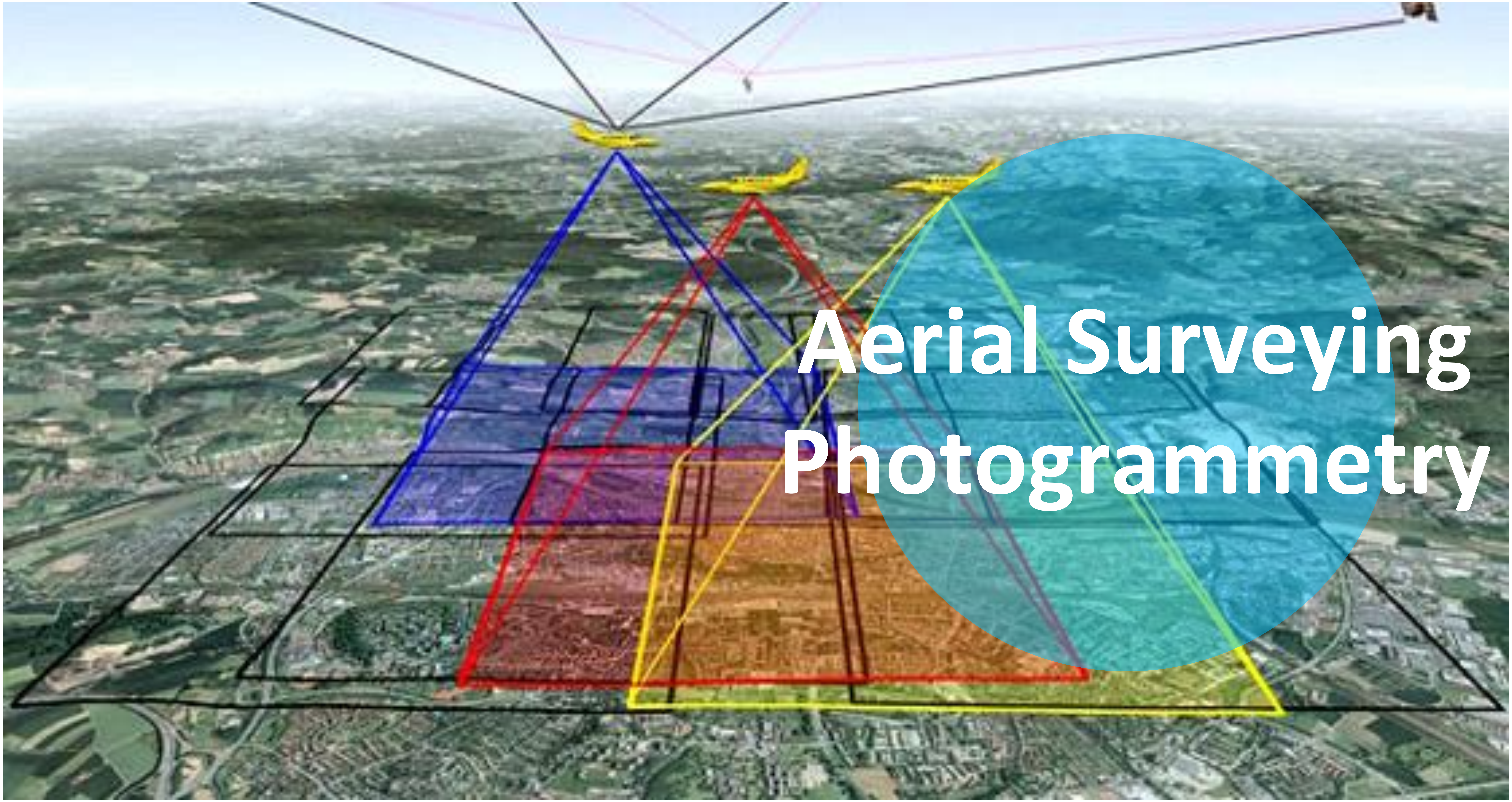

Aerial Surveying Photogrammetry

Ibrahim Almohanna, 2019

Photogrammetry

Photogrammetry defined as the science and technique of making measurements on photographs;

Photographs are classified as:

1-Ground photographs or Close range or Terrestrial Photographs.

2-Aerial photographs

3-Space photographs

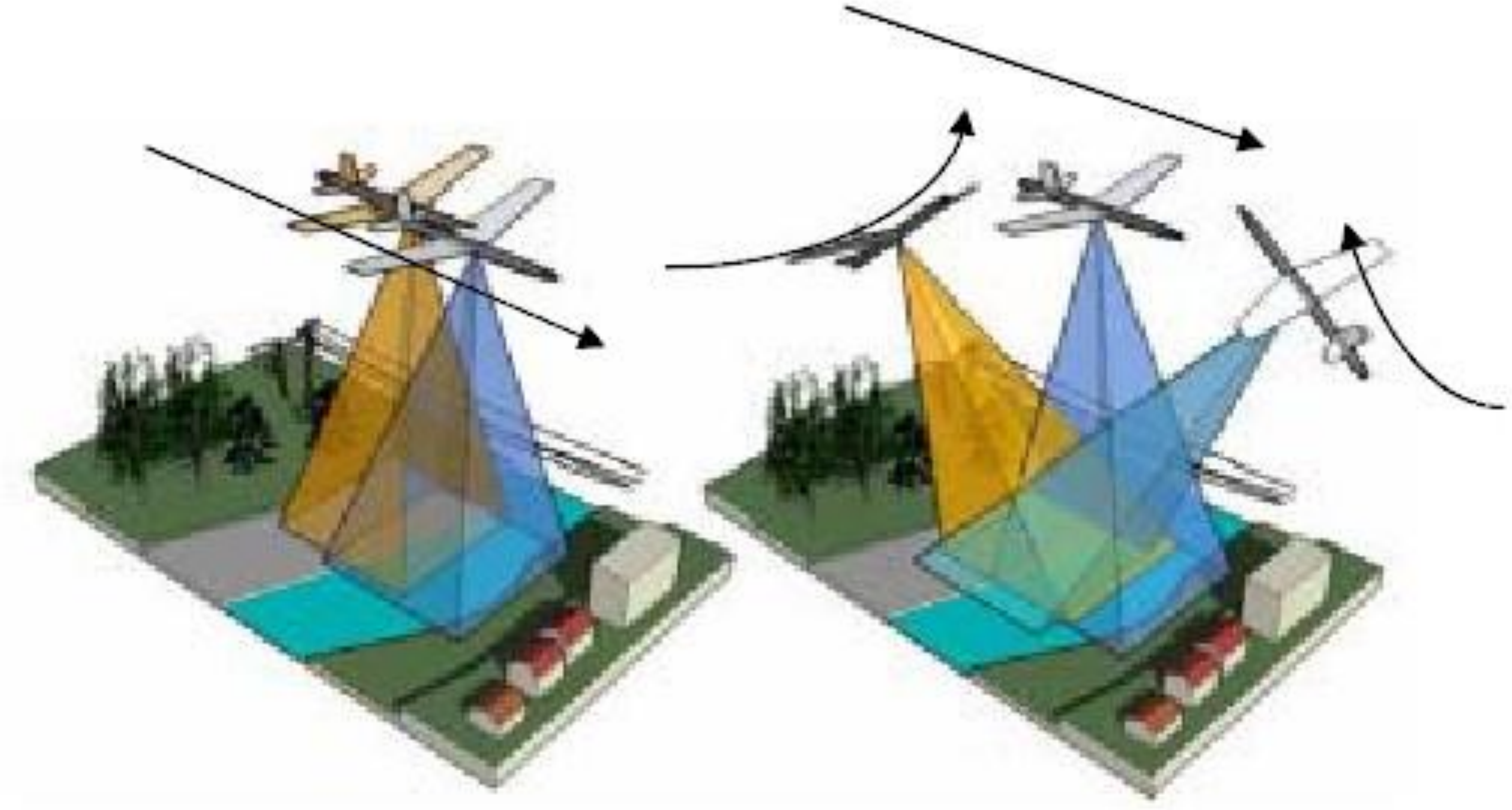

Figure 1. Flight path for stereo shots

Figure 2. Aerial images scanned with 2000dpi

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Parts of A Single Lens Frame Camera

Lorem Ipsum is simply dummy text of the printing and typesetting industry. Lorem Ipsum has been the industry's unknown printer took a galley of type and scrambled it to make a type specimen book. It has survived not only five centuries, but also the leap into electronic typesetting, remaining essentially unchanged. It was popularised in the Lorem has survived not only five centuries, but also the dummy text of the printing and typesetting industry. Lorem Ipsum has been the industry's standard dummy text ever since the 1500s, when an unknown printer took a

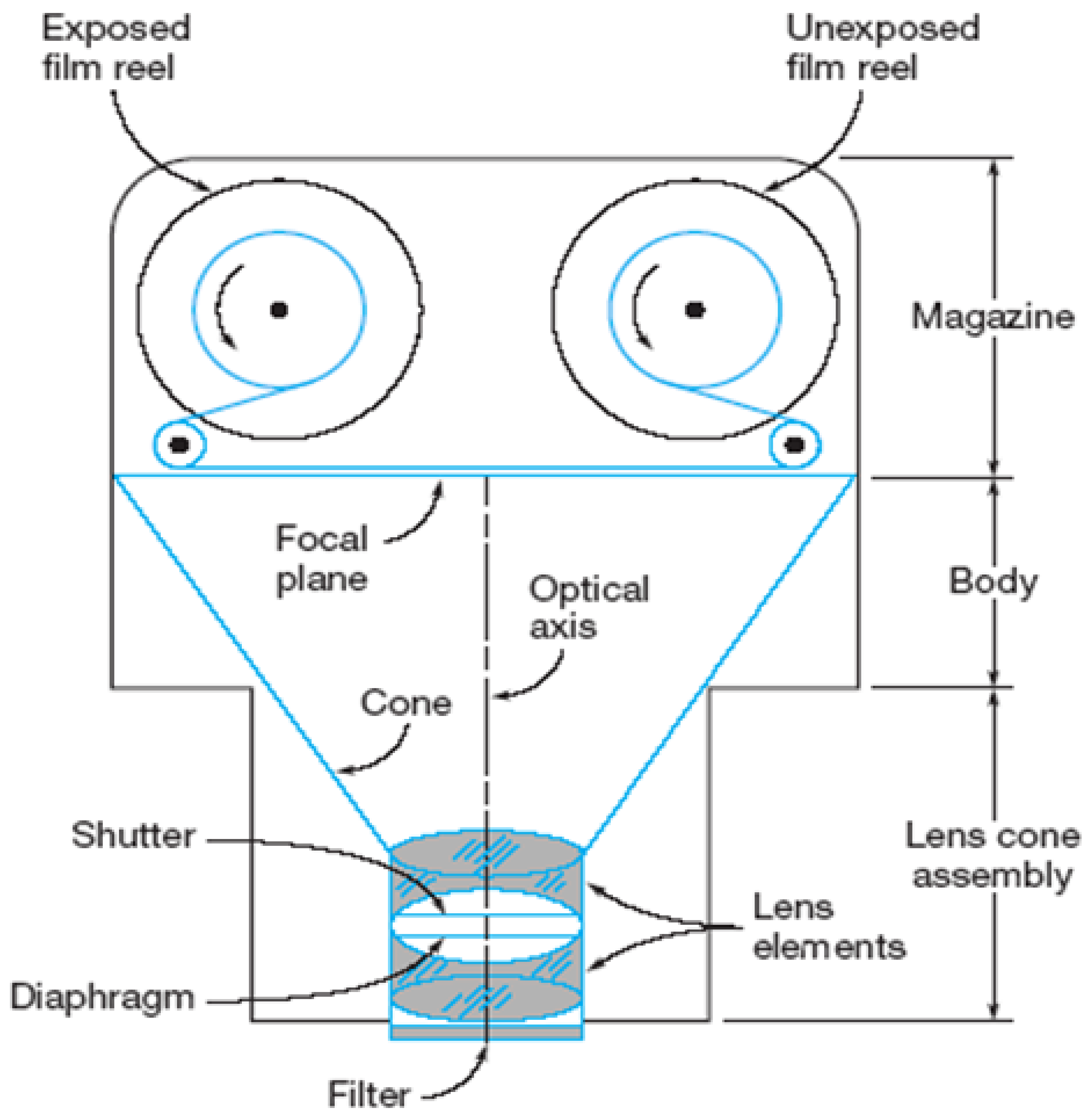

Figure 27–2 Principal components of a single lens frame aerial camera.

Photo Scale

- For a flat ground, if flying height is H and focal length is f,
- photo scale = f/H
- Example: A photograph taken from height 3000m using a camera of focal length 150.00mm, Compute the photo scale:
- Photo scale = (150)mm/(3000)m = 150/3000000 = 1/10000

- Scale at point A= f / (H – h_A).
- Example: camera focal length= 100mm, flying height = 2400m, height of point A= 400m. Compute scale at point A:
- Scale at point A = 100 / [(2400 – 400) x 1000] = 100/2000000 = 1/20000

- Ground Distance AB = photo distance ab (measured) x average photo scale no.

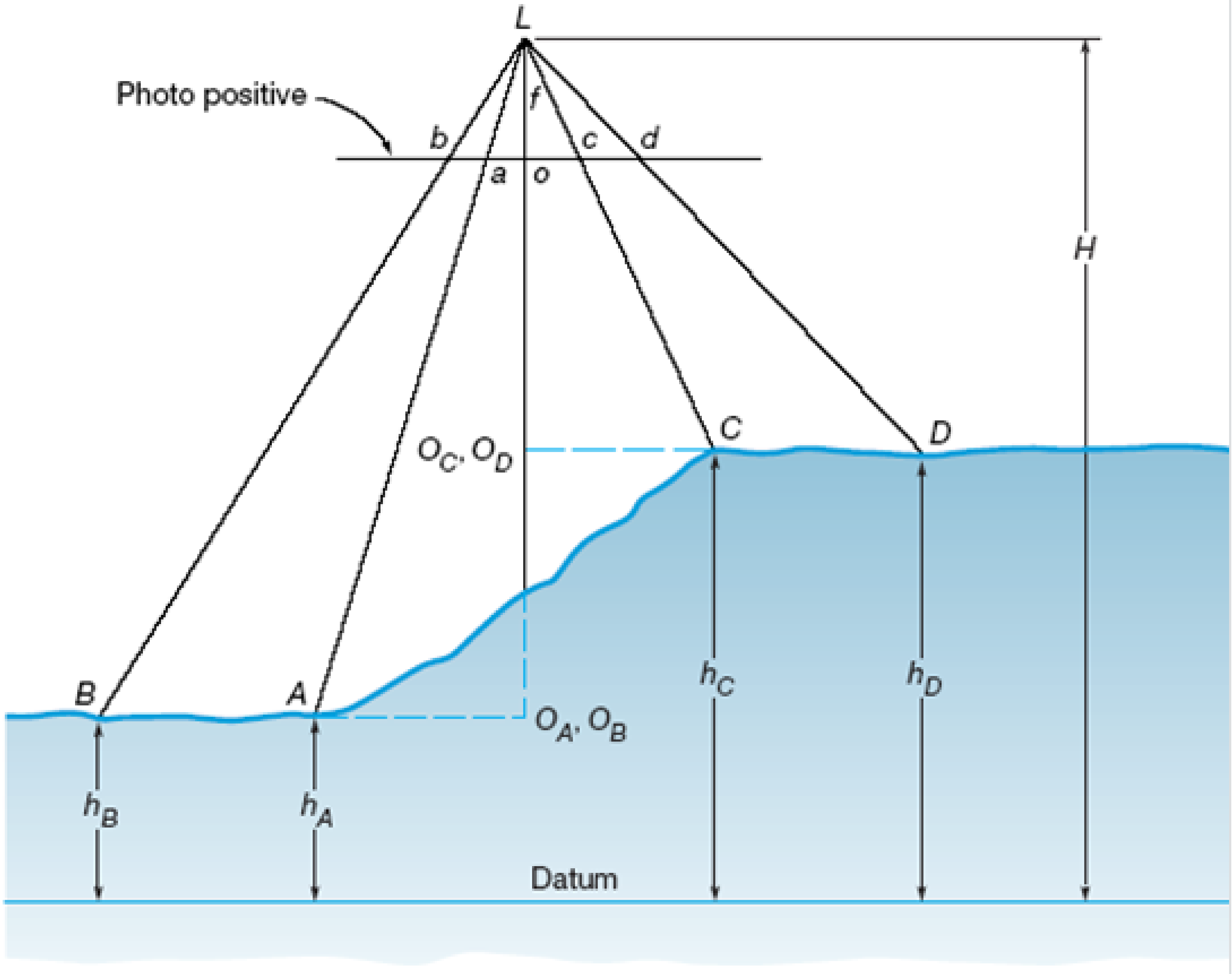

Figure 27–7 Scale of a vertical photograph.

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Ground Coordinates from Image Coordinates

- An image coordinate system is chosen such that x-axis is along flight direction, the y-axis is perpendicular to it at the principal point. A ground coordinate system, X-Y, is to be parallel to the image coordinate system.
- Ground coordinates of point A:
- $X_A = x_a * (H – h_A)/f$ and $Y_A = y_a * (H – h_A)/f$
- Ground coordinates of point B:
- $X_B = x_b * (H – h_B)/f$ and $Y_B = y_b * (H – h_B)/f$

- Ground distance AB = $[(XA - XB)^2 + (YA-YB)^2]^{1/2}$

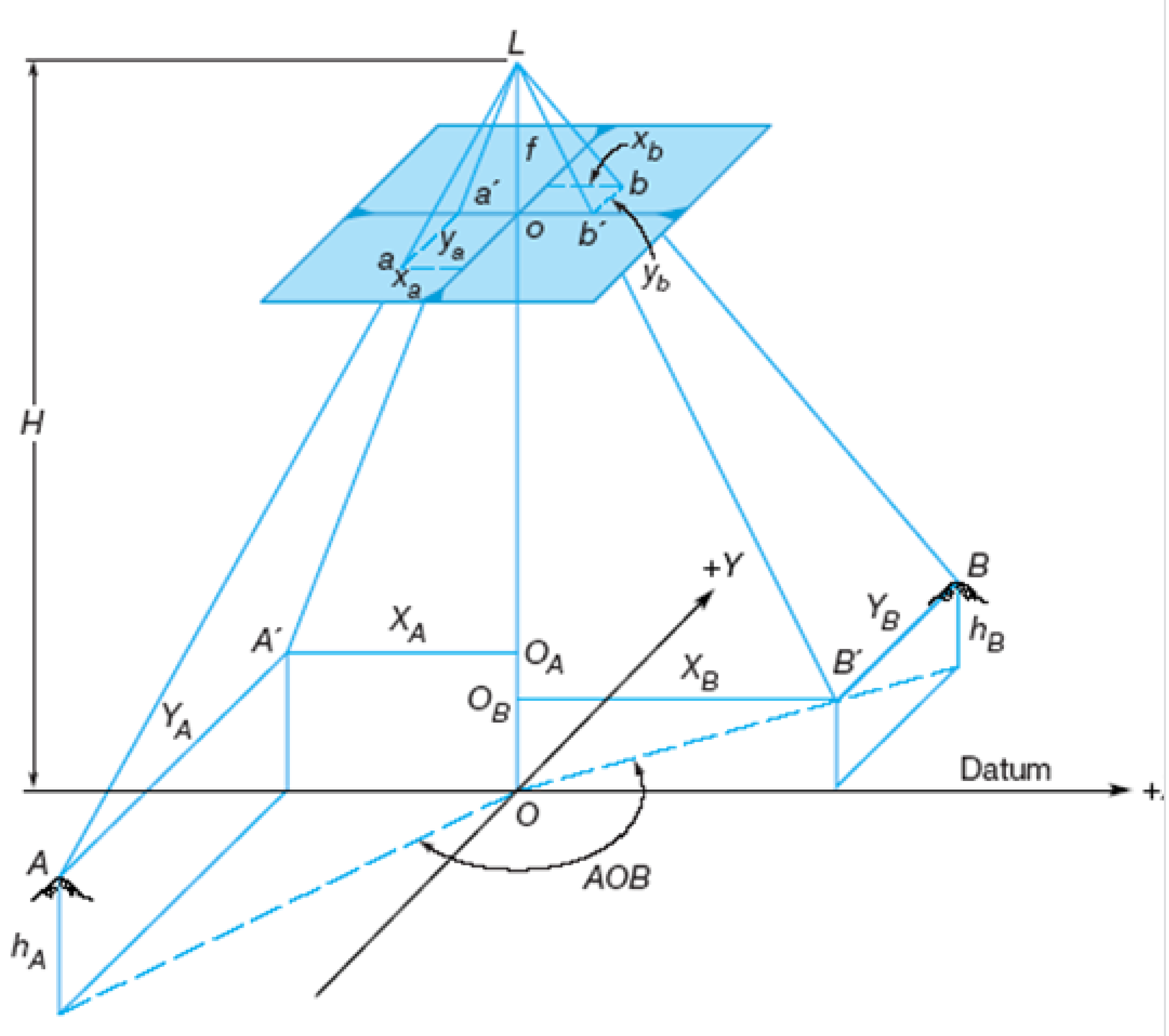

Figure 27–8 Ground coordinates from a vertical photograph.

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Coordinates Example

- Example:
- The images a and b of ground points A and B have photo coordinates: a(-30, -60)mm and b(40, 80)mm. Elevations of A and B above MSL are 200.00m and 150.00m, respectively. Flying height above MSL=2000.00m, and camera focal length=150.00mm. Compute ground coordinates of points A and B and horizontal distance between therm.
- Solution:
- $X_A = x_a * (H – h_A)/f$ = (-30)*(2000.00 – 200.00)/150 = -360.00m.
- Y_A = -720.00m,
- $X_B = x_b * (H – h_B)/f$ = (40)*(2000.00-150.00)/150 = 760.00m.
- YB=1520.00m.
- Ground Distance AB = [(-360-760)2 + (-720-1520)2]1/2 =

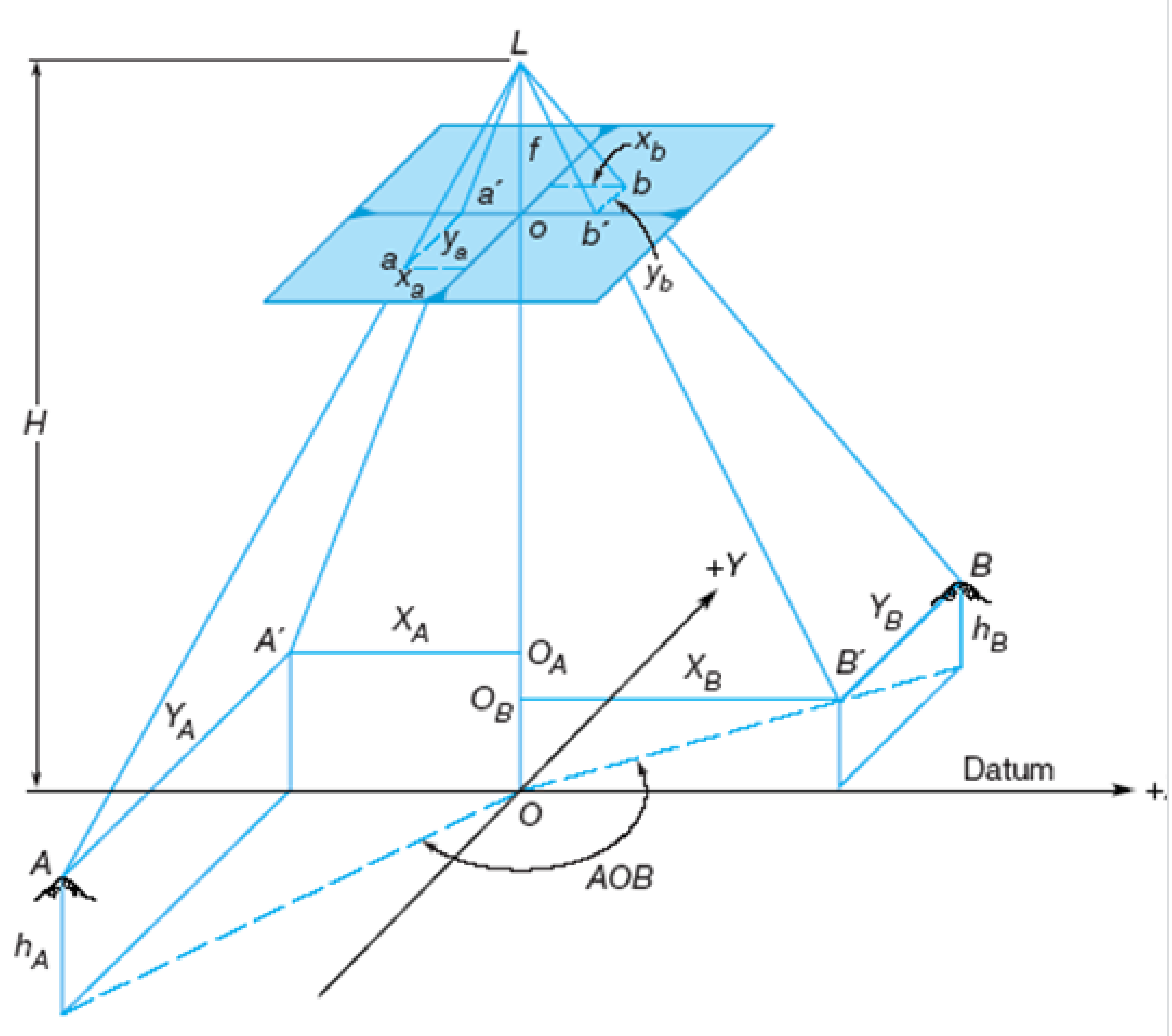

Figure 27–8 Ground coordinates from a vertical photograph.

Relief Displacement

- Relief Displacement is a radial displacement from photo principal point caused by difference in ground elevations and perspective projection of image.
- dr = rt – rb
- Where:
- dr is the length of the displaced object on the photo (relief displacement)
- rt is the radial distance from the nadir to the top point.
- rb is radial distance from nadir to base of point.

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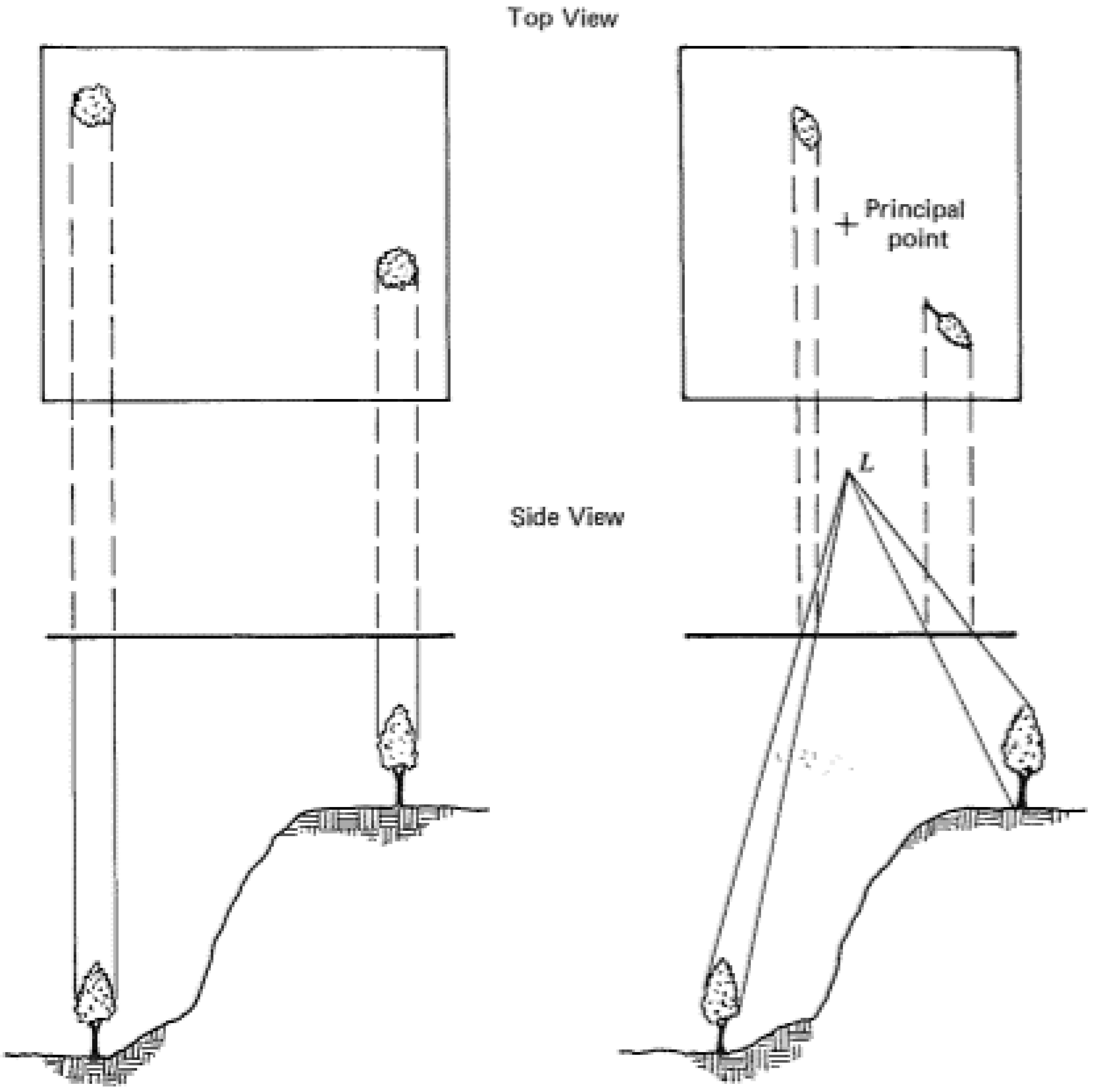

(a) Map (orthographic projection)
Constant scale
No relief displacement

(b) Photo (perspective projection)
Varied scale
Relief displacement

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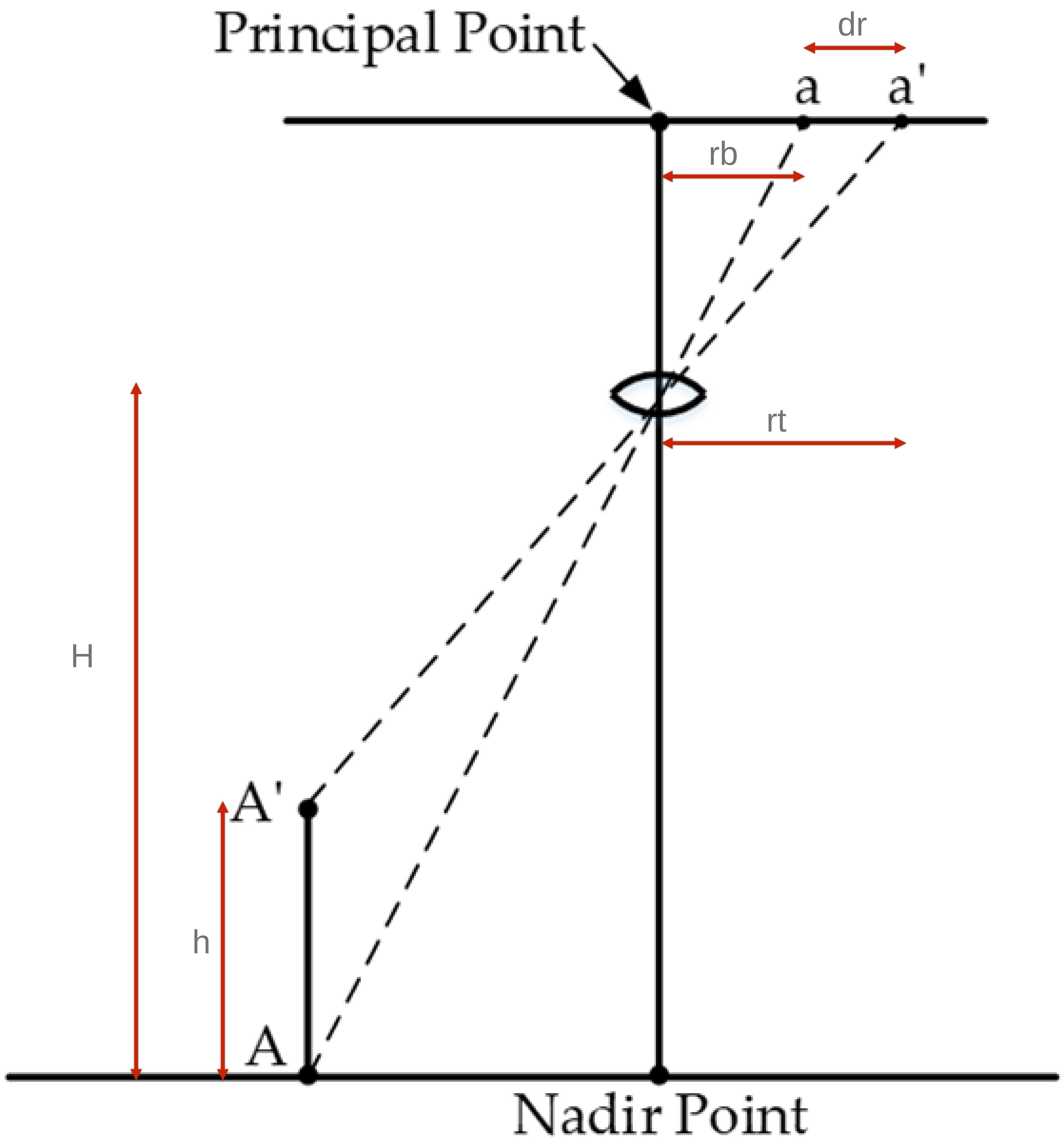
Object height

- Object height, $h = dr \cdot H / rt$
- dr and rt should have same units (mm). If H is given in m the object height will be found in m too.



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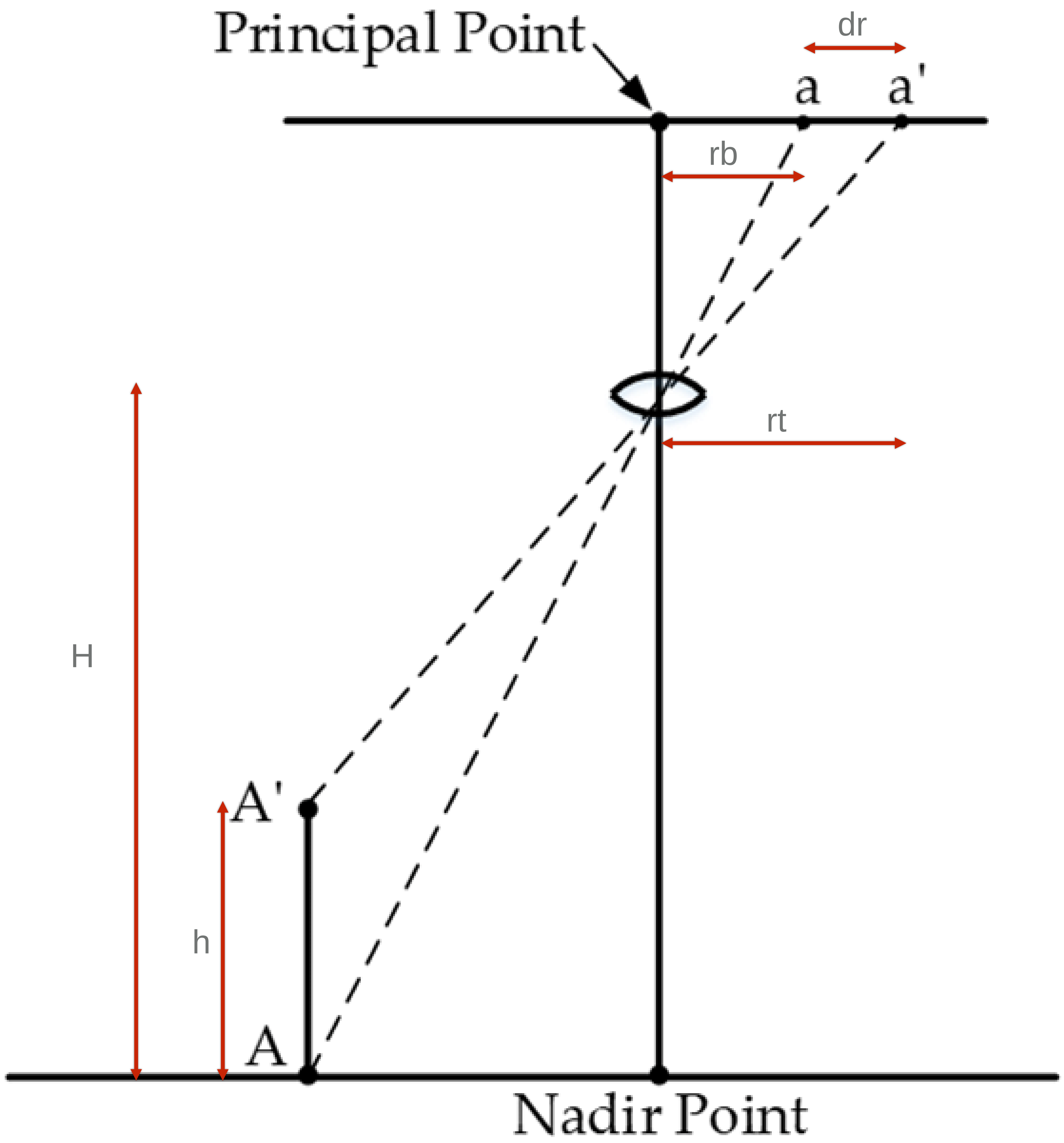
Object height

- Example:
- Assume that the flying height of the aircraft was 1,500 m above average ground surface; estimate the height of TV Tower using the relief displacement method, given: relief displacement=2.0mm, the radial distance from top of image to principal point = 80.0mm

- TV Tower height = 2.0 x 1500 / 80.0 = 37.5m



Accuracy

- The accuracy in photogrammetric surveys depends on:
- - the scale and type of photography,
- - the photo measuring instruments used,
- - the skill of the operator
- - the density of ground control,
- - the amount of relief.

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