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ELECTROMAGNETIC PROPERTIES FOR COMPOSITE STRUCTURES

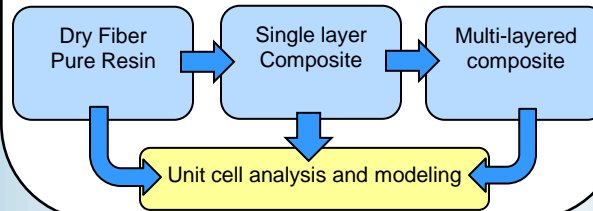
Influence of fabric characteristics on microwave properties of structural composites is not well understood. This project will address these features and give a more complete model for composite design

- ◆ Composites for naval structures as well as embedded antennas
- ◆ More accurate modeling can be used for custom RF response with hybrid stacking sequences



APPROACH

- ◆ Fabric unit cell characterization
- ◆ Numerical model development
 - ◆ Structural property model from fabric micromechanics
 - ◆ Microwave properties from electromagnetic models
- ◆ Material characterization for model validation
 - ◆ Dry fabric
 - ◆ Single layer
 - ◆ Multi-layer



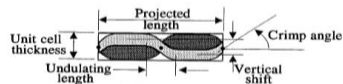
COMPOSITE PROCESSING

- ◆ Panels are manufactured using VARTM
 - ◆ Caul plates used for uniform surface finish
 - ◆ Wet layups preformed for low permeability fabrics.
 - ◆ Inhibitor added to resin for gel time control

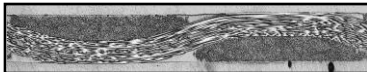


24oz. E-glass 11 layers

UNIT CELL MEASUREMENTS



Geometry needed for unit cell model



Microscopy

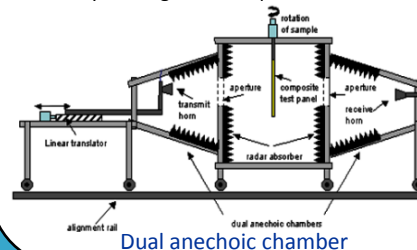
	X (μm)	Y (μm)	Z (μm)
AVG	3547.145	3423.35	227.4388
STD	307.1071	30.85914	3.32444

Unit Cell Geometric Statistics

MICROWAVE TESTING

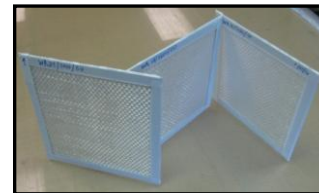
Microwave testing chamber

- ◆ 18-110 GHz range
- ◆ Linear actuator for focusing wavelength location within composite
- ◆ Can vary the angle of test specimen



SAMPLE PREPARATION

- ◆ Final panel cut to 12X12 inch for testing with warp direction labeled
- ◆ Excess cut and orientation labeled for unit cell photographs



dry single layer fiber

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