ENERGY ABSORBING RADOMES FOR GROUND VEHICLES

S. Yarlagadda, J. Etherington, M. Kubota (BSChE)

University of Delaware . Center for Composite Materials

INTRODUCTION

- The Army Digitized Force's antenna systems on ground vehicles need protection from small arms fire and fragmentation from incoming munitions.
- Conventional radomes do not provide ballistic protection.
- Ballistic radomes protecting communications antennas will increase the survivability and maintain the lethality of combat platforms.

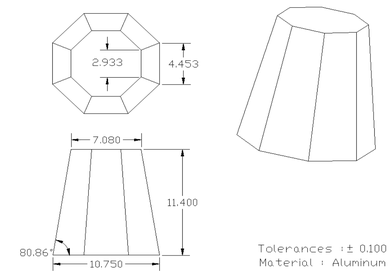
PANEL DATA & TEST RESULTS

	Thickness (in)	Areal Density (lb/ft^2)	RF Test	Ballistic Test V_{50}*
23 Ply S2	0.310	3.34	Pass	115.29%
30 Ply S2	0.425	4.25	Pass	No penetration**
20 Ply Kevlar	0.232	1.42	Pass	101.10%
2/20/2 S2/Kevlar/S2	0.274	1.95	Pass	111.10%
4/15/4 S2/Kevlar/S2	0.294	2.13	Pass	107.48%

* Percentage compared to standard
** Maximum velocity > 120%
Ballistic Test performed using a .44 Magnum

RADOME DESIGN

•Utilizing the 30-layer Polystrand S2/Polypropylene as preliminary design, a low-profile radome prototype was designed and constructed with the following constraints:
•Fabrication time
•Ease of fabrication
•Meets dimension requirements



MATERIALS & PROCESSING

Selection of materials was carried out using the following criteria:

•Ballistic performance
•NIJ III and NIJ IIIA Ballistic protection
•RF Transmission performance
•< 1 dB transmission loss
•Minimal dynamic deflection for protection of the antenna
•Meet standard radome requirements for mobility loads, environmental conditions, etc.

MATERIALS & PROCESSING

Materials used in this project are as follows:

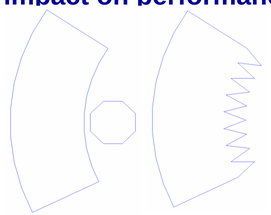
•Fiberglass (S2) / Polypropylene (PP) Prepreg

•Kevlar / Polypropylene (PP) Prepreg

These materials were chosen because of their good combination of fiber energy absorption and resin dielectric properties

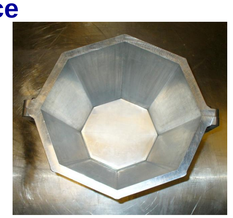
RADOME DESIGN & FABRICATION

Layer geometries and dimensions created utilizing CATIA and Fiber SIM software
• Alternating the two cutting patterns (A & B) during lay-up allowed for staggering seams to minimize seam impact on performance



Pattern A

Pattern B



Mold

FUTURE WORK

•Hybrids of S2/Kevlar show significant impact performance improvement compared to monolithic materials
•More combinations of hybrid panels will be evaluated
•In parallel with Punch Shear, evaluate structural performance and RF (through simulations) to generate optimal multifunctional solution

ACKNOWLEDGEMENTS

This work is supported by the US Army CERDEC through an SBIR program with JEM Engineering