Topic 7-Answers to PRACTICE SCALE PROBLEMS

1/S = representative fraction scale expression
f = focal length in feet (or meters)
H = platform altitude - a.s.l. (above sealevel)
h = terrain elevation, either point or average
PES = photo scale reciprocal: RF denominator/12 expressed in ft./in.

1. 1/S = f/H-h
1/S: 4" = 1 mi, 1in. = 1/4 mi = 1320 ft. x 12: = 1/15,840
f = 6"/12"/ft. = 0.5 ft.
H - h = X
1/15,840 = 0.5/X 7920 = X
H - h = 7920 ft. H - 2000 = 7,920 H = 9,920 ft.

2. 1/S = f/H-h
1/S: 1" = 20 ch x 66'/ch x 12"/ft
1/S = 1/15,840
h = 800 ft.
f = 6" = 0.5 ft.

$$\frac{1}{15,840} = \frac{0.5}{H - 800}$$

7920 = H - 800; H = 8720 ft.

3. 1/S = d/D = f/H-h
d = 50/60" = 0.8333"
D = 5280' x 12 = 63,360"
f = 12" = 1'

1/S = d/D = 0.8333/63,360 = 1/76,035
1/S = f/(H-h)
1/76,035 = 1/(H-1500)
H = 76,035 + 1500 = 77,535 ft. = 14.68 miles

4. 1/S = 1/16,000 PES = 16,000/12" 1" = 1333 ft/in.
"d" x PES = D, or D/PES = d (ft/ft/in = in)
120 ft/1333 ft/in = 0.09" x 60 = 5.4/60ths
60 ft/1333 ft/in = 0.045"x 60 = 2.7/60ths

5. image coverage = 9" x 9" = 81 sq. in.
acres/sq. in? At 1/6000, 1" = 500 ft.
1 sq. in = 250,000 sq. ft

250,000 sq. ft./43,560 sq. ft /ac. = 5.74 ac/sq. in.
81 sq. in. x 5.74 = 465 ac.

At 12,000, is scale smaller or larger? How much?
Smaller, therefore cover more acres per square inch.
How many more? Area = L squared;
therefore 12,000/6000 = 2 squared = 4 times.
Thus 465 x 4 = 1860 ac per image @ 1/12,000
At 30,000; 30/6 = 5 squared = 25 x 465 ac/frame = 11,625 ac

6. 1/S = f/H-h
6 ' = 0.5' 8.25" = 0.69' 12" = 1'
PES = 2000'/" therefore 1/S = 1/24,000
1/24,000 = (a) 0.5', (b) .69'/X, (c) 1'/X
X = 12,000 ft. 16,500 ft. 24,000 ft.

7. d/D = 1/S = f/H-h
f = 0.5' d = 0.4" D = 80 ft x 12 = 960"
0.4"/960" = 0.5/H-h

$$\frac{0.4"}{0.4} = \frac{960"}{0.4} \quad \text{or } 1/2400$$

1/2400 = 0.5/X **X = 1200 ft.**

8. d/D = 1/S = f/H-h
0.42' = 5280 ft 1' = 5280/.42 = 12,571ft or 1/12,571

1/12,571 = f/11,000
f = 11,000/12,571 = 0.875 ft (x 304.8 = 267 mm)

9. PES = 11,500/12 1" = 958 ft.
d x PES = D 1.5" x 958 ft/in = 1437 ft
3.0" x 958 ft/in = 2874 ft.
1437' x 2874'/43,560 = 94.8 ac.
PES metric 11,500/1000mm
25.4 mm/in x 1.5 by 3.0" or 38.1mm x 76.2mm
1mm = 11.5m (38.1 x 11.5) x (76.2 x 11.5)
= 38.4 ha (94.8/2.47 = 38.4 ha)

10. 1/s = f/H-h
1/S = 1/(12,000 - 1500) = 1/10,500

11. 1/S = d/D = f/H-h
1/S: 0.01" /(4 ft x 12 = 48") or 1/4800
1/4800 = 0.5/X X = 2400 ft.

12. 0.5 ac = 43,560 sq. ft/2 = 21,780 sq. ft.

$$\frac{\text{Pi } D^2}{4} = 21{,}780$$

$.785\ D^2 = 21780$ D = 21,780/.785
D = 166.6 ft.
PES = 15,840/12 = 1320 ft/in.
D/PES = d

d = 167 ft./1320 ft/in d = 0.13"
spacing 20 x 66 = 1320 ft/1320 ft./in = 1.00 inches

13. 1/s - f/H-h
1/12,000 = 0.5/(7000 - h)
6000 = 7000 - h
h = 1000 ft.

14. 1/Sa = f/H-ha 1/7920 = .5/H - 1200
H = 3960 + 1200 = 5160 ft.

1/S @ 1500' = 0.5/5160 - 1500 = 0.5/3660
1/S = 1/7320 or 610 ft/in @ 1500 ft.

1/S @ 300' = 0.5/5160 - 300 = 0.5/4860
1/S = 1/9720 or 810 ft/in

@ 1500 ft, 1 sq. in = 372,100 sq. ft. or 8.54 ac.
@ 300 ft, 1 sq. in = 656,100 sq. ft. or 15.06 ac.
Therefore at 1500 ft there are 150 trees/8.54 ac = 18 T/A and at 300 ft, 100/15.06 = 7 T/A

The stand at 1500 ft. has the highest density

15. h_{ave}= (165 + 385)/2 = 275 ft

1/S = [(209.55/25.4/12) / (8250 - 275)] = 1/11,600

16. PES_{NE}= (8250 - 165)/ (209.55/25.4) = 980 ft per inch
Ground distance Y_{NE}= 980ft/inch * 3.0 inches = 2940 feet
Ground distance X_{SW}= 953.3ft/inch * 2.5 inches = 2383.25 feet

17. D^2= $(1470 + 2383.25)^2 + (2940+ 3336.7)^2$
D = 7365.09 feet

18. Bearing = N 4°15'W + N1°15'E = N5°30'W = N5.5°W

19. Tan A = 3853.25/6276.7 = 0.6138974
A = 31.5456°

Bearing = 31.5456° - 5.5° = 26.0456° = N26°2.74'E