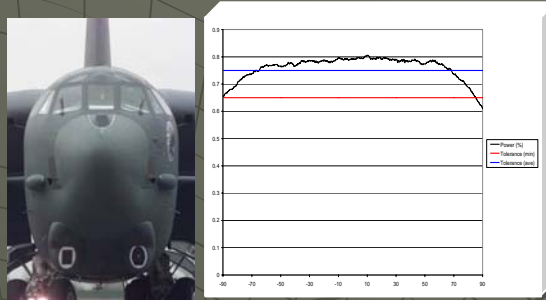


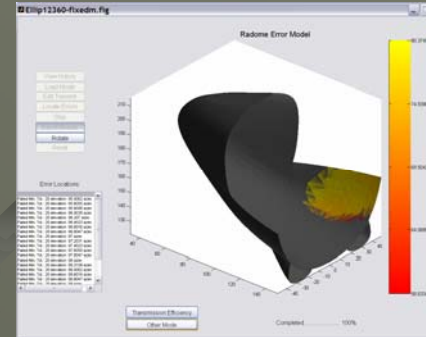
Software Based Image Processing for Radome Characterization: A Multi-Disciplinary Approach at OU and Tinker AFB

The PROBLEM: Current radome scanning techniques do not provide accurate information to determine the location of electromagnetic (EM) anomalies (corrosions, defects, ...) within acceptable tolerances. Over time, radomes deteriorate in response to moisture, bird strikes, lighting strikes, aging, delaminations, and the like.

1. Measurements collected at the radar test facility



3. Extensive 3-D Visualization Software Development relying on adaptive algorithms and laboratory measurements.



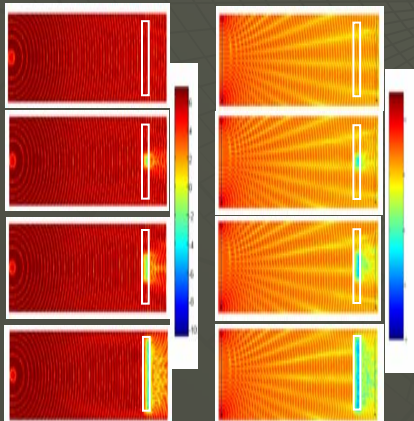
For Scan i , polygon j
 Initializations: for all $j: W_{overall,j} = 0$

$$W_{i,j} = \frac{1}{R_j^2} \sum_{k=j \in i} \frac{1}{R_k^2}$$

$$TE_j = \frac{W_{i,j} \times TE_i + W_{old,j} \times TE_i}{W_{i,j} + W_{old,j}}$$

$$W_{overall,j} = W_{i,j} + W_{i,overall}$$

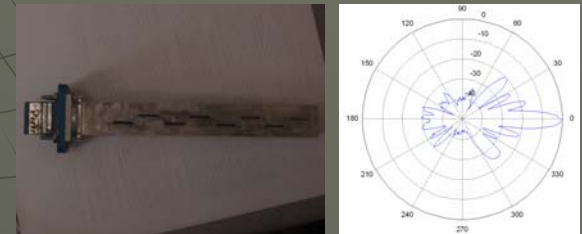
2. Theoretical Modeling: Corrosion causes decay of the EM fields in a radome. The electric field distributions throughout the simulation domain are given for varying amounts of corrosion.



The SOLUTION:

A five part multi-disciplinary approach was used to design experiments to characterize the radomes via innovative hardware and visualization software development.

4. Innovative Hardware Development. One example is the team's slotted waveguide antenna (left) and its radiation pattern (right).



5. Physical Modeling & Test Specimen Development:



The CONCLUSIONS: For the first time, adaptive algorithms were developed to process the received data in order to enhance the effective resolution of the scanning equipment. Then these new values were mapped to a 3-D model of the radome structure to provide a visual representation of the location of EM anomalies. These experiments were important, since an aircraft's nose cone is a protective cover for the aircraft that not only provides aerodynamic stability, but also serves as an electromagnetically transparent shield for a radar that is located behind it.