}$$

c) Scale with variable Ground elevation :-

When Ground is not flat, the distance b/w the camera & ground changes.

$$S = \frac{f}{H-h}$$

H = Camera elevation above Reference datum.

h = ground elevation at specific point.

Q-7.

Given: focal length, $f = 152.35 \text{ mm}$

picture size = $230 \times 230 \text{ mm}$

flying Height, $H = 2400 \text{ mtr}$ or $2,400,000 \text{ mm}$

Average Scale of the photograph = ?

Amount of Ground area covered, $A = ?$

Soln:-

(A)

Average scale of the photograph: $s = \frac{f}{H}$

$$s = \frac{152.35 \text{ mm}}{2,400,000 \text{ mm} \times 100 \text{ mm}} = \frac{1}{15752.5}$$

$$\boxed{s \approx 1 : 15753}$$

B) Amount of Ground area covered = $a = 230 \text{ mm}$

$$a = 230 \text{ mm} \times 15,753$$

$$= 3623075 \text{ mm}$$

$$\text{or } 3.623 \text{ km} \quad \left\{ \begin{array}{l} \text{convert mm to km} \\ \text{ie } 1 \text{ mm} = 10^{-6} \text{ km} \end{array} \right\}$$

$$\therefore \text{Area, } A = 3.623 \times 3.623$$

$$\boxed{\text{Area} = 13.13 \text{ km}^2}$$

Q-8.

Given: distance on Aerial photograph = 6.50 cm

distance on map = 2.30 cm

Scale = $1 : 50,000$

Approx scale, $s = ?$

Actual distance on photo = $1 \times 6.50 = 6.50 \text{ cm}$

Actual distance on map = $50,000 \times \frac{2.30}{100} = 1,15,000 \text{ cm}$

We know that, Scale (s) = $\frac{\text{Photo distance}}{\text{Ground distance}}$

$$= \frac{6.50}{1,15,000} = \frac{1}{17692.3}$$

$$= \boxed{s \approx 1 : 17,692}$$

$$\boxed{s \approx 1 : 17,692}$$

Q-9.

Given, Length on map, $l = 2.8 \text{ mm}$

Scale, $s = 1 : 15000$

Angle of elevation of sun, $\theta = 36^\circ$

Height of tree = ?

Convert shadow on map
into Ground Length =

$$= \frac{2.8 \text{ mm}}{10} \times 15,000$$

$$= 42,000 \text{ mm or } 42 \text{ m}$$

$$\therefore \tan \theta = \frac{h}{l} \text{ or } \tan \theta \cdot l = h$$

$$\Rightarrow \tan \theta \cdot l = h \Rightarrow \tan 36^\circ \cdot 42 = h \Rightarrow 0.7265 \times 42 = h$$

$$\boxed{h \approx 30.51 \text{ m}}$$

Hence, Height of Tree, $h \approx 30.5 \text{ m}$.

Q-10.

Given: shadow Length on photograph, $l = 3 \text{ cm}$

Scale, $s = 1 : 4500$

Angle of Elevation of sun, $\theta = 60^\circ$

Building height, $h = ?$

Soln:-

Building Height, $h = \theta = \frac{h}{l}$

$$\Rightarrow 3 \text{ cm} \times 4500 = 13,500 \text{ cm}$$

$$\text{or } 135 \text{ m}$$

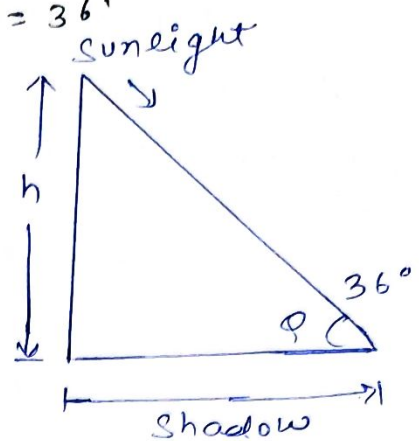
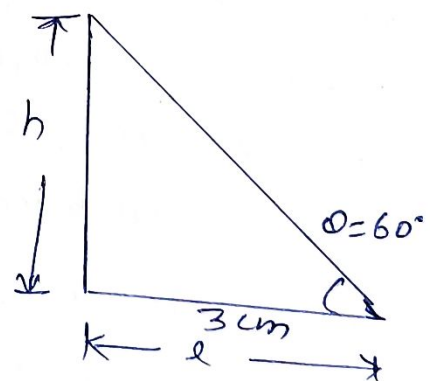
$$\Rightarrow h = \tan \theta \cdot l = h$$

$$h = \tan 60^\circ \times 135$$

$$\Rightarrow h = 1.732 \times 135 \quad [\tan 60^\circ = \sqrt{3} = 1.762]$$

$$\boxed{h \approx 233.82 \text{ m}}$$

$\therefore$ Height of Building, $h \approx 233.82 \text{ mtr.}$



Q-11.

Given, Height of Radio Antenna, $h_1 = 125\text{ m}$
 Length of shadow of Radio Antenna, $e_1 = 1.68\text{ cm}$
 Length of shadow of chimney, $e_2 = 1.25\text{ cm}$
 Height of chimney, $h_2 = ?$

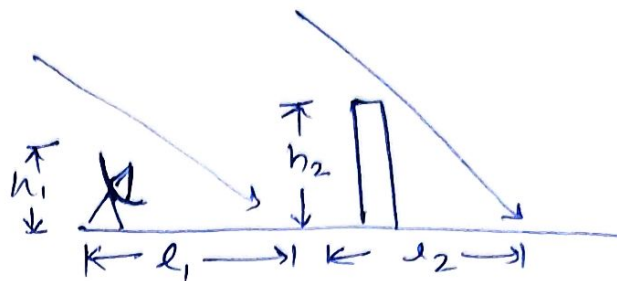
Soln:-

$$\frac{h_1}{h_2} = \frac{e_1}{e_2}$$

$$\Rightarrow \frac{125}{h_2} = \frac{1.68}{1.25}$$

$$\Rightarrow h_2 = \frac{125 \times 1.25}{1.68} \Rightarrow \approx 93.01\text{ m} \text{ or } 93\text{ m}$$

$\therefore$ Height of chimney is 93 m .



Q-12.

Derive the Relief displacement formula & show the geometry of Relief displacement in a vertical photograph with diagram. Relief displacement is the Radial shifting of an object photographic Image from its true planimetric position, caused by object elevation above or below a reference datum.

Ans:-

- It is zero at Nadir point & max. at edge's.
- Smaller the Height of object, smaller the displacement.

$$h \propto \text{displacement}$$

Q-14

Soln: -

Given, flying height = 1500 m

Relief displacement, $d = 1.6$ cm

Distance from the centre of photograph to the image of the top of flagpole = 11 cm

Base Elevation from above datum = 200 m

We know, that relief displacement, $d = \frac{sh}{s}$

$$\text{or } h = \frac{d \times H}{s}$$

$$\Rightarrow h = \frac{1.6 \text{ cm} \times 1500 \text{ m}}{11 \text{ cm}} = 218.18 \text{ m}$$

$$\boxed{h = 218.18 \text{ m}}$$

Flagpole Height = Elevation of top above datum -
elevation of flagpole above datum.

$$\Rightarrow 218.18 - 200 = 18.18 \text{ m}$$

$\therefore$ Height of flagpole = 18.2 m

Q-15,

Given, Top & foot of Tower = 87 mm & 47 mm
flying Height (H) = 1500 m.

Height of Tower = ?

Soln: -

Relief displacement, $d = 87 - 47 = 40$ mm

We know that, $h = \frac{dH}{s}$

$$\Rightarrow h = \frac{87.47 \times 1500}{87} \quad \left[\begin{array}{l} \text{because Relative disp} \\ \text{is measured relative to top} \end{array} \right]$$

$$h \approx 689.66 \text{ m or } \approx 690 \text{ m.}$$