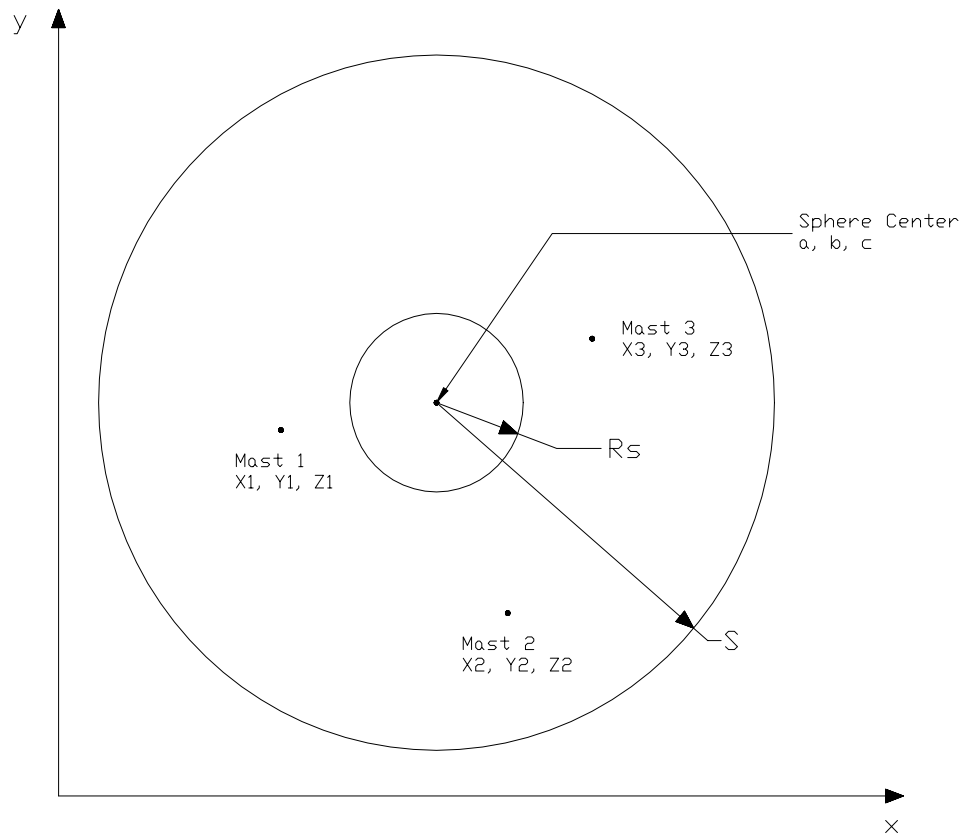


PROTECTED AREA INSIDE THREE UNEQUAL HEIGHT MASTS

To determine the location of the sphere resting on top of three masts, set up a Mathcad Solve block using the three known coordinates on the surface of the sphere in the general equation for a sphere

$S_m^2 = (x-a)^2 + (y-b)^2 + (z-c)^2$, where a, b, c are the coordinates of the sphere center.



Strike distance

$$S := 100\text{ft}$$

Height of equipment plane
(bus height)

$$he := 28\text{ft}$$

Mast heights

$$hm1 := 80\text{ft}$$

$$hm2 := 100\text{ft}$$

$$hm3 := 90\text{ft}$$

Mast top coordinates:

$$X1 := 0\text{ft}$$

$$Y1 := 0\text{ft}$$

$$Z1 := hm1$$

$$X2 := 110\text{ft}$$

$$Y2 := -100\text{ft}$$

$$Z2 := hm2$$

$$X3 := 130\text{ft}$$

$$Y3 := 90\text{ft}$$

$$Z3 := hm3$$

Sphere center guess values:

$$a := 50\text{ft}$$

$$b := -10\text{ft}$$

$$c := 200\text{ft}$$

Given

$$S^2 = [(X1 - a)^2 + (Y1 - b)^2 + (Z1 - c)^2]$$

$$S^2 = [(X2 - a)^2 + (Y2 - b)^2 + (Z2 - c)^2]$$

$$S^2 = [(X3 - a)^2 + (Y3 - b)^2 + (Z3 - c)^2]$$

$$SC := \text{Find}(a, b, c)$$

$$x_s := SC_0$$

$$y_s := SC_1$$

$$C := SC_2$$

Sphere center

$$x_s = 95.33 \text{ ft}$$

$$y_s = -1.61 \text{ ft}$$

$$C = 110.16 \text{ ft}$$

Height of sphere center above
equipment plane

$$C - h_e = 82.16 \text{ ft}$$

Radius of circle where sphere intersects the equipment plane (unprotected area)

$$R_s := \sqrt{S^2 - (C - h_e)^2}$$

$$R_s = 57.01 \text{ ft}$$

If the sphere is completely above the equipment plane, there is no unprotected area and R_s is imaginary. If there is no solution for any center guess values, then the masts are too far apart; the protected area is defined by each pair of masts separately.