Appendix 1. SAFE DISTANCE DETERMINATION

The following information can be used to establish a minimum safe distance from the antenna for personnel near an operating airborne weather radar. The minimum safe distance is based upon the FCC's exposure limit at 9.3-9.5 GHz for general population/uncontrolled environments. This limit is 1mW/cm^2 .

1) NEAR FIELD/FAR FIELD INTERSECTION

The distance to the near field/ far field intersection (Ri) is calculated by:

$$R_i = \frac{G * \lambda}{8 * \pi}$$

Where:

R_i = intersection distance from the antenna (in meters)
λ = Wavelength (in meters)
G = Antenna gain

2) DISTANCE TO SAFE LIMIT

The distance from a far field power density of PD $_{\text{Safe Limit}}$ is calculated by:

$$R_s = \sqrt{\frac{G * P}{40 * \pi * PD_{SafeLimit}}}$$

Where:

R_s = The minimum safe distance (in Meters)
P = Transmitted average power (in watts)
G = Antenna Gain
$PD_{SafeLimit}$ = Desired Safe Limit Power Density of 1 mW/cm^2 (in mW/cm^2)

3) PROCEDURE FOR DETERMINING MINIMUM SAFE DISTANCE FROM MPEL

Use the above formulas to calculate the minimum safe distance by:

a. Calculate the distance (R_i) to the near field/ far field intersection
b. Calculate the distance (R_s) to the Desired Safe Limit Power Density
c. If the distance (R_s) is less than the distance (R_i), use distance (R_i) as the minimum safe distance
d. If the distance (R_s) is greater than the distance (R_i), use distance (R_s) as the minimum safe distance

4) EXAMPLE

a The following data is for a GWX-56 and GWX-58 airborne weather radar

Antenna Diameter	12 inches (0.305 meters)
Transmitter Frequency	9375 MHz
Wave Length	0.032 meters
Pulse Length	3.7 microseconds
Pulse Repetition	109 Hz
Peak Power	7.5kW
Average Power	3.1W (Peak*Pulse Length*Pulse Repetition)
Antenna Gain	446.7 (26.5dB)

b **CALCULATIONS**

1) Distance (R_i) to near field/ far field intersection

$$R_i = \frac{446.7 * 0.032}{8 * \pi}$$

R_i = 0.57 meters (1.87 Feet)

2) Distance (R_s) to 1 mW/cm^2 safe limit

$$R_s = \sqrt{\frac{446.7 * 3.1}{40 * \pi * 1}}$$

R_s = 3.32 meters (10.89 ft)

3) Safe Distance Determination

The distance (R_s) is greater than the distance (R_i), therefore, the minimum safe distance is 3.32 meters (10.89 feet)