Name: Key

FO-4313/6313

First Hour Exam, 2006

Formulae:

1. $RF = \frac{1}{S} = \frac{d}{D} = \frac{f}{(H-h)}$ **2.** $\frac{\delta h}{(H-h)} = \frac{d}{r}$ **3.** $\frac{\delta h}{(H-h)} = \frac{dp}{AP_b + dp}$

$dp = |X - X'|$ $AP_b = |Z - Z'|$

1. The two primary characteristics of an RF are:

   a. Unitless (5)

   b. 1 in numerator (5)

2. In Equation 1above, define/explain the following variables:

   d is image distance (5)

   D is ground distance (5)

3. In Equations 2 and 3 above, the primary differences between **d** and **dp** are:

   d = image length in radial direction from PP

   dp = image length in X- direction from (4)

4. After printing a draft of your GIS map using ARC/View, you see that the scale bar is not a standard scale bar with 1 inch graduations and you wish to compute a Representative Fraction for the graphic scale bar. If one graduation on the scale bar is 69.4/60 inches in length and this graduation is labeled as 1,350 feet on the ground, the computed RF is 1: 14,005 (5)

   $\frac{1}{S} = \frac{69.4/60/12}{1350}$

5. You obtain aerial imagery from a friend that shows your mountain cabin located at 7,500 ft elevation (msl), but you don't know the scale of the imagery. If your cabin has ground dimensions of 30 by 30 feet and image dimensions of 2/60 by 2/60 inches

   A. The scale of the imagery is calculated to be: 1: 10,800 (5)

   $\frac{1}{S} = \frac{2/60/12}{30 ft.}$

   B. If the original photograph was taken with a 152.4mm focal length and the cabin was located at sea level, the image would scale .0140 by .0140 inches (5)

   $\frac{1}{10,800} = \frac{.5 ft}{H - 7500}$ $\quad \frac{d}{30 ft.} = \frac{.5 ft.}{12,900 ft.}$

   $H = 12,900$ ft.

6. Since an aerial camera is an angle recording device and the principal point (PP) is the geometric center of the film plane, we can use the fiducial marks to describe an x, y coordinate location relative to the PP; i.e. the PP is the origin of the x, y axis.

Points 1and 2 are identified on a vertical aerial image of unknown scale taken with a camera of 152.4 mm focal length at an aircraft altitude of 10,000 ft (msl).

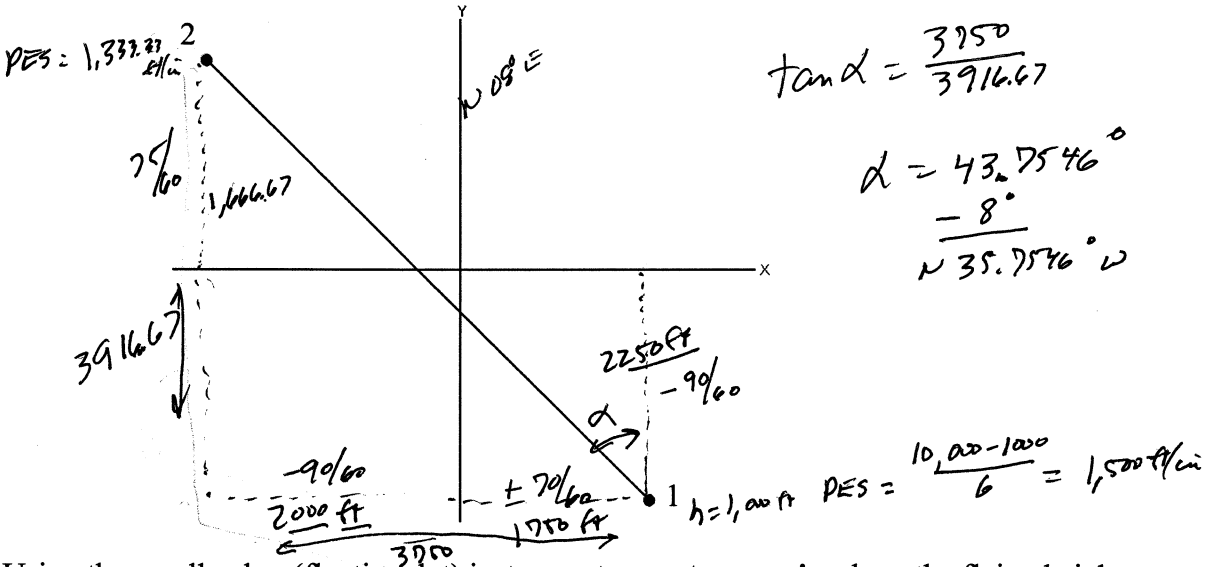
Point 1 is located at 1,000 ft of elevation at photo coordinates +70/60, -90/60 inches.
Point 2 is located at 2,000 ft of elevation at photo coordinates -90/60, +75/60 inches.

A. The R.F. scale at Point 1 is computed to be: 1:18,000 $\frac{1}{5} = \frac{.5}{10{,}000 - 1{,}000}$ (4)

B. Thus, the photo equivalent scale (PES) at Point 2 is: $\frac{10{,}000 - 2{,}000}{6''} = 1{,}333.33$ ft/in (3)

C. The horizontal ground distance between Points 1 and 2 is: 5427.44 ft (5)
$D = \sqrt{(3916.67)^2 + (3750)^2}$

D. If the N/S fiducial has a magnetic bearing of N 8^0 E, the magnetic bearing of the line is: N 35.7546° W (decimal degrees) (3)



7. Using the parallax bar (floating dot) instrument on a **stereo pair** where the flying height was 2,500 ft above average terrain elevation and the average base distance between the PP and CPP was 7.50 centimeters, the following parallax measurements were obtained:

Reading at top of object = 12.76 mm
Reading at bottom of object = 10.00 mm

$\frac{\Delta h}{2500} = \frac{2.76 \text{ mm}}{75 \text{ mm} + 2.76}$

The height of the object is 88.73 ft. (10)

8. If an object located at 350 ft elevation measures 0.27 inches in length on an aerial photograph taken with a 76.2mm focal length and the same object is 540 ft in length on the ground:

a. The RF scale of the photo at 350 ft is: 1:24,000 (4)

$\frac{1}{S} = \frac{0.27''}{540\ ft}$ $S = 24{,}000$

b. If the aircraft maintained the same altitude, the RF scale of the photo **at 750 ft** (m.s.l) would be 1: 22,400 (5)

$\frac{1}{24{,}000} = \frac{0.25\ ft}{H - 350}$ $H = 6{,}350\ ft.$

c. If the 0.27 in. object was located **at 750 ft** (m.s.l.), it would have a **ground length** of 504 ft. (5)

$\frac{1}{S} = \frac{0.25}{6350 - 350}$ $S = 22{,}400$

$\frac{1}{22{,}400} = \frac{0.27\ in.}{D}$

9. On a **single aerial image**, a radial line is selected that passes over a longleaf pine tree whose base is located at 150 feet of elevation. What is the height of the tree if the photo scale is 1 inch equals 500 feet at the tree base elevation, the camera focal length is 152.4mm, and the 60 scale on the engineer's scale is used to obtain the following measurements parallax measurements?

Nadir to base of tree = 247 increments
Nadir to top of tree = 255 increments

Height of tree = 94.11 ft. (10)

$1'' = 500\ ft \rightarrow 1:6{,}000$

$\frac{1}{6{,}000} = \frac{.5\ ft}{H - 150\ ft.}$ $H = 3{,}150\ ft.$

$\frac{\Delta H}{3{,}150 - 150} = \frac{8}{255}$

10. You want to contract for new 9 inch by 9 inch format aerial imagery that has a scale of 1 inch equals 660 feet at an average terrain elevation of 350 ft (msl) and the contractor's camera has a focal length of 152.4mm. If the standard requirements are 60% stereo coverage, 25% photographic side lap, and 25% safety overhang:

$1'' = 660\ ft = 1:7{,}920$

A. The desired RF scale of the imagery is: 1: 7,920 (2)

B. To achieve the desired scale, the aircraft must flight at an altitude of 4310 ft (2)

$\frac{1}{7920} = \frac{.5}{H - 350}$ $H = 4310$

C. At the desired scale, one photograph encompasses 810 acres (2)

$Acres = \frac{(9 \times 660)^2}{43{,}560}$

D. For stereoscopic overlap, the photo centers will be 2,376 ft apart. (2)

E. For sidelap, the flight lines will theoretically be 4,455 ft apart. (2)

F. For overhang, the 1st and nth lines will located 1485 ft from the boundary. (2)